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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/535,279	11/03/2015	9179085	DUELP010/DL017	1035

28875

10/14/2015

Zilka-Kotab, PC 1155 N. 1st St. Suite 105 SAN JOSE, CA 95112

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

William Rivard, Menlo Park, CA; Duelight LLC, Sunnyvale, CA; Adam Feder, Mountain View, CA; Brian Kindle, Sunnyvale, CA;

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UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandria, Virginia 22313-1450 www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/535,279	11/06/2014	William Rivard	DUELP010/DL017	1035
²⁸⁸⁷⁵ Zilka-Kotab, PO	7590 10/07/201	5	EXAM	INER
1155 N. 1st St. Suite 105			GEBRIEL,	SELAM T
SAN JOSE, CA	95112		ART UNIT	PAPER NUMBER
			2661	
			NOTIFICATION DATE	DELIVERY MODE
			10/07/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

zk-uspto@zilkakotab.com



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Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandria, Virginia 22313-1450

APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
14/535,279	06 November, 2014	RIVARD ET AL.	DUELP010/DL017

	E	KAMINER
lka-Kotab, PC 155 N. 1st St.	SELA	M GEBRIEL
Suite 105 SAN JOSE, CA 95112	ART UNIT	PAPER
	2661	20151001

DATE MAILED:

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

IDS filed on 09/23/2015 is considered	
	/TUAN HO/
	Primary Examiner, Art Unit 2661
PTO-90C (Rev.04-03)	

Becejpt date: 09/23/2015

Doc description: Information Disclosure Statement (IDS) Filed

14535279 - GALL/026615)

Approved for use through 07/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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	Application Number		14535279	
	Filing Date		2014-11-06	
INFORMATION DISCLOSURE	First Named Inventor William Rivard		m Rivard	
STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Art Unit		2661	
Not for Submission under 07 of K 1.55)	Examiner Name	S. T. Gebriel		
	Attorney Docket Number		DUELP010/DL017	

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Examiner Initial*	Cite No	Pate	nt Number	Kind Code ¹	Issue D)ate	Name of Patentee or Applicant of cited Document		Pages,Columns,Lines when Relevant Passages or Rele Figures Appear		
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If you wish to add additional Foreign Patent Document citation information please click the Add button Add											
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Examiner Initials* Cite No Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.								T5			

Receipt date: 09/23/2015 INFORMATION DISCLOSURE		Application Number		14535279 14	535279	- GAU:	2661
		Filing Date		2014-11-06			
		First Named Inventor	Willia	am Rivard			
	T BY APPLICANT sion under 37 CFR 1.99)	Art Unit		2661			
(NOT IOI SUDIIIS:	sion under 37 CFK 1.99)	Examiner Name	S. T.	Gebriel			
		Attorney Docket Numb	er	DUELP010/DL017			
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<u> </u>	·	EXAMINER SIGNA		·			
Examiner Signatu	re /Selam Gebriel/			Date Considered	10/01/2	015	
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.							
Standard ST.3). 3 For	SPTO Patent Documents at <u>www.U</u> Japanese patent documents, the inc	dication of the year of the reign	of the Er	mperor must precede the se	erial number of	the patent d	ocument.

	LAMITHE INAME	0. 1. 1	Ochilei			
(Not for Submission under or of it 1.33)	Examiner Name	S T				
(Not for submission under 37 CFR 1.99)	Art Unit		2661			
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	First Named Inventor	Willia	m Rivard			
	Filing Date		2014-11-06			
Receipt date: 09/23/2015	Application Number		14535279	14535279 - GAU: 266		

CERTIFICATION STATEMENT

Plea	Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):						
	That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).						
OR	t						
X	That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).						
	See attached ce	rtification statement.					
×	The fee set forth	in 37 CFR 1.17 (p) has been submitted here	ewith.				
	A certification sta	atement is not submitted herewith.					
SIGNATURE A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.							
Sigr	nature	/JAMIE ROSSI/	Date (YYYY-MM-DD)	2015-09-23			
Nan	lame/Print Jamie L. Rossi Registration Numl		Registration Number	56875			
		rmation is required by 37 CFR 1.97 and 1.98 (and by the USPTO to process) an application					

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Receipt date: 09/23/2015 14535279 - GAU: 2661

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

- 1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.
- 2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
- 3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
- 8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
- 9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail

Mail Stop ISSUE FEE Commissioner for Patents P.O. Box 1450

Alexandria, Virginia 22313-1450

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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

naintenance fee notifications.							
CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address) 28875 ZILKA-KOTAB, PC 1155 N. 1st St. Suite 105				Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission. Certificate of Mailing or Transmission I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.			
							(Depositor's name)
							(Signature)
							(Date)
APPLICATION NO. FILING	DATE	FIRST NAMED INVEN	TOR	ATTORN.	EY DOCKET NO.	CONFIRM	IATION NO.
14/535,279 11/06/	2014	William Rivard		DUE	LP010/DL017	10	035
	SENSOR APPARA GRAPHIC SCENE	TUS AND METHOD FOR O	BTAINING LO	OW-NOISE, H	IIGH-SPEED CAPTU	JRES OF A	
APPLN. TYPE ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID	ISSUE FEE	TOTAL FEE(S) DU	E DA	ATE DUE
nonprovisional SMALL	\$480.00			•	\$480.00	11	1/30/2015
EXAMINER	ART UNIT	CLASS-SUBCLASS					
S. T. Gebriel	2661	348-302	•				
1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached. "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required. 2. For printing on the patent front page, list (1) The names of up to 3 registered patent attorneys or agents at member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.							
3. ASSIGNEE NAME AND RESIDE	NCE DATA TO BE	E PRINTED ON THE PATEN	Γ (print or type))			
PLEASE NOTE: Unless an assigned for recordation as set forth in 37 CF (A) NAME OF ASSIGNEE		n of this form is NOT a substit		assignment.		he document	has been filed
Duelight LLC		Sunnyvale	e, California				
Please check the appropriate assignee categories	ry or categories (will r		· .	X Corporati	on or other private grou	p entity	Government
4a. The following fee(s) are submitted X Issue Fee Publication Fee (No small entire		4b. Payment of Fee(s): (Pl A check is enced) X Payment by cr				shown above	e)
Advance Order - # of Copies			•	-	e the required fee(s), a 50-1351 (enclose a		•
5. Change in Entity Status (from stat	us indicated above)	1					
Applicant certifying micro enti	ty status. See 37 CF				Status (see forms PTO/S pted at the risk of applic		
Applicant asserting small entity	y status. See 37 CFF	NOTE: If the applic be a notification of I			cro entity status, checki ity status.	ing this box w	ill be taken to
Applicant changing to regular	undiscounted fee sta	atus. NOTE: Checking the entity status, as appl		ken to be a not	ification of loss of enti	tlement to sma	all or micro
NOTE: This form must be signed in accord	dance with 37 CFR 1	.31 and 1.33. See 37 CFR 1.4 for	signature requir	rements and ce	ertifications.		
Authorized Signature	/3	JAMIE ROSSI/		Date	September 23, 20	015	
Typed or printed name	Ţ	Jamie L. Rossi		Regi	stration No.	56,875	

Doc code: IDS Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-15)

Approved for use through 07/31/2016. OMB 0651-0031

Mation Disclosure Statement (IDS) Filed

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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	Application Number		14535279	
INFORMATION BIOOL COURT	Filing Date		2014-11-06	
INFORMATION DISCLOSURE	First Named Inventor	d Inventor William Rivard		
STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Art Unit		2661	
(Not for submission under 57 of K 1.55)	Examiner Name	S. T.	Gebriel	
	Attorney Docket Number		DUELP010/DL017	

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue D	ate	Name of Pate of cited Docu	entee or Applicant ment	Relev	es,Columns,Lines where vant Passages or Relev es Appear	
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Examiner Initial*		Foreign Document Number³	Country Code ²		Kind Code ⁴	Publication Date	Name of Patented Applicant of cited Document		Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T5
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If you wish to add additional Foreign Patent Document citation information please click the Add button Add										
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Examiner Initials*	Examiner Initials* Cite No Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.									

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		14535279
Filing Date		2014-11-06
First Named Inventor William		m Rivard
Art Unit		2661
Examiner Name S. T.		Gebriel
Attorney Docket Number		DUELP010/DL017

	1	Final	Office Action from U.S. Application No. 14/568,045, dated September 18, 2015				
If you wisl	f you wish to add additional non-patent literature document citation information please click the Add button Add						
			EXAMINER SIGNATURE				
Examiner Signature Date Considered							
			reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a rmance and not considered. Include copy of this form with next communication to applicant.				
Standard ST 4 Kind of doo	Γ.3). ³ F cument	or Japa by the a	TO Patent Documents at www.uspto.gov or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPC anese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark he on is attached.	ent.			

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		14535279
Filing Date		2014-11-06
First Named Inventor William		m Rivard
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Attorney Docket Number		DUELP010/DL017

	CERTIFICATION STATEMENT					
Plea	lease see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):					
	That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).					
OF	₹					
×	foreign patent of after making rea any individual d	f information contained in the information di office in a counterpart foreign application, an asonable inquiry, no item of information conta lesignated in 37 CFR 1.56(c) more than thr 37 CFR 1.97(e)(2).	d, to the knowledge of thained in the information di	ne person signing the certification sclosure statement was known to		
	See attached ce	ertification statement.				
X	The fee set forth	n in 37 CFR 1.17 (p) has been submitted here	ewith.			
	A certification st	atement is not submitted herewith.				
	signature of the ar n of the signature	SIGNAT oplicant or representative is required in accord.		18. Please see CFR 1.4(d) for the		
Sig	nature	/JAMIE ROSSI/	Date (YYYY-MM-DD)	2015-09-23		
Nar	me/Print	Jamie L. Rossi	Registration Number	56875		

public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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- 6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
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- 8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
- 9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal					
Application Number:	145	535279			
Filing Date:	06-	Nov-2014			
Title of Invention:		AGE SENSOR APPAR 5H-SPEED CAPTURE		ETHOD FOR OBTAIN IGRAPHIC SCENE	ING LOW-NOISE,
First Named Inventor/Applicant Name:	Wil	liam Rivard			
Filer: Jamie Lynn Rossi/Justin Bocchino					
Attorney Docket Number:	DUELP010/DL017				
Filed as Small Entity					
Filing Fees for Utility under 35 USC 111(a)					
Description		Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:					
Pages:					
Claims:					
Miscellaneous-Filing:					
Petition:					
Patent-Appeals-and-Interference:					
Post-Allowance-and-Post-Issuance:					
Utility Appl Issue Fee		2501	1	480	480

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
xtension-of-Time:				
Miscellaneous:				
Submission- Information Disclosure Stmt	2806	1	90	90
	Tot	al in USD	(\$)	570

Electronic Acknowledgement Receipt				
EFS ID:	23581034			
Application Number:	14535279			
International Application Number:				
Confirmation Number:	1035			
Title of Invention:	IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE			
First Named Inventor/Applicant Name:	William Rivard			
Customer Number:	28875			
Filer:	Jamie Lynn Rossi/Justin Bocchino			
Filer Authorized By:	Jamie Lynn Rossi			
Attorney Docket Number:	DUELP010/DL017			
Receipt Date:	23-SEP-2015			
Filing Date:	06-NOV-2014			
Time Stamp:	19:47:52			
Application Type:	Utility under 35 USC 111(a)			

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$570
RAM confirmation Number	5454
Deposit Account	501351
Authorized User	ZILKA, KEVIN J

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees) Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees) Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges) File Listing: **Document** File Size(Bytes)/ Multi **Pages Document Description File Name** Number **Message Digest** Part /.zip (if appl.) 32867 1 Issue Fee Payment (PTO-85B) Issue_Fee_Transmittal.pdf 1 no f16e3d0b655d3765128c201221d63b001c Warnings: Information: 717101 DUELP003A_DL001A_FOA_09-2 Non Patent Literature 18 no 18-2015.pdf 2a75feb7557bf65dd472617b7f5292903c9 Warnings: Information: 1034814 Information Disclosure Statement (IDS) Information_Disclosure_State 3 4 no Form (SB08) ment_Fillable_PDF_03.pdf 06cc66feee1a979ea88dd0e330f87a78e529 1a63 Warnings: Information: A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems. 32383 4 Fee Worksheet (SB06) fee-info.pdf no 2 3b4d000361185382f1cd0cecd6bb31d6fea Warnings:

Total Files Size (in bytes):

1817165

Information:

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1 EPAS ID: PAT3538897 Stylesheet Version v1.2

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
WILLIAM RIVARD	10/30/2014
ADAM FEDER	10/30/2014
BRIAN KINDLE	10/30/2014

RECEIVING PARTY DATA

Name:	DUELIGHT LLC
Street Address:	1057 ROCKEFELLER DR.
City:	SUNNYVALE
State/Country:	CALIFORNIA
Postal Code:	94087

PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	14535279

CORRESPONDENCE DATA

Fax Number: (408)971-4660

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone: (408) 971-2573

Email:justin@zilkakotab.comCorrespondent Name:ZILKA-KOTAB, PCAddress Line 1:1155 N. 1ST ST.

Address Line 2: SUITE 105

Address Line 4: SAN JOSE, CALIFORNIA 95112

ATTORNEY DOCKET NUMBER:	DUELP010/DL017
NAME OF SUBMITTER:	JAMIE L. ROSSI
SIGNATURE:	/JAMIE ROSSI/
DATE SIGNED:	09/23/2015
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 3

source=DUELP010_Signed Combined Declaration and Assignment#page1.tif source=DUELP010_Signed Combined Declaration and Assignment#page2.tif



Attorney Docket No.: DUELP010/DL017

COMBINED DECLARATION (37 C.F.R. 1.63) AND ASSIGNMENT FOR UTILITY APPLICATION USING AN APPLICATION DATA SHEET (37 C.F.R. 1.76)

Title of Invention: <u>IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE</u>, <u>HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE</u>

As the below named inventor, I hereby declare that:
This declaration is directed to the attached application, or (if following box is checked) United States application or PCT international application number, filed on
The above-identified application was made or authorized to be made by me.
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.
I hereby state that I have reviewed and understand the contents of the above identified application, including the claims.
I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, CFR § 1.56.
Whereas, I the undersigned inventor have invented certain new and useful improvements as set forth in the above-identified patent application and further identified by the Attorney Docket Number provided above in the header of this document.
For good and valuable consideration, the receipt and sufficiency of which is hereby admowledged, I the undersigned inventor hereby:
1) Sell(s), assign(s) and transfer(s) to <u>Duelight LLC</u> , a California limited liability company having a place of business at 1057 Rockefeller Dr., Sunnyvale, CA 94087, (hereinafter referred to as ("ASSIGNEE"), the entire right title and interest in any and all improvements and inventions disclosed in, application(s) based upon, and Patent(s) (including foreign patents) granted upon the information which is disclosed in the above referenced application.
2) Authorize and request the Commissioner of Patents to issue any and all Letters Patents resulting from said application or any division(s), continuation(s), substitutes(s) or reissue(s) thereof to the ASSIGNEE.
3) Agree to execute all papers and documents and, entirely at the ASSIGNEE's expense, perform any acts which are reasonably necessary in connection with the prosecution of said application, as well as any derivative and applications thereof, foreign applications based thereon, and/or the enforcement of patents resulting from such applications.
4) Agree that the terms, covenants and conditions of this assignment shall inure to the benefit of the Assignee, its successors, assigns and other legal representative, and shall be binding upon the inventor(s), as well as the inventor's heirs, legal representatives and assigns.
5) Warrant and represent that I have not entered, and will not enter into any assignment, contract, or understanding that conflicts with this assignment.
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.
Signed on the date indicated beside my signature.
Legal Name of Inventor:William Rivard
Signature:

Attorney Docket No.: DUELP010/DL017

COMBINED DECLARATION (37 C.F.R. 1.63) AND ASSIGNMENT FOR UTILITY APPLICATION USING AN APPLICATION DATA SHEET (37 C.F.R. 1.76)

Title of Invention: IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE

CAPTURES OF A THOTOGRAM 122
As the below named inventor, I hereby declare that:
This declaration is directed to the attached application, or (if following box is checked) United States application or PCT international application number, filed on
The above-identified application was made or authorized to be made by me.
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.
I hereby state that I have reviewed and understand the contents of the above identified application, including the claims.
I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Field 57,
Whereas, I the undersigned inventor have invented certain new and useful improvements as set forth in the above-identified patent application and further identified by the Attorney Docket Number provided above in the header of this document.
For each and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, I the undersigned inventories by
1) Sell(s), assign(s) and transfer(s) to <u>Duelight LLC</u> , a California limited liability company having a place of business at 1037 Rockefeller Dr., Sunnyvale, CA 94087, (hereinafter referred to as ("ASSIGNEE"), the entire right title and interest in any and all improvements and inventions disclosed in, application(s) based upon, and Patent(s) (including foreign patents) granted upon the information which is disclosed in the above referenced application.
2) Authorize and request the Commissioner of Patents to issue any and all Letters Patents resulting from said application of any division(s), continuation(s), substitutes(s) or reissue(s) thereof to the ASSIGNEE.
3) Agree to execute all papers and documents and, entirely at the ASSIGNEE's expense, perform any acts which are reasonably necessary in connection with the prosecution of said application, as well as any derivative and applications thereof, foreign applications based thereon, and/or the enforcement of patents resulting from such applications.
4) Agree that the terms, covenants and conditions of this assignment shall inure to the benefit of the Assignee, its successors, assigns and other legal representative, and shall be binding upon the inventor(s), as well as the inventor's heirs, legal representatives and assigns.
5) Warrant and represent that I have not entered, and will not enter into any assignment, contract, or understanding that conflicts with this assignment.
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.
Signed on the date indicated beside my signature.
Legal Name of Inventor: Adam Feder Signature: Date:

Attorney Docket No.: DUELP010/DL017

COMBINED DECLARATION (37 C.F.R. 1.63) AND ASSIGNMENT FOR UTILITY APPLICATION USING AN APPLICATION DATA SHEET (37 C.F.R. 1.76)

Title of Invention: <u>IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE</u>

As the below named inventor, I hereby declare that:
This declaration is directed to the attached application, or (if following box is checked) United States application or PCT international application number, filed on
The above-identified application was made or authorized to be made by me.
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.
I hereby state that I have reviewed and understand the contents of the above identified application, including the claims.
I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, CFR § 1.56.
Whereas, I the undersigned inventor have invented certain new and useful improvements as set forth in the above-identified patent application and further identified by the Attorney Docket Number provided above in the header of this document.
For good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, I the undersigned inventor hereby:
1) Sell(s), assign(s) and transfer(s) to <u>Duelight LLC</u> , a California limited liability company having a place of business at 1057 Rockefeller Dr., Sunnyvale, CA 94087, (hereinafter referred to as ("ASSIGNEE"), the entire right title and interest in any and all improvements and inventions disclosed in, application(s) based upon, and Patent(s) (including foreign patents) granted upon the information which is disclosed in the above referenced application.
2) Authorize and request the Commissioner of Patents to issue any and all Letters Patents resulting from said application or any division(s), continuation(s), substitutes(s) or reissue(s) thereof to the ASSIGNEE.
3) Agree to execute all papers and documents and, entirely at the ASSIGNEE's expense, perform any acts which are reasonably necessary in connection with the prosecution of said application, as well as any derivative and applications thereof, foreign applications based thereon, and/or the enforcement of patents resulting from such applications.
4) Agree that the terms, covenants and conditions of this assignment shall inure to the benefit of the Assignee, its successors, assigns and other legal representative, and shall be binding upon the inventor(s), as well as the inventor's heirs, legal representatives and assigns.
5) Warrant and represent that I have not entered, and will not enter into any assignment, contract, or understanding that conflicts with this assignment.
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.
Signed on the date indicated beside my signature.
Legal Name of Inventor: Brian Kindle
Signature:

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandria, Virginia 22313-1450

NOTICE OF ALLOWANCE AND FEE(S) DUE

28875 7590 Zilka-Kotab, PC 1155 N. 1st St. Suite 105 SAN JOSE, CA 95112 08/31/2015

EXAMINER

GEBRIEL, SELAM T

ART UNIT PAPER NUMBER

2661

DATE MAILED: 08/31/2015

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/535,279	11/06/2014	William Rivard	DUELP010/DL017	1035

TITLE OF INVENTION: IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A

PHOTOGRAPHIC SCENE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0	\$0	\$480	11/30/2015

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE

Mail Stop ISSUE FEE Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450

Alexandria, Virgi or <u>Fax</u> (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

maintenance fee notifica	tions.	nerwise in Block 1, by (c	s) speerlying a new con	espondence address,	,	(b) moreating a sept	122 1251255 16
CURRENT CORRESPOND	ENCE ADDRESS (Note: Use Bi	lock 1 for any change of address)	Fo	o(c) Transmittal Th	ic cortifi	icate cannot be used f	or domestic mailings of the for any other accompanying int or formal drawing, must
28875 Zilka-Kotab, P 1155 N. 1st St. Suite 105		/2015	I h St ad tra	Cer hereby certify that the hates Postal Service we dressed to the Mai nsmitted to the USP	tificate is Fee(s vith suff I Stop TO (57)	of Mailing or Trans) Transmittal is being ficient postage for firs ISSUE FEE address 1) 273-2885, on the date	mission g deposited with the United st class mail in an envelope above, or being facsimile ate indicated below.
SAN JOSE, CA	95112						(Depositor's name)
			_				(Signature)
			L				(Date)
APPLICATION NO.	FILING DATE		FIRST NAMED INVENTO	R	ATTO	RNEY DOCKET NO.	CONFIRMATION NO.
14/535,279	11/06/2014	•	William Rivard		DU	JELP010/DL017	1035
TITLE OF INVENTIC PHOTOGRAPHIC SCE		APPARATUS AND M	ETHOD FOR OBTAIN	IING LOW-NOISE	, HIGH	H-SPEED CAPTURE	S OF A
APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSU	E FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0	\$0		\$480	11/30/2015
EXAM	MINER .	ART UNIT	CLASS-SUBCLASS	٦			
	SELAM T	2661	348-302000	J			
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CFR 1.363).			(1) The names of up	to 3 registered pater		eys 1	
☐ Change of corresp Address form PTO/S	ondence address (or Cha B/122) attached.	inge of Correspondence	or agents OR, alterna (2) The name of a sin	•	memb	era 2	
"Fee Address" ind PTO/SB/47; Rev 03-0 Number is required.	lication (or "Fee Address 22 or more recent) attach	" Indication form ed. Use of a Customer	registered attorney or 2 registered patent at listed, no name will b	agent) and the nam corneys or agents. If	es of up	o to	
		A TO BE PRINTED ON T		, 1			
PLEASE NOTE: Un recordation as set fort	less an assignee is ident h in 37 CFR 3.11. Com	ified below, no assignee pletion of this form is NO	data will appear on the T a substitute for filing a	patent. If an assign n assignment.	ee is id	entified below, the de	ocument has been filed for
(A) NAME OF ASSI		•	(B) RESIDENCE: (CIT				
			-				
Please check the appropr	riate assignee category or	categories (will not be pr	rinted on the patent):	┛Individual Co	orporati	on or other private gro	oup entity 🗖 Government
4a. The following fee(s)	are submitted:	4t	D. Payment of Fee(s): (Ple		ny prev	iously paid issue fee	shown above)
Issue Fee	No small entity discount p	permitted)	☐ A check is enclosed☐ Payment by credit contact.		Ric attac	shed	
	of Copies		The director is hereb	y authorized to char	ge the re	equired fee(s), any def	ficiency, or credits any
		<u> </u>	overpayment, to Dep	osit Account Numb	er	(enclose a	n extra copy of this form).
5. Change in Entity Sta	tus (from status indicate	d above)					
Applicant certifying	ng micro entity status. Se	ee 37 CFR 1.29					O/SB/15A and 15B), issue application abandonment.
Applicant asserting	g small entity status. See	37 CFR 1.27		n was previously un	der mic	ro entity status, check	ing this box will be taken
Applicant changin	ng to regular undiscounte	d fee status.	NOTE: Checking this be entity status, as applical		e a noti	fication of loss of enti	tlement to small or micro
NOTE: This form must b	pe signed in accordance v	with 37 CFR 1.31 and 1.33	3. See 37 CFR 1.4 for sig	nature requirements	and cer	tifications.	
Authorized Signature				Date			
Typed or printed nam	e			Registration N	No		



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMESIONER FOR PATENTS

P.O. Box 1450 Alexandria, Virginia 22313-1450 www.uspto.gov

DATE MAILED: 08/31/2015

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/535,279	11/06/2014	William Rivard	DUELP010/DL017	1035
28875 75	90 08/31/2015		EXAM	IINER
Zilka-Kotab, PC			GEBRIEL,	SELAM T
1155 N. 1st St. Suite 105			ART UNIT	PAPER NUMBER
SAN JOSE, CA 95	112		2661	

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

- 1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
- 2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
- 3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
- 8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
- 9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

	Application No. 14/535,279	Applicant(s) RIVARD ET	
Notice of Allowability	Examiner SELAM GEBRIEL	Art Unit 2661	AIA (First Inventor to File) Status Yes
The MAILING DATE of this communication appear All claims being allowable, PROSECUTION ON THE MERITS IS (wherewith (or previously mailed), a Notice of Allowance (PTOL-85) of NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RICO of the Office or upon petition by the applicant. See 37 CFR 1.313	OR REMAINS) CLOSED in this apport of the suppropriate communication GHTS. This application is subject to	olication. If not will be mailed i	e address included in due course. THIS
1. A declaration(s)/affidavit(s) under 37 CFR 1.130(b) was/			
2. An election was made by the applicant in response to a restriction requirement and election have been incorporated into this action.	•	ne interview on	; the restriction
 The allowed claim(s) is/are <u>1-20</u>. As a result of the allowed cl Highway program at a participating intellectual property office <u>http://www.uspto.gov/patents/init_events/pph/index.jsp</u> or ser 	e for the corresponding application.	For more inforr	
 4. ☐ Acknowledgment is made of a claim for foreign priority under Certified copies: a) ☐ All b) ☐ Some *c) ☐ None of the: 1. ☐ Certified copies of the priority documents have 2. ☐ Certified copies of the priority documents have 3. ☐ Copies of the certified copies of the priority documents have International Bureau (PCT Rule 17.2(a)). * Certified copies not received: 	been received. been received in Application No		application from the
Applicant has THREE MONTHS FROM THE "MAILING DATE" o noted below. Failure to timely comply will result in ABANDONME THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.		complying with	the requirements
5. CORRECTED DRAWINGS (as "replacement sheets") must	be submitted.		
including changes required by the attached Examiner's Paper No./Mail Date			
Identifying indicia such as the application number (see 37 CFR 1.8 each sheet. Replacement sheet(s) should be labeled as such in the			not the back) of
6. DEPOSIT OF and/or INFORMATION about the deposit of Blattached Examiner's comment regarding REQUIREMENT FOR			he
Attachment(s) 1. ☐ Notice of References Cited (PTO-892) 2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date	5. ☐ Examiner's Amendr 6. ☑ Examiner's Stateme 7. ☐ Other		
/TUAN HO/ Primary Examiner, Art Unit 2661			

Art Unit: 2661

DETAILED ACTION

Allowable Subject Matter

Claims 1 – 20 are allowed

The following is an examiner's statement of reasons for allowance:

Regarding claim 1: In combination with other elements the prior art of record alone or in combination does not disclose:

An apparatus comprising:

A second photodiode within a first cell of a second pixel configured to communicate a second current to the first node based on a second light intensity associated with the second photodiode, wherein the second current is communicated through a second transistor and an interconnect; a third photodiode within a first cell of a third pixel configured to communicate a third current to the first node based on a third light intensity associated with the third photodiode, wherein the third current is communicated through a third transistor and the interconnect; a fourth photodiode within a first cell of a fourth pixel configured to communicate a fourth current to the first node based on a fourth light intensity associated with the fourth photodiode, wherein the fourth current is communicated through a fourth transistor and the interconnect; and a second analog sampling circuit in communication with a second node for storing a second sample, wherein the second photodiode is further configured to communicate the second current to the second node through the second transistor.

Regarding claim 20: In combination with other elements the prior art of record alone or in combination does not disclose:

Art Unit: 2661

A method comprising:

Causing a second photodiode within a first cell of a second pixel to communicate a second current to the first node based on a second light intensity associated with the second photodiode, wherein the second current is communicated through a second transistor and an interconnect; causing a third photodiode within a first cell of a third pixel to communicate a third current to the first node based on a third light intensity associated with the third photodiode, wherein the third current is communicated through a third transistor and the interconnect; causing a fourth photodiode within a first cell of a fourth pixel to communicate a fourth current to the first node based on a fourth light intensity associated with the fourth photodiode, wherein the fourth current is communicated through a fourth transistor and the interconnect; and storing a second sample on a second node in communication with a second analog sampling circuit, wherein the second photodiode is further configured to communicate the second current to the second node through the second transistor.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SELAM GEBRIEL whose telephone number is (571)270-1652. The examiner can normally be reached on 8:00 AM - 5:00 PM. If

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Art Unit: 2661

attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sinh Tran can be reached on (571)272-7564. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/SELAM GEBRIEL/ Examiner, Art Unit 2661

Issue Classification



14535279

Examiner

SELAM GEBRIEL

Applicant(s)/Patent Under Reexamination

RIVARD ET AL.

Art Unit

2661

CPC							
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Symbol	Туре	Set	Ranking	Version				

/SELAM GEBRIEL/ Examiner.Art Unit 2661	08/23/2015	Total Claims Allowed: 20		
(Assistant Examiner)	(Date)			
/TUAN HO/ Primary Examiner.Art Unit 2661	08/24/2015	O.G. Print Claim(s)	O.G. Print Figure	
(Primary Examiner)	(Date)	1	2	

U.S. Patent and Trademark Office Part of Paper No. 20150820

Issue Classification



Application/Control No.	Applicant(s)/Patent Under Reexamination
14535279	RIVARD ET AL.
Examiner	Art Unit
SELAM GEBRIEL	2661

US ORIGINAL CLASSIFICATION						INTERNATIONAL CLASSIFICATION							NC		
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/SELAM GEBRIEL/ Examiner.Art Unit 2661	08/23/2015	Total Claims Allowed:			
(Assistant Examiner)	(Date)	20			
/TUAN HO/ Primary Examiner.Art Unit 2661	08/24/2015	O.G. Print Claim(s)	O.G. Print Figure		
(Primary Examiner)	(Date)	1	2		

U.S. Patent and Trademark Office Part of Paper No. 20150820

Issue Classification



	Application/Control No.	Applicant(s)/Patent Under Reexamination
'	14535279	RIVARD ET AL.
	Examiner	Art Unit
	SELAM GERRIEL	2661

×	☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47														
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/SELAM GEBRIEL/ Examiner.Art Unit 2661	08/23/2015	Total Claims Allowed:			
(Assistant Examiner)	(Date)	20			
/TUAN HO/ Primary Examiner.Art Unit 2661	08/24/2015	O.G. Print Claim(s)	O.G. Print Figure		
(Primary Examiner)	(Date)	1	2		

U.S. Patent and Trademark Office Part of Paper No. 20150820

Search Notes



Application/Control No.	Applicant(s)/Patent Under Reexamination
14535279	RIVARD ET AL.
Examiner	Art Unit
SELAM GEBRIEL	2661

CPC- SEARCHED		
Symbol	Date	Examiner
H04N5/355;H01L27/14641;H04N5/3745	8/23/2015	S.G.

CPC COMBINATION SETS - SEARCHED						
Symbol	Date	Examiner				

US CLASSIFICATION SEARCHED							
Class	Subclass	Date	Examiner				
348	294,302,308,311	1/26/2015	S.G.				
	See East Search History For Updated Search	8/23/2015	S.G.				

SEARCH NOTES		
Search Notes	Date	Examiner
See East Search History For Text and Inventership Search	1/26/2015	S.G.

INTERFERENCE SEARCH						
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner			
	See East Search History For Interference Search	8/23/2015	S.G.			

/SELAM GEBRIEL/ Examiner.Art Unit 2661	08/23/2015

U.S. Patent and Trademark Office Part of Paper No.: 20150820

	Application/Control No.	Applicant(s)/Patent Under Reexamination		
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U.S. Patent and Trademark Office Part of Paper No.: 20150820

Becejet date: 08/11/2015

Doc description: Information Disclosure Statement (IDS) Filed

14535279 - GAJ-1, 2661) Approved for use through 07/31/2012. OMB 0651-0031 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		14535279				
Filing Date		2014-11-06				
First Named Inventor	Willia	m Rivard				
Art Unit		2661				
Examiner Name S. T.		Gebriel				
Attorney Docket Number		DUELP010/DL017				

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Examiner Cite Initial* Patent Number		Kind Code ¹	Issue Date Name of Patentee or Applicant of cited Document		Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear			
	1	6243430		2001-06-05	Mathe			
	2	6498926		2002-12-24	Ciccarelli et al.			
	3	8761245		2014-06-24	Puri et al.			
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	1	20130223530	A1	2013-08-29	Demos			
	2	20130279584	A1	2013-10-24	Demos			
	3	20130301729	A1	2013-11-14	Demos			

IIS PATENTS

Receipt	date	e: 08/11/2015		Applic	ation N	umber		14535279	14	535279 - GAU: 2	2661		
INICOD	N# A T	TION DISCLOSI	IDE	Filing	Date			2014-11-06					
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	1	Notice of Allowance from	ı U.S. Ap	plication	No. 14/5	i34,079, dat	ed Ma	ay 11, 2015					
	2	Notice of Allowance fron	ı U.S. Ap	plication	No. 14/5	i35,274, dat	ed Ma	ay 26, 2015					
		Notice of Allowance from U.S. Application No. 14/534,089, dated June 23, 2015											

Receipt	date	e: 08/11/2015	Application Number		14535279	14535	279 ·	- GAU:	2661
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		TION DISCLOSURE	First Named Inventor	Willia	m Rivard				
		NT BY APPLICANT	Art Unit	I	2661				
(Not for	subm	ssion under 37 CFR 1.99)	Examiner Name	S. T.	Gebriel				
			Attorney Docket Numb	er	DUELP010/DL017				
	4	Notice of Allowance from U.S. Ap	plication No. 14/535,282, da	ited Jur	ne 23, 2015				
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	5	Notice of Allowance from U.S. Ap	pplication No. 14/536,524, dated June 29, 2015						
	6	Nation of Allowanea from LLS. An	nligation No. 14/524 069, de	ابدا امما	v 20. 2045				
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¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document.

⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

Receipt date: 08/11/2015	Application Number		14535279	14535279 -	GAU: 266		
,	Filing Date		2014-11-06				
INFORMATION DISCLOSURE	First Named Inventor	Willia	am Rivard				
STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Art Unit		2661				
(Not lot outsimosion under or or it not)	Examiner Name	S. T. 0	Gebriel				
	Attorney Docket Number DUELP010/DL017			•			

	CERTIFICATION STATEMENT								
Plea	ase see 37 CFR [^]	1.97 and 1.98 to make the appropriate se	election(s):						
	from a foreign	of information contained in the informa patent office in a counterpart foreign a losure statement. See 37 CFR 1.97(e)(1	pplication not more than three						
OR	t .								
X	That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).								
	See attached ce	ertification statement.							
×	The fee set forth	n in 37 CFR 1.17 (p) has been submitted	herewith.						
	A certification st	atement is not submitted herewith.							
	ignature of the ap n of the signature	oplicant or representative is required in a	GNATURE accordance with CFR 1.33, 10.	18. Please see CFR 1.4(d) for the					
Sigr	nature	/JAMIE ROSSI/	Date (YYYY-MM-DD)	2015-08-11					
Nan	ne/Print	Jamie L. Rossi	Registration Number	56875					
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This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Receipt date: 08/11/2015 14535279 - GAU: 2661

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The information provided by you in this form will be subject to the following routine uses:

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- 2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
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- 5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
- 8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
- 9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
	18134	348/294,302,308.ccls. 250/208.1.ccls. 257/291,292.ccls. H01L27/14641.cpc.	US-PGPUB; USPAT; USOCR		ON	2015/08/23 17:08
L2	108	shared near3 Float\$4 near3 region same pixel	US-PGPUB; USPAT; USOCR	OR	ON	2015/08/23 17:09
L3	0	shared near3 Float\$4 near3 region same pixel same (first and second) near2 analog	US-PGPUB; USPAT; USOCR	OR	ON	2015/08/23 17:09
L4	0	shared near3 Float\$4 near3 region same pixel same (first and second) near2 sampling	US-PGPUB; USPAT; USOCR	OR	ON	2015/08/23 17:10
L5	0	shared near3 diffus\$4 near3 region same pixel same (first and second) near2 sampling	US-PGPUB; USPAT; USOCR	OR	ON	2015/08/23 17:10
L6	9	diffus\$4 near3 region same pixel same (first and second) near2 sampling	US-PGPUB; USPAT; USOCR	OR	ON	2015/08/23 17:10
L7	18156	L1 or L2	US-PGPUB; USPAT; USOCR	OR	ON	2015/08/23 17:11
L8	86	L1 and L2	US-PGPUB; USPAT; USOCR	OR	ON	2015/08/23 17:11
S1	10	((William) near2 (Rivard)).INV.	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/25 22:20
S2	25	((Adam) near2 (Feder)).INV.	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/25 22:20
ಽಽಽ	15	((Brian) near2 (Kindle)).INV.	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/25 22:20
S 4	45	S1 or S2 or S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/25 22:21
S5	0	S4 and (first and second) near3 cell	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/25 22:21
S6	2270	(first and second) near3 cell with pixel	US-PGPUB;	A DJ	ON	2015/01/25

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT, IBM_TDB			22:21
S7	369	(first and second) near3 cell with pixel and (first and second) near2 (node or capacitor or storage or sampl\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/25 22:23
S8	8	(first and second) near3 cell with unit pixel and (first and second) near2 (node or capacitor or storage or sampl\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/25 22:24
S9	12	(first and second) near3 divided with unit pixel and (first and second) near2 (node or capacitor or storage or sampl\$3)		ADJ	ON	2015/01/25 22:29
S10	283	(first and second) near3 divided with pixel and (first and second) near2 (node or capacitor or storage or sampl\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/25 22:33
S11	23	(US-20030015645-\$ or US- 20110090385-\$ or US-20130240716-\$ or US-20140219422-\$ or US-20120002089- \$ or US-20110134267-\$ or US- 20060050165-\$ or US-20130335596-\$ or US-20090244301-\$ or US-20080106625- \$ or US-20110242334-\$ or US- 20030142745-\$).did. or (US-8310562-\$ or US-8830338-\$ or US-8144198-\$ or US-8928789-\$ or US-8149310-\$ or US- 7834915-\$ or US-6734905-\$ or US- 7245320-\$ or US-8165416-\$ or US- 8340453-\$ or US-8493476-\$).did.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:35
S12	4614	(first and second and third and fourth) near2 sample	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:36
S13	310	(first and second and third and fourth) near2 sample with (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:39
S14	4	(first and second and third and fourth) near2 sample with (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) same pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:39
S15	6607	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) with (green and blue and red) same pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:41

S16	0	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) with (green and blue and red) same pixel and (348/294-308).clm.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:42
S17	88	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) with (green and blue and red) same pixel and (348/294-308).cds.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:42
S18	8	Pixel near2 divid\$4 with sample and (348/294-308).ccls.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:52
S19	101039	(shar\$4 or common) near2 (FD or stor\$4 or Diffusion)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:53
S20	0	(shar\$4 or common) near2 (FD or stor\$4 or Diffusion) same sample near3 (green and blue and red)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:54
S21	0	(shar\$4 or common) near2 (FD or stor\$4 or Diffusion) same sample near3 (green or blue or red)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:55
S22	0	(shar\$4 or common) near2 (FD or stor\$4 or node or floting diffusion) same sample near3 (green or blue or red)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:57
S23	0	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) same sample near3 (green or blue or red)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:57
S24	183899	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:58
S25	1944	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) and (first and second) near3 sample	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:58
S26	43	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) and (first and second) near3 sample and (divid\$4) near3 pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:59
S27	7	("20100208099" "20120162465" "20120262600" "20120314100" "20130335596" "20140176757" "7760246").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:00
S28	3	("20080012969" "20100177226" "20100013969").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:00
S29	0	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) and (first and second) near3 sample same unit pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:02
S30	226	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) same unit pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:02
S31	16843	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) pixel	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:03
S32	107485	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) with pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:03
S33	16843	S31 and S32	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:04
\$34	88	S30 and S32	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:05
S35	11	("7671912" "20080180555" "8314870" "7705901" "7196365"	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:11

		"20100118167" "20040159861" "20090046189" "20100013969" "7812878" "6956605").PN.				
S36	20	S35 or S27 or S28	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:12
S37	0	(red and blue and green) near2 (sample and storage)	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:15
S38	0	(red and blue and green) near2 (sample and FD or node Floating)	US-PGPUB; USPAT	A DJ	ON	2015/01/2 23:15
S39	9	(red and blue and green) near2 (FD or node Floating)	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:16
S40	6995	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) near3 (red and blue and green)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:16
S41	1197	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) near3 (red and blue and green) and "348".clas.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:17
S42	11	("7671912" "20080180555" "8314870" "7705901" "7196365" "20100118167" "20040159861" "20090046189" "20100013969" "7812878" "6956605").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/29 23:28
S43	179	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) with (red or blue or green)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:34
S44	5	S40 AND S43	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:35
S45	7	("20100208099" "20120162465" "20120262600" "20120314100" "20130335596" "20140176757" "7760246").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/2! 23:47
S46	1139	Pixel binn\$4	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:47
S47	132	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) and S46	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:47
S48	5	"13035785"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/25 23:50
S49	24	("7479998" "20040141075" "20090009623" "20040080652" "20040080652" "20070285526" "20070045681" "20070273785" "20070285526" "20060192873" "20070273785" "20090059048").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/29 23:53
S50	3	("2009/0059048").URPN.	USPAT	A DJ	ON	2015/01/25 23:54
S51	0	("8624997").URPN.	USPAT	A DJ	ON	2015/01/2! 23:55
S52	223	First near2 (cell or photodiode or photoelectric or photoconver\$4) near3 (unit near2 pixel)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 11:35

S53	310	(first and second and third and fourth) near2 sample with (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix)	US-PGPUB; USPAT	ADJ	ON	2015/01/26 11:35
S54	0	S52 and S53	US-PGPUB; USPAT	A DJ	ON	2015/01/26 11:36
S55	134	second near2 (cell or photodiode or photoelectric or photoconver\$4) near3 (unit near2 pixel)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 11:38
S56	9	second near2 (cell or photodiode or photoelectric or photoconver\$4) near3 (unit near2 pixel) same (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 11:38
S57	5	"13035785"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/26 11:41
S58	3	"20040141075"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/26 11:43
S59	82861	(first and second) near2 sample	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/26 11:44
S60	13097	(first and second) near2 sample same (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/26 11:44
S61	8571	(first and second) near2 pixel same (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/26 11:52
S62	81	S60 and S61	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/26 11:53
S63	7984	Divide near2 pixel	US-PGPUB; USPAT; USOCR; FPRS;	ADJ	ON	2015/01/26 12:00

			EPO; JPO; DERWENT; IBM_TDB			
S64	42795	Divid\$4 near2 pixel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/26 12:00
S65	89	add near3 divid\$4 near2 pixel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/26 12:00
S66	78	S64 and S65	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/26 12:00
S67	87	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) same (green or blue or red) near3 pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/26 12:02
S68	15	("20090173974" "20050083544" "7283679" "20080273105" "6107655" "20010026321" "20090066782" "7256381" "5999661" "7515186" "20080062290" "6992714" "7663680" "6614553" "20080136933").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/26 12:17
S69	15	("20090173974" "20050083544" "7283679" "20080273105" "6107655" "20010026321" "20090066782" "7256381" "5999661" "7515186" "20080062290" "6992714" "7663680" "6614553" "20080136933").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/26 12:38
S70	301	H04n5/355.cpc.	US-PGPUB; USPAT	ADJ	ON	2015/01/26 12:42
S71	2	"20110019051"	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/04 11:42
S72	0	"14535279"	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/04 11:44
S73	0	"14/535279"	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/04 11:44
S74	0	14/535279.app.	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/04 11:44
S75	35	(First and second and third and fourth) near3 (pixel or unit pixel) with (common or shar\$4) near3 (FD or stor\$4 or	US-PGPUB; USPAT	ADJ	ON	2015/05/04 11:47

		Diffusion or floatting)				
S76	174	(four) near3 (pixel or unit pixel) near3 (common or shar\$4) near3 (FD or stor\$4 or Diffusion or floatting)	US-PGPUB; USPAT	ADJ	ON	2015/05/04 11:48
S77	128	(four) near3 (pixel or unit pixel) near3 (common or shar\$4) near3 (FD or stor\$4 or Diffusion or floatting) and "348".clas.	US-PGPUB; USPAT	ADJ	ON	2015/05/04 11:48
S78	1013	(First and second and third and fourth) near2 (photodiode or photoelectric or photoconversion or photo sens\$4)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/08/11 12:10
S79	35	(First and second and third and fourth) near2 (photodiode or photoelectric or photoconversion or photo sens\$4) and (first and second) near3 sampl\$4	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/08/11 12:11
S80	69249	Pixel same cell	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/08/11 12:13
S81	438	Pixel same cell and (first and second) near2 analog	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/08/11 12:13
S82	6	Pixel same cell and (first and second) near2 analog sampl\$4	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/08/11 12:17
S83	2	"20110019051"	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/08/11 12:18
S84	1	(First and second and third and fourth) near2 (photodiode or photoelectric or photoconversion or photo sens\$4) near2 unit same cell	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/08/11 12:21
S85	4	(First and second and third and fourth) near2 (photodiode or photoelectric or photoconversion or photo sens\$4 or pixel) near2 unit same cell	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/08/11 12:21
S86	12	(First and second and third and fourth) near2 (photodiode or photoelectric or photoconversion or photo sens\$4) same pixel unit	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/08/11 12:28
S87	20	(First and second and third and fourth) near2 (photodiode or photoelectric or photoconversion or photo sens\$4) same shar\$4 near3 (NODE or float\$4 or diffus\$4 or FD)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/08/11 12:37

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	1 :	Time Stamp
L9	0	((First and second) near2 analog near2 sampl\$4 and (first and second and third and fourth) near2 (photoconversion or photoelectric or photodiode)).clm.	US- PGPUB; USPAT; UPAD	OR	ON	2015/08/23 17:13
L10	1	((First and second) near2 sampl\$4 and (first and second and third and fourth) near2 (photoconversion or photoelectric or photodiode)).clm.	US- PGPUB; USPAT; UPAD	OR	ON	2015/08/23 17:13
L11	63	((First and second) near2 sampl\$4 and	US-	OR	ON	2015/08/23

		(first and second and third and fourth) near2 (pixel)).clm.	PGPUB; USPAT; UPAD			17:13
L12	494484	((First and second) near2 sampl\$4 and (first and second and third and fourth) near2 (pixel) and (first and second)(node or FD or float\$5 or diffus\$4)).clm.	US- PGPUB; USPAT; UPAD	OR	ON	2015/08/23 17:15
L13	1	((First and second) near2 sampl\$4 and (first and second and third and fourth) near2 (pixel) and (first and second)(node or FD or float\$5 or diffus\$4)).clm.	US- PGPUB; USPAT; UPAD	ADJ	ON	2015/08/23 17:15
L14	39	("2006/0256221").URPN.	USPAT	ADJ	ON	2015/08/23 17:16

 $8/\ 23/\ 2015\ 5:17:21\ PM$ C:\ Users\ sgebriel\ Documents\ EAST\ Workspaces\ application_14535279.wsp

Becejpt date: 05/05/2015

Doc description: Information Disclosure Statement (IDS) Filed

14535279 - GAJ-1, 2661) Approved for use through 07/31/2012. OMB 0651-0031 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		14535279				
Filing Date		2014-11-06				
First Named Inventor	Willia	m Rivard				
Art Unit		2661				
Examiner Name	S. T.	Gebriel				
Attorney Docket Numb	er	DUELP010/DL017				

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	1	8976264		2015-03-10	Rivard et al.	
	2	5818977		1998-10-06	Tansley	
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	1	20130114894	A1	2013-05-09	Yadav et al.	
	2	20100194851	A1	2010-08-05	PASUPALETI et al.	
	3	20080192064	A1	2008-08-14	Hong et al.	
	4	20070030357	A1	2007-02-08	Levien et al.	

Receipt date: 05/05/2015 14535279 - GAU: 2661 **Application Number** 14535279 Filing Date 2014-11-06 First Named Inventor William Rivard Art Unit 2661 (Not for submission under 37 CFR 1.99) **Examiner Name** S. T. Gebriel DUELP010/DL017 Attorney Docket Number

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I	T		1		
5	20070025714	A1	2007-02-01	Shiraki	
6	20080030592	A1	2008-02-07	Border et al.	
7	20090153245	A1	2009-06-18	Lee	
8	20100118204	A1	2010-05-13	Proca et al.	
9	20100302407	A1	2010-12-02	Ayers et al.	
10	20110115971	A1	2011-05-19	Furuya et al.	
11	20110280541	A1	2011-11-17	LEE	
12	20120069213	A1	2012-03-22	Jannard et al.	
13	20130107062	A1	2013-05-02	OKAZAKI	
14	20130147979	A1	2013-06-13	McMahon et al.	
15	20130176458	A1	2013-07-11	VAN DALEN et al.	

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Attorney Docket Number

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16	20130271631	A1	2013-10-17	TATSUZAWA et al.	
17	20140098248	A1	2014-04-10	OKAZAKI	
18	20140244858	A1	2014-08-28	OKAZAKI	
19	20140247979	A1	2014-09-04	Roffet et al.	
20	20140300795	A1	2014-10-09	Bilcu et al.	
21	20120033118	A1	2012-02-09	Lee et al.	
22	20110134267	A1	2011-06-09	Ohya	
23	20060050165	A1	2006-03-09	Amano	
24	20030142745	A1	2003-07-31	Osawa	
25	20030015645	A1	2003-01-23	Brickell et al.	
26	20110090385	A1	2011-04-21	Aoyama et al.	

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	27	20110242334	A1	2011-10	-06	Wilburn et	al.					
	28	20120002089	A1	2012-01	-05	Wang et a	ıl.					
	29	20060245014	A1	2006-11	-02	Haneda						
	30	20070242900	A1	2007-10	ı-18	Chen et al	l.					
	31	20080158398	A1	2008-07	'-03	Yaffe et al						
	32	20090295941	A1	2009-12	!-03	Nakajima	et al.					
	33	20110194618	A1	2011-08	:-11	Gish et al.						
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Examiner Initials*	- I I I I I I I I I I I I I I I I I I I							
	1	RIVARD, W. et al., U.S. Application No. 14/568,045, filed December 11, 2014						
	2	Restriction Requirement from U.S. Application No. 14/568,045, dated January 15, 2015						
	3	RIVARD, W. et al., U.S. Application No. 14/534,068, filed November 5, 2014						
	4	Non-Final Office Action from U.S. Application No. 14/534,068, dated February 17, 2015						
	5	RIVARD, W. et al., U.S. Application No. 14/534,079, filed November 5, 2014						
	6	Non-Final Office Action from U.S. Application No. 14/534,079, dated January 29, 2015						
	7	RIVARD, W. et al., U.S. Application No. 14/534,089, filed November 5, 2014						
	8	Non-Final Office Action from U.S. Application No. 14/534,089, dated February 25, 2015						
	9	RIVARD, W. et al., U.S. Application No. 14/535,274, filed November 6, 2014						

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(Not for s	submi	ission under 37 CFR 1.99)	Examiner Name	S. T.	Gebriel				
			Attorney Docket Numb		DUELP010/DL017				
	Non-Final Office Action from U.S. Application No. 14/535,274, dated February 3, 2015								
	11	RIVARD, W. et al., U.S. Application No. 14/535,282, filed November 6, 2014							
	12	Non-Final Office Action from U.S. Application No. 14/535,282, dated January 30, 2015							
	13	Non-Final Office Action from U.S. Application No. 14/536,524, dated March 3, 2015							
	14	RIVARD, W. et al., U.S. Application No. 14/536,524, November 7, 2014							
	15	Notice of Allowance from U.S. Application No. 13/753,252, dated October 22, 2014							
	16	Non-Final Office Action from U.S. Application No.14/568,045, dated March 24, 2015							
	17	RIVARD, W. et al., U.S. Application No. 14/702,549, filed May 1, 2015							
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			EXAMINER SIGNAT	TURE					
Examiner	Signa	ture /Selam Gebriel/			Date Considered 08/23/2015				
					mance with MPEP 609. Draw line through a h next communication to applicant.				
¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.									

Receipt date: 05/05/2015	Application Number		14535279	535279 14535279 - GAU: 266		
INFORMATION BIOCH COURT	Filing Date		2014-11-06			
INFORMATION DISCLOSURE	First Named Inventor	Willian	m Rivard			
STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Art Unit		2661			
(Notice Submission under or of it isso,	Examiner Name	S. T. 0	Gebriel			
	Attorney Docket Number	er	DUELP010/DL017			

CERTIFICATION STATEMENT							
Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):							
That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).							
OR							
That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).							
See attached certification statement.							
The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.							
☒ A certification statement is not submitted herewith.							
SIGNATURE A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.							
Signature /JAMIE ROSSI/ Date (YYYY-I	MM-DD) 2015-05-05						
Name/Print Jamie L. Rossi Registration	lumber 56875						
This collection of information is required by 37 CFR 1.97 and 1.98. The information	on is required to obtain or retain a benefit by the						
public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR							

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Receipt date: 05/05/2015 14535279 - GAU: 2661

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

- 1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.
- 2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
- 3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
- 8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
- 9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Doc code: IDS Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)

Approved for use through 07/31/2012. OMB 0651-0031

Mation Disclosure Statement (IDS) Filed

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

	Application Number		14535279	
	Filing Date		2014-11-06	
INFORMATION DISCLOSURE	First Named Inventor	Willia	m Rivard	
(Not for submission under 37 CFR 1.99)	Art Unit		2661	
(Not for Submission under 67 of K 1.00)	Examiner Name	S. T.	Gebriel	
	Attorney Docket Number		DUELP010/DL017	

				U.S.I	PATENTS	Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6243430		2001-06-05	Mathe	
	2 6498926 2002-12-24		Ciccarelli et al.			
	3	8761245		2014-06-24	Puri et al.	
If you wis	h to add	additional U.S. Paten	t citatio	n information pl	ease click the Add button.	Add
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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20130223530	A1	2013-08-29	Demos	
	2	20130279584	A1	2013-10-24	Demos	
	3	20130301729	A1	2013-11-14	Demos	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		14535279
Filing Date		2014-11-06
First Named Inventor	Willia	m Rivard
Art Unit		2661
Examiner Name	S. T.	Gebriel
Attorney Docket Numb	er	DUELP010/DL017

	4	20140211852	A1	2014-07	'-31	Demos					
	5	20150005637	A1	2015-01	-01	Stegman et al.					
	6	20150092852	A1	2015-04	-02	Demos					
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Examiner Initial*	Cite No	Foreign Document Number ³	_		Kind Code ⁴	Publication Date	Name of Patentee Applicant of cited Document	e or	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T 5	
	1										
If you wisl	h to ac	ld additional Foreign Pa	atent Do	cument	citation	information pl	ease click the Add	buttor	1 Add		
			NON	I-PATEN	NT LITE	RATURE DO	CUMENTS		Remove		
Examiner Initial* Cite Foreign Document Country Code² Code²							T5				
	1	Notice of Allowance from	ı U.S. Ap	plication	No. 14/5	534,079, dated N	<i>l</i> lay 11, 2015				
	2	Notice of Allowance from	ı U.S. Ap	plication	No. 14/5	535,274, dated N	May 26, 2015				
	3	Notice of Allowance from	U.S. Ap	plication	No. 14/5	534,089, dated J	une 23, 2015				

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		14535279
Filing Date		2014-11-06
First Named Inventor	Willia	m Rivard
Art Unit		2661
Examiner Name	S. T.	Gebriel
Attorney Docket Numb	er	DUELP010/DL017

	4	Notice	e of Allowance from U.S. Application No. 14/535,282, dated June 2	23, 2015				
	5	Notice	ee of Allowance from U.S. Application No. 14/536,524, dated June 2	29, 2015				
	6	Notice	ee of Allowance from U.S. Application No. 14/534,068, dated July 29	9, 2015				
If you wisl	n to ac	ld add	ditional non-patent literature document citation information pl	ease click the Add b	utton Add			
			EXAMINER SIGNATURE					
Examiner	Signa	ture		Date Considered				
	*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.							
Standard ST 4 Kind of doo	.3). ³ Fourment	or Japa by the a	FO Patent Documents at www.uspto.gov or MPEP 901.04. ² Enter office anese patent documents, the indication of the year of the reign of the Empe appropriate symbols as indicated on the document under WIPO Standard Son is attached.	eror must precede the ser	ial number of the patent doc	ument.		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		14535279
Filing Date		2014-11-06
First Named Inventor	Willia	m Rivard
Art Unit		2661
Examiner Name	S. T.	Gebriel
Attorney Docket Numb	er	DUELP010/DL017

		CERTIFICATION	STATEMENT	
Plea	ase see 37 CFR 1	.97 and 1.98 to make the appropriate selection	on(s):	
	from a foreign p	of information contained in the information patent office in a counterpart foreign applications osure statement. See 37 CFR 1.97(e)(1).		<u> </u>
OR	ł			
X	foreign patent of after making rea any individual d	information contained in the information diffice in a counterpart foreign application, an isonable inquiry, no item of information contaesignated in 37 CFR 1.56(c) more than thr 37 CFR 1.97(e)(2).	d, to the knowledge of thair	e person signing the certification sclosure statement was known to
	See attached ce	rtification statement.		
X	The fee set forth	in 37 CFR 1.17 (p) has been submitted here	with.	
	A certification sta	atement is not submitted herewith.		
	ignature of the ap n of the signature.	SIGNAT oplicant or representative is required in accord		8. Please see CFR 1.4(d) for the
Sigr	nature	/JAMIE ROSSI/	Date (YYYY-MM-DD)	2015-08-11
Nan	ne/Print	Jamie L. Rossi	Registration Number	56875
		•	,	•

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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- 6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
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- 9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent A	App	olication Fee	Transmit	ttal		
Application Number:	14:	535279				
Filing Date:	06-	-Nov-2014				
Title of Invention:		AGE SENSOR APPAF GH-SPEED CAPTURE			ING LOW-NOISE,	
First Named Inventor/Applicant Name:	William Rivard					
Filer:	Jamie Lynn Rossi/Justin Bocchino					
Attorney Docket Number:	DUELP010/DL017					
Filed as Small Entity						
Filing Fees for Utility under 35 USC 111(a)						
Description		Fee Code	Quantity	Amount	Sub-Total in USD(\$)	
Basic Filing:						
Pages:						
Claims:						
Miscellaneous-Filing:						
Petition:						
Patent-Appeals-and-Interference:						
Post-Allowance-and-Post-Issuance:						
Extension-of-Time:						

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Submission- Information Disclosure Stmt	2806	1	90	90
	Tot	al in USD	(\$)	90

Electronic Ack	knowledgement Receipt
EFS ID:	23182596
Application Number:	14535279
International Application Number:	
Confirmation Number:	1035
Title of Invention:	IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE
First Named Inventor/Applicant Name:	William Rivard
Customer Number:	28875
Filer:	Jamie Lynn Rossi/Justin Bocchino
Filer Authorized By:	Jamie Lynn Rossi
Attorney Docket Number:	DUELP010/DL017
Receipt Date:	11-AUG-2015
Filing Date:	06-NOV-2014
Time Stamp:	20:30:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$90
RAM confirmation Number	6147
Deposit Account	501351
Authorized User	ZILKA, KEVIN J

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	DL014_DUELP007_NOA_05-11-	1027171	no	21
·		15.pdf	bf3214e81d2b589fa8a36e76ace25d04cb0 e983d		
Warnings:					
Information:					
2	Non Patent Literature	DUELP009_DL016_NOA_5-26-1	879933	no	20
		5.pdf	a2efef76f60dbaaec275115a9cfc1d811cb2b 4a0		
Warnings:					
Information:					
3	Non Patent Literature	DUELP008_DL015_NOA_6-23-2	840726	no	20
J	Train atem Electrical	015.pdf	6e57b96d7ddaa7e5f96d9dd295ebb95396 cb903a	110	
Warnings:					
Information:					
4	Non Patent Literature	DUELP011_DL018_NOA_6-23-2	737877	no	17
		015.pdf	06a3d138840d422bba50fdb43826c29e64e c9d4a		
Warnings:					
Information:					
5	Non Patent Literature	DUELP012_DL019_NOA_06-29-	789588	no	17
		2015.pdf	eee64c428e8d334c2c888cbb2ee24220cac 679dd	110	
Warnings:					
Information:					
6	Non Patent Literature	DUELP005_DL011_NOA_07-29-	738332	no	18
		2015.pdf	56de935914f6db7683f824486990b476e30 b615b		
Warnings:					
Information:					
7	Information Disclosure Statement (IDS)	Information_Disclosure_State	612628	no	5
·	Form (SB08)	ment_Fillable_PDF_02.pdf	dc4d1caa7bb76f8f3a7e179bda682a4330d 94141	5	
Warnings:					
Information:					

8	Fee Worksheet (SB06)	fee-info.pdf	30769	no	2					
			4def98df5e4cd5b03d39645e579c6c0a04d 964dc							
Warnings:										
Information:										
		Total Files Size (in bytes):	es): 5657024							

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandria, Virginia 22313-1450 www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO. CONFIRMATION NO.	
14/535,279	11/06/2014	William Rivard	DUELP010/DL017	1035
²⁸⁸⁷⁵ Zilka-Kotab, PO	7590 05/13/201	5	EXAM	INER
1155 N. 1st St. Suite 105	-		GEBRIEL,	SELAM T
SAN JOSE, CA	. 95112		ART UNIT	PAPER NUMBER
			2661	
			NOTIFICATION DATE	DELIVERY MODE
			05/13/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

zk-uspto@zilkakotab.com

Applicant Initiated Interview Comment	14/535,279	RIVARD ET AL.						
Applicant-Initiated Interview Summary	Examiner	Art Unit						
	SELAM GEBRIEL	2661						
All participants (applicant, applicant's representative, PTO personnel):								
(1) <u>SELAM GEBRIEL</u> .	(3)							
(2) <u>Britten D. Sessions</u> .	(4)							
Date of Interview: <u>04 May 2015</u> .	Date of Interview: 04 May 2015.							
Type: 🛛 Telephonic 🔲 Video Conference 🔲 Personal [copy given to: 🔲 applicant [applicant's representative]							
Exhibit shown or demonstration conducted: Yes If Yes, brief description:	☑ No.							
Issues Discussed 101 112 102 103 Others (For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)								
Claim(s) discussed: <u>1 and 20</u> .								
Identification of prior art discussed: Yin et al.[US 2011/0018	<u>9051 A1]</u> .							
Substance of Interview (For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc)								
Applicant representative argued the prior art does not discle proposed amendment seems to overcome the prior art. It's a the examiner will contact applicant representative if necessare response for the outstanding office action.	agreed upon that a further sea	rch will be condu	ucted and					
Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the								
general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised. Attachment								
/SELAM GEBRIEL/	/SINH TRAN/							
Examiner, Art Unit 2661	Supervisory Patent Examiner, Art Ur	nit 2661						

Application No.

Applicant(s)

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews

Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner.
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,
 - (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

William Rivard et al.

Application No.: 14/535,279

Filed: 11/06/2014

For: IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES

OF A PHOTOGRAPHIC SCENE

Confirmation No.: 1035

Examiner: GEBRIEL, SELAM T

Art Unit: 2661

Atty. Docket No.:

DUELP010/DL017

Date: 05/05/2015

AMENDMENT A

Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Examiner:

In response to the Office Action dated 02/05/15, please enter the following amendments believed to place the claims in condition for allowance.

AMENDMENTS TO THE CLAIMS

Amended claims follow:

1. (Currently Amended) An apparatus, comprising:

a first <u>analog sampling circuit within a first cell</u> of a first pixel, the first analog <u>sampling circuit</u> in communication with a first node for storing a first sample; and

a second cell of a second pixel in communication with a second node for storing a second sample; a first photodiode within the first cell of the first pixel configured to communicate a first current to the first node based on a first light intensity associated with the first photodiode, wherein the first current is communicated through a first transistor;

a second photodiode within a first cell of a second pixel configured to communicate a second current to the first node based on a second light intensity associated with the second photodiode, wherein the second current is communicated through a second transistor and an interconnect;

a third photodiode within a first cell of a third pixel configured to communicate a third current to the first node based on a third light intensity associated with the third photodiode, wherein the third current is communicated through a third transistor and the interconnect;

a fourth photodiode within a first cell of a fourth pixel configured to communicate a fourth current to the first node based on a fourth light intensity associated with the fourth photodiode, wherein the fourth current is communicated through a fourth transistor and the interconnect; and

wherein the first analog circuit of the first cell and the second analog circuit of the first cell communicate. a second analog sampling circuit in communication with a second node for storing a second sample, wherein the second photodiode is further configured to communicate the second current to the second node through the second transistor.

- 2. (Currently amended) The apparatus of Claim 1, further comprising: a second cell of the second pixel in communication with the second node for storing the second sample;
- a third cell of [[a]]the third pixel in communication with a third node for storing a third sample; and
- a fourth cell of [[a]]the fourth pixel in communication with a fourth node for storing a fourth sample;

wherein the first cell, the second cell, the third cell, and the fourth cell are in communication.

- 3. (Currently amended) The apparatus of Claim 1, wherein the first cell of the first pixel and [[the]]a second cell of the second pixel are in communication such that the first cell of the first pixel and the second cell of the second pixel concurrently store the first sample to the first node, such that the first sample stored at the first node is based on both of a first light intensity at the first cell and a second light intensity at the second cell.
- 4. (Currently amended) The apparatus of Claim 1, wherein the apparatus is configured such that the first pixel includes a plurality of cells in addition to the first cell that are not communicatively coupled to [[the]]a second cell of the second pixel, and the second pixel includes a plurality of cells in addition to the second cell that are not communicatively coupled to the first cell of the first pixel.
- 5. (Currently amended) The apparatus of Claim 1, wherein the apparatus is configured such that the first cell of the first pixel is communicatively coupled to a first capacitor of the first node, and [[the]]a second cell of the second pixel is communicatively coupled to the first capacitor of the first node.
- 6. (Currently amended) The apparatus of Claim 1, wherein the apparatus is configured such that the first cell of the first pixel and [[the]]a second cell of the second

<u>pixel</u> are in communication utilizing a communicative coupling that includes at least one transistor.

- 7. (Currently amended) The apparatus of Claim 1, wherein the apparatus is configured such that the first cell of the first pixel and [[the]]a second cell of the second pixel are in communication utilizing a communicative coupling that includes [[a]]the first transistor having a drain communicatively coupled to the first node and the second node, a source, and a gate.
- 8. (Original) The apparatus of Claim 1, wherein the apparatus is operable such that the first sample is output in a first analog signal.
- 9. (Currently amended) The apparatus of Claim 1, wherein the apparatus is operable such that [[a]]the first photodiode current of the first cell and a second photodiode current of [[the]]a second cell are combined for storing the first sample at the first node.
- 10. (Original) The apparatus of Claim 9, wherein the apparatus is operable such that the first sample is output in a first analog signal that is amplified utilizing a first gain, resulting in a first amplified analog signal.
- 11. (Original) The apparatus of Claim 10, wherein the apparatus is operable such that the first amplified analog signal is converted to at least a portion of a first digital signal associated with a first digital image.
- 12. (Original) The apparatus of Claim 11, wherein the apparatus is operable such that sliding indicia is displayed, and in response to the sliding indicia being manipulated by a user the first digital signal is blended with a second digital signal associated with a second digital image.

- 13. (Previously Presented) The apparatus of Claim 12, wherein the apparatus is operable such that the second digital signal is generated utilizing, at least in part, a second amplified analog signal, wherein the second amplified analog signal is generated from applying a second gain to a second analog signal, wherein the second analog signal includes an analog value based on the second sample stored at the second node.
- 14. (Original) The apparatus of Claim 13, wherein the apparatus is operable such that the first sample and the second sample are stored during a single exposure of a photographic scene.
- 15. (Original) The apparatus of Claim 12, wherein the apparatus is operable such that the first digital signal includes the first digital image having a first resolution, and the second digital signal includes the second digital image having a second resolution different than the first resolution.
- 16. (Original) The apparatus of Claim 15, wherein the second resolution of the second digital image is greater than the first resolution of the first digital image.
- 17. (Previously Presented) The apparatus of Claim 1, wherein the apparatus is operable such that at least one of the first sample and the second sample is converted to a plurality of digital signals.
- 18. (Original) The apparatus of Claim 17, wherein the apparatus is operable for transferring the digital signals over a network for being combined remotely.
- 19. (Original) The apparatus of Claim 17, wherein the apparatus is operable for transferring the digital signals over a network for being combined remotely, resulting in at least a portion of a high dynamic range (HDR) image.

20. (Currently amended) A method, comprising:

storing a first sample on a first node in communication with a first <u>analog</u> sampling circuit within a first cell of a first pixel;

storing a second sample on a second node in communication with a second cell of a second pixel; and

causing a first photodiode within the first cell of the first pixel to communicate a first current to the first node based on a first light intensity associated with the first photodiode, wherein the first current is communicated through a first transistor;

causing a second photodiode within a first cell of a second pixel to communicate a second current to the first node based on a second light intensity associated with the second photodiode, wherein the second current is communicated through a second transistor and an interconnect;

causing a third photodiode within a first cell of a third pixel to communicate a third current to the first node based on a third light intensity associated with the third photodiode, wherein the third current is communicated through a third transistor and the interconnect;

causing a fourth photodiode within a first cell of a fourth pixel to communicate a fourth current to the first node based on a fourth light intensity associated with the fourth photodiode, wherein the fourth current is communicated through a fourth transistor and the interconnect; and

storing a second sample on a second node in communication with a second analog sampling circuit, wherein the second photodiode is further configured to communicate the second current to the second node through the second transistor.

communicatively coupling the first node and the second node.

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REMARKS

The Examiner has rejected Claims 1-20 under 35 U.S.C. 102(b) as being anticipated by Yin et al. (U.S. Publ. No. 2011/0019051). Applicant respectfully disagrees with such rejections, especially in view of the amendments made hereinabove to each of the independent claims.

Specifically, applicant has amended the independent claims as follows:

a first <u>analog sampling circuit within a first cell of a first pixel, the first analog sampling circuit</u> in communication with a first node for storing a first sample; and

a second cell of a second pixel in communication with a second node for storing a second sample; a first photodiode within the first cell of the first pixel configured to communicate a first current to the first node based on a first light intensity associated with the first photodiode, wherein the first current is communicated through a first transistor;

a second photodiode within a first cell of a second pixel configured to communicate a second current to the first node based on a second light intensity associated with the second photodiode, wherein the second current is communicated through a second transistor and an interconnect;

a third photodiode within a first cell of a third pixel configured to communicate a third current to the first node based on a third light intensity associated with the third photodiode, wherein the third current is communicated through a third transistor and the interconnect;

a fourth photodiode within a first cell of a fourth pixel configured to communicate a fourth current to the first node based on a fourth light intensity associated with the fourth photodiode, wherein the fourth current is communicated through a fourth transistor and the interconnect; and

wherein the first analog circuit of the first cell and the second analog circuit of the first cell communicate.a second analog sampling circuit in

communication with a second node for storing a second sample, wherein the second photodiode is further configured to communicate the second current to the second node through the second transistor (as amended, see this or similar, but not necessarily identical language in the independent claims).

Applicant respectfully notes that the Yin reference, relied upon by the Examiner, discloses that "charge summing configurations may be used in which pixels in alternate (skipping) rows are operated either individually (no charge summing) or in a shared mode (charge summing)" (Paragraph [0034] – emphasis added) and that "each pixel has an associated floating diffusion onto which charge may be transferred using an associated one of transfer gates 24" (Paragraph [0035] – emphasis added).

However, disclosing a general charge summing configurations, where each pixel has an associated floating diffusion, as in Yin, fails to teach applicant's claimed:

- a first analog sampling circuit within a first cell of a first pixel, the first analog sampling circuit in communication with a first node for storing a first sample;
- a <u>first photodiode within the first cell</u> of the first pixel configured to communicate a <u>first current to the first node</u> based on a <u>first light intensity</u> associated with the first photodiode, wherein the first current is <u>communicated</u> through a first transistor;
- a second photodiode within a first cell of a second pixel configured to communicate a second current to the first node based on a second light intensity associated with the second photodiode, wherein the second current is communicated through a second transistor and an interconnect;
- a <u>third photodiode within a first cell</u> of a <u>third pixel</u> configured to communicate a <u>third current to the first node</u> based on a <u>third light intensity</u> associated with the third photodiode, wherein the third current is <u>communicated</u> through a third transistor and the interconnect;

a <u>fourth photodiode within a first cell</u> of a <u>fourth pixel</u> configured to communicate a <u>fourth current to the first node</u> based on a <u>fourth light intensity</u> associated with the fourth photodiode, wherein the fourth current is <u>communicated through a fourth transistor and the interconnect</u>; and

a <u>second analog sampling circuit</u> in communication with a second node for storing a <u>second sample</u>, wherein the second photodiode is further configured to <u>communicate the second current to the second node through the second transistor</u>. (emphasis added).

The Examiner is reminded that a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. Of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Moreover, the identical invention must be shown in as complete detail as contained in the claim. *Richardson v. Suzuki Motor Co.*868 F.2d 1226, 1236, 9USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim.

The foregoing anticipation criterion has simply not been met by the above reference excerpt(s), as noted above. Thus, a notice of allowance or specific prior art showing of each of the foregoing claim elements, in combination with the remaining claimed features, is respectfully requested.

In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 971-2573 or Jamie@zilkakotab.com. The Commissioner is authorized to charge any additional fees or credit any overpayment to Deposit Account No. 50-1351.

Respectfully submitted, Zilka-Kotab, PC.

/JAMIE ROSSI/

1155 N. 1st Street, Suite 105 San Jose, CA 95112-4925 408-971-2573 Jamie L. Rossi Registration No. 56,875

Electronic Patent Application Fee Transmittal						
Application Number:	14535279					
Filing Date:	06-	-Nov-2014				
Title of Invention:	IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE					
First Named Inventor/Applicant Name:	William Rivard					
Filer:	Jamie Lynn Rossi/Justin Bocchino					
Attorney Docket Number:	DU	JELP010/DL017				
Filed as Small Entity						
Filing Fees for Utility under 35 USC 111(a)						
Description		Fee Code	Quantity	Amount	Sub-Total in USD(\$)	
Basic Filing:						
Pages:						
Claims:						
Miscellaneous-Filing:						
Petition:						
Patent-Appeals-and-Interference:						
Post-Allowance-and-Post-Issuance:						
Extension-of-Time:						

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Submission- Information Disclosure Stmt	2806	1	90	90
	Tot	al in USD	(\$)	90

Electronic Acknowledgement Receipt						
EFS ID:	22256940					
Application Number:	14535279					
International Application Number:						
Confirmation Number:	1035					
Title of Invention:	IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE					
First Named Inventor/Applicant Name:	William Rivard					
Customer Number:	28875					
Filer:	Jamie Lynn Rossi/Justin Bocchino					
Filer Authorized By:	Jamie Lynn Rossi					
Attorney Docket Number:	DUELP010/DL017					
Receipt Date:	05-MAY-2015					
Filing Date:	06-NOV-2014					
Time Stamp:	19:45:05					
Application Type:	Utility under 35 USC 111(a)					

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Submitted with Payment	yes
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Payment was successfully received in RAM	\$90
RAM confirmation Number	5424
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Authorized User	ZILKA, KEVIN J

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	DL001A_DUELP003A_Restrictio	209375	no	6
		n_01-15-15.pdf	53d9c7905eb7dc8e56e454a33e63635fb03 bbcc2		
Warnings:					
Information:					
2	Non Patent Literature	DL011_DUELP005_OA1_02-17-	441664	no	14
		15.pdf	c0ac766becc6195ba20f6da3f07dd59991af 4fc5		
Warnings:					
Information:					
3	Non Patent Literature	DL014_DUELP007_OA1_01-29-	691642	no	19
		15.pdf	f02096b9044d6189d9d4bd3b2d3747fee85 a7106		19
Warnings:					
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4 No	Non Patent Literature	DL015_DUELP008_OA1_02-25-	1105250	no	31
		15.pdf	41dd63f13b7e830e7d9d25b909dda29e88 87bb07		
Warnings:					
Information:			<u> </u>		
5	Non Patent Literature	DL016_DUELP009_OA1_02-03-	1020051	no	29
		15.pdf	8ce0e803065807d5ce9e49efaeaeaacd5db 750b5		
Warnings:					
Information:					
6	Non Patent Literature	DL08_DUELP011_OA1_01-30-1	505859	no	16
		5.pdf	1477ff00977a4c6135604783cb1dd247373 759c8		
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7	Non Patent Literature	DL019_DUELP012_OA1_03-03-	740186	no	19
,	Horri dient Encluture	15.pdf	6cd8ddcd81571c7fb216ceecefbd3fedf839 89b9	110	
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8	Non Patent Literature	DL001_DUELP003_NOA_10-22- 14.pdf	b41ccb41221ceb6c189c9c65716cd83fd7d ce43d	no	18
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Information:					
9	Non Patent Literature	DUELP003A_OA1_03-24-15.pdf	887843	no	23
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10	Information Disclosure Statement (IDS) Form (SB08)	Information_Disclosure_State ment_Fillable_PDF.pdf	613637	no	8
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Information:	•				
11	Applicant summary of interview with	DUELP010_DL017_ExaminerInt erviewSummary_05-05-2015.	86250	no	10
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Information:					
12		DUELP010_DL017_AmendOA_	158992	yes	11
		05-05-2015.pdf	5adac67f1dc59a3be6d6e995578897710f90 c85f	,	
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	Document Des	scription	Start	Eı	nd
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	Transmittal L	Letter	1		1
	Amendment/Req. Reconsiderati	on-After Non-Final Reject	2		2
	Claims		3		7
	Applicant Arguments/Remarks	Made in an Amendment	8	1	11
Warnings:					
Information:	•				
13	Fee Worksheet (SB06)	fee-info.pdf	30769	no	2
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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc code: IDS Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)

Approved for use through 07/31/2012. OMB 0651-0031

Mation Disclosure Statement (IDS) Filed

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

	Application Number		14535279	
	Filing Date		2014-11-06	
INFORMATION DISCLOSURE	First Named Inventor	Willia	m Rivard	
STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Art Unit		2661	
(Not for Submission under or of K 1.00)	Examiner Name S. T. C		. Gebriel	
	Attorney Docket Number		DUELP010/DL017	

				U.S.	PATENTS	Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	8976264		2015-03-10	Rivard et al.	
	2	5818977		1998-10-06	Tansley	
If you wis	h to add	additional U.S. Paten	t citatio	n information pl	ease click the Add button.	Add
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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20130114894	A1	2013-05-09	Yadav et al.	
	2	20100194851	A1	2010-08-05	PASUPALETI et al.	
	3	20080192064	A1	2008-08-14	Hong et al.	
	4	20070030357	A1	2007-02-08	Levien et al.	

Application Number		14535279	
Filing Date		2014-11-06	
First Named Inventor	Willia	m Rivard	
Art Unit		2661	
Examiner Name	S. T. Gebriel		
Attorney Docket Numb	er	DUEL P010/DL017	

5	20070025714	A1	2007-02-01	Shiraki	
6	20080030592	A1	2008-02-07	Border et al.	
7	20090153245	A1	2009-06-18	Lee	
8	20100118204	A1	2010-05-13	Proca et al.	
9	20100302407	A1	2010-12-02	Ayers et al.	
10	20110115971	A1	2011-05-19	Furuya et al.	
11	20110280541	A1	2011-11-17	LEE	
12	20120069213	A1	2012-03-22	Jannard et al.	
13	20130107062	A1	2013-05-02	OKAZAKI	
14	20130147979	A1	2013-06-13	McMahon et al.	
15	20130176458	A1	2013-07-11	VAN DALEN et al.	

Application Number		14535279	
Filing Date		2014-11-06	
First Named Inventor	Willia	m Rivard	
Art Unit		2661	
Examiner Name	S. T. Gebriel		
Attorney Docket Numb	er	DUEL P010/DL017	

16	20130271631	A1	2013-10-17	TATSUZAWA et al.	
17	20140098248	A1	2014-04-10	OKAZAKI	
18	20140244858	A1	2014-08-28	OKAZAKI	
19	20140247979	A1	2014-09-04	Roffet et al.	
20	20140300795	A1	2014-10-09	Bilcu et al.	
21	20120033118	A1	2012-02-09	Lee et al.	
22	20110134267	A1	2011-06-09	Ohya	
23	20060050165	A1	2006-03-09	Amano	
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25	20030015645	A1	2003-01-23	Brickell et al.	
26	20110090385	A1	2011-04-21	Aoyama et al.	

Application Number		14535279
Filing Date		2014-11-06
First Named Inventor	William Rivard	
Art Unit		2661
Examiner Name	S. T. Gebriel	
Attorney Docket Numb	er	DUELP010/DL017

	27		20110242334	A1	2011-10	-06	Wilburn et al.				
	28		20120002089	A1	2012-01	-05	Wang et al.				
	29		20060245014	A1	2006-11	-02	Haneda				
	30		20070242900	A1	2007-10	-18	Chen et al.				
	31		20080158398	A1	2008-07	-03	Yaffe et al.				
	32		20090295941	A1	2009-12	-03	Nakajima et al.				
	33		20110194618	A1	2011-08	-11	Gish et al.				
	34		20150098651	A1	2015-04	-09	Rivard et al.				
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Application Number		14535279
Filing Date		2014-11-06
First Named Inventor William		m Rivard
Art Unit		2661
Examiner Name	S. T.	Gebriel
Attorney Docket Number		DUELP010/DL017

		NON-PATENT LITERATURE DOCUMENTS Remove	
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T 5
	1	RIVARD, W. et al., U.S. Application No. 14/568,045, filed December 11, 2014	
	2	Restriction Requirement from U.S. Application No. 14/568,045, dated Janaury 15, 2015	
	3	RIVARD, W. et al., U.S. Application No. 14/534,068, filed November 5, 2014	
	4	Non-Final Office Action from U.S. Application No. 14/534,068, dated February 17, 2015	
	5	RIVARD, W. et al., U.S. Application No. 14/534,079, filed November 5, 2014	
	6	Non-Final Office Action from U.S. Application No. 14/534,079, dated January 29, 2015	
	7	RIVARD, W. et al., U.S. Application No. 14/534,089, filed November 5, 2014	
	8	Non-Final Office Action from U.S. Application No. 14/534,089, dated February 25, 2015	
	9	RIVARD, W. et al., U.S. Application No. 14/535,274, filed November 6, 2014	

Application Number		14535279
Filing Date		2014-11-06
First Named Inventor William		m Rivard
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Examiner Name	S. T.	Gebriel
Attorney Docket Number		DUELP010/DL017

	10	Non-Final Office Action from U.S. Application No. 14/535,274, dated February 3, 2015							
	11	RIVARD, W. et al., U.S. Application No. 14/535,282, filed November 6, 2014							
	12	Non-Final Office Action from U.S. Application No. 14/535,282, dated January 30, 2015							
	13	Non-Final Office Action from U.S. Application No. 14/536,524, dated March 3, 2015							
	14	RIVARD, W. et al., U.S. Application No. 14/536,524, November 7, 2014							
	15	Notice of Allowance from U.S. Application No. 13/753,252, dated October 22, 2014							
	16	6 Non-Final Office Action from U.S. Application No.14/568,045, dated March 24, 2015							
	17 RIVARD, W. et al., U.S. Application No. 14/702,549, filed May 1, 2015								
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¹ See Kind Codes of USPTO Patent Documents at <u>www.USPTO.GOV</u> or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.									

(Not for submission under 37 CFR 1.99)

Application Number		14535279		
Filing Date		2014-11-06		
First Named Inventor	William Rivard			
Art Unit		2661		
Examiner Name	S. T. Gebriel			
Attorney Docket Number		DUELP010/DL017		

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SIGNATURE A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.								
Sigr	nature	/JAMIE ROSSI/	Date (YYYY-MM-DD)	2015-05-05				
Nan	ne/Print	Jamie L. Rossi	Registration Number	56875				

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

William Rivard et al.

Application No.: 14/535,279

Filed: 11/06/2014

For: IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED

CAPTURES OF A PHOTOGRAPHIC

SCENE

Confirmation No.: 1035

Examiner: GEBRIEL, SELAM T

Art Unit: 2661

Atty. Docket No.:

DUELP010/DL017

Date: 05/05/2015

Examiner Interview

Date of interview 05/04/2015

Type of interview Telephonic

Name of participant(s): Britten Sessions, William Rivard, Examiner Gebriel

Exhibit shown? APPENDIX A

Claims discussed Independent claims

Prior art discussed Yin et al (U.S. Publ. No. 20110019051)

<u>Substance of interview</u> Reviewed proposed amendments with Examiner, asked Examiner if they had any suggestions to help proceed towards an allowance.

<u>Agreement reached?</u> The Examiner noted that the proposed amendments should help in moving the claim towards an allowance. The amendments will merit a further search and consideration.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

William Rivard et al.

Application No.: 14/535,279

Filed: 11/06/2014

For: IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING

LOW-NOISE, HIGH-SPEED CAPTURES

OF A PHOTOGRAPHIC SCENE

Confirmation No.: 1035

Examiner: GEBRIEL, SELAM T

Art Unit: 2661

Atty. Docket No.:

DUELP010/DL017

Date: 05/01/2015

Examiner Interview Summary – APPENDIX A

Examiner:

Please see below for proposed amendments to be discussed in our upcoming interview.

PROPOSED AMENDMENTS TO THE CLAIMS

PROPOSED Amended claims follow:

1. (Currently Amended) An apparatus, comprising:

a first <u>analog sampling circuit within a first cell</u> of a first pixel, the first analog <u>sampling circuit</u> in communication with a first node for storing a first sample; and

a second cell of a second pixel in communication with a second node for storing a second sample; a first photodiode within the first cell configured to communicate a first current to the first node based on a first light intensity associated with the first photodiode, wherein the first current is communicated through a first transistor;

a second photodiode within a first cell of a second pixel configured to communicate a second current to the first node based on a second light intensity associated with the second photodiode, wherein the second current is communicated through a second transistor and an interconnect;

a third photodiode within a first cell of a third pixel configured to communicate a third current to the first node based on a third light intensity associated with the third photodiode, wherein the third current is communicated through a third transistor and the interconnect;

a fourth photodiode within a first cell of a fourth pixel configured to communicate a fourth current to the first node based on a fourth light intensity associated with the fourth photodiode, wherein the fourth current is communicated through a fourth transistor and the interconnect; and

wherein the first analog circuit of the first cell and the second analog circuit of the first cell communicate. a second analog sampling circuit in communication with a second node for storing a second sample, wherein the second photodiode is further configured to communicate the second current to the second node through the second transistor.

2. (Currently amended) The apparatus of Claim 1, further comprising: a second cell of the second pixel in communication with the second node for storing the second sample;

a third cell of [[a]]the third pixel in communication with a third node for storing a third sample; and

a fourth cell of [[a]]the fourth pixel in communication with a fourth node for storing a fourth sample;

wherein the first cell, the second cell, the third cell, and the fourth cell are in communication.

- 3. (Currently amended) The apparatus of Claim 1, wherein the first cell and [[the]]a second cell are in communication such that the first cell of the first pixel and the second cell of the second pixel concurrently store the first sample to the first node, such that the first sample stored at the first node is based on both of a first light intensity at the first cell and a second light intensity at the second cell.
- 4. (Currently amended) The apparatus of Claim 1, wherein the apparatus is configured such that the first pixel includes a plurality of cells in addition to the first cell that are not communicatively coupled to [[the]]a second cell of the second pixel, and the second pixel includes a plurality of cells in addition to [[the]]a second cell that are not communicatively coupled to the first cell of the first pixel.
- 5. (Currently amended) The apparatus of Claim 1, wherein the apparatus is configured such that the first cell is communicatively coupled to a first capacitor of the first node, and [[the]]a second cell is communicatively coupled to the first capacitor of the first node.
- 6. (Currently amended) The apparatus of Claim 1, wherein the apparatus is configured such that the first cell and [[the]]a second cell are in communication utilizing a communicative coupling that includes at least one transistor.
- 7. (Currently amended) The apparatus of Claim 1, wherein the apparatus is configured such that the first cell and [[the]]a second cell are in communication utilizing

a communicative coupling that includes a first transistor having a drain communicatively coupled to the first node and the second node, a source, and a gate.

- 8. (Original) The apparatus of Claim 1, wherein the apparatus is operable such that the first sample is output in a first analog signal.
- 9. (Currently amended) The apparatus of Claim 1, wherein the apparatus is operable such that [[a]]the first photodiode current of the first cell and a second photodiode current of [[the]]a second cell are combined for storing the first sample at the first node.
- 10. (Original) The apparatus of Claim 9, wherein the apparatus is operable such that the first sample is output in a first analog signal that is amplified utilizing a first gain, resulting in a first amplified analog signal.
- 11. (Original) The apparatus of Claim 10, wherein the apparatus is operable such that the first amplified analog signal is converted to at least a portion of a first digital signal associated with a first digital image.
- 12. (Original) The apparatus of Claim 11, wherein the apparatus is operable such that sliding indicia is displayed, and in response to the sliding indicia being manipulated by a user the first digital signal is blended with a second digital signal associated with a second digital image.
- 13. (Currently amended) The apparatus of Claim 12, wherein the apparatus is operable such that the second digital signal is generated utilizing, at least in part, a second amplified analog signal, wherein the second amplified analog signal is generated from applying a second gain to a second analog signal, wherein the second analog signal includes an analog value based on [[the]]a second sample stored at the second node.

- 14. (Original) The apparatus of Claim 13, wherein the apparatus is operable such that the first sample and the second sample are stored during a single exposure of a photographic scene.
- 15. (Original) The apparatus of Claim 12, wherein the apparatus is operable such that the first digital signal includes the first digital image having a first resolution, and the second digital signal includes the second digital image having a second resolution different than the first resolution.
- 16. (Original) The apparatus of Claim 15, wherein the second resolution of the second digital image is greater than the first resolution of the first digital image.
- 17. (Currently amended) The apparatus of Claim 1, wherein the apparatus is operable such that at least one of the first sample and [[the]]a second sample is converted to a plurality of digital signals.
- 18. (Original) The apparatus of Claim 17, wherein the apparatus is operable for transferring the digital signals over a network for being combined remotely.
- 19. (Original) The apparatus of Claim 17, wherein the apparatus is operable for transferring the digital signals over a network for being combined remotely, resulting in at least a portion of a high dynamic range (HDR) image.
 - 20. (Currently amended) A method, comprising:

storing a first sample on a first node in communication with a first <u>analog</u> sampling circuit within a first cell of a first pixel;

storing a second sample on a second node in communication with a second cell of a second pixel; and

causing a first photodiode within the first cell to communicate a first current to the first node based on a first light intensity associated with the first photodiode, wherein the first current is communicated through a first transistor;

causing a second photodiode within a first cell of a second pixel to communicate a second current to the first node based on a second light intensity associated with the second photodiode, wherein the second current is communicated through a second transistor and an interconnect;

causing a third photodiode within a first cell of a third pixel to communicate a third current to the first node based on a third light intensity associated with the third photodiode, wherein the third current is communicated through a third transistor and the interconnect;

causing a fourth photodiode within a first cell of a fourth pixel to communicate a fourth current to the first node based on a fourth light intensity associated with the fourth photodiode, wherein the fourth current is communicated through a fourth transistor and the interconnect; and

storing a second sample on a second node in communication with a second analog sampling circuit, wherein the second photodiode is further configured to communicate the second current to the second node through the second transistor.

communicatively coupling the first node and the second node.

PROPOSED REMARKS

The Examiner has rejected Claims 1-20 under 35 U.S.C. 102(b) as being anticipated by Yin et al. (U.S. Publ. No. 2011/0019051). Applicant respectfully disagrees with such rejections, especially in view of the amendments made hereinabove to each of the independent claims.

Specifically, applicant has amended the independent claims as follows:

a first <u>analog sampling circuit within a first cell of a first pixel, the first analog sampling circuit</u> in communication with a first node for storing a first sample; and

a second cell of a second pixel in communication with a second node for storing a second sample; a first photodiode within the first cell configured to communicate a first current to the first node based on a first light intensity associated with the first photodiode, wherein the first current is communicated through a first transistor;

a second photodiode within a first cell of a second pixel configured to communicate a second current to the first node based on a second light intensity associated with the second photodiode, wherein the second current is communicated through a second transistor and an interconnect;

a third photodiode within a first cell of a third pixel configured to communicate a third current to the first node based on a third light intensity associated with the third photodiode, wherein the third current is communicated through a third transistor and the interconnect;

a fourth photodiode within a first cell of a fourth pixel configured to communicate a fourth current to the first node based on a fourth light intensity associated with the fourth photodiode, wherein the fourth current is communicated through a fourth transistor and the interconnect; and

wherein the first analog circuit of the first cell and the second analog circuit of the first cell communicate a second analog sampling circuit in

communication with a second node for storing a second sample, wherein the second photodiode is further configured to communicate the second current to the second node through the second transistor. (as amended, see this or similar, but not necessarily identical language in the independent claims).

Applicant respectfully notes that the Yin reference, relied upon by the Examiner, discloses that "charge summing configurations may be used in which pixels in alternate (skipping) rows are operated either individually (no charge summing) or in a shared mode (charge summing)" (Paragraph [0034] – emphasis added) and that "each pixel has an associated floating diffusion onto which charge may be transferred using an associated one of transfer gates 24" (Paragraph [0035] – emphasis added).

However, disclosing a general charge summing configurations, where each pixel has an associated floating diffusion, as in Yin, fails to teach applicant's claimed:

- a first analog sampling circuit within a first cell of a first pixel, the first analog sampling circuit in communication with a first node for storing a first sample;
- a <u>first photodiode within the first cell</u> configured to communicate a <u>first current to the first node</u> based on a <u>first light intensity</u> associated with the first photodiode, wherein the first current is <u>communicated through a first transistor</u>;
- a second photodiode within a first cell of a second pixel configured to communicate a second current to the first node based on a second light intensity associated with the second photodiode, wherein the second current is communicated through a second transistor and an interconnect;
- a <u>third photodiode</u> within a first <u>cell</u> of a <u>third pixel</u> configured to communicate a <u>third current</u> to the first node based on a <u>third light intensity</u> associated with the third photodiode, wherein the third current is <u>communicated</u> through a third transistor and the interconnect;
- a <u>fourth photodiode within a first cell</u> of a <u>fourth pixel</u> configured to communicate a <u>fourth current to the first node</u> based on a <u>fourth light intensity</u>

associated with the fourth photodiode, wherein the fourth current is communicated through a fourth transistor and the interconnect; and

a <u>second analog sampling circuit</u> in communication with a second node for storing a <u>second sample</u>, wherein the second photodiode is further configured to <u>communicate the second current to the second node through the second transistor</u>. (emphasis added).

AMEN	AMENDMENT TRANSMITTAL LETTER Docket No. DUELP010/DL017									
Application No. Filing Date Examiner Art Unit 14/535,279 November 6, 2014 S. T. Gebriel 2661										
14/535,279 November 6, 2014 S. T. Gebriel 2										
Applicant(s): Willi	Applicant(s): William Rivard et al.									
Invention: IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH- SPEED CAPTURES OF A PHOTOGRAPHIC SCENE										
	TO THE COMMISSIONER FOR PATENTS									
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	Claims Remaining After Amendment	Highest Number Previously Paid	Number Extra Claims Present	Rate						
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Independent Claims	2	- 3 =		х						
Multiple Depend	lent Claims (ch	eck if applicabl	e)							
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	SEARCH FEE (37 CFR 1.16(k), (i), o	or (m))	N/A		N/A		N/A		
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In re Application of:	William Rivard et al.			
Application No.	14/535,279			
Filed:	November 6, 2014			
Title:	IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE			
Attorney Docket No.	DUELP010/DL017	Art Unit:	2661	

The practitioner named below is authorized to conduct interviews and has the authority to bind the principal concerned. (Note: pursuant to 37 CFR 10.57(c), a practitioner cannot authorize other registered practitioners to conduct interviews without consent of the client after full disclosure.) Furthermore, the practitioner is authorized to file correspondence in the above-identified application pursuant to 37 CFR 1.34:

Name	Registration Number
Britten Sessions	68,278

This is not a Power of Attorney to the above-named practitioner. Accordingly, the practitioner named above does not have authority to sign a request to change the correspondence address, a request for an express abandonment, a disclaimer, a power of attorney, or other document requiring the signature of the applicant, assignee of the entire interest or an attorney of record. If appropriate, a separate Power of Attorney to the above-named practitioner should be executed and filed in the United States Patent and Trademark Office.

SIGNATURE of Practitioner of Record				
Signature	/JAMIE ROSSI/	Date April 23, 2015		
Name	Jamie L. Rossi	Registration No., if applicable 56,875		
Telephone	(408) 971-2573			

Electronic Acknowledgement Receipt				
EFS ID:	22152749			
Application Number:	14535279			
International Application Number:				
Confirmation Number:	1035			
Title of Invention:	IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE			
First Named Inventor/Applicant Name:	William Rivard			
Customer Number:	28875			
Filer:	Jamie Lynn Rossi/Justin Bocchino			
Filer Authorized By:	Jamie Lynn Rossi			
Attorney Docket Number:	DUELP010/DL017			
Receipt Date:	23-APR-2015			
Filing Date:	06-NOV-2014			
Time Stamp:	16:52:53			
Application Type:	Utility under 35 USC 111(a)			

Payment information:

Submitted with Payment	no
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File Listing:

1 Power of Attorney Authorization_to_Act_in_a_Re presentative_Capacity.pdf Authorization_to_Act_in_a_Re presentative_Capacity.pdf	Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
	1	Power of Attorney		4282b69508abd26d588b857a9360791f2df	no	1

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/535,279 11/06/2014 Willia		William Rivard	DUELP010/DL017	1035
²⁸⁸⁷⁵ Zilka-Kotab, PC	7590 02/05/201	5	EXAM	INER
1155 N. 1st St. Suite 105	-		GEBRIEL,	SELAM T
SAN JOSE, CA	95112		ART UNIT	PAPER NUMBER
			2661	
			NOTIFICATION DATE	DELIVERY MODE
			02/05/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

zk-uspto@zilkakotab.com

	Application No. 14/535,279	Applicant(s) RIVARD ET	
Office Action Summary	Examiner SELAM GEBRIEL	Art Unit 2661	AIA (First Inventor to File) Status Yes
The MAILING DATE of this communication app Period for Reply	ears on the cover sheet with the c	orresponden	ce address
A SHORTENED STATUTORY PERIOD FOR REPLY THIS COMMUNICATION. - Extensions of time may be available under the provisions of 37 CFR 1.13 after SIX (6) MONTHS from the mailing date of this communication. - If NO period for reply is specified above, the maximum statutory period w - Failure to reply within the set or extended period for reply will, by statute, Any reply received by the Office later than three months after the mailing earned patent term adjustment. See 37 CFR 1.704(b).	ill apply and will expire SIX (6) MONTHS from cause the application to become ABANDONE	nely filed the mailing date o ED (35 U.S.C. § 133	f this communication.
Status			
1) Responsive to communication(s) filed on 11/06	S/2014.		
A declaration(s)/affidavit(s) under 37 CFR 1.1			
	action is non-final.		
3) An election was made by the applicant in response		set forth durin	ng the interview on
the restriction requirement and election	·		·
4) Since this application is in condition for allowan	·		to the merits is
closed in accordance with the practice under E			
Disposition of Claims*			
5) Claim(s) <u>1-20</u> is/are pending in the application.			
5a) Of the above claim(s) is/are withdraw	vn from consideration		
6) Claim(s) is/are allowed.			
7) Claim(s) <u>1-20</u> is/are rejected.			
8) Claim(s) is/are objected to.			
9) Claim(s) are subject to restriction and/or	election requirement.		
* If any claims have been determined <u>allowable,</u> you may be eli		secution High	nway program at a
participating intellectual property office for the corresponding ap	pplication. For more information, plea	ase see	
http://www.uspto.gov/patents/init_events/pph/index.jsp or send	an inquiry to PPHfeedback@uspto.c	<u>gov</u> .	
Application Papers			
10) The specification is objected to by the Examiner			
11) The drawing(s) filed on 10/06/2014 is/are: a)		the Examine	er.
Applicant may not request that any objection to the c			
Replacement drawing sheet(s) including the correcti	= : :		
Priority under 35 U.S.C. § 119			
12) Acknowledgment is made of a claim for foreign	priority under 35 H.S.C. & 119(a)	\-(d) or (f)	
Certified copies:	priority under do o.e.o. g 1 ro(u,	, (a) or (i).	
a) ☐ All b) ☐ Some** c) ☐ None of the:			
1.☐ Certified copies of the priority document	s have been received.		
2. Certified copies of the priority document		tion No.	
3. Copies of the certified copies of the prior			
application from the International Bureau	(PCT Rule 17.2(a)).		
** See the attached detailed Office action for a list of the certifie	d copies not received.		
Attachment(s)			
1) X Notice of References Cited (PTO-892)	3) 🔲 Interview Summary	(PTO-413)	
2) X Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/S	Paper No(s)/Mail Da	ate	
Paper No(s)/Mail Date	4) U Other:		

DETAILED ACTION

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -(a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

Claims 1 – 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Yin et al. [US 2011/0019051 A1]

Regarding claim 1 and 20: Yin discloses an apparatus [Figure 6: Image Sensor 12], comprising:

A first cell [14-1] of a first pixel in communication with a first node [FD1] for storing a first sample [Section 0034 – 0037]; and

A second cell [14-3] of a second pixel in communication with a second node [FD3] for storing a second sample; wherein the first cell and the second cell are in communication [See Figure 6 and Sections 0034 – 0037].

Regarding claim 2: Yin further discloses the apparatus of Claim 1, further comprising: a third cell [14-2] of a third pixel in communication with a third node [FD2] for storing a third sample; and a fourth cell [14-4] of a fourth pixel in communication with a fourth node [FD4] for storing a fourth sample; wherein the first cell, the second cell,

the third cell, and the fourth cell are in communication [See Figure 6 and Sections 0034 – 0037: All pixels within the image sensor are communicating].

Page 3

Regarding claim 3: Yin further discloses the apparatus of Claim 1, wherein the first cell and the second cell are in communication such that the first ceil of the first pixel and the second ceil of the second pixel concurrently store the first sample to the first node, such that the first sample stored at the first node [66-1] is based on both of a first light intensity at the first cell and a second light intensity at the second cell [See Figure 6 and Sections 0034 – 0037: All pixels within the image sensor are communicating].

Regarding claim 4: Yin further discloses the apparatus of Claim 1, wherein the apparatus is configured such that the first pixel includes a plurality of cells in addition to the first cell that are not communicatively coupled to the second cell of the second pixel and the second pixel includes a plurality of cells in addition to the second cell that are not communicatively coupled to the first cell of the first pixel [See Figure 6 and Sections 0034 – 0037:].

Regarding claim 5: Yin further discloses the apparatus of Claim 1, wherein the apparatus is configured such that the first cell is communicatively coupled to a first capacitor of the first node, and the second cell is communicatively coupled to the first capacitor of the first node [Section 0018 – 0020 and Section 0015].

Regarding claim 6: Yin further discloses the apparatus of Cn 1, wherein the apparatus is configured such that the first cell and the second cell are in communication utilizing a communicative coupling that includes at least one transistor [See Figure 5 and 6 and Section 0018 - 0025]

Regarding claim 7: Yin further discloses the apparatus of Claim 1, wherein the apparatus is configured such that the first cell and the second cell are in communication utilizing a communicative coupling that includes a first transistor having a drain communicatively coupled to the first node and the second node, a source, and a gate [Section 0018 - 0025].

Regarding claim 8: Yin further discloses the apparatus of Claim 1, wherein the apparatus is operable such that the first sample is output in a first analog signal [Section 0018 - 0025].

Regarding claim 9: Yin further discloses the apparatus of Claim I, wherein the apparatus is operable such that a first photodiode current of the first call and a second photodiode current of the second cell are combined for storing the first sample at the first node [Section 0018 - 0025].

Regarding claim 10: Yin further discloses the apparatus of Claim 9, wherein the apparatus is operable such that the first sample is output in a first analog signal that is amplified utilizing a first gain, resulting in a first amplified analog signal [Section 0018 - 0025]..

Regarding claim 11: Yin further discloses the apparatus of Claim 10, wherein the apparatus is operable such that the first amplified analog signal is converted to at least a portion of a first digital signal associated with a first digital image [Section 0018 - 0025]..

Regarding claim 12: Yin further discloses the apparatus of Claim 11, wherein the apparatus is operable such that sliding indicia is displayed, and in response to the

sliding indicia being manipulated by a user the first digital signal is blended with a second digital signal associated with a second digital image [Section 0018 - 0025].

Regarding claim 13: Yin further discloses the apparatus of Claim 12, wherein the apparatus is operable such that the second digital signal is generated utilizing, at least in part, a second amplified analog signal, wherein the second amplified analog signal is generated from applying a second gain to a second analog signal, wherein the second analog signal includes an analog value based on the second sample stored at the second node [Section 0018 - 0025].

Regarding claim 14: Yin further discloses the apparatus of Claim 13, wherein the apparatus is operable such that the first sample and the second sample are stored during a single exposure of a photographic scene [Section 0018 - 0025].

Regarding claim 15: Yin further discloses the apparatus of Claim 12, wherein the apparatus is operable such that the first digital signal includes the first digital image having a first resolution, and the second digital signal includes the second digital image having a second resolution different than the first resolution [Section 0018 - 0025].

Regarding claim 16: Yin further discloses the apparatus of Claim 15, wherein the second resolution of the second digital image is greater than the first resolution of tire first digital image [Section 0018 - 0025].

Regarding claim 17: Yin further discloses the apparatus of Claim 1, wherein the apparatus is operable such that at least one of the first sample and the second sample is converted to a plurality- of digital signals [Section 0018 - 0025].

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Art Unit: 2661

Regarding claim 18: Yin further discloses the apparatus of Claim 17, wherein the apparatus is operable for transferring the digital signals over a network being combined remotely [Sections 0016 and 0018 - 0025].

Page 6

Regarding claim 19: Yin further discloses the apparatus of Claim 17, wherein the apparatus is operable for transferring the digital signals over a network for being combined remotely, resulting in at least a portion of a high dynamic range (HDR) image [Sections 0016 and 0018 - 0025].

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SELAM GEBRIEL whose telephone number is (571)270-1652. The examiner can normally be reached on 8:00 AM - 5:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sinh Tran can be reached on (571)272-7564. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO

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Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/DANIEL M PASIEWICZ/ Primary Examiner, Art Unit 2661 /SELAM GEBRIEL/ Examiner, Art Unit 2661

Notice of References Cited	Application/Control No. 14/535,279	Applicant(s)/Patent Under Reexamination RIVARD ET AL.	
Notice of Hererences Office	Examiner	Art Unit	
	SELAM GEBRIEL	2661	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	Α	US-2009/0066782	03-2009	Choi et al.	348/25
*	В	US-7,256,381	08-2007	Asaba, Tetsuo	250/208.1
*	С	US-2011/0019051	01-2011	Yin et al.	348/311
	D	US-			
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FOREIGN PATENT DOCUMENTS

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NON-PATENT DOCUMENTS

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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).) Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Becejpt date: 12/08/2014

Doc description: Information Disclosure Statement (IDS) Filed

14535279 - GALL, 26610)

Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14535279	
	Filing Date		2014-11-06	
	First Named Inventor William		illiam Rivard	
	Art Unit		2827	
	Examiner Name	Unassigned		
	Attorney Docket Number		DUELP010/DL017	

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		Attorney Docket Numb	ber DU	JELP010/DL017	,			
1	U.S. Application No. 14/534,068,	filed November 5, 2014						
2	U.S. Application No. 14/534,079,	filed November 5, 2014						
3	U.S. Application No. 14/534,089,	filed November 5, 2014						
4	U.S. Application No. 14/535,274,	filed November 6, 2014						
5	U.S. Application No. 14/535,282,	filed November 6, 2014						
6	U.S. Application No. 14/536,524,	filed November 7, 2014						
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Receipt date: 12/08/2014	Application Number		14535279	14535279 - GAU: 2661	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Filing Date		2014-11-06		
	First Named Inventor	Willian	am Rivard		
	Art Unit		2827		
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	Attorney Docket Number		DUELP010/DL017		

		CERTIFICATION	STATEMENT						
Plea	ase see 37 CFR 1	.97 and 1.98 to make the appropriate selection	on(s):						
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Nan	ne/Print	Jamie L. Rossi	Registration Number	56,875					
		mation is required by 37 CFR 1.97 and 1.98	•	_					

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Search Notes



Application/Control No	Э.
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14535279

Applicant(s)/Patent Under Reexamination

RIVARD ET AL.

Examiner

SELAM GEBRIEL

Art Unit

2661

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Symbol	Date	Examiner		

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348	294,302,308,311	1/26/2015	S.G.

SEARCH NOTES		
Search Notes	Date	Examiner
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/SELAM GEBRIEL/ Examiner.Art Unit 2661	01/26/2015

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BIB DATA SHEET

CONFIRMATION NO. 1035

SERIAL NUM	BER	FILING or DATE			CLASS	GR	DUP ART	UNIT	ATTORNEY DOCKET	
14/535,27	'9	11/06/2			348		2661		DUELP010/DL017	
		RULE								
APPLICANTS Duelight LLC, Sunnyvale, CA, Assignee (with 37 CFR 1.172 Interest);										
INVENTORS William Rivard, Menlo Park, CA; Adam Feder, Mountain View, CA; Brian Kindle, Sunnyvale, CA;										
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	223	First near2 (cell or photodiode or photoelectric or photoconver\$4) near3 (unit near2 pixel)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 11:35
L2	310	(first and second and third and fourth) near2 sample with (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix)	US-PGPUB; USP A T		ON	2015/01/26 11:35
L3	0	L1 and L2	US-PGPUB; USPAT	A DJ	ON	2015/01/26 11:36
L4	134	second near2 (cell or photodiode or photoelectric or photoconver\$4) near3 (unit near2 pixel)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 11:38
L5	9	second near2 (cell or photodiode or photoelectric or photoconver\$4) near3 (unit near2 pixel) same (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/26 11:38
L10	5	"13035785"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/26 11:41
L11	3	"20040141075"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/26 11:43
L12	82861	(first and second) near2 sample	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/26 11:44
L13	13097	(first and second) near2 sample same (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/26 11:44
L14	8571	(first and second) near2 pixel same (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;		ON	2015/01/26 11:52

			DERWENT; IBM_TDB			
L15	81	L13 and L14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/26 11:53
L16	7984	Divide near2 pixel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/26 12:00
L17	42795	Divid\$4 near2 pixel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/26 12:00
L18	89	add near3 divid\$4 near2 pixel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/26 12:00
L19	78	L17 and L18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/26 12:00
L20	87	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) same (green or blue or red) near3 pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/26 12:02
L21	15	("20090173974" "20050083544" "7283679" "20080273105" "6107655" "20010026321" "20090066782" "7256381" "5999661" "7515186" "20080062290" "6992714" "7663680" "6614553" "20080136933").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/26 12:17
L22	15	("20090173974" "20050083544" "7283679" "20080273105" "6107655" "20010026321" "20090066782" "7256381" "5999661" "7515186" "20080062290" "6992714" "7663680" "6614553" "20080136933").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/26 12:38
L23	301	H04n5/355.cpc.	US-PGPUB; USPAT	A DJ	ON	2015/01/26 12:42
S1	10	((William) near2 (Rivard)).INV.	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/25 22:20
\$2	25	((Adam) near2 (Feder)).INV.	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/25 22:20

S3	15	((Brian) near2 (Kindle)).INV.	US-PGPUB; USPAT; USOCR	A DJ	ON	2015/01/25 22:20
S4	45	S1 or S2 or S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/25 22:21
S5	0	S4 and (first and second) near3 cell	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/25 22:21
S6	2270	(first and second) near3 cell with pixel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/25 22:21
S7	369	(first and second) near3 cell with pixel and (first and second) near2 (node or capacitor or storage or sampl\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/25 22:23
S8	8	(first and second) near3 cell with unit pixel and (first and second) near2 (node or capacitor or storage or sampl\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/25 22:24
S9	12	(first and second) near3 divided with unit pixel and (first and second) near2 (node or capacitor or storage or sampl\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/25 22:29
S10	283	(first and second) near3 divided with pixel and (first and second) near2 (node or capacitor or storage or sampl\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/25 22:33
S11	23	(US-20030015645-\$ or US- 20110090385-\$ or US-20130240716-\$ or US-20140219422-\$ or US- 20120002089-\$ or US-20110134267-\$ or US-20060050165-\$ or US- 20130335596-\$ or US-20090244301-\$ or US-20080106625-\$ or US- 20110242334-\$ or US-20030142745- \$).did. or (US-8310562-\$ or US-	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:35

		8830338-\$ or US-8144198-\$ or US- 8928789-\$ or US-8149310-\$ or US- 7834915-\$ or US-6734905-\$ or US- 7245320-\$ or US-8165416-\$ or US- 8340453-\$ or US-8493476-\$).did.				
S12	4614	(first and second and third and fourth) near2 sample	US-PGPUB; USPAT	A DJ	ON	2015/01/25 22:36
S13	310	(first and second and third and fourth) near2 sample with (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:39
S14	4	(first and second and third and fourth) near2 sample with (combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) same pixel	US-PGPUB; USPAT	A DJ	ON	2015/01/25 22:39
S15	6607	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) with (green and blue and red) same pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:41
S16	0	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) with (green and blue and red) same pixel and (348/294-308).clm.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:42
S17	88	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) with (green and blue and red) same pixel and (348/294-308).ccls.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:42
S18	8	Pixel near2 divid\$4 with sample and (348/294-308).ccls.	US-PGPUB; USPAT	A DJ	ON	2015/01/25 22:52
S19	101039	(himmenn)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:53
S20	0	(shar\$4 or common) near2 (FD or stor\$4 or Diffusion) same sample near3 (green and blue and red)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:54
S21	0	(shar\$4 or common) near2 (FD or stor\$4 or Diffusion) same sample near3 (green or blue or red)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:55
S22	0	(shar\$4 or common) near2 (FD or stor\$4 or node or floting diffusion) same sample near3 (green or blue or red)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:57
S23	0	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) same sample near3 (green or blue or red)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:57
S24	183899	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion)	US-PGPUB; USPAT	A DJ	ON	2015/01/25 22:58
S25	1944	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) and (first and second) near3 sample	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:58
S26	43	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) and (first and second) near3 sample and (divid\$4) near3 pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/25 22:59
S27	7	("20100208099" "20120162465" "20120262600" "20120314100" "20130335596" "20140176757" "7760246").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:00
S28	3	("20080012969" "20100177226" "20100013969").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:00
1	i.	: }	1	1	1	1 1

S29	0	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) and (first and second) near3 sample same unit pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:02
S30	226	<u> </u>	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:02
S31	16843	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:03
S32	107485	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) with pixel	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:03
S33	16843	S31 and S32	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:04
S34	88	S30 and S32	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:05
S35	11	("7671912" "20080180555" "8314870" "7705901" "7196365" "20100118167" "20040159861" "20090046189" "20100013969" "7812878" "6956605").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:11
S36	20	S35 or S27 or S28	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:12
\$37	0	(red and blue and green) near2 (sample and storage)	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:15
S38	0	(red and blue and green) near2 (sample and FD or node Floating)	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:15
S39	9	(red and blue and green) near2 (FD or node Floating)	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:16
S40	6995	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) near3 (red and blue and green)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:16
S41	1197	(combin\$4 or composit\$4 or blend\$4 or add or added or adding or mix) near3 (red and blue and green) and "348".clas.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:17
S42	11	("7671912" "20080180555" "8314870" "7705901" "7196365" "20100118167" "20040159861" "20090046189" "20100013969" "7812878" "6956605").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:28
S43	179	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) with (red or blue or green)	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:34
S44	5	S40 AND S43	US-PGPUB; USPAT	A DJ	ON	2015/01/25 23:35
S45	7	("20100208099" "20120162465" "20120262600" "20120314100" "20130335596" "20140176757" "7760246").PN.	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:47
S46	1139	Pixel binn\$4	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:47
S47	132	(shar\$4 or common) near2 (FD or stor\$4 or node or floating diffusion) and S46	US-PGPUB; USPAT	ADJ	ON	2015/01/25 23:47
S48	5	"13035785"	US-PGPUB; USPAT; USOCR;	ADJ	ON	2015/01/25 23:50

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S49	24	("7479998" "20040141075" "20090009623" "20040080652" "20040080652" "20070285526" "20070045681" "20070273785" "20070285526" "20060192873" "20070273785" "20090059048").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	11 -	2015/01/25 23:53
S50	3	("2009/0059048").URPN.	USPAT	A DJ	ON	2015/01/25 23:54
S51	0	("8624997").URPN.	USPAT	A DJ	ON	2015/01/25 23:55

EAST Search History (Interference)

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1/26/2015 12:53:43 PM

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Becejpt date: 11/06/2014

Doc description: Information Disclosure Statement (IDS) Filed

14535279 - GALL, 26610)

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	Application Number			
INCORMATION DIGGL COURT	Filing Date			
INFORMATION DISCLOSURE	First Named Inventor William		m Rivard	
STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Art Unit			
(Not for Submission under or of it 1.00)	Examiner Name			
	Attorney Docket Numb	er	DUELP010/DL017	

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7760246		2010-07-20	Dalton et al.	
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	1	20100208099	A1	2010-08-19	Nomura Kenichiroh	
	2	20120262600	A1	2012-10-18	Velarde Ruben M. et al.	
	3	20130335596	A1	2013-12-19	Demandolx Denis et al.	
	4	20140176757	A1	2014-06-26	Rivard William Guie et al.	
	5	20120162465	A1	2012-06-28	Culbert Michael F. et al.	

Receint	date	s - 1	1/06/2014		Applic	ation N	umber		1/1	535279 - GAU: 2	661		
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					Alloin	ey Doc	ket Number		DUELP010/DL017				
	6		20120314100	A1	2012-12-13 Frank Michael								
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	1	Non	-Final Office Action t	rom U.S.	Applicati	ion No. ′	13/573,252, d	ated J	uly 10, 2014				
	2	Noti	ce of Allowance fron	n U.S. Ap	plication	No. 13/5	573,252, date	d Octo	ber 22, 2014				
	3 FEDER et al., U.S. Application No. 13/999,678, filed March 14, 214												
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Receipt date: 11/06/2014	Application Number		14535279 - GAU: 2661		
	Filing Date				
INFORMATION DISCLOSURE	First Named Inventor	Willia	am Rivard		
STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Art Unit				
(Not for submission under 37 OFIX 1.33)	Examiner Name				
	Attorney Docket Numb	er	DUELP010/DL017		

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Receipt date: 11/06/2014	Application Number		14535279 - GAU: 2661		
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Filing Date				
	First Named Inventor	Willia	m Rivard		
	Art Unit	•			
	Examiner Name				
	Attorney Docket Numb	er	DUELP010/DL017		
	CERTIFICATION STA	remei	NT		
Please see 37 CFR 1.97 and 1.98 to make the	appropriate selection(s):				
That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).					

OR

That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

X A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/JAMIE ROSSI/	Date (YYYY-MM-DD)	2014-11-06
Name/Print	Jamie L. Rossi	Registration Number	56,875

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Receipt date: 11/06/2014 14535279 - GAU: 2661

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	Application/Control No.	Applicant(s)/Patent Under Reexamination
Index of Claims	14535279	RIVARD ET AL.
	Examiner	Art Unit
	SELAM GEBRIEL	2661

√ F	Rejected		-	Cancelled		N	Non-E	lected		Α	Apı	peal
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☐ Claims renumbered in the same order as presented by applicant ☐ CPA							□ СРА] T.C). 🗆	R.1.47	
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	5	✓			•							
	6	✓										

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U.S. Patent and Trademark Office Part of Paper No. : 20150124

Doc code: IDS Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)

Approved for use through 07/31/2012. OMB 0651-0031

Mation Disclosure Statement (IDS) Filed

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

	Application Number		14535279	
INFORMATION PIONI COURT	Filing Date		2014-11-06	
INFORMATION DISCLOSURE	First Named Inventor William		liam Rivard	
STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Art Unit		2827	
(Notice submission under or or it not)	Examiner Name	Unass	signed	
	Attorney Docket Number		DUELP010/DL017	

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue D	ate	of cited Document		Relev	s,Columns,Lines where vant Passages or Releves es Appear	
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Examiner Initials*	Examiner Cite Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item									

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		14535279
Filing Date		2014-11-06
First Named Inventor	Willia	m Rivard
Art Unit		2827
Examiner Name	Unass	signed
Attorney Docket Numb	er	DUELP010/DL017

	1 U.S. Application No. 14/534,068, filed November 5, 2014					
	2	U.S. <i>i</i>	Application No. 14/534,079, filed November 5, 2014]		
	3	U.S. <i>i</i>	Application No. 14/534,089, filed November 5, 2014]		
	4	U.S. A	Application No. 14/535,274, filed November 6, 2014			
	5	U.S. A	Application No. 14/535,282, filed November 6, 2014			
	6	U.S. <i>i</i>	Application No. 14/536,524, filed November 7, 2014]		
If you wish to add additional non-patent literature document citation information please click the Add button Add						
EXAMINER SIGNATURE						
Examiner Signature		ture	Date Considered			
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.						
¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.						

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		14535279
Filing Date		2014-11-06
First Named Inventor	Willia	m Rivard
Art Unit		2827
Examiner Name	Unass	signed
Attorney Docket Number		DUELP010/DL017

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):							
	That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).						
OR							
	foreign patent of after making rea any individual de	information contained in the information diffice in a counterpart foreign application, an sonable inquiry, no item of information contaesignated in 37 CFR 1.56(c) more than thr 37 CFR 1.97(e)(2).	d, to the knowledge of th ained in the information dis	e person signing the certification sclosure statement was known to			
	See attached ce	rtification statement.					
	The fee set forth	in 37 CFR 1.17 (p) has been submitted here	with.				
×	A certification sta	atement is not submitted herewith.					
SIGNATURE							
A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.							
Sigr	nature	/JAMIE ROSSI/	Date (YYYY-MM-DD)	2014-12-08			
Name/Print		Jamie L. Rossi	Registration Number	56,875			
pub 1.14	lic which is to file it. This collection it	rmation is required by 37 CFR 1.97 and 1.98 (and by the USPTO to process) an applicatio is estimated to take 1 hour to complete, inclu e USPTO. Time will vary depending upon the	n. Confidentiality is gover ding gathering, preparing	ned by 35 U.S.C. 122 and 37 CFR and submitting the completed			

require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria**,

CERTIFICATION STATEMENT

VA 22313-1450.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

- 1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.
- 2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
- 3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
- 8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
- 9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt				
EFS ID:	20899324			
Application Number:	14535279			
International Application Number:				
Confirmation Number:	1035			
Title of Invention:	IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE			
First Named Inventor/Applicant Name:	William Rivard			
Customer Number:	28875			
Filer:	Jamie Lynn Rossi/Justin Bocchino			
Filer Authorized By:	Jamie Lynn Rossi			
Attorney Docket Number:	DUELP010/DL017			
Receipt Date:	08-DEC-2014			
Filing Date:	06-NOV-2014			
Time Stamp:	18:46:42			
Application Type:	Utility under 35 USC 111(a)			

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		DUELP010_PreAmend_12-08-2 014.pdf	83925 207598638f1d57a7049b805a10c15720554	yes	5

	Multipart Description/PDF files in .zip description			
	Document Description	Start	End	
	Preliminary Amendment	1	1	
	Specification	2	4	
	Applicant Arguments/Remarks Made in an Amendment	5	5	
Warnings:		I	<u> </u>	
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2 Information Disclosure Statement (IDS) Form (SB08)

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4.pdf	6cf7a14ec24946af60730ef358b4a9a1efd32		

Warnings:

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A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.

Total Files Size (in bytes):

696034

4

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Rivard et al.

Application No.: 14/535,279

Filed: 11/06/2014

For: IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC

SCENE

Confirmation No.: 1035

Examiner: Unassigned

Art Unit: 2827

Atty. Docket No.: DULEP010/DL017

Date: 12/08/2014

PRELIMINARY AMENDMENT A

Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450

Examiner:

Prior to substantive examination, please enter the following amendments in the above application.

AMENDMENTS TO THE SPECIFICATION

Please amend paragraph [0001] of the application as follows:

Please amend paragraph [00118] of the application as follows:

[00118] When the sample signal 618(0) and the sample signal 618(1) are activated sequentially, the photodiode current I_PD of the photodiode 602 may be sampled by the analog sampling circuits 603 sequentially, such that the first exposure time and the second exposure time do not overlap. Sequential sampling of the photodiode current I_PD of the photodiode 602 using two or more analog sampling circuits is explained in greater depth within U.S. Patent Application No. (DUELP009/DL016)14/535,274, filed xx/xx/xxxx11/06/2014, entitled "IMAGE SENSOR APPARATUS AND METHOD FOR SIMULTANEOUSLY CAPTURING FLASH AND AMBIENT ILLUMINATED IMAGES," the contents of which are incorporated herein as though set forth in full. Further disclosure regarding sequential sampling of the photodiode 602 using two or

more analog sampling circuits may also be found in U.S. Patent Application No. 13/999,678, entitled "Systems and methods for a digital image sensor," which is also incorporated herein as though set forth in full.

Please amend paragraph [00125] of the application as follows:

[00125] Thus, in addition to the 2x photodiode current serving to reduce noise in any final digital image, four different digital images may be generated for the single exposure, each with a different effective exposure and light sensitivity. These four digital images may comprise, and be processed as, an image stack, as described in U.S. Patent Application No Application No. (DUELP009/DL016)14/535,274, filed **x*/*x******11/06/2014, entitled "IMAGE SENSOR APPARATUS AND METHOD FOR SIMULTANEOUSLY CAPTURING FLASH AND AMBIENT ILLUMINATED IMAGES," the contents of which are incorporated herein as though set forth in full. In other embodiments, the four analog sampling circuits 603 may be activated and deactivated together for sampling the 2x photodiode current, such that each of the analog sampling circuits 603 store a substantially identical analog value. In yet other embodiments, the four analog sampling circuits 603 may be activated and deactivated in a sequence for sampling the 2x photodiode current, such that no two analog sampling circuits 603 are actively sampling at any given moment.

Please amend paragraph [00163] of the application as follows:

[00163] Of course, in other embodiments, the analog-to-digital unit 922 may apply a plurality of gains to each instance of analog pixel data, to thereby generate an image stack based on each analog storage plane 802 and 842. Image stack generation is discussed more fully within Application No. 14/534,089, filed 11/05/2014, entitled "IMAGE SENSOR APPARATUS AND METHOD FOR SIMULTANEOUSLY CAPTURING MULTIPLE IMAGES"; Application No. (DUELP009/DL016)14/535,274, filed **x/xx/xxxx*11/06/2014*, entitled "IMAGE SENSOR APPARATUS AND METHOD FOR SIMULTANEOUSLY CAPTURING FLASH AND AMBIENT ILLUMINATED

IMAGES," which are each incorporated as though set forth herein in full. Each image stack may be manipulated as set forth in those applications, or as set forth below.

REMARKS

No new matter has been added. In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 971-2573. The Commissioner is authorized to charge any additional fees or credit any overpayment to Deposit Account No. 50-1351.

Respectfully submitted, Zilka-Kotab, PC

/JAMIE ROSSI/

Jamie L. Rossi Registration No. 56,875

1155 N. 1st St., Suite 105 San Jose, CA 95112 408-971-2573

UNITED STATES DEPARTMENT OF COMMERCE United States Patent and Trademark Office Address: COMMISSIONER FOR PATENTS P.O. Box 1450 Alexandria, Virginia 22313-1450 www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/535,279	11/06/2014	William Rivard	DUELP010/DL017	1035
²⁸⁸⁷⁵ Zilka-Kotab, PC	7590 12/04/201	4	EXAM	INER
1155 N. 1st St. Suite 105	-			
SAN JOSE, CA	95112		ART UNIT	PAPER NUMBER
			2827	
			NOTIFICATION DATE	DELIVERY MODE
			12/04/2014	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

zk-uspto@zilkakotab.com



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> Doc Code: TRACK1.GRANT

	Prior	Granting Request for itized Examination ck I or After RCE)	Application No.: 14/535,279				
1.	THE REQU	JEST FILED <u>11/6/14</u>	IS GRANTE	<u>≡D</u> .			
	The above-identified application has met the requirements for prioritized examination A.						
2.	2. The above-identified application will undergo prioritized examination. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:						
	A.	filing a petition for extension of	f time to extend	d the time period for filing a reply;			
	B.	filing an amendment to amend	the application	n to contain more than four independent			
		claims, more than thirty total c	<u>:laims</u> , or a mu	ltiple dependent claim;			
	C.	filling a request for continued examination;					
	D.	filing a notice of appeal;					
	E.	E. filing a request for suspension of action;					
	F.	mailing of a notice of allowance;					
	G.	mailing of a final Office action;					
	H.	completion of examination as de	fined in 37 CFF	R 41.102; or			
	I. abandonment of the application.						
	Telephone inquiries with regard to this decision should be directed to Terri Johnson at 571-272-2991						
	/Terri Johns	son/		Paralegal Specialist			
	[Signature		_	(Title)			

Office of Petitions: Routing Sheet



Application No. 14/535,279

This application is being forwarded to your office for further processing. A decision has been rendered on a petition filed in this application.

DISMISSED

DENIED

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875							Filing Date 11/06/2014	To be Mailed	
	ENTITY: LARGE SMALL MICRO								
				APPLICA	ATION AS FIL	ED – PAF	RTI		
			(Column 1	1)	(Column 2)				
L	FOR		NUMBER FIL	_ED	NUMBER EXTRA		RATE (\$) FEE (\$)		
Ш	BASIC FEE (37 CFR 1.16(a), (b),	or (c))	N/A		N/A		N/A		
	SEARCH FEE (37 CFR 1.16(k), (i), (i)	or (m))	N/A		N/A		N/A		
	EXAMINATION FE (37 CFR 1.16(o), (p),	Ε	N/A		N/A		N/A		
	TAL CLAIMS CFR 1.16(i))		mir	nus 20 = *			X \$ =		
	EPENDENT CLAIM CFR 1.16(h))	S	m	inus 3 = *			X \$ =		
	APPLICATION SIZE (37 CFR 1.16(s))	of p for frac	aper, the a	ation and drawing application size f y) for each additi of. See 35 U.S.C	ee due is \$310 (onal 50 sheets o	\$155 or			
	MULTIPLE DEPEN			477					
* If t	he difference in colu	ımn 1 is less tha	n zero, ente	r "0" in column 2.			TOTAL		
		(Column 1)		APPLICAT (Column 2)	ION AS AMEN		ART II		
TN:	12/02/2014	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EX	TRA	RATE (\$)	ADDITIO	ONAL FEE (\$)
AMENDMENT	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x \$40 =		0
EN	Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0		x \$210 =		0
AM	Application Size Fee (37 CFR 1.16(s))								
	FIRST PRESEN	NTATION OF MULT	IPLE DEPEN	DENT CLAIM (37 CFF	R 1.16(j))				
							TOTAL ADD'L FE		0
		(Column 1)		(Column 2)	(Column 3)			
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EX	TRA	RATE (\$)	ADDITK	ONAL FEE (\$)
ENT	Total (37 CFR 1.16(i))	*	Minus	**	=		X \$ =		
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IEN	Application Size Fee (37 CFR 1.16(s))								
AM	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
							TOTAL ADD'L FE		
** If *** I	the entry in column the "Highest Numbe f the "Highest Numb "Highest Number P	er Previously Pai per Previously Pa	d For" IN Th aid For" IN T	HIS SPACE is less HIS SPACE is less	than 20, enter "20' s than 3, enter "3".		LDRC /PAMELA ROC		

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.



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APPLICATION	FILING or	GRP ART				
NUMBER	371(c) DATE	UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/535,279	11/06/2014	2827	730	DUELP010/DL017	20	2

CONFIRMATION NO. 1035

FILING RECEIPT

28875 Zilka-Kotab, PC P.O. BOX 721120 SAN JOSE, CA 95172-1120

Date Mailed: 11/25/2014

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections

Inventor(s)

William Rivard, Menlo Park, CA; Adam Feder, Mountain View, CA; Brian Kindle, Sunnyvale, CA;

Applicant(s)

Duelight LLC, Sunnyvale, CA

Power of Attorney: The patent practitioners associated with Customer Number 28875

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the Patent Prosecution **Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None. Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access - A proper Authorization to Permit Access to Application by Participating Offices (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 11/21/2014

The country code and number of your priority application, to be used for filing abroad under the Paris Convention,

is US 14/535,279

Projected Publication Date: 05/12/2016

Non-Publication Request: No

Early Publication Request: No ** SMALL ENTITY ** Title

IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE

Preliminary Class

365

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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Application or Docket Number PATENT APPLICATION FEE DETERMINATION RECORD 14/535,279 Substitute for Form PTO-875 APPLICATION AS FILED - PART I OTHER THAN SMALL ENTITY OR SMALL ENTITY (Column 1) (Column 2) RATE(\$) RATE(\$) FOR NUMBER FILED NUMBER EXTRA FEE(\$) FEE(\$) BASIC FEE N/A 70 N/A N/A N/A (37 CFR 1.16(a), (b), or (c)) SEARCH FEE N/A N/A N/A 300 N/A (37 CFR 1.16(k), (i), or (m)) **EXAMINATION FEE** N/A N/A N/A 360 N/A (37 CFR 1.16(o), (p), or (q)) TOTAL CLAIMS 20 40 0.00 OR minus 20 = (37 CFR 1.16(i)) INDEPENDENT CLAIMS 2 210 0.00 minus 3 = (37 CFR 1.16(h)) If the specification and drawings exceed 100 APPLICATION SIZE sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. FEE 0.00 (37 CFR 1.16(s)) 41(a)(1)(G) and 37 CFR 1.16(s). MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) 0.00 * If the difference in column 1 is less than zero, enter "0" in column 2. TOTAL 730 TOTAL APPLICATION AS AMENDED - PART II OTHER THAN SMALL ENTITY OR SMALL ENTITY (Column 1) (Column 2) (Column 3) CLAIMS HIGHEST REMAINING PRESENT ADDITIONAL ADDITIONAL NUMBER RATE(\$) RATE(\$) ⋖ AFTER AMENDMENT PREVIOUSLY EXTRA FEE(\$) FEE(\$) **AMENDMENT** PAID FOR Total Minus OR (37 CFR 1.16(i)) Independent (37 CFR 1.16(h)) Minus OR Application Size Fee (37 CFR 1.16(s)) FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) OR TOTAL TOTAL OR ADD'L FEE ADD'L FEE (Column 1) (Column 2) (Column 3) CLAIMS HIGHEST REMAINING NUMBER PRESENT ADDITIONAL ADDITIONAL RATE(\$) RATE(\$) Ш PREVIOUSLY **AFTER** EXTRA FEE(\$) FEE(\$) **AMENDMENT** PAID FOR **AMENDMENT** Minus Total OR (37 CFR 1.16(i)) Independent Minus OR (37 CFR 1.16(h)) Application Size Fee (37 CFR 1.16(s)) OR FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) TOTAL TOTAL OR ADD'L FEE ADD'L FEE * If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20" *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3"

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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	DUELP010/DL017
First Inventor	William Rivard
Title	IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE
Express Mail I abel No	N/A

	ON ELEMENTS ing utility patent application contents.	ADDRESS TO:	Commissioner for Patents ADDRESS TO: P.O. Box 1450 Alexandria VA 22313-1450				
1. Fee Transmittal Form. (PTO/SB/17 or equivalent)		ACCOMPAN	ACCOMPANYING APPLICATION PARTS				
2. Applicant claims small See 37 CFR 1.27. Specification. Roth the claims and abstract	[Total Pages 72] through the start on a new page at arrangement, see MPEP § 608.01(a))	9. Assignment Papers. (cover sheet & document(s)) Name of Assignee Duelight LLC					
Inventor's Oath or Declaration (including substitute statements under 3 oath or declaration under 37 CFR 1.63(c)	37 CFR 1.64 and assignments serving as an	· L ` `	10. 37 CFR 3.73(c) Statement. Power of Attorney.				
a. Newly executed (orig b. A copy from a prior a	inal or copy) pplication (37 CFR 1.63(d))	11. English Trans	lation Document.				
6. Application Data Sheet See 37 CFR 1.76 (PTO/AIA/14	(PTO/SB/08 or PTO	isclosure Statemen 0-1449) is of citations attached					
7. CD-ROM or CD-R. in duplicate, large table or Comp	uter Program <i>(Appendix)</i>	13. Preliminary A					
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(if applicable, items a. – c. a a. Computer Readal b. Specification Seq i. CD-ROM or ii. Paper	ole Form (CRF)	 15. Certified Copy of Priority Document(s). (If foreign priority is claimed) 16. Nonpublication Request. Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 17. ✓ Other: PTO/AIA/82A- Transmittal for Power of Attorney PTO/SB/424- Track One Request Form 					
(2) For applications filed assignee, person to	*Note: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 must be included in an Application Data Sheet (ADS). (2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).						
	18. CORRESPO	NDENCE ADDRESS					
The address associated with Co	The address associated with Customer Number: 28875 OR Correspondence address below						
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Name (Print/Type) Jamie L. I		Registration No (Attorney/Agent). 56,875				

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IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE

RELATED APPLICATIONS

[0001] This application is related to the following U.S. Patent Application, the entire disclosures being incorporated by reference herein: Application No. 13/999,678, filed 03/14/2014, entitled "SYSTEMS AND METHODS FOR DIGITAL IMAGE SENSOR"; Application No. 14/534,068, filed 11/05/2014, entitled "SYSTEMS AND METHODS FOR HIGH-DYNAMIC RANGE IMAGES"; Application No. 14/534,079, filed 11/05/2014, entitled "IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING MULTIPLE EXPOSURES WITH ZERO INTERFRAME TIME"; Application No. 14/534,089, filed 11/04/2014, entitled "IMAGE SENSOR APPARATUS AND METHOD FOR SIMULTANEOUSLY CAPTURING MULTIPLE IMAGES"; Application No. (DUELP009/DL016), filed xx/xx/xxxx, entitled "IMAGE SENSOR APPARATUS AND METHOD FOR SIMULTANEOUSLY CAPTURING FLASH AND AMBIENT ILLUMINATED IMAGES"; and Application No. (DUELP012/DL019), filed xx/xx/xxxx, entitled "SYSTEMS AND METHODS FOR GENERATING A HIGH-DYNAMIC RANGE (HDR) PIXEL STREAM."

FIELD OF THE INVENTION

[0002] The present invention relates to photographic systems, and more particularly to an image sensor apparatus and method for obtaining exposures low-noise, high-speed captures.

BACKGROUND

[0003] Traditional digital photography systems are inherently limited by the amount of light measured at a capturing image sensor. One solution to such limitation is the application of large amounts of gain to captured photographs. Another solution is increasing a shutter or exposure time during capture. However, both of these solutions suffer from problems that reduce the quality of any resulting photographs, such as increased noise or blur.

SUMMARY

[0004] A system, method, and computer program product are provided for obtaining low-noise, high-speed captures of a photographic scene. In use, a first cell of a first pixel is in communication with a first node for storing a first sample. Further, a second cell of a second pixel is in communication with a second node for storing a second sample. Still further, the first cell and the second cell are communicatively coupled. Additional systems, methods, and computer program products are also presented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Figure 1 illustrates an exemplary system for obtaining low-noise, high-speed captures of a photographic scene, in accordance with one embodiment.

[0006] Figure 2 illustrates an exemplary system for obtaining low-noise, high-speed captures of a photographic scene, in accordance with another embodiment.

[0007] Figure 3A illustrates a digital photographic system configured to obtain low-noise, high-speed captures of a photographic scene, in accordance with an embodiment.

[0008] Figure 3B illustrates a processor complex within a digital photographic system, according to one embodiment.

[0009] Figure 3C illustrates a digital camera, in accordance with an embodiment.

[0010] Figure 3D illustrates a wireless mobile device, in accordance with another embodiment.

[0011] Figure 3E illustrates a camera module configured to sample an image, according to one embodiment.

[0012] Figure 3F illustrates a camera module configured to sample an image, according to another embodiment.

[0013] Figure 3G illustrates a camera module in communication with an application processor, in accordance with an embodiment.

[0014] Figure 4 illustrates a network service system, in accordance with another embodiment.

- [0015] Figures 5A-5E illustrate systems for converting optical scene information to an electronic representation of a photographic scene, in accordance with other embodiments.
- [0016] Figure 6A illustrates a circuit diagram for a photosensitive cell, according to one embodiment.
- [0017] Figure 6B illustrates a circuit diagram for another photosensitive cell, according to another embodiment.
- [0018] Figure 6C illustrates a circuit diagram for a plurality of communicatively coupled photosensitive cells, according to yet another embodiment.
- [0019] Figure 7 illustrates a system for converting analog pixel data of an analog signal to digital pixel data, in accordance with another embodiment.
- [0020] Figure 8 illustrates implementations of different analog storage planes, in accordance with another embodiment.
- [0021] Figure 9 illustrates a system for converting analog pixel data of an analog signal to digital pixel data, in accordance with another embodiment.
- [0022] Figure 10 illustrates a user interface system for generating a combined image, according to an embodiment.
- [0023] Figure 11 is a flow diagram of method steps for generating a combined image, according to one embodiment.
- [0024] Figure 12 illustrates a message sequence for generating a combined image utilizing a network, according to another embodiment.

DETAILED DESCRIPTION

[0025] Figure 1 illustrates a system 100 for obtaining low-noise, high-speed captures of a photographic scene, in accordance with one embodiment. As an option, the system 100 may be implemented in the context of any of the Figures disclosed herein. Of course, however, the system 100 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[0026] As shown in Figure 1, the system 100 includes a first pixel 105, a second pixel 107, a first sample storage node 121, and a second sample storage node 123. Further, the first pixel 105 is shown to include a first cell 101, and the second pixel 107 is shown to include a second cell 103. In one embodiment, each pixel may include one or more cells. For example, in some embodiments, each pixel may include four cells. Further, each of the cells may include a photodiode, photosensor, or any photo-sensing electrical element. A photodiode may comprise any semiconductor diode that generates a potential difference, current, or changes its electrical resistance, in response to photon absorption. Accordingly, a photodiode may be used to detect or measure a light intensity.

[0027] Referring again to Figure 1, the first cell 101 and the first sample storage node 121 are in communication via interconnect 111, the second cell 103 and the second sample storage node 123 are in communication via interconnect 113, and the first cell 101 and the second cell 103 are in communication via interconnect 112.

[0028] Each of the interconnects 111-113 may carry an electrical signal from one or more cells to a sample storage node. For example, the interconnect 111 may carry an electrical signal from the cell 101 to the first sample storage node 121. The interconnect 113 may carry an electrical signal from the cell 103 to the second sample storage node 123. Further, the interconnect 112 may carry an electrical signal from the cell 103 to the first sample storage node 121, or may carry an electrical signal from the cell 101 to the second sample storage node 123. In such embodiments, the interconnect 112 may enable a communicative coupling between the first cell 101 and the second cell 103. Further, in some embodiments, the interconnect 112 may

be operable to be selectively enabled or disabled. In such embodiments, the interconnect 112 may be selectively enabled or disable using one or more transistors and/or control signals.

[0029] In one embodiment, each electrical signal carried by the interconnects 111-113 may include a photodiode current. For example, each of the cells 101 and 103 may include a photodiode. Each of the photodiodes of the cells 101 and 103 may generate a photodiode current which is communicated from the cells 101 and 103 via the interconnects 111-113 to one or more of the sample storage nodes 121 and 123. In configurations where the interconnect 112 is disabled, the interconnect 113 may communicate a photodiode current from the cell 103 to the second sample storage node 123, and, similarly, the interconnect 111 may communicate a photodiode current from the cell 101 to the first sample storage node 121. However, in configurations where the interconnect 112 is enabled, both the cell 101 and the cell 103 may communicate a photodiode current to the first sample storage node 121 and the second sample storage node 123.

[0030] Of course, each sample storage node may be operative to receive any electrical signal from one or more communicatively coupled cells, and then store a sample based upon the received electrical signal. In some embodiments, each sample storage node may be configured to store two or more samples. For example, the first sample storage node 121 may store a first sample based on a photodiode current from the cell 101, and may separately store a second sample based on, at least in part, a photodiode current from the cell 103.

[0031] In one embodiment, each sample storage node includes a charge storing device for storing a sample, and the sample stored at a given storage node may be a function of a light intensity detected at one or more associated photodiodes. For example, the first sample storage node 121 may store a sample as a function of a received photodiode current, which is generated based on a light intensity detected at a photodiode of the cell 101. Further, the second sample storage node 123 may store a sample as a function of a received photodiode current, which is generated based on a light intensity detected at a photodiode of the cell 103. As yet another example, when the interconnect 112 is enabled, the first sample storage node 121 may receive a photodiode current from each of the cells 101 and 103, and the first sample storage node 121

may thereby store a sample as a function of both the light intensity detected at the photodiode of the cell **101** and the light intensity detected at the photodiode of the cell **103**.

[0032] In one embodiment, each sample storage node may include a capacitor for storing a charge as a sample. In such an embodiment, each capacitor stores a charge that corresponds to an accumulated exposure during an exposure time or sample time. For example, current received at each capacitor from one or more associated photodiodes may cause the capacitor, which has been previously charged, to discharge at a rate that is proportional to incident light intensity detected at the one or more photodiodes. The remaining charge of each capacitor may be referred to as a value or analog value, and may be subsequently output from the capacitor. For example, the remaining charge of each capacitor may be output as an analog value that is a function of the remaining charge on the capacitor. In one embodiment, via the interconnect 112, the cell 101 may be communicatively coupled to one or more capacitors of the first sample storage node 121, and the cell 103 may also be communicatively coupled to one or more capacitors of the first sample storage node 121.

[0033] In some embodiments, each sample storage node may include circuitry operable for receiving input based on one or more photodiodes. For example, such circuitry may include one or more transistors. The one or more transistors may be configured for rendering the sample storage node responsive to various control signals, such as sample, reset, and row select signals received from one or more controlling devices or components. In other embodiments, each sample storage node may include any device for storing any sample or value that is a function of a light intensity detected at one or more associated photodiode. In some embodiments, the interconnect 112 may be selectively enabled or disabled using one or more associated transistors. Accordingly, the cell 101 and the cell 103 may be in communication utilizing a communicative coupling that includes at least one transistor. In embodiments where each of the pixels 105 and 107 include additional cells (not shown), the additional cells may not be communicatively coupled to the cells 101 and 103 via the interconnect 112.

[0034] In various embodiments, the pixels 105 and 107 may be two pixels of an array of pixels of an image sensor. Each value stored at a sample storage node may include an electronic

representation of a portion of an optical image that has been focused on the image sensor that includes the pixels 105 and 107. In such an embodiment, the optical image may be focused on the image sensor by a lens. The electronic representation of the optical image may comprise spatial color intensity information, which may include different color intensity samples (e.g. red, green, and blue light, etc.). In other embodiments, the spatial color intensity information may also include samples for white light. In one embodiment, the optical image may be an optical image of a photographic scene. Such an image sensor may comprise a complementary metal oxide semiconductor (CMOS) image sensor, or charge-coupled device (CCD) image sensor, or any other technically feasible form of image sensor.

[0035] Figure 2 illustrates a system 200 for obtaining low-noise, high-speed captures of a photographic scene, in accordance with another embodiment. As an option, the system 200 may be implemented in the context of any of the Figures disclosed herein. Of course, however, the system 200 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[10036] As shown in Figure 2, the system 200 includes a plurality of pixels 240. Specifically, the system 200 is shown to include pixels 240(0), 240(1), 240(2), and 240(3). Each of the pixels 240 may be substantially identical with respect to composition and configuration. Further, each of the pixels 240 may be a single pixel of an array of pixels comprising an image sensor. To this end, each of the pixels 240 may comprise hardware that renders the pixel operable to detect or measure various wavelengths of light, and convert the measured light into one or more electrical signals for rendering or generating one or more digital images. Each of the pixels 240 may be substantially identical to the pixel 105 or the pixel 107 of Figure 1.

[0037] Further, each of the pixels 240 is shown to include a cell 242, a cell 243, a cell 244 and a cell 245. In one embodiment, each of the cells 242-245 includes a photodiode operative to detect and measure one or more peak wavelengths of light. For example, each of the cells 242 may be operative to detect and measure red light, each of the cells 243 and 244 may be operative to detect and measure green light, and each of the cells 245 may be operative to detect and measure blue light. In other embodiments, a photodiode may be configured to detect

wavelengths of light other than only red, green, or blue. For example, a photodiode may be configured to detect white, cyan, magenta, yellow, or non-visible light such as infrared or ultraviolet light. Any communicatively coupled cells may be configured to detect a same peak wavelength of light.

[0038] In various embodiments, each of the cells 242-245 may generate an electrical signal in response to detecting and measuring its associated one or more peak wavelengths of light. In one embodiment, each electrical signal may include a photodiode current. A given cell may generate a photodiode current which is sampled by a sample storage node for a selected sample time or exposure time, and the sample storage node may store an analog value based on the sampling of the photodiode current. Of course, as noted previously, each sample storage node may be capable of concurrently storing more than one analog value.

[0039] As shown in Figure 2, each of the cells 242 are communicatively coupled via an interconnect 250. In one embodiment, the interconnect 250 may be enabled or disabled using one or more control signals. When the interconnect 250 is enabled, the interconnect may carry a combined electrical signal. The combined electrical signal may comprise a combination of electrical signals output from each of the cells 242. For example, the combined electrical signal may comprise a combined photodiode current, where the combined photodiode current includes photodiode current received from photodiodes of each of the cells 242. Thus, enabling the interconnect 250 may serve to increase a combined photodiode current generated based on one or more peak wavelengths of light. In some embodiments, the combined photodiode current may be used to more rapidly store an analog value at a sample storage node than if a photodiode current generated by only a single cell was used to store the analog value. To this end, the interconnect 250 may be enabled to render the pixels 240 of an image sensor more sensitive to incident light. Increasing the sensitivity of an image sensor may allow for more rapid capture of digital images in low light conditions, capture of digital images with reduced noise, and/or capture of brighter or better exposed digital images in a given exposure time.

[0040] The embodiments disclosed herein may advantageously enable a camera module to sample images to have less noise, less blur, and greater exposure in low-light conditions than

conventional techniques. In certain embodiments, images may be effectively sampled or captured simultaneously, which may reduce inter-sample time to, or near, zero. In other embodiments, the camera module may sample images in coordination with the strobe unit to reduce inter-sample time between an image sampled without strobe illumination and an image sampled with strobe illumination.

[0041] More illustrative information will now be set forth regarding various optional architectures and uses in which the foregoing method may or may not be implemented, per the desires of the user. It should be strongly noted that the following information is set forth for illustrative purposes and should not be construed as limiting in any manner. Any of the following features may be optionally incorporated with or without the exclusion of other features described.

[0042] Figure 3A illustrates a digital photographic system 300, in accordance with one embodiment. As an option, the digital photographic system 300 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the digital photographic system 300 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[0043] As shown, the digital photographic system 300 may include a processor complex 310 coupled to a camera module 330 via an interconnect 334. In one embodiment, the processor complex 310 is coupled to a strobe unit 336. The digital photographic system 300 may also include, without limitation, a display unit 312, a set of input/output devices 314, non-volatile memory 316, volatile memory 318, a wireless unit 340, and sensor devices 342, each coupled to the processor complex 310. In one embodiment, a power management subsystem 320 is configured to generate appropriate power supply voltages for each electrical load element within the digital photographic system 300. A battery 322 may be configured to supply electrical energy to the power management subsystem 320. The battery 322 may implement any technically feasible energy storage system, including primary or rechargeable battery technologies. Of course, in other embodiments, additional or fewer features, units, devices, sensors, or subsystems may be included in the system.

[0044] In one embodiment, a strobe unit 336 may be integrated into the digital photographic system 300 and configured to provide strobe illumination 350 during an image sample event performed by the digital photographic system 300. In another embodiment, a strobe unit 336 may be implemented as an independent device from the digital photographic system 300 and configured to provide strobe illumination 350 during an image sample event performed by the digital photographic system 300. The strobe unit 336 may comprise one or more LED devices, a gas-discharge illuminator (e.g. a Xenon strobe device, a Xenon flash lamp, etc.), or any other technically feasible illumination device. In certain embodiments, two or more strobe units are configured to synchronously generate strobe illumination in conjunction with sampling an image. In one embodiment, the strobe unit 336 is controlled through a strobe control signal 338 to either emit the strobe illumination 350 or not emit the strobe illumination 350. The strobe control signal 338 may be implemented using any technically feasible signal transmission protocol. The strobe control signal 338 may indicate a strobe parameter (e.g. strobe intensity, strobe color, strobe time, etc.), for directing the strobe unit 336 to generate a specified intensity and/or color of the strobe illumination 350. The strobe control signal 338 may be generated by the processor complex 310, the camera module 330, or by any other technically feasible combination thereof. In one embodiment, the strobe control signal 338 is generated by a camera interface unit within the processor complex 310 and transmitted to both the strobe unit 336 and the camera module 330 via the interconnect 334. In another embodiment, the strobe control signal 338 is generated by the camera module 330 and transmitted to the strobe unit 336 via the interconnect 334.

[0045] Optical scene information 352, which may include at least a portion of the strobe illumination 350 reflected from objects in the photographic scene, is focused as an optical image onto an image sensor 332 within the camera module 330. The image sensor 332 generates an electronic representation of the optical image. The electronic representation comprises spatial color intensity information, which may include different color intensity samples (e.g. red, green, and blue light, etc.). In other embodiments, the spatial color intensity information may also include samples for white light. The electronic representation is transmitted to the processor complex 310 via the interconnect 334, which may implement any technically feasible signal transmission protocol.

[0046] In one embodiment, input/output devices 314 may include, without limitation, a capacitive touch input surface, a resistive tablet input surface, one or more buttons, one or more knobs, light-emitting devices, light detecting devices, sound emitting devices, sound detecting devices, or any other technically feasible device for receiving user input and converting the input to electrical signals, or converting electrical signals into a physical signal. In one embodiment, the input/output devices 314 include a capacitive touch input surface coupled to a display unit 312. A touch entry display system may include the display unit 312 and a capacitive touch input surface, also coupled to processor complex 310.

[0047] Additionally, in other embodiments, non-volatile (NV) memory 316 is configured to store data when power is interrupted. In one embodiment, the NV memory 316 comprises one or more flash memory devices (e.g. ROM, PCM, FeRAM, FRAM, PRAM, MRAM, NRAM, etc.). The NV memory 316 comprises a non-transitory computer-readable medium, which may be configured to include programming instructions for execution by one or more processing units within the processor complex 310. The programming instructions may implement, without limitation, an operating system (OS), UI software modules, image processing and storage software modules, one or more input/output devices 314 connected to the processor complex 310, one or more software modules for sampling an image stack through camera module 330, one or more software modules for presenting the image stack or one or more synthetic images generated from the image stack through the display unit 312. As an example, in one embodiment, the programming instructions may also implement one or more software modules for merging images or portions of images within the image stack, aligning at least portions of each image within the image stack, or a combination thereof. In another embodiment, the processor complex 310 may be configured to execute the programming instructions, which may implement one or more software modules operable to create a high dynamic range (HDR) image.

[0048] Still yet, in one embodiment, one or more memory devices comprising the NV memory 316 may be packaged as a module configured to be installed or removed by a user. In one embodiment, volatile memory 318 comprises dynamic random access memory (DRAM) configured to temporarily store programming instructions, image data such as data associated

with an image stack, and the like, accessed during the course of normal operation of the digital photographic system 300. Of course, the volatile memory may be used in any manner and in association with any other input/output device 314 or sensor device 342 attached to the process complex 310.

[0049] In one embodiment, sensor devices 342 may include, without limitation, one or more of an accelerometer to detect motion and/or orientation, an electronic gyroscope to detect motion and/or orientation, a magnetic flux detector to detect orientation, a global positioning system (GPS) module to detect geographic position, or any combination thereof. Of course, other sensors, including but not limited to a motion detection sensor, a proximity sensor, an RGB light sensor, a gesture sensor, a 3-D input image sensor, a pressure sensor, and an indoor position sensor, may be integrated as sensor devices. In one embodiment, the sensor devices may be one example of input/output devices 314.

[0050] Wireless unit 340 may include one or more digital radios configured to send and receive digital data. In particular, the wireless unit 340 may implement wireless standards (e.g. WiFi, Bluetooth, NFC, etc.), and may implement digital cellular telephony standards for data communication (e.g. CDMA, 3G, 4G, LTE, LTE-Advanced, etc.). Of course, any wireless standard or digital cellular telephony standards may be used.

In one embodiment, the digital photographic system 300 is configured to transmit one or more digital photographs to a network-based (online) or "cloud-based" photographic media service via the wireless unit 340. The one or more digital photographs may reside within either the NV memory 316 or the volatile memory 318, or any other memory device associated with the processor complex 310. In one embodiment, a user may possess credentials to access an online photographic media service and to transmit one or more digital photographs for storage to, retrieval from, and presentation by the online photographic media service. The credentials may be stored or generated within the digital photographic system 300 prior to transmission of the digital photographs. The online photographic media service may comprise a social networking service, photograph sharing service, or any other network-based service that provides storage of digital photographs, processing of digital photographs, transmission of digital photographs,

sharing of digital photographs, or any combination thereof. In certain embodiments, one or more digital photographs are generated by the online photographic media service based on image data (e.g. image stack, HDR image stack, image package, etc.) transmitted to servers associated with the online photographic media service. In such embodiments, a user may upload one or more source images from the digital photographic system **300** for processing by the online photographic media service.

[10052] In one embodiment, the digital photographic system 300 comprises at least one instance of a camera module 330. In another embodiment, the digital photographic system 300 comprises a plurality of camera modules 330. Such an embodiment may also include at least one strobe unit 336 configured to illuminate a photographic scene, sampled as multiple views by the plurality of camera modules 330. The plurality of camera modules 330 may be configured to sample a wide angle view (e.g., greater than forty-five degrees of sweep among cameras) to generate a panoramic photograph. In one embodiment, a plurality of camera modules 330 may be configured to sample two or more narrow angle views (e.g., less than forty-five degrees of sweep among cameras) to generate a stereoscopic photograph. In other embodiments, a plurality of camera modules 330 may be configured to generate a 3-D image or to otherwise display a depth perspective (e.g. a z-component, etc.) as shown on the display unit 312 or any other display device.

[0053] In one embodiment, a display unit 312 may be configured to display a two-dimensional array of pixels to form an image for display. The display unit 312 may comprise a liquid-crystal (LCD) display, a light-emitting diode (LED) display, an organic LED display, or any other technically feasible type of display. In certain embodiments, the display unit 312 may be able to display a narrower dynamic range of image intensity values than a complete range of intensity values sampled from a photographic scene, such as within a single HDR image or over a set of two or more images comprising a multiple exposure or HDR image stack. In one embodiment, images comprising an image stack may be merged according to any technically feasible HDR blending technique to generate a synthetic image for display within dynamic range constraints of the display unit 312. In one embodiment, the limited dynamic range may specify an eight-bit per color channel binary representation of corresponding color intensities. In other

embodiments, the limited dynamic range may specify more than eight-bits (e.g., 10 bits, 12 bits, or 14 bits, etc.) per color channel binary representation.

[0054] Figure 3B illustrates a processor complex 310 within the digital photographic system 300 of Figure 3A, in accordance with one embodiment. As an option, the processor complex 310 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the processor complex 310 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[0055] As shown, the processor complex 310 includes a processor subsystem 360 and may include a memory subsystem 362. In one embodiment, processor complex 310 may comprise a system on a chip (SoC) device that implements processor subsystem 360, and memory subsystem 362 comprises one or more DRAM devices coupled to the processor subsystem 360. In another embodiment, the processor complex 310 may comprise a multi-chip module (MCM) encapsulating the SoC device and the one or more DRAM devices comprising the memory subsystem 362.

[0056] The processor subsystem 360 may include, without limitation, one or more central processing unit (CPU) cores 370, a memory interface 380, input/output interfaces unit 384, and a display interface unit 382, each coupled to an interconnect 374. The one or more CPU cores 370 may be configured to execute instructions residing within the memory subsystem 362, volatile memory 318, NV memory 316, or any combination thereof. Each of the one or more CPU cores 370 may be configured to retrieve and store data through interconnect 374 and the memory interface 380. In one embodiment, each of the one or more CPU cores 370 may include a data cache, and an instruction cache. Additionally, two or more of the CPU cores 370 may share a data cache, an instruction cache, or any combination thereof. In one embodiment, a cache hierarchy is implemented to provide each CPU core 370 with a private cache layer, and a shared cache layer.

[0057] In some embodiments, processor subsystem 360 may include one or more graphics processing unit (GPU) cores 372. Each GPU core 372 may comprise a plurality of multi-threaded execution units that may be programmed to implement, without limitation, graphics

acceleration functions. In various embodiments, the GPU cores 372 may be configured to execute multiple thread programs according to well-known standards (e.g. OpenGLTM, WebGLTM, OpenCLTM, CUDATM, etc.), and/or any other programmable rendering graphic standard. In certain embodiments, at least one GPU core 372 implements at least a portion of a motion estimation function, such as a well-known Harris detector or a well-known Hessian-Laplace detector. Such a motion estimation function may be used at least in part to align images or portions of images within an image stack. For example, in one embodiment, an HDR image may be compiled based on an image stack, where two or more images are first aligned prior to compiling the HDR image.

As shown, the interconnect 374 is configured to transmit data between and among the memory interface 380, the display interface unit 382, the input/output interfaces unit 384, the CPU cores 370, and the GPU cores 372. In various embodiments, the interconnect 374 may implement one or more buses, one or more rings, a cross-bar, a mesh, or any other technically feasible data transmission structure or technique. The memory interface 380 is configured to couple the memory subsystem 362 to the interconnect 374. The memory interface 380 may also couple NV memory 316, volatile memory 318, or any combination thereof to the interconnect 374. The display interface unit 382 may be configured to couple a display unit 312 to the interconnect 374. The display interface unit 382 may implement certain frame buffer functions (e.g. frame refresh, etc.). Alternatively, in another embodiment, the display unit 312 may implement certain frame buffer functions (e.g. frame refresh, etc.). The input/output interfaces unit 384 may be configured to couple various input/output devices to the interconnect 374.

[0059] In certain embodiments, a camera module 330 is configured to store exposure parameters for sampling each image associated with an image stack. For example, in one embodiment, when directed to sample a photographic scene, the camera module 330 may sample a set of images comprising the image stack according to stored exposure parameters. A software module comprising programming instructions executing within a processor complex 310 may generate and store the exposure parameters prior to directing the camera module 330 to sample the image stack. In other embodiments, the camera module 330 may be used to meter an image or an image stack, and the software module comprising programming instructions executing within a processor complex 310 may generate and store metering parameters prior to directing

the camera module 330 to capture the image. Of course, the camera module 330 may be used in any manner in combination with the processor complex 310.

[0060] In one embodiment, exposure parameters associated with images comprising the image stack may be stored within an exposure parameter data structure that includes exposure parameters for one or more images. In another embodiment, a camera interface unit (not shown in Fig. 3B) within the processor complex 310 may be configured to read exposure parameters from the exposure parameter data structure and to transmit associated exposure parameters to the camera module 330 in preparation of sampling a photographic scene. After the camera module 330 is configured according to the exposure parameters, the camera interface may direct the camera module 330 to sample the photographic scene; the camera module 330 may then generate a corresponding image stack. The exposure parameter data structure may be stored within the camera interface unit, a memory circuit within the processor complex 310, volatile memory 318, NV memory 316, the camera module 330, or within any other technically feasible memory circuit. Further, in another embodiment, a software module executing within processor complex 310 may generate and store the exposure parameter data structure.

[0061] Figure 3C illustrates a digital camera 302, in accordance with one embodiment. As an option, the digital camera 302 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the digital camera 302 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[0062] In one embodiment, the digital camera 302 may be configured to include a digital photographic system, such as digital photographic system 300 of Figure 3A. As shown, the digital camera 302 includes a camera module 330, which may include optical elements configured to focus optical scene information representing a photographic scene onto an image sensor, which may be configured to convert the optical scene information to an electronic representation of the photographic scene.

[0063] Additionally, the digital camera 302 may include a strobe unit 336, and may include a shutter release button 315 for triggering a photographic sample event, whereby digital camera

302 samples one or more images comprising the electronic representation. In other embodiments, any other technically feasible shutter release mechanism may trigger the photographic sample event (e.g. such as a timer trigger or remote control trigger, etc.).

[0064] Figure 3D illustrates a wireless mobile device 376, in accordance with one embodiment. As an option, the mobile device 376 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the mobile device 376 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[0065] In one embodiment, the mobile device 376 may be configured to include a digital photographic system (e.g. such as digital photographic system 300 of Figure 3A), which is configured to sample a photographic scene. In various embodiments, a camera module 330 may include optical elements configured to focus optical scene information representing the photographic scene onto an image sensor, which may be configured to convert the optical scene information to an electronic representation of the photographic scene. Further, a shutter release command may be generated through any technically feasible mechanism, such as a virtual button, which may be activated by a touch gesture on a touch entry display system comprising display unit 312, or a physical button, which may be located on any face or surface of the mobile device 376. Of course, in other embodiments, any number of other buttons, external inputs/outputs, or digital inputs/outputs may be included on the mobile device 376, and which may be used in conjunction with the camera module 330.

[0066] As shown, in one embodiment, a touch entry display system comprising display unit 312 is disposed on the opposite side of mobile device 376 from camera module 330. In certain embodiments, the mobile device 376 includes a user-facing camera module 331 and may include a user-facing strobe unit (not shown). Of course, in other embodiments, the mobile device 376 may include any number of user-facing camera modules or rear-facing camera modules, as well as any number of user-facing strobe units or rear-facing strobe units.

[0067] In some embodiments, the digital camera 302 and the mobile device 376 may each generate and store a synthetic image based on an image stack sampled by camera module 330. The image stack may include one or more images sampled under ambient lighting conditions,

one or more images sampled under strobe illumination from strobe unit 336, or a combination thereof.

[0068] Figure 3E illustrates camera module 330, in accordance with one embodiment. As an option, the camera module 330 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the camera module 330 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[0069] In one embodiment, the camera module 330 may be configured to control strobe unit 336 through strobe control signal 338. As shown, a lens 390 is configured to focus optical scene information 352 onto image sensor 332 to be sampled. In one embodiment, image sensor 332 advantageously controls detailed timing of the strobe unit 336 though the strobe control signal 338 to reduce inter-sample time between an image sampled with the strobe unit 336 enabled, and an image sampled with the strobe unit 336 disabled. For example, the image sensor 332 may enable the strobe unit 336 to emit strobe illumination 350 less than one microsecond (or any desired length) after image sensor 332 completes an exposure time associated with sampling an ambient image and prior to sampling a strobe image.

[0070] In other embodiments, the strobe illumination 350 may be configured based on a desired one or more target points. For example, in one embodiment, the strobe illumination 350 may light up an object in the foreground, and depending on the length of exposure time, may also light up an object in the background of the image. In one embodiment, once the strobe unit 336 is enabled, the image sensor 332 may then immediately begin exposing a strobe image. The image sensor 332 may thus be able to directly control sampling operations, including enabling and disabling the strobe unit 336 associated with generating an image stack, which may comprise at least one image sampled with the strobe unit 336 disabled, and at least one image sampled with the strobe unit 336 either enabled or disabled. In one embodiment, data comprising the image stack sampled by the image sensor 332 is transmitted via interconnect 334 to a camera interface unit 386 within processor complex 310. In some embodiments, the camera module 330

may include an image sensor controller, which may be configured to generate the strobe control signal 338 in conjunction with controlling operation of the image sensor 332.

[0071] Figure 3F illustrates a camera module 330, in accordance with one embodiment. As an option, the camera module 330 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the camera module 330 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[0072] In one embodiment, the camera module 330 may be configured to sample an image based on state information for strobe unit 336. The state information may include, without limitation, one or more strobe parameters (e.g. strobe intensity, strobe color, strobe time, etc.), for directing the strobe unit 336 to generate a specified intensity and/or color of the strobe illumination 350. In one embodiment, commands for configuring the state information associated with the strobe unit 336 may be transmitted through a strobe control signal 338, which may be monitored by the camera module 330 to detect when the strobe unit 336 is enabled. For example, in one embodiment, the camera module 330 may detect when the strobe unit 336 is enabled or disabled within a microsecond or less of the strobe unit 336 being enabled or disabled by the strobe control signal 338. To sample an image requiring strobe illumination, a camera interface unit 386 may enable the strobe unit 336 by sending an enable command through the strobe control signal 338. In one embodiment, the camera interface unit 386 may be included as an interface of input/output interfaces 384 in a processor subsystem 360 of the processor complex 310 of Figure 3B. The enable command may comprise a signal level transition, a data packet, a register write, or any other technically feasible transmission of a command. The camera module 330 may sense that the strobe unit 336 is enabled and then cause image sensor 332 to sample one or more images requiring strobe illumination while the strobe unit 336 is enabled. In such an implementation, the image sensor 332 may be configured to wait for an enable signal destined for the strobe unit 336 as a trigger signal to begin sampling a new exposure.

[0073] In one embodiment, camera interface unit 386 may transmit exposure parameters and commands to camera module 330 through interconnect 334. In certain embodiments, the camera interface unit 386 may be configured to directly control strobe unit 336 by transmitting control commands to the strobe unit 336 through strobe control signal 338. By directly controlling both the camera module 330 and the strobe unit 336, the camera interface unit 386 may cause the camera module 330 and the strobe unit 336 to perform their respective operations in precise time synchronization. In one embodiment, precise time synchronization may be less than five hundred microseconds of event timing error. Additionally, event timing error may be a difference in time from an intended event occurrence to the time of a corresponding actual event occurrence.

[0074] In another embodiment, camera interface unit 386 may be configured to accumulate statistics while receiving image data from camera module 330. In particular, the camera interface unit 386 may accumulate exposure statistics for a given image while receiving image data for the image through interconnect 334. Exposure statistics may include, without limitation, one or more of an intensity histogram, a count of over-exposed pixels, a count of under-exposed pixels, an intensity-weighted sum of pixel intensity, or any combination thereof. The camera interface unit 386 may present the exposure statistics as memory-mapped storage locations within a physical or virtual address space defined by a processor, such as one or more of CPU cores 370, within processor complex 310. In one embodiment, exposure statistics reside in storage circuits that are mapped into a memory-mapped register space, which may be accessed through the interconnect 334. In other embodiments, the exposure statistics are transmitted in conjunction with transmitting pixel data for a captured image. For example, the exposure statistics for a given image may be transmitted as in-line data, following transmission of pixel intensity data for the captured image. Exposure statistics may be calculated, stored, or cached within the camera interface unit 386.

[0075] In one embodiment, camera interface unit 386 may accumulate color statistics for estimating scene white-balance. Any technically feasible color statistics may be accumulated for estimating white balance, such as a sum of intensities for different color channels comprising red, green, and blue color channels. The sum of color channel intensities may then be used to perform a white-balance color correction on an associated image, according to a white-balance

model such as a gray-world white-balance model. In other embodiments, curve-fitting statistics are accumulated for a linear or a quadratic curve fit used for implementing white-balance correction on an image.

[0076] In one embodiment, camera interface unit 386 may accumulate spatial color statistics for performing color-matching between or among images, such as between or among an ambient image and one or more images sampled with strobe illumination. As with the exposure statistics, the color statistics may be presented as memory-mapped storage locations within processor complex 310. In one embodiment, the color statistics are mapped in a memory-mapped register space, which may be accessed through interconnect 334, within processor subsystem 360. In other embodiments, the color statistics may be transmitted in conjunction with transmitting pixel data for a captured image. For example, in one embodiment, the color statistics for a given image may be transmitted as in-line data, following transmission of pixel intensity data for the image. Color statistics may be calculated, stored, or cached within the camera interface 386.

In one embodiment, camera module 330 may transmit strobe control signal 338 to strobe unit 336, enabling the strobe unit 336 to generate illumination while the camera module 330 is sampling an image. In another embodiment, camera module 330 may sample an image illuminated by strobe unit 336 upon receiving an indication signal from camera interface unit 386 that the strobe unit 336 is enabled. In yet another embodiment, camera module 330 may sample an image illuminated by strobe unit 336 upon detecting strobe illumination within a photographic scene via a rapid rise in scene illumination. In one embodiment, a rapid rise in scene illumination may include at least a rate of increasing intensity consistent with that of enabling strobe unit 336. In still yet another embodiment, camera module 330 may enable strobe unit 336 to generate strobe illumination while sampling one image, and disable the strobe unit 336 while sampling a different image.

[0078] Figure 3G illustrates camera module 330, in accordance with one embodiment. As an option, the camera module 330 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the camera module 330 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the

description below.

[0079] In one embodiment, the camera module 330 may be in communication with an application processor 335. The camera module 330 is shown to include image sensor 332 in communication with a controller 333. Further, the controller 333 is shown to be in communication with the application processor 335.

[0080] In one embodiment, the application processor 335 may reside outside of the camera module 330. As shown, the lens 390 may be configured to focus optical scene information onto image sensor 332 to be sampled. The optical scene information sampled by the image sensor 332 may then be communicated from the image sensor 332 to the controller 333 for at least one of subsequent processing and communication to the application processor 335. In another embodiment, the controller 333 may control storage of the optical scene information sampled by the image sensor 332, or storage of processed optical scene information.

[0081] In another embodiment, the controller 333 may enable a strobe unit to emit strobe illumination for a short time duration (e.g. less than one microsecond, etc.) after image sensor 332 completes an exposure time associated with sampling an ambient image. Further, the controller 333 may be configured to generate strobe control signal 338 in conjunction with controlling operation of the image sensor 332.

[0082] In one embodiment, the image sensor 332 may be a complementary metal oxide semiconductor (CMOS) sensor or a charge-coupled device (CCD) sensor. In another embodiment, the controller 333 and the image sensor 332 may be packaged together as an integrated system or integrated circuit. In yet another embodiment, the controller 333 and the image sensor 332 may comprise discrete packages. In one embodiment, the controller 333 may provide circuitry for receiving optical scene information from the image sensor 332, processing of the optical scene information, timing of various functionalities, and signaling associated with the application processor 335. Further, in another embodiment, the controller 333 may provide circuitry for control of one or more of exposure, shuttering, white balance, and gain adjustment. Processing of the optical scene information by the circuitry of the controller 333 may include one

or more of gain application, amplification, and analog-to-digital conversion. After processing the optical scene information, the controller 333 may transmit corresponding digital pixel data, such as to the application processor 335.

[0083] In one embodiment, the application processor 335 may be implemented on processor complex 310 and at least one of volatile memory 318 and NV memory 316, or any other memory device and/or system. The application processor 335 may be previously configured for processing of received optical scene information or digital pixel data communicated from the camera module 330 to the application processor 335.

[0084] Figure 4 illustrates a network service system 400, in accordance with one embodiment. As an option, the network service system 400 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the network service system 400 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

loos5| In one embodiment, the network service system 400 may be configured to provide network access to a device implementing a digital photographic system. As shown, network service system 400 includes a wireless mobile device 376, a wireless access point 472, a data network 474, data center 480, and a data center 481. The wireless mobile device 376 may communicate with the wireless access point 472 via a digital radio link 471 to send and receive digital data, including data associated with digital images. The wireless mobile device 376 and the wireless access point 472 may implement any technically feasible transmission techniques for transmitting digital data via digital a radio link 471 without departing the scope and spirit of the present invention. In certain embodiments, one or more of data centers 480, 481 may be implemented using virtual constructs so that each system and subsystem within a given data center 480, 481 may comprise virtual machines configured to perform specified data processing and network tasks. In other implementations, one or more of data centers 480, 481 may be physically distributed over a plurality of physical sites.

[0086] The wireless mobile device 376 may comprise a smart phone configured to include a digital camera, a digital camera configured to include wireless network connectivity, a reality augmentation device, a laptop configured to include a digital camera and wireless network connectivity, or any other technically feasible computing device configured to include a digital photographic system and wireless network connectivity.

[0087] In various embodiments, the wireless access point 472 may be configured to communicate with wireless mobile device 376 via the digital radio link 471 and to communicate with the data network 474 via any technically feasible transmission media, such as any electrical, optical, or radio transmission media. For example, in one embodiment, wireless access point 472 may communicate with data network 474 through an optical fiber coupled to the wireless access point 472 and to a router system or a switch system within the data network 474. A network link 475, such as a wide area network (WAN) link, may be configured to transmit data between the data network 474 and the data center 480.

[0088] In one embodiment, the data network 474 may include routers, switches, long-haul transmission systems, provisioning systems, authorization systems, and any technically feasible combination of communications and operations subsystems configured to convey data between network endpoints, such as between the wireless access point 472 and the data center 480. In one implementation, a wireless the mobile device 376 may comprise one of a plurality of wireless mobile devices configured to communicate with the data center 480 via one or more wireless access points coupled to the data network 474.

[0089] Additionally, in various embodiments, the data center 480 may include, without limitation, a switch/router 482 and at least one data service system 484. The switch/router 482 may be configured to forward data traffic between and among a network link 475, and each data service system 484. The switch/router 482 may implement any technically feasible transmission techniques, such as Ethernet media layer transmission, layer 2 switching, layer 3 routing, and the like. The switch/router 482 may comprise one or more individual systems configured to transmit data between the data service systems 484 and the data network 474.

[0090] In one embodiment, the switch/router 482 may implement session-level load balancing among a plurality of data service systems 484. Each data service system 484 may include at least one computation system 488 and may also include one or more storage systems 486. Each computation system 488 may comprise one or more processing units, such as a central processing unit, a graphics processing unit, or any combination thereof. A given data service system 484 may be implemented as a physical system comprising one or more physically distinct systems configured to operate together. Alternatively, a given data service system 484 may be implemented as a virtual system comprising one or more virtual systems executing on an arbitrary physical system. In certain scenarios, the data network 474 may be configured to transmit data between the data center 480 and another data center 481, such as through a network link 476.

[0091] In another embodiment, the network service system 400 may include any networked mobile devices configured to implement one or more embodiments of the present invention. For example, in some embodiments, a peer-to-peer network, such as an ad-hoc wireless network, may be established between two different wireless mobile devices. In such embodiments, digital image data may be transmitted between the two wireless mobile devices without having to send the digital image data to a data center 480.

[0092] Figure 5A illustrates a system for capturing optical scene information for conversion to an electronic representation of a photographic scene, in accordance with one embodiment. As an option, the system of Figure 5A may be implemented in the context of the details of any of the Figures. Of course, however, the system of Figure 5A may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[0093] As shown in Figure 5A, a pixel array 510 is in communication with row logic 512 and a column read out circuit 520. Further, the row logic 512 and the column read out circuit 520 are both in communication with a control unit 514. Still further, the pixel array 510 is shown to include a plurality of pixels 540, where each pixel 540 may include four cells, cells 542-545. In the context of the present description, the pixel array 510 may be included in an

image sensor, such as image sensor 332 of camera module 330. Also, each of the pixels 540 may be implemented as the pixels 240 of Figure 2, and, correspondingly, each of the cells 542, 543, 544, and 545 may be implemented as the cells 242, 243, 244, and 245, respectively, of Figure 2. Although not shown in Figure 5A, two or more corresponding cells between two or more pixels 540 may be communicatively coupled using an interconnect. For example, two or more cells 542 may be communicatively coupled using an interconnect, or two or more cells 545 may be communicatively coupled using an interconnect.

[0094] As shown, the pixel array 510 includes a 2-dimensional array of the pixels 540. For example, in one embodiment, the pixel array 510 may be built to comprise 4,000 pixels 540 in a first dimension, and 3,000 pixels 540 in a second dimension, for a total of 12,000,000 pixels 540 in the pixel array 510, which may be referred to as a 12 megapixel pixel array. Further, as noted above, each pixel 540 is shown to include four cells 542-545. In one embodiment, cell 542 may be associated with (e.g. selectively sensitive to, etc.) a first color of light, cell 543 may be associated with a second color of light, cell 544 may be associated with a third color of light, and cell 545 may be associated with a fourth color of light. In one embodiment, each of the first color of light, such that each of the cells 542-545 may be associated with different colors of light. In another embodiment, at least two cells of the cells 542-545 may be associated with the same color of light. For example, the cell 543 and the cell 544 may be associated with the same color of light.

[0095] Further, each of the cells 542-545 may be capable of storing an analog value. In one embodiment, each of the cells 542-545 may be associated with a capacitor for storing a charge that corresponds to an accumulated exposure during an exposure time. In such an embodiment, asserting a row select signal to circuitry of a given cell may cause the cell to perform a read operation, which may include, without limitation, generating and transmitting a current that is a function of the stored charge of the capacitor associated with the cell. In one embodiment, prior to a readout operation, current received at the capacitor from an associated photodiode may cause the capacitor, which has been previously charged, to discharge at a rate that is proportional to an incident light intensity detected at the photodiode. The remaining charge of the capacitor

of the cell may then be read using the row select signal, where the current transmitted from the cell is an analog value that reflects the remaining charge on the capacitor. To this end, an analog value received from a cell during a readout operation may reflect an accumulated intensity of light detected at a photodiode. The charge stored on a given capacitor, as well as any corresponding representations of the charge, such as the transmitted current, may be referred to herein as analog pixel data. Of course, analog pixel data may include a set of spatially discrete intensity samples, each represented by continuous analog values.

[0096] Still further, the row logic 512 and the column read out circuit 520 may work in concert under the control of the control unit 514 to read a plurality of cells 542-545 of a plurality of pixels 540. For example, the control unit 514 may cause the row logic 512 to assert a row select signal comprising row control signals 530 associated with a given row of pixels 540 to enable analog pixel data associated with the row of pixels to be read. As shown in Figure 5A, this may include the row logic 512 asserting one or more row select signals comprising row control signals 530(0) associated with a row 534(0) that includes pixel 540(0) and pixel 540(a). In response to the row select signal being asserted, each pixel 540 on row 534(0) transmits at least one analog value based on charges stored within the cells 542-545 of the pixel 540. In certain embodiments, cell 542 and cell 543 are configured to transmit corresponding analog values in response to a first row select signal, while cell 544 and cell 545 are configured to transmit corresponding analog values in response to a second row select signal.

[0097] In one embodiment, analog values for a complete row of pixels 540 comprising each row 534(0) through 534(r) may be transmitted in sequence to column read out circuit 520 through column signals 532. In one embodiment, analog values for a complete row or pixels or cells within a complete row of pixels may be transmitted simultaneously. For example, in response to row select signals comprising row control signals 530(0) being asserted, the pixel 540(0) may respond by transmitting at least one analog value from the cells 542-545 of the pixel 540(0) to the column read out circuit 520 through one or more signal paths comprising column signals 532(0); and simultaneously, the pixel 540(a) will also transmit at least one analog value from the cells 542-545 of the pixel 540(a) to the column read out circuit 520 through one or more signal paths comprising column signals 532(c). Of course, one or more analog values may

be received at the column read out circuit 520 from one or more other pixels 540 concurrently to receiving the at least one analog value from pixel 540(0) and concurrently receiving the at least one analog value from the pixel 540(a). Together, a set of analog values received from the pixels 540 comprising row 534(0) may be referred to as an analog signal, and this analog signal may be based on an optical image focused on the pixel array 510. An analog signal may be a set of spatially discrete intensity samples, each represented by continuous analog values.

Further, after reading the pixels 540 comprising row 534(0), the row logic 512 may select a second row of pixels 540 to be read. For example, the row logic 512 may assert one or more row select signals comprising row control signals 530(r) associated with a row of pixels 540 that includes pixel 540(b) and pixel 540(z). As a result, the column read out circuit 520 may receive a corresponding set of analog values associated with pixels 540 comprising row 534(r).

The column read out circuit 520 may serve as a multiplexer to select and forward one or more received analog values to an analog-to-digital converter circuit, such as analog-to-digital unit 722 of Figure 7. The column read out circuit 520 may forward the received analog values in a predefined order or sequence. In one embodiment, row logic 512 asserts one or more row selection signals comprising row control signals 530, causing a corresponding row of pixels to transmit analog values through column signals 532. The column read out circuit 520 receives the analog values and sequentially selects and forwards one or more of the analog values at a time to the analog-to-digital unit 622. Selection of rows by row logic 512 and selection of columns by column read out circuit 620 may be directed by control unit 514. In one embodiment, rows 534 are sequentially selected to be read, starting with row 534(0) and ending with row 534(r), and analog values associated with sequential columns are transmitted to the analog-to-digital unit 622. In other embodiments, other selection patterns may be implemented to read analog values stored in pixels 540.

[0099] Further, the analog values forwarded by the column read out circuit 520 may comprise analog pixel data, which may later be amplified and then converted to digital pixel data for generating one or more digital images based on an optical image focused on the pixel array 510.

[00100] Figures 5B-5D illustrate three optional pixel configurations, according to one or more embodiments. As an option, these pixel configurations may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, these pixel configurations may be implemented in any desired environment. By way of a specific example, any of the pixels 540 of Figures 5B-5D may operate as one or more of the pixels 540 of the pixel array 510.

[00101] As shown in Figure 5B, a pixel 540 is illustrated to include a first cell (R) for measuring red light intensity, second and third cells (G) for measuring green light intensity, and a fourth cell (B) for measuring blue light intensity, in accordance with one embodiment. As shown in Figure 5C, a pixel 540 is illustrated to include a first cell (R) for measuring red light intensity, a second cell (G) for measuring green light intensity, a third cell (B) for measuring blue light intensity, and a fourth cell (W) for measuring white light intensity, in accordance with another embodiment. As shown in Figure 5D, a pixel 540 is illustrated to include a first cell (C) for measuring cyan light intensity, a second cell (M) for measuring magenta light intensity, a third cell (Y) for measuring yellow light intensity, and a fourth cell (W) for measuring white light intensity, in accordance with yet another embodiment.

[00102] Of course, while pixels 540 are each shown to include four cells, a pixel 540 may be configured to include fewer or more cells for measuring light intensity. Still further, in another embodiment, while certain of the cells of pixel 540 are shown to be configured to measure a single peak wavelength of light, or white light, the cells of pixel 540 may be configured to measure any wavelength, range of wavelengths of light, or plurality of wavelengths of light.

[00103] Referring now to Figure 5E, a system is shown for capturing optical scene information focused as an optical image on an image sensor 332, in accordance with one embodiment. As an option, the system of Figure 5E may be implemented in the context of the details of any of the Figures. Of course, however, the system of Figure 5E may be carried out in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[00104] As shown in Figure 5E, an image sensor 332 is shown to include a first cell 544, a second cell 545, and a third cell 548. Further, each of the cells 544-548 is shown to include a photodiode 562. Still further, upon each of the photodiodes 562 is a corresponding filter 564, and upon each of the filters 564 is a corresponding microlens 566. For example, the cell 544 is shown to include photodiode 562(0), upon which is filter 564(0), and upon which is microlens 566(0). Similarly, the cell 545 is shown to include photodiode 562(1), upon which is filter 564(1), and upon which is microlens 566(1). Still yet, as shown in Figure 5E, pixel 540 is shown to include each of cells 544 and 545, photodiodes 562(0) and 562(1), filters 564(0) and 564(1), and microlenses 566(0) and 566(1).

[00105] In one embodiment, each of the microlenses 566 may be any lens with a diameter of less than 50 microns. However, in other embodiments each of the microlenses 566 may have a diameter greater than or equal to 50 microns. In one embodiment, each of the microlenses 566 may include a spherical convex surface for focusing and concentrating received light on a supporting substrate beneath the microlens 566. For example, as shown in Figure 5E, the microlens 566(0) focuses and concentrates received light on the filter 564(0). In one embodiment, a microlens array 567 may include microlenses 566, each corresponding in placement to photodiodes 562 within cells 544 of image sensor 332.

[00106] In the context of the present description, the photodiodes 562 may comprise any semiconductor diode that generates a potential difference, or changes its electrical resistance, in response to photon absorption. Accordingly, the photodiodes 562 may be used to detect or measure light intensity. Further, each of the filters 564 may be optical filters for selectively transmitting light of one or more predetermined wavelengths. For example, the filter 564(0) may be configured to selectively transmit substantially only green light received from the corresponding microlens 566(0), and the filter 564(1) may be configured to selectively transmit substantially only blue light received from the microlens 566(1). Together, the filters 564 and microlenses 566 may be operative to focus selected wavelengths of incident light on a plane. In one embodiment, the plane may be a 2-dimensional grid of photodiodes 562 on a surface of the image sensor 332. Further, each photodiode 562 receives one or more predetermined wavelengths of light, depending on its associated filter. In one embodiment, each photodiode

562 receives only one of red, blue, or green wavelengths of filtered light. As shown with respect to Figures **5B-5D**, it is contemplated that a photodiode may be configured to detect wavelengths of light other than only red, green, or blue. For example, in the context of Figures **5C-5D** specifically, a photodiode may be configured to detect white, cyan, magenta, yellow, or non-visible light such as infrared or ultraviolet light.

To this end, each coupling of a cell, photodiode, filter, and microlens may be [00107] operative to receive light, focus and filter the received light to isolate one or more predetermined wavelengths of light, and then measure, detect, or otherwise quantify an intensity of light received at the one or more predetermined wavelengths. The measured or detected light may then be represented as one or more analog values stored within a cell. For example, in one embodiment, each analog value may be stored within the cell utilizing a capacitor. Further, each analog value stored within a cell may be output from the cell based on a selection signal, such as a row selection signal, which may be received from row logic 512. Further still, each analog value transmitted from a cell may comprise one analog value in a plurality of analog values of an analog signal, where each of the analog values is output by a different cell. Accordingly, the analog signal may comprise a plurality of analog pixel data values from a plurality of cells. In one embodiment, the analog signal may comprise analog pixel data values for an entire image of a photographic scene. In another embodiment, the analog signal may comprise analog pixel data values for a subset of the entire image of the photographic scene. For example, the analog signal may comprise analog pixel data values for a row of pixels of the image of the photographic scene. In the context of Figures 5A-5E, the row 534(0) of the pixels 540 of the pixel array 510 may be one such row of pixels of the image of the photographic scene.

[00108] Figure 6A illustrates a circuit diagram for a photosensitive cell 600, in accordance with one possible embodiment. As an option, the cell 600 may be implemented in the context of any of the Figures disclosed herein. Of course, however, the cell 600 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[00109] As shown in Figure 6A, a photosensitive cell 600 includes a photodiode 602 coupled to a first analog sampling circuit 603(0) and a second analog sampling circuit 603(1). The photodiode 602 may be implemented as a photodiode of a cell 101 described within the context of Figure 1, or any of the photodiodes 562 of Figure 5E. In one embodiment, a unique instance of photosensitive cell 600 may be implemented as any of cells 242-245 within the context of Figure 2, or any of cells 542-545 within the context of Figures 5A-5E. Further, the first analog sampling circuit 603(0) and the second analog sampling circuit 603(1) may separately, or in combination, comprise a sample storage node, such as one of the sample storage nodes 121 or 123 of Figure 1.

[00110] As shown, the photosensitive cell 600 comprises two analog sampling circuits 603, and a photodiode 602. The two analog sampling circuits 603 include a first analog sampling circuit 603(0) which is coupled to a second analog sampling circuit 603(1). As shown in Figure 6A, the first analog sampling circuit 603(0) comprises transistors 606(0), 610(0), 612(0), 614(0), and a capacitor 604(0); and the second analog sampling circuit 603(1) comprises transistors 606(1), 610(1), 612(1), 614(1), and a capacitor 604(1). In one embodiment, each of the transistors 606, 610, 612, and 614 may be a field-effect transistor.

[00111] The photodiode 602 may be operable to measure or detect incident light 601 of a photographic scene. In one embodiment, the incident light 601 may include ambient light of the photographic scene. In another embodiment, the incident light 601 may include light from a strobe unit utilized to illuminate the photographic scene. Of course, the incident light 601 may include any light received at and measured by the photodiode 602. Further still, and as discussed above, the incident light 601 may be concentrated on the photodiode 602 by a microlens, and the photodiode 602 may be one photodiode of a photodiode array that is configured to include a plurality of photodiodes arranged on a two-dimensional plane.

[00112] In one embodiment, the analog sampling circuits 603 may be substantially identical. For example, the first analog sampling circuit 603(0) and the second analog sampling circuit 603(1) may each include corresponding transistors, capacitors, and interconnects configured in a substantially identical manner. Of course, in other embodiments, the first analog sampling

circuit **603(0)** and the second analog sampling circuit **603(1)** may include circuitry, transistors, capacitors, interconnects and/or any other components or component parameters (e.g. capacitance value of each capacitor **604)** which may be specific to just one of the analog sampling circuits **603**.

[00113] In one embodiment, each capacitor 604 may include one node of a capacitor comprising gate capacitance for a transistor 610 and diffusion capacitance for transistors 606 and 614. The capacitor 604 may also be coupled to additional circuit elements (not shown) such as, without limitation, a distinct capacitive structure, such as a metal-oxide stack, a poly capacitor, a trench capacitor, or any other technically feasible capacitor structures.

sampling circuit 603(0) and the analog sampling circuit 603(1). The interconnect 644 includes a transistor 641, which comprises a gate 640 and a source 642. A drain of the transistor 641 is coupled to each of the analog sampling circuit 603(0) and the analog sampling circuit 603(1). When the gate 640 is turned off, the cell 600 may operate in isolation. When operating in isolation, the cell 600 may operate in a manner whereby the photodiode 602 is sampled by one or both of the analog sampling circuits 603 of the cell 600. For example, the photodiode 602 may be sampled by the analog sampling circuit 603(0) and the analog sampling circuit 603(1) in a concurrent manner, or the photodiode 602 may be sampled by the analog sampling circuit 603(1) in a sequential manner. In alternative embodiments, the drain terminal of transistor 641 is coupled to interconnect 644 and the source terminal of transistor 641 is coupled to the sampling circuits 603 and the photodiode 602.

[00115] With respect to analog sampling circuit 603(0), when reset 616(0) is active (low), transistor 614(0) provides a path from voltage source V2 to capacitor 604(0), causing capacitor 604(0) to charge to the potential of V2. When sample signal 618(0) is active, transistor 606(0) provides a path for capacitor 604(0) to discharge in proportion to a photodiode current (I_PD) generated by the photodiode 602 in response to the incident light 601. In this way, photodiode current I_PD is integrated for a first exposure time when the sample signal 618(0) is active, resulting in a corresponding first voltage on the capacitor 604(0). This first voltage on the

capacitor 604(0) may also be referred to as a first sample. When row select 634(0) is active, transistor 612(0) provides a path for a first output current from V1 to output 608(0). The first output current is generated by transistor 610(0) in response to the first voltage on the capacitor 604(0). When the row select 634(0) is active, the output current at the output 608(0) may therefore be proportional to the integrated intensity of the incident light 601 during the first exposure time.

[00116] With respect to analog sampling circuit 603(1), when reset 616(1) is active (low), transistor 614(1) provides a path from voltage source V2 to capacitor 604(1), causing capacitor 604(1) to charge to the potential of V2. When sample signal 618(1) is active, transistor 606(1) provides a path for capacitor 604(1) to discharge in proportion to a photodiode current (I_PD) generated by the photodiode 602 in response to the incident light 601. In this way, photodiode current I_PD is integrated for a second exposure time when the sample signal 618(1) is active, resulting in a corresponding second voltage on the capacitor 604(1). This second voltage on the capacitor 604(1) may also be referred to as a second sample. When row select 634(1) is active, transistor 612(1) provides a path for a second output current from V1 to output 608(1). The second output current is generated by transistor 610(1) in response to the second voltage on the capacitor 604(1). When the row select 634(1) is active, the output current at the output 608(1) may therefore be proportional to the integrated intensity of the incident light 601 during the second exposure time.

[00117] As noted above, when the cell 600 is operating in an isolation mode, the photodiode current I_PD of the photodiode 602 may be sampled by one of the analog sampling circuits 603 of the cell 600; or may be sampled by both of the analog sampling circuits 603 of the cell 600, either concurrently or sequentially. When both the sample signal 618(0) and the sample signal 618(1) are activated simultaneously, the photodiode current I_PD of the photodiode 602 may be sampled by both analog sampling circuits 603 concurrently, such that the first exposure time and the second exposure time are, at least partially, overlapping. Concurrent sampling of the photodiode 602 using two or more analog sampling circuits is explained in greater depth within U.S. Patent Application No. 14/534,089, filed 11/05/2014, entitled "IMAGE SENSOR"

APPARATUS AND METHOD FOR SIMULTANEOUSLY CAPTURING MULTIPLE IMAGES," the contents of which are incorporated herein as though set forth in full.

[00118] When the sample signal 618(0) and the sample signal 618(1) are activated sequentially, the photodiode current I_PD of the photodiode 602 may be sampled by the analog sampling circuits 603 sequentially, such that the first exposure time and the second exposure time do not overlap. Sequential sampling of the photodiode current I_PD of the photodiode 602 using two or more analog sampling circuits is explained in greater depth within U.S. Patent Application No. (DUELP009/DL016), filed xx/xx/xxxx, entitled "IMAGE SENSOR APPARATUS AND METHOD FOR SIMULTANEOUSLY CAPTURING FLASH AND AMBIENT ILLUMINATED IMAGES," the contents of which are incorporated herein as though set forth in full. Further disclosure regarding sequential sampling of the photodiode 602 using two or more analog sampling circuits may also be found in U.S. Patent Application No. 13/999,678, entitled "Systems and methods for a digital image sensor," which is also incorporated herein as though set forth in full.

In various embodiments, when the gate 640 is turned on, the cell 600 may be thereby [00119] communicatively coupled to one or more other instances of cell 600 of other pixels via the interconnect 644. In one embodiment, when two or more cells 600 are coupled together, the two or more corresponding instances of photodiode 602 may collectively provide a shared photodiode current on the interconnect 644. In such an embodiment, one or more analog sampling circuits 603 of the two instances of cell 600 may sample the shared photodiode current. For example, in one embodiment, a single sample signal 618(0) may be activated such that a single analog sampling circuit 603 samples the shared photodiode current. In another embodiment two instances of a sample signal 618(0), each associated with a different cell 600, may be activated to sample the shared photodiode current, such that two analog sampling circuits 603 of two different cells 600 sample the shared photodiode current. In yet another embodiment, both of a sample signal 618(0) and 618(1) of a single cell 600 may be activated to sample the shared photodiode current, such that two analog sampling circuits 603(0) and 603(1) of one of the cells 600 sample the shared photodiode current, and neither of the analog sampling circuits 603 of the other cell 600 sample the shared photodiode current.

[00120] In a specific example, two instances of cell 600 may be coupled via the interconnect 644. Each instance of the cell 600 may include a photodiode 602 and two analog sampling circuits 603. In such an example, the two photodiodes 602 may be configured to provide a shared photodiode current to one, two, three, or all four of the analog sampling circuits 603 via the interconnect 644. If the two photodiodes 602 detect substantially identical quantities of light, then the shared photodiode current may be twice the magnitude that any single photodiode current would be from a single one of the photodiodes 602. Thus, this shared photodiode current may otherwise be referred to as a 2x photodiode current. If only one analog sampling circuit 603 is activated to sample the 2x photodiode current, the analog sampling circuit 603 may effectively sample the 2x photodiode current twice as fast for a given exposure level as the analog sampling circuit 603 would sample a photodiode current received from a single photodiode 602. Further, if only one analog sampling circuit 603 is activated to sample the 2x photodiode current, the analog sampling circuit 603 may be able to obtain a sample twice as bright as the analog sampling circuit 603 would obtain by sampling a photodiode current received from a single photodiode 602 for a same exposure time. However, in such an embodiment, because only a single analog sampling circuit 603 of the two cells 600 actively samples the 2x photodiode current, one of the cells 600 does not store any analog value representative of the 2x photodiode current. Accordingly, when a 2x photodiode current is sampled by only a subset of corresponding analog sampling circuits 603, image resolution may be reduced in order to increase a sampling speed or sampling sensitivity.

[00121] In one embodiment, communicatively coupled cells 600 may be located in a same row of pixels of an image sensor. In such an embodiment, sampling with only a subset of communicatively coupled analog sampling circuits 603 may reduce an effective horizontal resolution of the image sensor by 1/2. In another embodiment, communicatively coupled cells 600 may be located in a same column of pixels of an image sensor. In such an embodiment, sampling with only a subset of communicatively coupled analog sampling circuits 603 may reduce an effective vertical resolution of the image sensor by 1/2.

[00122] In another embodiment, an analog sampling circuit 603 of each of the two cells 600 may be simultaneously activated to concurrently sample the 2x photodiode current. In such an embodiment, because the 2x photodiode current is shared by two analog sampling circuits 603, sampling speed and sampling sensitivity may not be improved in comparison to a single analog sampling circuit 603 sampling a photodiode current of a single photodiode 602. However, by sharing the 2x photodiode current over the interconnect 644 between the two cells 600, and then sampling the 2x photodiode current using an analog sampling circuit 603 in each of the cells 600, the analog values sampled by each of the analog sampling circuits 603 may be effectively averaged, thereby reducing the effects of any noise present in a photodiode current output by either of the coupled photodiodes 602.

[00123] In yet another example, two instances of cell 600 may be coupled via the interconnect 644. Each instance of the cell 600 may include a photodiode 602 and two analog sampling circuits 603. In such an example, the two photodiodes 602 may be configured to provide a shared photodiode current to one, two, three, or all four of the analog sampling circuits 603 via the interconnect 644. If the two photodiodes 602 detect substantially identical quantities of light, then the shared photodiode current may be twice the magnitude that any single photodiode current would be from a single one of the photodiodes 602. Thus, this shared photodiode current may otherwise be referred to as a 2x photodiode current. Two analog sampling circuits 603 of one of the cells 600 may be simultaneously activated to concurrently sample the 2x photodiode current in a manner similar to that described hereinabove with respect to the analog sampling circuits 603(0) and 603(1) sampling the photodiode current I_PD of the photodiode 602 in isolation. In such an embodiment, two analog storage planes may be populated with analog values at a rate that is 2x faster than if the analog sampling circuits 603(0) and 603(1) received a photodiode current from a single photodiode 602.

[00124] In another embodiment including two instances of cell 600 coupled via interconnect 644 for sharing a 2x photodiode current, such that four analog sampling circuits 603 may be simultaneously activated for a single exposure. In such an embodiment, the four analog sampling circuits 603 may concurrently sample the 2x photodiode current in a manner similar to that described hereinabove with respect to the analog sampling circuits 603(0) and 603(1)

sampling the photodiode current I_PD of the photodiode 602 in isolation. In such an embodiment, the four analog sampling circuits 603 may be disabled sequentially, such that each of the four analog sampling circuits 603 stores a unique analog value representative of the 2x photodiode current. Thereafter, each analog value may be output in a different analog signal, and each analog signal may be amplified and converted to a digital signal comprising a digital image.

[00125] Thus, in addition to the 2x photodiode current serving to reduce noise in any final digital image, four different digital images may be generated for the single exposure, each with a different effective exposure and light sensitivity. These four digital images may comprise, and be processed as, an image stack, as described in U.S. Patent Application No Application No. (DUELP009/DL016), filed xx/xx/xxxx, entitled "IMAGE SENSOR APPARATUS AND METHOD FOR SIMULTANEOUSLY CAPTURING FLASH AND AMBIENT ILLUMINATED IMAGES," the contents of which are incorporated herein as though set forth in full. In other embodiments, the four analog sampling circuits 603 may be activated and deactivated together for sampling the 2x photodiode current, such that each of the analog sampling circuits 603 store a substantially identical analog value. In yet other embodiments, the four analog sampling circuits 603 may be activated and deactivated in a sequence for sampling the 2x photodiode current, such that no two analog sampling circuits 603 are actively sampling at any given moment.

[00126] Of course, while the above examples and embodiments have been described for simplicity in the context of two instances of a cell 600 being communicatively coupled via interconnect 644, more than two instances of a cell 600 may be communicatively coupled via the interconnect 644. For example, four instances of a cell 600 may be communicatively coupled via an interconnect 644. In such an example, eight different analog sampling circuits 603 may be addressable, in any sequence or combination, for sampling a 4x photodiode current shared between the four instances of cell 600. Thus, as an option, a single analog sampling circuit 603 may be able to sample the 4x photodiode current at a rate 4x faster than the analog sampling circuit 603 would be able to sample a photodiode current received from a single photodiode 602.

[00127] For example, an analog value stored by sampling a 4x photodiode current at a 1/120 second exposure time may be substantially identical to an analog value stored by sampling a 1x photodiode current at a 1/30 second exposure time. By reducing an exposure time required to sample a given analog value under a given illumination, blur may be reduced within a final digital image. Thus, sampling a shared photodiode current may effectively increase the ISO, or light sensitivity, at which a given photographic scene is sampled without increasing the noise associated with applying a greater gain.

[00128] As another option, the single analog sampling circuit 603 may be able to obtain, for a given exposure time, a sample 4x brighter than a sample obtained by sampling a photodiode current received from a single photodiode. Sampling a 4x photodiode current may allow for much more rapid sampling of a photographic scene, which may serve to reduce any blur present in a final digital image, to more quickly capture a photographic scene (e.g., 1/4 exposure time), to increase the brightness or exposure of a final digital image, or any combination of the foregoing. Of course, sampling a 4x photodiode current with a single analog sampling circuit 603 may result in an analog storage plane having 1/4 the resolution of an analog storage plane in which each cell 600 generates a sample. In another embodiment, where four instances of a cell 600 may be communicatively coupled via an interconnect 644, up to eight separate exposures may be captured by sequentially sampling the 4x photodiode current with each of the eight analog sampling circuits 603. In one embodiment, each cell includes one or more analog sampling circuits 603.

[00129] Figure 6B illustrates a circuit diagram for a photosensitive cell 660, in accordance with one possible embodiment. As an option, the cell 660 may be implemented in the context of any of the Figures disclosed herein. Of course, however, the cell 660 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[00130] As shown, the photosensitive cell 660 comprises a photodiode 602 that is substantially identical to the photodiode 602 of cell 600, a first analog sampling circuit 603(0) that is substantially identical to the first analog sampling circuit 603(0) of cell 600, a second

analog sampling circuit 603(1) that is substantially identical to the second analog sampling circuit 603(1) of cell 600, and an interconnect 654. The interconnect 654 is shown to comprise three transistors 651-653, and a source 650. Each of the transistors 651, 652, and 653, include a gate 656, 657, and 658, respectively. The cell 660 may operate in substantially the same manner as the cell 600 of Figure 6A, however the cell 660 includes only two pass gates from photodiodes 602 of other cells 660 coupled via the interconnect 654, whereas the cell 600 includes three pass gates from the photodiodes 602 of other cells 600 coupled via the interconnect 644.

[00131] Figure 6C illustrates a circuit diagram for a system 690 including plurality of communicatively coupled photosensitive cells 694, in accordance with one possible embodiment. As an option, the system 690 may be implemented in the context of any of the Figures disclosed herein. Of course, however, the system 690 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[00132] As illustrated in Figure 6C, the system 690 is shown to include four pixels 692, where each of the pixels 692 includes a respective cell 694, and a set of related cells 694 are communicatively coupled via interconnect 698. Each of the pixels 692 may be implemented as a pixel 240 of Figure 2, each of the cells 694 may be implemented as a cell 242 of Figure 2, and the interconnect 698 may be implemented as the interconnect 250 of Figure 2. Further, the interconnect 698 is shown to include multiple instances of a source 696, and multiple instances of a gate 691. Also, each cell 694 may include an analog sampling circuit 603 coupled to a photodiode 602 for measuring or detecting incident light 601. The analog sampling circuit 603 may be substantially identical to either of the analog sampling circuits 603(0) and 603(1) disclosed in the context of Figure 6A.

[00133] When all instances of the gate 691 are turned on, each of the cells 694 may be thereby communicatively coupled to each of the other cells 694 of the other pixels 692 via the interconnect 698. As a result, a shared photodiode current may be generated. As shown in Figure 6C, each of the cells 694(1), 694(2), and 694(3) output a substantially similar photodiode current I_PD on the interconnect 698. The photodiode current I_PD generated by each of the cells 694(1), 694(2), and 694(3) may be generated by the respective photodiodes 602(1), 602(2),

and 602(3). The photodiode current from the cells 694(1), 694(2), and 694(3) may combine on the interconnect 698 to form a combined photodiode current of 3*I_PD, or a 3x photodiode current.

[00134] When sample signal 618 of analog sampling circuit 603 is asserted, the 3x photodiode combines with the photodiode current I_PD of photodiode 602(0), and a 4x photodiode current may be sampled by the analog sampling circuit 603. Thus, a sample may be stored to capacitor 604 of analog sampling circuit 603 of cell 694(0) at a rate 4x faster than if the single photodiode 602(0) generated the photodiode current I_PD sampled by the analog sampling circuit 603. As an option, the 4x photodiode current may be sampled for a same given exposure time that a 1x photodiode current would be sampled for, which may significantly increase or decrease a value of the analog value stored in the analog sampling circuit 603. For example, an analog value stored from sampling the 4x photodiode current for the given exposure time may be associated with a final digital pixel value that is effectively 4x brighter than an analog value stored from sampling a 1x photodiode current for the given exposure time.

[00135] When all instances of the gate 691 are turned off, each of the cells 694 may be uncoupled from the other cells 694 of the other pixels 692. When the cells 694 are uncoupled, each of the cells 694 may operate in isolation as discussed previously, for example with respect to Figure 6A. For example, when operating in isolation, analog sampling circuit 603 may only sample, under the control of sample signal 618, a photodiode current I_PD from a respective photodiode 602(0).

[00136] In one embodiment, pixels 692 within an image sensor each include a cell 694 configured to be sensitive to red light (a "red cell"), a cell 694 configured to be sensitive to green light (a "green cell"), and a cell 694 configured to be sensitive to blue light (a "blue cell"). Furthermore, sets of two or more pixels 692 may be configured as described above in Figures 6A-6C to switch into a photodiode current sharing mode, whereby red cells within each set of pixels share photodiode current, green cells within each set of pixels share photodiode current, and blue cells within each set of pixels share photodiode current. In certain embodiments, the pixels 692 also each include a cell 694 configured to be sensitive to white light (a "white cell"),

whereby each white cell may operate independently with respect to photodiode current while the red cells, green cells, and blue cells operate in a shared photodiode current mode. All other manufacturing parameters being equal, each white cell may be more sensitive (e.g., three times more sensitive) to incident light than any of the red cells, green cells, or blue cells, and, consequently, a white cell may require less exposure time or gain to generate a comparable intensity signal level. In such an embodiment, the resolution of color information (from the red cells, green cells, and blue cells) may be reduced to gain greater sensitivity and better noise performance, while the resolution of pure intensity information (from the white cells) may be kept at full sensor resolution without significantly sacrificing sensitivity or noise performance with respect to intensity information. For example, a 4K pixel by 4K pixel image sensor may be configured to operate as a 2K pixel by 2K pixel image sensor with respect to color, thereby improving color sensitivity by a factor of 4x, while, at the same time, being able to simultaneously capture a 4K pixel by 4K pixel intensity plane from the white cells. In such a configuration, the quarter resolution color information provided by the red cells, green cells, and blue cells may be fused with full resolution intensity information provided by the white cells. To this end, a full 4K by 4K resolution color image may be generated by the image sensor, with better overall sensitivity and noise performance than a comparable conventional image sensor.

[00137] Figure 7 illustrates a system for converting analog pixel data to digital pixel data, in accordance with an embodiment. As an option, the system of Figure 7 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the system of Figure 7 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[00138] As shown in Figure 7, analog pixel data 721 is received from column read out circuit 520 at analog-to-digital unit 722 under the control of control unit 514. The analog pixel data 721 may be received within an analog signal, as noted hereinabove. Further, the analog-to-digital unit 722 generates digital pixel data 725 based on the received analog pixel data 721.

[00139] In one embodiment, a unique instance of analog pixel data 721 may include, as an ordered set of individual analog values, all analog values output from all corresponding analog

sampling circuits or sample storage nodes. For example, in the context of the foregoing figures, each cell of cells **542-545** of a plurality of pixels **540** of a pixel array **510** may include one or more analog sampling circuits **603**.

[00140] In one embodiment, the pixel array 510 may include a plurality of first analog sampling circuits 603(0) and also include a plurality of second analog sampling circuits 603(1). In such an embodiment, a first instance of analog pixel data 721 may be received containing a discrete analog value from a plurality of first analog sampling circuits 603(0), and a second instance of analog pixel data 721 may be received containing a discrete analog value from a plurality of second analog sampling circuits 603(1). Thus, in embodiments where cells of a pixel array include two or more analog sampling circuits, the pixel array may output two or more discrete analog signals, where each analog signal includes a unique instance of analog pixel data 721.

[00141] In some embodiments, only a subset of the cells of a pixel array may include two or more analog sampling circuits. For example, not every cell may include both a first analog sampling circuit 603(0) and a second analog sampling circuit 603(1).

[00142] With continuing reference to Figure 7, the analog-to-digital unit 722 includes an amplifier 750 and an analog-to-digital converter 754. In one embodiment, the amplifier 750 receives an instance of analog pixel data 721 and a gain 752, and applies the gain 752 to the analog pixel data 721 to generate gain-adjusted analog pixel data 723. The gain-adjusted analog pixel data 723 is transmitted from the amplifier 750 to the analog-to-digital converter 754. The analog-to-digital converter 754 receives the gain-adjusted analog pixel data 723, and converts the gain-adjusted analog pixel data 723 to the digital pixel data 725, which is then transmitted from the analog-to-digital converter 754. In other embodiments, the amplifier 750 may be implemented within the column read out circuit 520 instead of within the analog-to-digital unit 722. The analog-to-digital converter 754 may convert the gain-adjusted analog pixel data 723 to the digital pixel data 725 using any technically feasible analog-to-digital conversion technique.

[00143] In an embodiment, the gain-adjusted analog pixel data 723 results from the application of the gain 752 to the analog pixel data 721. In one embodiment, the gain 752 may be selected by the analog-to-digital unit 722. In another embodiment, the gain 752 may be selected by the control unit 514, and then supplied from the control unit 514 to the analog-to-digital unit 722 for application to the analog pixel data 721.

[00144] In one embodiment, the amplifier 750 may be a transimpedance amplifier (TIA). Furthermore, the gain 752 may be specified by a digital value. In one embodiment, the digital value specifying the gain 752 may be set by a user of a digital photographic device, such as by operating the digital photographic device in a "manual" mode. Still yet, the digital value may be set by hardware or software of a digital photographic device. As an option, the digital value may be set by the user working in concert with the software of the digital photographic device.

[00145] In one embodiment, a digital value used to specify the gain 752 may be associated with an ISO. In the field of photography, the ISO system is a well-established standard for specifying light sensitivity. In one embodiment, the amplifier 750 receives a digital value specifying the gain 752 to be applied to the analog pixel data 721. In another embodiment, there may be a mapping from conventional ISO values to digital gain values that may be provided as the gain 752 to the amplifier 750. For example, each of ISO 100, ISO 200, ISO 400, ISO 800, ISO 1600, etc. may be uniquely mapped to a different digital gain value, and a selection of a particular ISO results in the mapped digital gain value being provided to the amplifier 750 for application as the gain 752. In one embodiment, one or more ISO values may be mapped to a gain of 1. Of course, in other embodiments, one or more ISO values may be mapped to any other gain value.

[00146] Accordingly, in one embodiment, each analog pixel value may be adjusted in brightness given a particular ISO value. Thus, in such an embodiment, the gain-adjusted analog pixel data 723 may include brightness corrected pixel data, where the brightness is corrected based on a specified ISO. In another embodiment, the gain-adjusted analog pixel data 723 for an

image may include pixels having a brightness in the image as if the image had been sampled at a certain ISO.

[00147] In accordance with an embodiment, the digital pixel data 725 may comprise a plurality of digital values representing pixels of an image captured using the pixel array 510.

[00148] In one embodiment, an instance of digital pixel data 725 may be output for each instance of analog pixel data 721 received. Thus, where a pixel array 510 includes a plurality of first analog sampling circuits 603(0) and also includes a plurality of second analog sampling circuits 603(1), then a first instance of analog pixel data 721 may be received containing a discrete analog value from the first analog sampling circuits 603(0), and a second instance of analog pixel data 721 may be received containing a discrete analog value from the second analog sampling circuits 603(1). In such an embodiment, a first instance of digital pixel data 725 may be output based on the first instance of analog pixel data 721, and a second instance of digital pixel data 725 may be output based on the second instance of analog pixel data 721.

[00149] Further, the first instance of digital pixel data 725 may include a plurality of digital values representing pixels of a first image captured using the plurality of first analog sampling circuits 603(0) of the pixel array 510, and the second instance of digital pixel data 725 may include a plurality of digital values representing pixels of a second image captured using the plurality of second analog sampling circuits 603(1) of the pixel array 510.

[00150] In some embodiments, two or more gains 752 may be applied to an instance of analog pixel data 721, such that two or more instances of digital pixel data 725 may be output for each instance of analog pixel data 721.

[00151] Figure 8 illustrates implementations of different analog storage planes, in accordance with another embodiment. As an option, the analog storage planes of Figure 8 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the analog storage planes of Figure 8 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[00152] Figure 8 is illustrated to include a first analog storage plane 802 and a second analog storage plane 842. A plurality of analog values are each depicted as a "V" within the analog storage planes 802 and 842. In the context of certain embodiments, each analog storage plane may comprise any collection of one or more analog values. In some embodiments, an analog storage plane may be capable of storing at least one analog pixel value for each pixel of a row or line of a pixel array. In one embodiment, an analog storage plane may cable of storing an analog value for each cell of each pixel of a plurality of pixels of a pixel array. Still yet, in another embodiment, an analog storage plane may be capable of storing at least one analog pixel value for each pixel of an entirety of a pixel array, which may be referred to as a frame. For example, an analog storage plane may be capable of storing an analog value for each cell of each pixel of every line or row of a pixel array.

[00153] In one embodiment, the analog storage plane 842 may be representative of a portion of an image sensor in which an analog sampling circuit of each cell has been activated to sample a corresponding photodiode current. In other words, for a given region of an image sensor, all cells include an analog sampling circuit that samples a corresponding photodiode current, and stores an analog value as a result of the sampling operation. As a result, the analog storage plane 842 includes a greater analog value density 846 than an analog value density 806 of the analog storage plane 802.

[00154] In one embodiment, the analog storage plane 802 may be representative of a portion of an image sensor in which only one-quarter of the cells include analog sampling circuits activated to sample a corresponding photodiode current. In other words, for a given region of an image sensor, only one-quarter of the cells include an analog sampling circuit that samples a corresponding photodiode current, and stores an analog value as a result of the sampling operation. The analog value density 806 of the analog storage plane 802 may result from a configuration, as discussed above, wherein four neighboring cells are communicatively coupled via an interconnect such that a 4x photodiode current is sampled by a single analog sampling circuit of one of the four cells, and the remaining analog sampling circuits of the other three cells are not activated to sample.

[00155] Figure 9 illustrates a system 900 for converting analog pixel data of an analog signal to digital pixel data, in accordance with another embodiment. As an option, the system 900 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the system 900 may be implemented in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[00156] The system 900 is shown in Figure 9 to include a first analog storage plane 802, an analog-to-digital unit 922, a first digital image 912, a second analog storage plane 842, and a second digital image 952. As illustrated in Figure 9, a plurality of analog values are each depicted as a "V" within each of the analog storage planes 802 and 842, and corresponding digital values are each depicted as a "D" within digital images 912 and 952, respectively.

[00157] As noted above, each analog storage plane 802 and 842 may comprise any collection of one or more analog values. In one embodiment, a given analog storage plane may comprise an analog value for each analog storage circuit 603 that receives an active sample signal 618, and thereby samples a photodiode current, during an associated exposure time.

[00158] In some embodiments, an analog storage plane may include analog values for only a subset of all the analog storage circuits 603 of an image sensor. This may occur, for example, when analog storage circuits 603 of only odd or even rows of pixels are activated to sample during a given exposure time. Similarly, this may occur when analog storage circuits 603 of only odd or even columns of pixels are activated to sample during a given exposure. As another example, this may occur when two or more photosensitive cells are communicatively coupled, such as by an interconnect 644, in a manner that distributes a shared photodiode current, such as a 2x or 4x photodiode current, between the communicatively coupled cells. In such an embodiment, only a subset of analog sampling circuits 603 of the communicatively coupled cells may be activated by a sample signal 618 to sample the shared photodiode current during a given exposure time. Any analog sampling circuits 603 activated by a sample signal 618 during the given exposure time may sample the shared photodiode current, and store an analog value to the analog storage plane associated with the exposure time. However, the analog storage plane associated with the exposure time.

analog sampling circuits 603 that are not activated by a sample signal 618 during the exposure time.

[00159] Thus, an analog value density of a given analog storage plane may depend on a subset of analog sampling circuits 603 activated to sample photodiode current during a given exposure associated with the analog storage plane. Specifically, a greater analog value density may be obtained, such as for the more dense analog storage plane 842, when a sample signal 618 is activated for an analog sampling circuit 603 in each of a plurality of neighboring cells of an image sensor during a given exposure time. Conversely, a decreased analog value density may be obtained, such as for the less dense analog storage plane 802, when a sample signal 618 is activated for only a subset of neighboring cells of an image sensor during a given exposure time.

[00160] Returning now to Figure 9, the analog values of the less dense analog storage plane 802 are output as analog pixel data 904 to the analog-to-digital unit 922. Further, the analog values of the more dense analog storage plane 842 are separately output as analog pixel data 944 to the analog-to-digital unit 922. In one embodiment, the analog-to-digital unit 922 may be substantially identical to the analog-to-digital unit 722 described within the context of Figure 7. For example, the analog-to-digital unit 922 may comprise at least one amplifier and at least one analog-to-digital converter, where the amplifier is operative to receive a gain value and utilize the gain value to gain-adjust analog pixel data received at the analog-to-digital unit 922. Further, in such an embodiment, the amplifier may transmit gain-adjusted analog pixel data to an analog-to-digital converter, which then generates digital pixel data from the gain-adjusted analog pixel data. To this end, an analog-to-digital conversion may be performed on the contents of each of two or more different analog storage planes 802 and 842.

[00161] In one embodiment, the analog-to-digital unit 922 applies at least two different gains to each instance of received analog pixel data. For example, the analog-to-digital unit 922 may receive analog pixel data 904, and apply at least two different gains to the analog pixel data 904 to generate at least a first gain-adjusted analog pixel data and a second gain-adjusted analog pixel data based on the analog pixel data 904; and the analog-to-digital unit 922 may receive analog pixel data 944, and then apply at least two different gains to the analog pixel data 944 to generate

at least a first gain-adjusted analog pixel data and a second gain-adjusted analog pixel data based on the analog pixel data 944.

[00162] Further, the analog-to-digital unit 922 may convert each instance of gain-adjusted analog pixel data to digital pixel data, and then output a corresponding digital signal. With respect to Figure 9 specifically, the analog-to-digital unit 922 is shown to generate a first digital signal comprising first digital pixel data 906 corresponding to application of Gain1 to analog pixel data 904; and a second digital signal comprising second digital pixel data 946 corresponding to application of Gain1 to analog pixel data 944. Each instance of digital pixel data may comprise a digital image, such that the first digital pixel data 906 comprises a digital image 912, and the second digital pixel data 946 comprises a digital image 952. In other words, a first digital image 912 may be generated based on the analog values of the less dense analog storage plane 802, and a second digital image 952 may be generated based on the analog values of the more dense analog storage plane 842.

[00163] Of course, in other embodiments, the analog-to-digital unit 922 may apply a plurality of gains to each instance of analog pixel data, to thereby generate an image stack based on each analog storage plane 802 and 842. Image stack generation is discussed more fully within Application No. 14/534,089, filed 11/05/2014, entitled "IMAGE SENSOR APPARATUS AND METHOD FOR SIMULTANEOUSLY CAPTURING MULTIPLE IMAGES"; Application No. (DUELP009/DL016), filed xx/xx/xxxx, entitled "IMAGE SENSOR APPARATUS AND METHOD FOR SIMULTANEOUSLY CAPTURING FLASH AND AMBIENT ILLUMINATED IMAGES," which are each incorporated as though set forth herein in full. Each image stack may be manipulated as set forth in those applications, or as set forth below.

[00164] In some embodiments, the digital image 952 may have a greater resolution than the digital image 912. In other words, a greater number of pixels may comprise digital image 952 than a number of pixels that comprise digital image 912. This may be because the digital image 912 was generated from the less dense analog storage plane 802 that included, in one example, only one-quarter the number of sampled analog values of more dense analog storage plane 842. In other embodiments, the digital image 952 may have the same resolution as the digital image

912. In such an embodiment, a plurality of digital pixel data values may be generated to make up for the reduced number of sampled analog values in the less dense analog storage plane 802. For example, the plurality of digital pixel data values may be generated by interpolation to increase the resolution of the digital image 912.

storage plane 802 may be used to improve the digital image 952 generated from the less dense analog storage plane 802 may be used to improve the digital image 952 generated from the more dense analog storage plane 842. As a specific non-limiting example, each of the less dense analog storage plane 802 and the more dense analog storage plane 842 may storage analog values for a single exposure of a photographic scene. In the context of the present description, a "single exposure" of a photographic scene may include simultaneously, at least in part, capturing the photographic scene using two or more sets of analog sampling circuits, where each set of analog sampling circuits may be configured to operate at different exposure times. Further, the single exposure may be further broken up into multiple discrete exposure times or samples times, where the exposure times or samples times may occur sequentially, partially simultaneously, or in some combination of sequentially and partially simultaneously.

[00166] During capture of the single exposure of the photographic scene using the two or more sets of analog sampling circuits, some cells of the capturing image sensor may be communicatively coupled to one or more other cells. For example, cells of an image sensor may be communicatively coupled as shown in Figure 2, such that each cell is coupled to three other cells associated with a same peak wavelength of light. Therefore, during the single exposure, each of the communicatively coupled cells may receive a 4x photodiode current.

[00167] During a first sample time of the single exposure, a first analog sampling circuit in each of the four cells may receive an active sample signal, which causes the first analog sampling circuit in each of the four cells to sample the 4x photodiode current for the first sample time. The more dense analog storage plane 842 may be representative of the analog values stored during such a sample operation. Further, a second analog sampling circuit in each of the four cells may be controlled to separately sample the 4x photodiode current. As one option, during a second sample time after the first sample time, only a single second analog sampling

circuit of the four coupled cells may receive an active sample signal, which causes the single analog sampling circuit to sample the 4x photodiode current for the second sample time. The less dense analog storage plane 802 may be representative of the analog values stored during such a sample operation.

[00168] As a result, analog values stored during the second sample time of the single exposure are sampled with an increased sensitivity, but a decreased resolution, in comparison to the analog values stored during the first sample time. In situations involving a low-light photographic scene, the increased light sensitivity associated with the second sample time may generate a better exposed and/or less noisy digital image, such as the digital image 912. However, the digital image 952 may have a desired final image resolution or image size. Thus, in some embodiments, the digital image 912 may be blended or mixed or combined with digital image 952 to reduce the noise and improve the exposure of the digital image 952. For example, a digital image with one-half vertical or one-half horizontal resolution may be blended with a digital image at full resolution. In another embodiment any combination of digital images at one-half vertical resolution, one-half horizontal resolution, and full resolution may be blended.

[00169] In some embodiments, a first exposure time (or first sample time) and a second exposure time (or second sample time) are each captured using an ambient illumination of the photographic scene. In other embodiments, the first exposure time (or first sample time) and the second exposure time (or second sample time) are each captured using a flash or strobe illumination of the photographic scene. In yet other embodiments, the first exposure time (or first sample time) may be captured using an ambient illumination of the photographic scene, and the second exposure time (or second sample time) may be captured using a flash or strobe illumination of the photographic scene.

[00170] In embodiments in which the first exposure time is captured using an ambient illumination, and the second exposure time is captured using flash or strobe illumination, analog values stored during the first exposure time may be stored to an analog storage plane at a higher density than the analog values stored during the second exposure time. This may effectively increase the ISO or sensitivity of the capture of the photographic scene at ambient illumination.

Subsequently, the photographic scene may then be captured at full resolution using the strobe or flash illumination. The lower resolution ambient capture and the full resolution strobe or flash capture may then be merged to create a combined image that includes detail not found in either of the individual captures.

[00171] Various options for combining the digital image 912 and the digital image 952 for obtaining a combined digital image with improved exposure and less noise are disclosed below, and provided in U.S. Patent Application No. 14/534,068, filed 11/05/2014, entitled "SYSTEMS AND METHODS FOR HIGH-DYNAMIC RANGE IMAGES," the disclosures of which are incorporated herein as though set forth in full.

[00172] Figure 10 illustrates a user interface (UI) system 1000 for generating a combined image 1020, according to one embodiment. As an option, the UI system 1000 may be implemented in the context of the details of any of the Figures disclosed herein. Of course, however, the UI system 1000 may be carried out in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[00173] In one embodiment, a combined image 1020 comprises a combination of at least two related digital images. For example, the combined image 1020 may comprise a combined rendering of at least two digital images of a single exposure of a photographic scene. Specifically, the combined image 1020 may comprise a combined rendering of a digital image 912 generated from a less dense analog storage plane 802, and a digital image 952 generated from a more dense analog storage plane 842.

[00174] In one embodiment, the UI system 1000 presents a display image 1010 that includes, without limitation, a combined image 1020, a slider control 1030 configured to move along track 1032, and two or more indication points 1040, which may each include a visual marker displayed within display image 1010.

[00175] In one embodiment, the UI system 1000 is generated by an adjustment tool executing within a processor complex 310 of a digital photographic system 300, and the display image

1010 is displayed on display unit 312. In one embodiment, at least two digital images comprise source images for generating the combined image 1020. The at least two digital images may reside within NV memory 316, volatile memory 318, memory subsystem 362, or any combination thereof. In another embodiment, the UI system 1000 is generated by an adjustment tool executing within a computer system, such as a laptop computer or a desktop computer. The at least two digital images may be transmitted to the computer system or may be generated by an attached camera device. In yet another embodiment, the UI system 1000 may be generated by a cloud-based server computer system, which may download the at least two digital images to a client browser, which may execute combining operations described below. In another embodiment, the UI system 1000 is generated by a cloud-based server computer system, which receives the at least two digital images from a digital photographic system in a mobile device, and which may execute the combining operations described below in conjunction with generating combined image 1020.

[00176] The slider control 1030 may be configured to move between two end points corresponding to indication points 1040-A and 1040-C. One or more indication points, such as indication point 1040-B may be positioned between the two end points. Each indication point 1040 may be associated with a specific rendering of a combined image 1020, or a specific combination of two or more digital images. For example, the indication point 1040-A may be associated with a first digital image, and the indication point 1040-C may be associated with a second digital image. Both the first digital image and the second digital image may be from a single exposure, as described hereinabove. In another embodiment, when the slider control 1030 is positioned directly over the indication point 1040-A, only the first digital image may be displayed as the combined image 1020 in the display image 1010, and similarly when the slider control 1030 is positioned directly over the indication point 1040-C, only the second digital image may be displayed as the combined image 1020 in the display image 1010.

[00177] In one embodiment, indication point 1040-B may be associated with a blending of the first digital image and the second digital image. For example, when the slider control 1030 is positioned at the indication point 1040-B, the combined image 1020 may be a blend of the first digital image and the second digital image. In one embodiment, blending of the first digital

image and the second digital image may comprise alpha blending, brightness blending, dynamic range blending, and/or tone mapping or other non-linear blending and mapping operations. In another embodiment, any blending of the first digital image and the second digital image may provide a new image that has a greater dynamic range or other visual characteristics that are different than either of the first image and the second image alone. Thus, a blending of the first digital image and the second digital image may provide a new computed HDR image that may be displayed as combined image 1020 or used to generate combined image 1020. To this end, a first digital signal and a second digital signal may be combined, resulting in at least a portion of a HDR image. Further, one of the first digital signal and the second digital signal may be further combined with at least a portion of another digital image or digital signal. In one embodiment, the other digital image may include another HDR image.

In one embodiment, when the slider control 1030 is positioned at the indication point [00178] 1040-A, the first digital image is displayed as the combined image 1020, and when the slider control 1030 is positioned at the indication point 1040-C, the second digital image is displayed as the combined image 1020; furthermore, when slider control 1030 is positioned at indication point 1040-B, a blended image is displayed as the combined image 1020. In such an embodiment, when the slider control 1030 is positioned between the indication point 1040-A and the indication point 1040-C, a mix (e.g. blend) weight may be calculated for the first digital image and the second digital image. For the first digital image, the mix weight may be calculated as having a value of 0.0 when the slider control 1030 is at indication point 1040-C and a value of 1.0 when slider control 1030 is at indication point 1040-A, with a range of mix weight values between 0.0 and 1.0 located between the indication points 1040-C and 1040-A, respectively. For the second digital image, the mix weight may be calculated as having a value of 0.0 when the slider control 1030 is at indication point 1040-A and a value of 1.0 when slider control 1030 is at indication point 1040-C, with a range of mix weight values between 0.0 and 1.0 located between the indication points 1040-A and 1040-C, respectively.

[00179] In other embodiments, in addition to the indication point 1040-B, there may exist a plurality of additional indication points along the track 1032 between the indication points 1040-

A and 1040-C. The additional indication points may be associated with additional digital images.

[00180] Thus, as a result of the slider control 1030 positioning, two or more digital signals may be blended, and the blended digital signals may be generated utilizing analog values from different analog storage planes. Further, the different analog storage planes may be associated with different analog value densities. As noted above, a digital image generated from an analog storage plane captured using a shared photodiode current may be captured to include less noise, and/or may be captured at a greater light sensitivity or brightness. This digital image may be blended with a higher noise and higher resolution digital image to generate an image at the higher resolution with decreased noise, increased brightness, and/or better exposure. Thus, a blend operation of two or more digital signals may serve to reduce the noise apparent in at least one of the digital signals.

[00181] Of course, any two or more effective exposures may be blended based on the indication point of the slider control 1030 to generate a combined image 1020 in the UI system 1000. Still further, any two or more effective exposures may be blended utilizing the systems and methods disclose within U.S. Patent Application No. 14/534,068, filed 11/05/2014, entitled "SYSTEMS AND METHODS FOR HIGH-DYNAMIC RANGE IMAGES."

[00182] In one embodiment, a mix operation may be applied to a first digital image and a second digital image based upon at least one mix weight value associated with at least one of the first digital image and the second digital image. In one embodiment, a mix weight of 1.0 gives complete mix weight to a digital image associated with the 1.0 mix weight. In this way, a user may blend between the first digital image and the second digital image. To this end, a first digital signal and a second digital signal may be blended in response to user input. For example, sliding indicia may be displayed, and a first digital signal and a second digital signal may be blended in response to the sliding indicia being manipulated by a user.

[00183] A system of mix weights and mix operations provides a UI tool for viewing a first digital image, a second digital image, and a blended image as a gradual progression from the first

digital image to the second digital image. In one embodiment, a user may save a combined image 1020 corresponding to an arbitrary position of the slider control 1030. The adjustment tool implementing the UI system 1000 may receive a command to save the combined image 1020 via any technically feasible gesture or technique. For example, the adjustment tool may be configured to save the combined image 1020 when a user gestures within the area occupied by combined image 1020. Alternatively, the adjustment tool may save the combined image 1020 when a user presses, but does not otherwise move the slider control 1030. In another implementation, the adjustment tool may save the combined image 1020 when a user gestures, such as by pressing a UI element (not shown), such as a save button, dedicated to receive a save command.

[00184] To this end, a slider control may be used to determine a contribution of two or more digital images to generate a final computed image, such as combined image 1020. Persons skilled in the art will recognize that the above system of mix weights and mix operations may be generalized to include two or more indication points, associated with two or more related images. Such related images may comprise, without limitation, any number of digital images that have been generated from two or more analog storage planes, and which may have zero, or near zero, interframe time.

[00185] Furthermore, a different continuous position UI control, such as a rotating knob, may be implemented rather than the slider control 1030.

[00186] In other embodiments, the UI system 1000 may include additional slider controls. For example, where the first digital image includes an ambient image, and the second digital image includes a strobe or flash image, then two or more slider controls may be provided on the UI system 1000. A first slider control in such an example may allow a user to control an application of gain to one or more of the digital images. For example, the first slider control may control an application of gain to the ambient image. Similarly, a second slider control may control an application of gain to the strobe or flash image. As an option, another slider control in such an example may allow a user to control a flash contribution of the flash image to a combined image.

[00187] Figure 11 is a flow diagram of method 1100 for generating a combined image, according to one embodiment. As an option, the method 1100 may be carried out in the context of the details of any of the Figures disclosed herein. Of course, however, the method 1100 may be carried out in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[00188] The method 1100 begins in step 1110, where an adjustment tool executing within a processor complex, such as processor complex 310, loads at least two related source images, such as a first digital image and a second digital image described in the context of Figure 10. In step 1112, the adjustment tool initializes a position for a UI control, such as slider control 1030 of Figure 10, to a default setting. In one embodiment, the default setting comprises an end point, such as indication point 1040-A, for a range of values for the UI control. In another embodiment, the default setting comprises a calculated value based on one or more of the at least two related source images. In certain embodiments, the default setting is initialized to a value previously selected by a user in association with an image object comprising at least the first digital image and the second digital image.

[00189] In step 1114, the adjustment tool generates and displays a combined image, such as combined image 1020 of Figure 10, based on a position of the UI control and the at least two related source images. In one embodiment, generating the combined image comprises mixing the at least two related source images as described previously in Figure 10. In step 1116, the adjustment tool receives user input. The user input may include, without limitation, a UI gesture such as a selection gesture or click gesture within display image 1010. If, in step 1120, the user input should change the position of the UI control, then the adjustment tool changes the position of the UI control and the method proceeds back to step 1114. Otherwise, the method proceeds to step 1130.

[00190] If, in step 1130, the user input does not comprise a command to exit, then the method proceeds to step 1140, where the adjustment tool performs a command associated with the user input. In one embodiment, the command comprises a save command and the adjustment tool

then saves the combined image, which is generated according to a position of the UI control. The method then proceeds back to step 1116.

[00191] Returning to step 1130, if the user input comprises a command to exit, then the method terminates in step 1190, where the adjustment tool exits, thereby terminating execution.

[00192] In summary, a technique is disclosed for generating a new digital photograph that beneficially blends a first digital image and a second digital image, where the first digital image and the second digital image are based on different analog signals received from two different analog storage planes, but from a single image sensor. The first digital image may be blended with the second digital image based on a function that implements any technically feasible blend technique. An adjustment tool may implement a user interface technique that enables a user to select and save the new digital photograph from a gradation of parameters for combining related images.

[00193] One advantage of the embodiments disclosed herein is that a digital photograph may be selectively generated based on user input using two or more different samples of a single exposure of a photographic scene. Accordingly, the digital photograph generated based on the user input may have a greater dynamic range than any of the individual samples. Further, the generation of an HDR image using two or more different samples with zero, or near zero, interframe time allows for the rapid generation of HDR images without motion artifacts.

[00194] Figure 12 illustrates a message sequence 1200 for generating a combined image utilizing a network, according to one embodiment. As an option, the message sequence 1200 may be carried out in the context of the details of any of the Figures disclosed herein. Of course, however, the message sequence 1200 may be carried out in any desired environment. Further, the aforementioned definitions may equally apply to the description below.

[00195] As shown in Figure 12, a wireless mobile device 376(0) generates at least two digital images. In one embodiment, the at least two digital images may include a digital image 912

generated from a less dense analog storage plane 802, and a digital image 952 generated from a more dense analog storage plane 842.

[00196] Referring again to Figure 12, the at least two digital images are transmitted from the wireless mobile device 376(0) to a data center 480 by way of a data network 474. The at least two digital images may be transmitted by the wireless mobile device 376(0) to the data center 480 using any technically feasible network communication method.

[00197] Further, in one embodiment, the data center 480 may then process the at least two digital images to generate a first computed image. The processing of the at least two digital images may include any processing of the at least two digital images that blends or merges at least a portion of each of the at least two digital images to generate the first computed image. To this end, the first digital image and the second digital image may be combined remotely from the wireless mobile device 376(0). For example, the processing of the at least two digital images may include an any type of blending operation, including but not limited to, an HDR image combining operation. In one embodiment, the processing of the at least two digital images may include any blending computations that produce a first computed image with less noise than at least one of the digital images received at the data center 480. In another embodiment, the processing of the at least two digital images may include any computations that produce a first computed image having a greater dynamic range than any one of the digital images received at the data center 480. Accordingly, in one embodiment, the first computed image generated by the data center 480 may be an HDR image. In other embodiments, the first computed image generated by the data center 480 may be at least a portion of an HDR image.

[00198] After generating the first computed image, the data center 480 may then transmit the first computed image to the wireless mobile device 376(0). In one embodiment, the transmission of the at least two digital images from the wireless mobile device 376(0), and the receipt of the first computed image at the wireless mobile device 376(0), may occur without any intervention or instruction being received from a user of the wireless mobile device 376(0). For example, in one embodiment, the wireless mobile device 376(0) may transmit the at least two digital images to the data center 480 immediately after capturing a photographic scene and generating the at

least two digital images utilizing one or more analog signals representative of the photographic scene. The photographic scene may be captured based on a user input or selection of an electronic shutter control, or pressing of a manual shutter button, on the wireless mobile device 376(0).

may generate an HDR image based on the at least two digital images, and transmit the HDR image to the wireless mobile device 376(0). The HDR image may be generated utilizing a blending of the at least two digital images for reducing the noise of the HDR image in comparison to at least one of the digital images. The wireless mobile device 376(0) may then display the received HDR image. Accordingly, a user of the wireless mobile device 376(0) may view on the display of the wireless mobile device 376(0) an HDR image computed by the data center 480. Thus, even though the wireless mobile device 376(0) does not perform any HDR image processing, the user may view on the wireless mobile device 376(0) the newly computed HDR image substantially instantaneously after capturing the photographic scene and generating the at least two digital images on which the HDR image is based.

[00200] As shown in Figure 12, the wireless mobile device 376(0) requests adjustment in processing of the at least two digital images. In one embodiment, upon receiving the first computed image from the data center 480, the wireless mobile device 376(0) may display the first computed image in a UI system, such as the UI system 1000 of Figure 10. In such an embodiment, the user may control a slider control, such as the slider control 1030, to adjust the processing of the at least two digital images transmitted to the data center 480. For example, user manipulation of a slider control may result in commands being transmitted to the data center 480. In one embodiment, the commands transmitted to the data center 480 may include mix weights for use in adjusting the processing of the at least two digital images. In other embodiments, the request to adjust processing of the at least two digital images includes any instructions from the wireless mobile device 376(0) that the data center 480 may use to again process the at least two digital images and generate a second computed image.

[00201] As shown in Figure 12, upon receiving the request to adjust processing, the data center 480 re-processes the at least two digital images to generate a second computed image. In one embodiment, the data center 480 may re-process the at least two digital images using parameters received from the wireless mobile device 376(0). The parameters may be provided as input with the at least two digital images to an HDR processing algorithm that executes at the data center 480. The parameters may be provided as input to a blending operation to adjust a blending of the at least two digital images. After generating the second computed image, the second computed image may be transmitted from the data center 480 to the wireless mobile device 376(0) for display to the user.

[00202] Referring again to Figure 12, the wireless mobile device 376(0) shares the second computed image with another wireless mobile device 376(1). In one embodiment, the wireless mobile device 376(0) may share any computed image received from the data center 480 with the other wireless mobile device 376(1). For example, the wireless mobile device 376(0) may share the first computed image received from the data center 480. As shown in Figure 12, the data center 480 communicates with the wireless mobile device 376(0) and the wireless mobile device 376(1) over the same data network 474. Of course, in other embodiments the wireless mobile device 376(0) may communicate with the data center 480 via a network different than a network utilized by the data center 480 and the wireless mobile device 376(1) for communication.

[00203] In another embodiment, the wireless mobile device 376(0) may share a computed image with the other wireless mobile device 376(1) by transmitting a sharing request to data center 480. For example, the wireless mobile device 376(0) may request that the data center 480 forward the second computed to the other wireless mobile device 376(1). In response to receiving the sharing request, the data center 480 may then transmit the second computed image to the wireless mobile device 376(1). In an embodiment, transmitting the second computed image to the other wireless mobile device 376(1) may include sending a URL at which the other wireless mobile device 376(1) may access the second computed image.

[00204] Still further, as shown in Figure 12, after receiving the second computed image, the other wireless mobile device 376(1) may send to the data center 480 a request to adjust

processing of the at least two digital images. For example, the other wireless mobile device 376(1) may display the second computed image in a UI system, such as the UI system 1000 of Figure 10. A user of the other wireless mobile device 376(1) may manipulate UI controls to adjust the processing of the at least two digital images transmitted to the data center 480 by the wireless mobile device 376(0). For example, user manipulation of a slider control at the other wireless mobile device 376(1) may result in commands being generated and transmitted to data center 480 for processing. In an embodiment, the request to adjust the processing of the at least two digital images sent from the other wireless mobile device 376(1) includes the commands generated based on the user manipulation of the slider control at the other wireless mobile device 376(1). In other embodiments, the request to adjust processing of the at least two digital images includes any instructions from the wireless mobile device 376(1) that the data center 480 may use to again process the at least two digital images and generate a third computed image.

[00205] As shown in Figure 12, upon receiving the request to adjust processing, the data center 480 re-processes the at least two digital images to generate a third computed image. In one embodiment, the data center 480 may re-process the at least two digital images using mix weights received from the wireless mobile device 376(1). In such an embodiment, the mix weights received from the wireless mobile device 376(1) may be provided as input with the at least two digital images to an HDR processing algorithm that executes at the data center 480. In another embodiment, the mix weights received from the wireless mobile device 376(1) may be used to adjust a blending of the at least two digital images. After generating the third computed image, the third computed image is then transmitted from the data center 480 to the wireless mobile device 376(1) for display. Still further, after receiving the third computed image, the wireless mobile device 376(1) may send to the data center 480 a request to store the third computed image. In another embodiment, other wireless mobile devices 376 in communication with the data center 480 may request storage of a computed image. For example, in the context of Figure 12, the wireless mobile device 376(0) may at any time request storage of the first computed image or the second computed image.

[00206] In response to receiving a request to store a computed image, the data center 480 may store the computed image for later retrieval. For example, the stored computed image may be

stored such that the computed image may be later retrieved without re-applying the processing that was applied to generate the computed image. In one embodiment, the data center **480** may store computed images within a storage system **486** local to the data center **480**. In other embodiments, the data center **480** may store computed images within hardware devices not local to the data center **480**, such as a data center **481**. In such embodiments, the data center **480** may transmit the computed images over the data network **474** for storage.

[00207] Still further, in some embodiments, a computed image may be stored with a reference to the at least two digital images utilized to generate the computed image. For example, the computed image may be associated with the at least two digital images utilized to generate the computed image, such as through a URL served by data center 480 or 481. By linking the stored computed image to the at least two digital images, any user or device with access to the computed image may also be given the opportunity to subsequently adjust the processing applied to the at least two digital images, and thereby generate a new computed image.

[00208] To this end, users of wireless mobile devices 376 may leverage processing capabilities of a data center 480 accessible via a data network 474 to generate a new image utilizing digital images that other wireless mobile devices 376 have captured and subsequently provided access to. For example, digital signals comprising digital images may be transferred over a network for being combined remotely, and the combined digital signals may result in at least a portion of a low-noise or HDR image. Still further, a user may be able to adjust a blending of two or more digital images to generate a new low-noise or HDR photograph without relying on their wireless mobile device 376 to perform the processing or computation necessary to generate the new photograph. Subsequently, the user's device may receive at least a portion of an image resulting from a combination of two or more digital signals. Accordingly, the user's wireless mobile device 376 may conserve power by offloading processing to a data center. Finally, the user may be able to obtain a low-noise or HDR photograph generated using an algorithm determined to be best for a photographic scene without having to select a blending or HDR algorithm himself or herself and without having installed software that implements such a blending or HDR algorithm on their wireless mobile device 376. For example, the user may rely

on the data center **480** to identify and to select a best blending or HDR algorithm for a particular photographic scene.

[00209] One advantage of the present invention is that a digital photograph may be selectively generated based on user input using two or more different images generated from a single exposure of a photographic scene. Accordingly, the digital photograph generated based on the user input may have a greater dynamic range than any of the individual images. Further, the generation of an HDR image using two or more different images with zero, or near zero, interframe time allows for the rapid generation of HDR images without motion artifacts.

[00210] When there is any motion within a photographic scene, or a capturing device experiences any jitter during capture, any interframe time between exposures may result in a motion blur within a final merged HDR photograph. Such blur can be significantly exaggerated as interframe time increases. This problem renders current HDR photography an ineffective solution for capturing clear images in any circumstance other than a highly static scene. Further, traditional techniques for generating a HDR photograph involve significant computational resources, as well as produce artifacts which reduce the image quality of the resulting image. Accordingly, strictly as an option, one or more of the above issues may or may not be addressed utilizing one or more of the techniques disclosed herein.

[00211] Still yet, in various embodiments, one or more of the techniques disclosed herein may be applied to a variety of markets and/or products. For example, although the techniques have been disclosed in reference to a photo capture, they may be applied to televisions, web conferencing (or live streaming capabilities, etc.), security cameras (e.g. increase contrast to determine characteristic, etc.), automobiles (e.g. driver assist systems, in-car infotainment systems, etc.), and/or any other product which includes a camera input.

[00212] While various embodiments have been described above, it should be understood that they have been presented by way of example only, and not limitation. Thus, the breadth and scope of a preferred embodiment should not be limited by any of the above-described exemplary

embodiments, but should be defined only in accordance with the following claims and their equivalents.

CLAIMS

and

What is claimed is:

1. An apparatus, comprising:

a first cell of a first pixel in communication with a first node for storing a first sample;

a second cell of a second pixel in communication with a second node for storing a second sample;

wherein the first cell and the second cell are in communication.

2. The apparatus of Claim 1, further comprising:

a third cell of a third pixel in communication with a third node for storing a third sample; and

a fourth cell of a fourth pixel in communication with a fourth node for storing a fourth sample;

wherein the first cell, the second cell, the third cell, and the fourth cell are in communication.

- 3. The apparatus of Claim 1, wherein the first cell and the second cell are in communication such that the first cell of the first pixel and the second cell of the second pixel concurrently store the first sample to the first node, such that the first sample stored at the first node is based on both of a first light intensity at the first cell and a second light intensity at the second cell.
- 4. The apparatus of Claim 1, wherein the apparatus is configured such that the first pixel includes a plurality of cells in addition to the first cell that are not communicatively coupled to the second cell of the second pixel, and the second pixel includes a plurality of cells in addition to the second cell that are not communicatively coupled to the first cell of the first pixel.

- 5. The apparatus of Claim 1, wherein the apparatus is configured such that the first cell is communicatively coupled to a first capacitor of the first node, and the second cell is communicatively coupled to the first capacitor of the first node.
- 6. The apparatus of Claim 1, wherein the apparatus is configured such that the first cell and the second cell are in communication utilizing a communicative coupling that includes at least one transistor.
- 7. The apparatus of Claim 1, wherein the apparatus is configured such that the first cell and the second cell are in communication utilizing a communicative coupling that includes a first transistor having a drain communicatively coupled to the first node and the second node, a source, and a gate.
- 8. The apparatus of Claim 1, wherein the apparatus is operable such that the first sample is output in a first analog signal.
- 9. The apparatus of Claim 1, wherein the apparatus is operable such that a first photodiode current of the first cell and a second photodiode current of the second cell are combined for storing the first sample at the first node.
- 10. The apparatus of Claim 9, wherein the apparatus is operable such that the first sample is output in a first analog signal that is amplified utilizing a first gain, resulting in a first amplified analog signal.
- 11. The apparatus of Claim 10, wherein the apparatus is operable such that the first amplified analog signal is converted to at least a portion of a first digital signal associated with a first digital image.
- 12. The apparatus of Claim 11, wherein the apparatus is operable such that sliding indicia is displayed, and in response to the sliding indicia being manipulated by a user the first digital signal is blended with a second digital signal associated with a second digital image.

- 13. The apparatus of Claim 12, wherein the apparatus is operable such that the second digital signal is generated utilizing, at least in part, a second amplified analog signal, wherein the second amplified analog signal is generated from applying a second gain to a second analog signal, wherein the second analog signal includes an analog value based on the second sample stored at the second node.
- 14. The apparatus of Claim 13, wherein the apparatus is operable such that the first sample and the second sample are stored during a single exposure of a photographic scene.
- 15. The apparatus of Claim 12, wherein the apparatus is operable such that the first digital signal includes the first digital image having a first resolution, and the second digital signal includes the second digital image having a second resolution different than the first resolution.
- 16. The apparatus of Claim 15, wherein the second resolution of the second digital image is greater than the first resolution of the first digital image.
- 17. The apparatus of Claim 1, wherein the apparatus is operable such that at least one of the first sample and the second sample is converted to a plurality of digital signals.
- 18. The apparatus of Claim 17, wherein the apparatus is operable for transferring the digital signals over a network for being combined remotely.
- 19. The apparatus of Claim 17, wherein the apparatus is operable for transferring the digital signals over a network for being combined remotely, resulting in at least a portion of a high dynamic range (HDR) image.
- 20. A method, comprising: storing a first sample on a first node in communication with a first cell of a first pixel; storing a second sample on a second node in communication with a second cell of a second pixel; and

communicatively coupling the first node and the second node.

<u>ABSTRACT</u>

A system, method, and computer program product are provided for obtaining low-noise, high-speed captures of a photographic scene. In use, a first cell of a first pixel is in communication with a first node for storing a first sample. Further, a second cell of a second pixel is in communication with a second node for storing a second sample. Still further, the first cell and the second cell are communicatively coupled.



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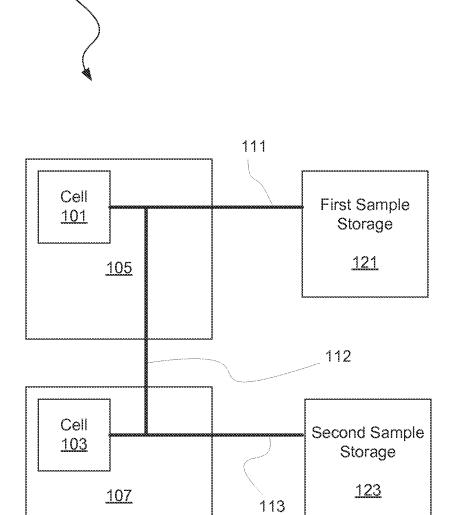


Figure 1

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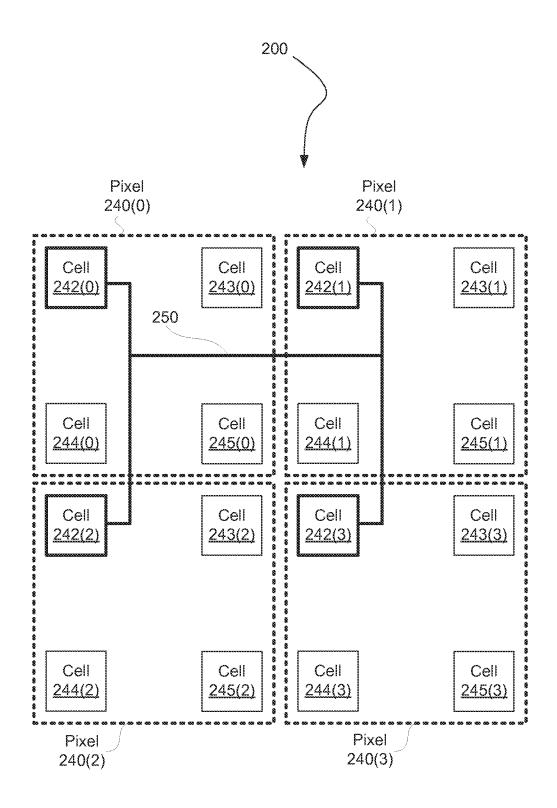


Figure 2

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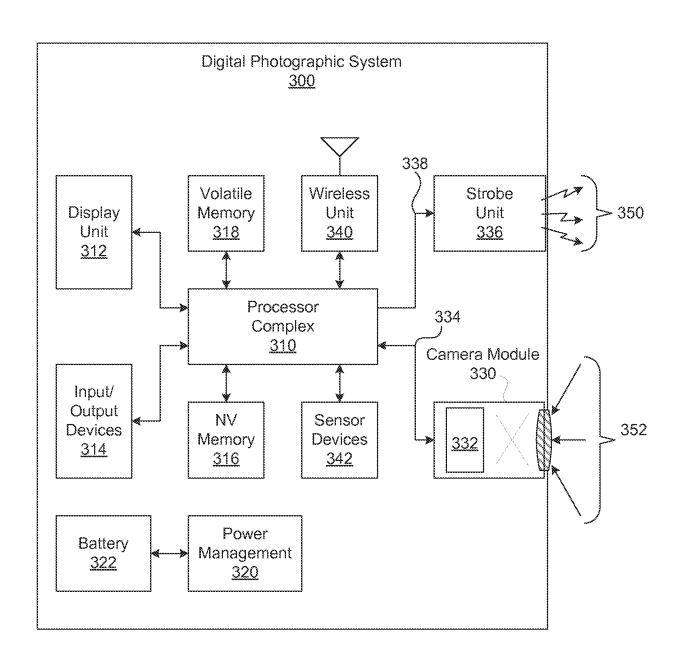


Figure 3A

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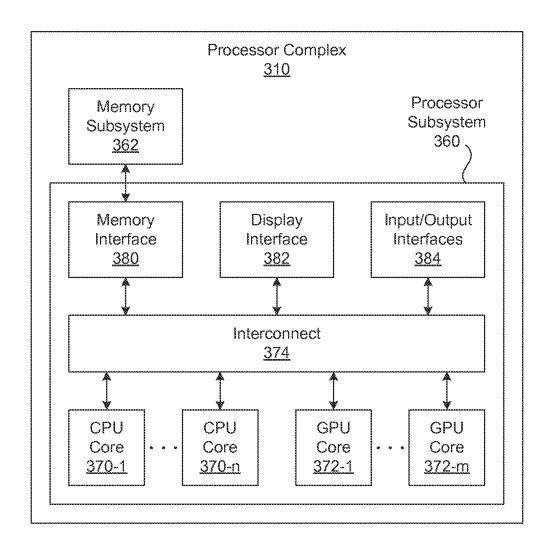


Figure 3B

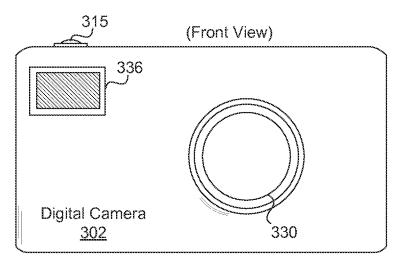


Figure 3C

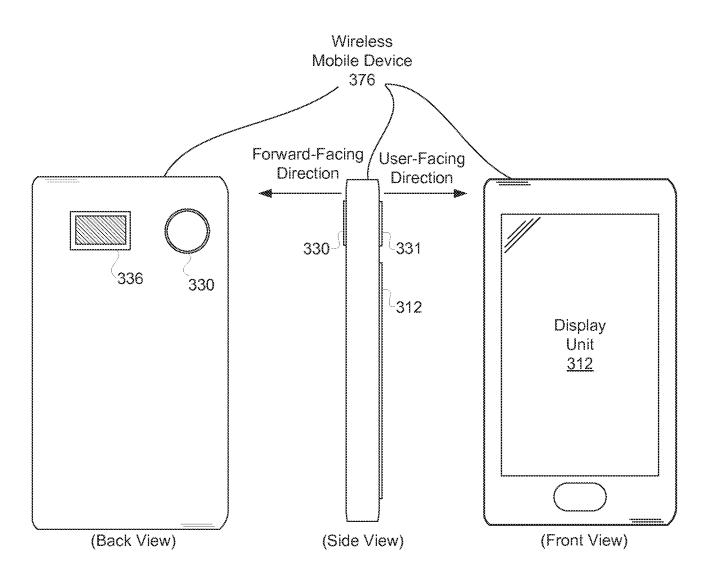


Figure 3D

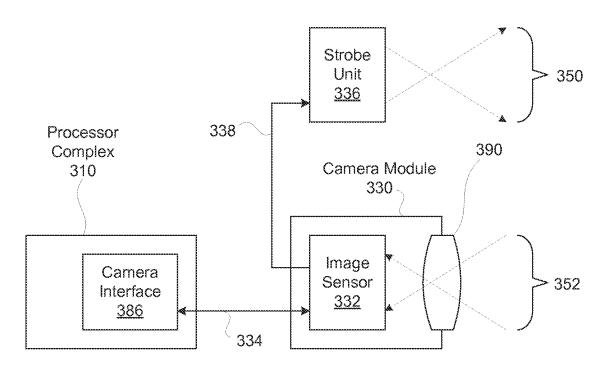


Figure 3E

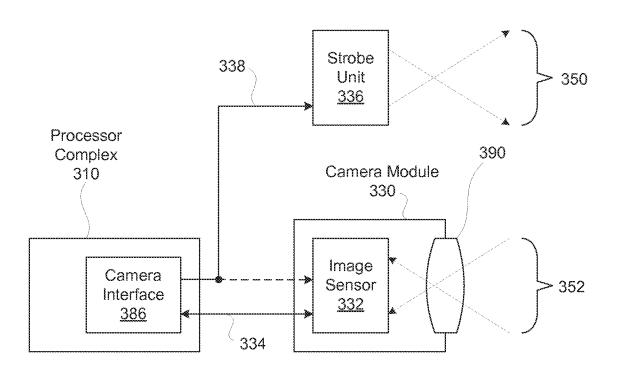


Figure 3F

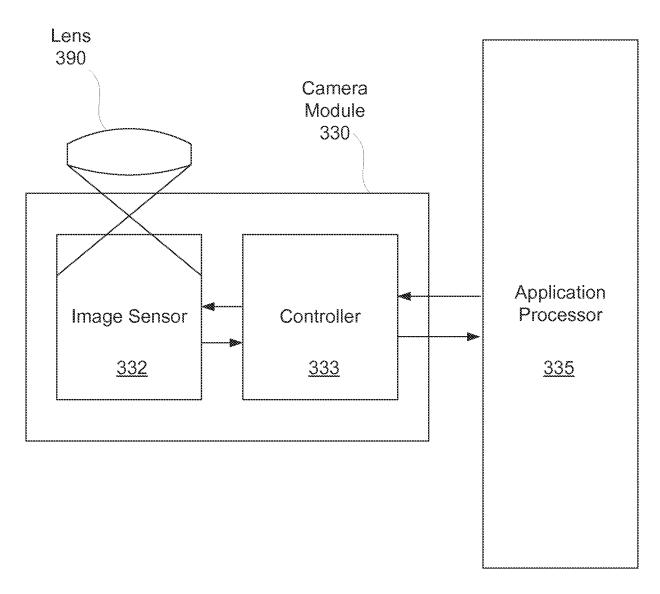


Figure 3G

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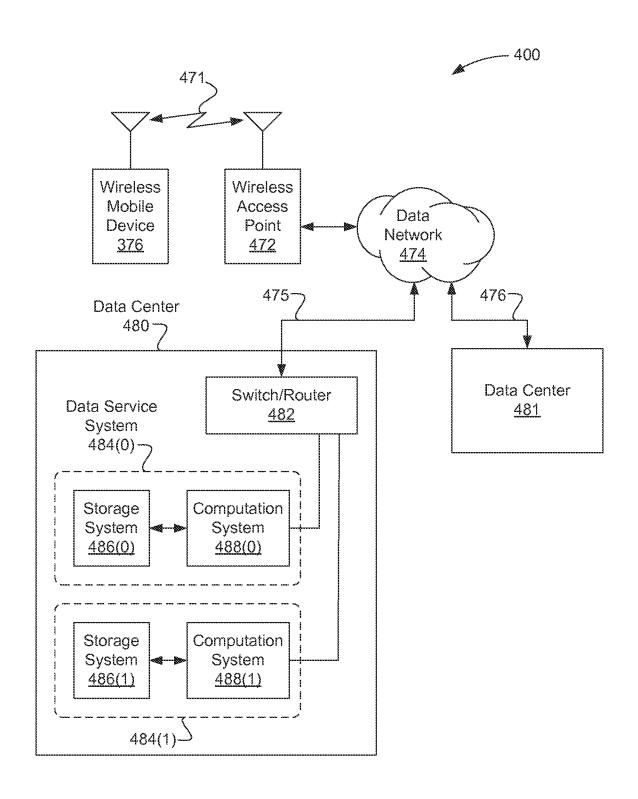


Figure 4

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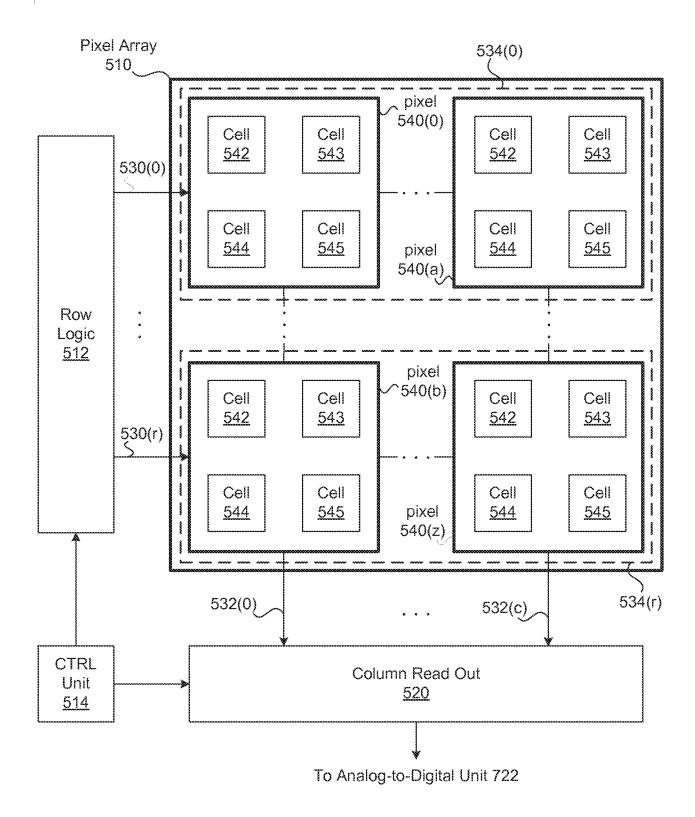
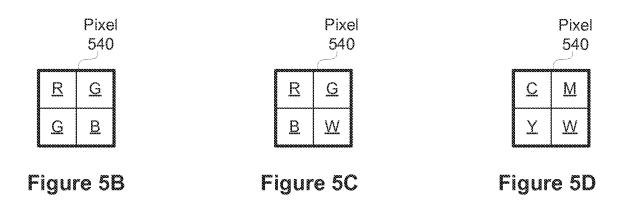


Figure 5A



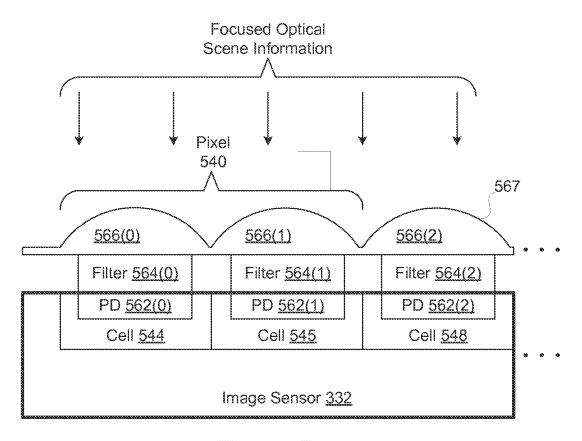


Figure 5E

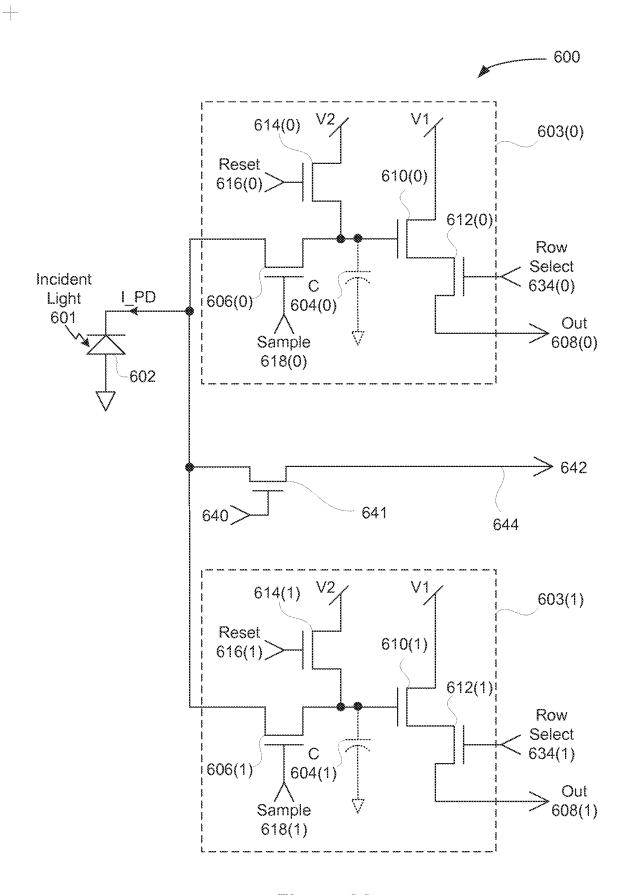


Figure 6A

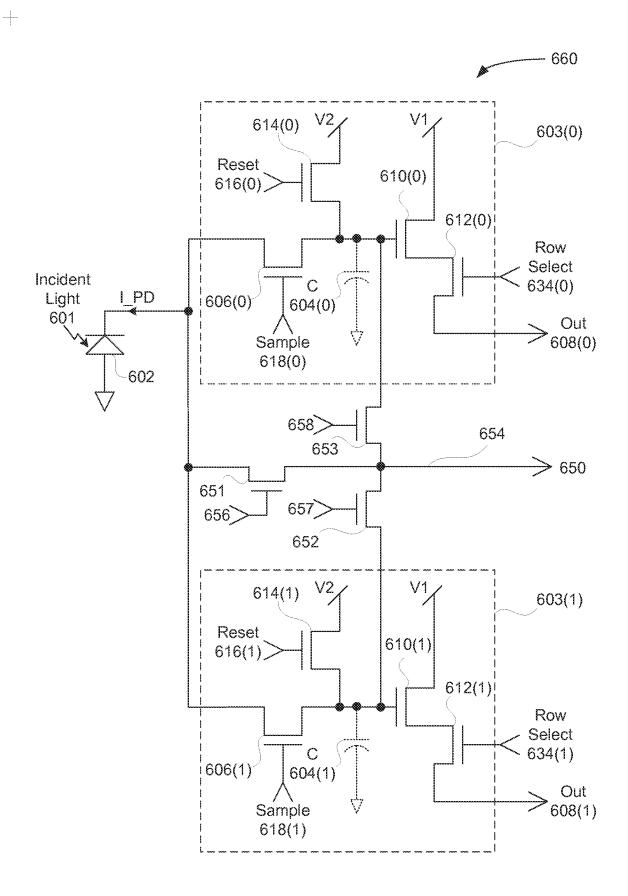


Figure 6B

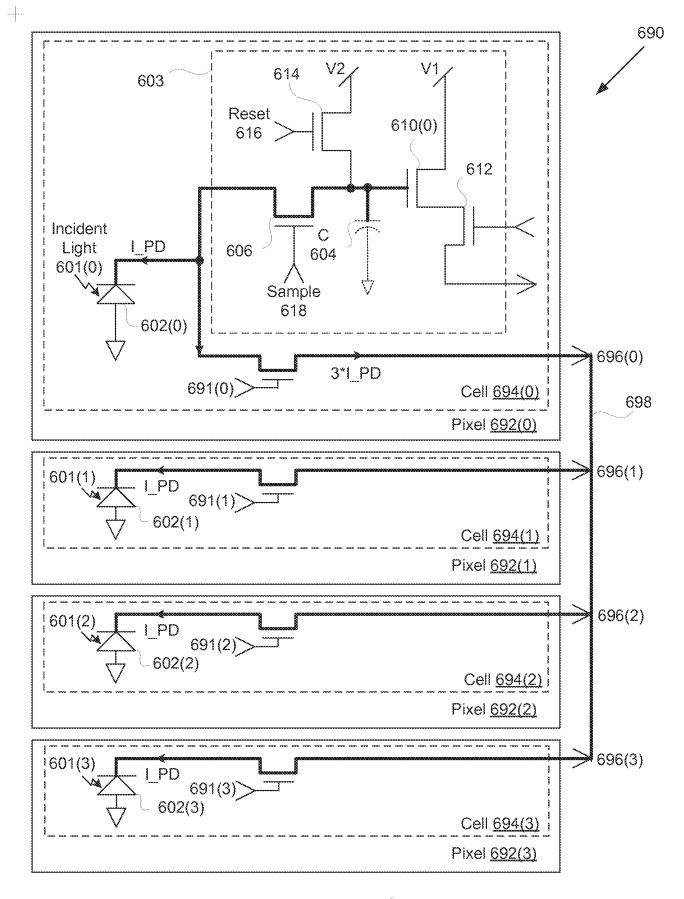


Figure 6C

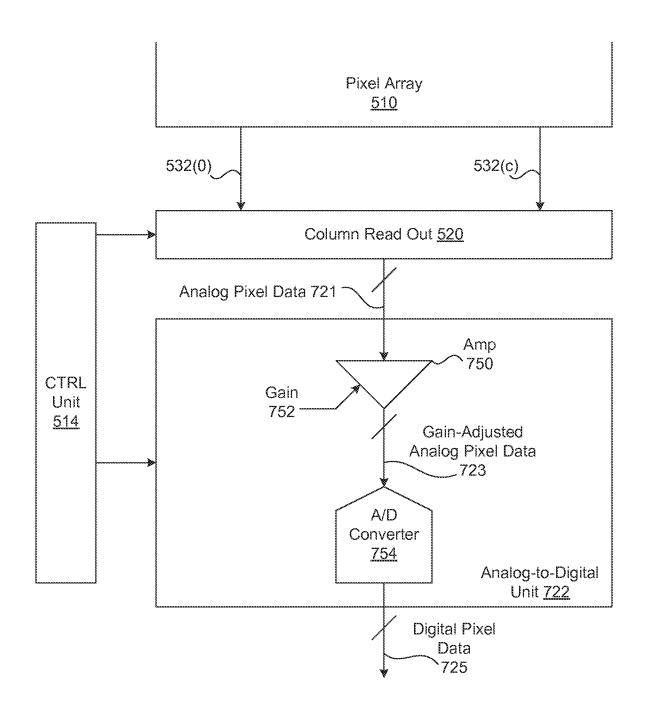
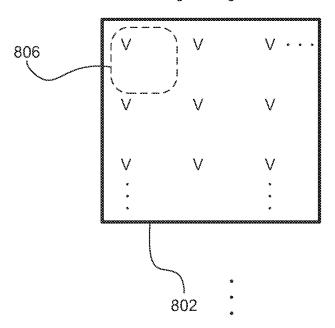


Figure 7

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Analog Storage Plane

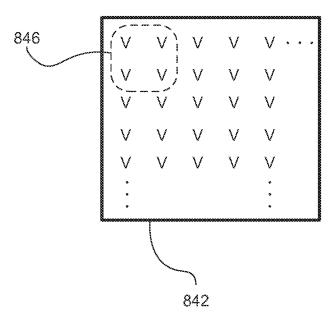


Figure 8

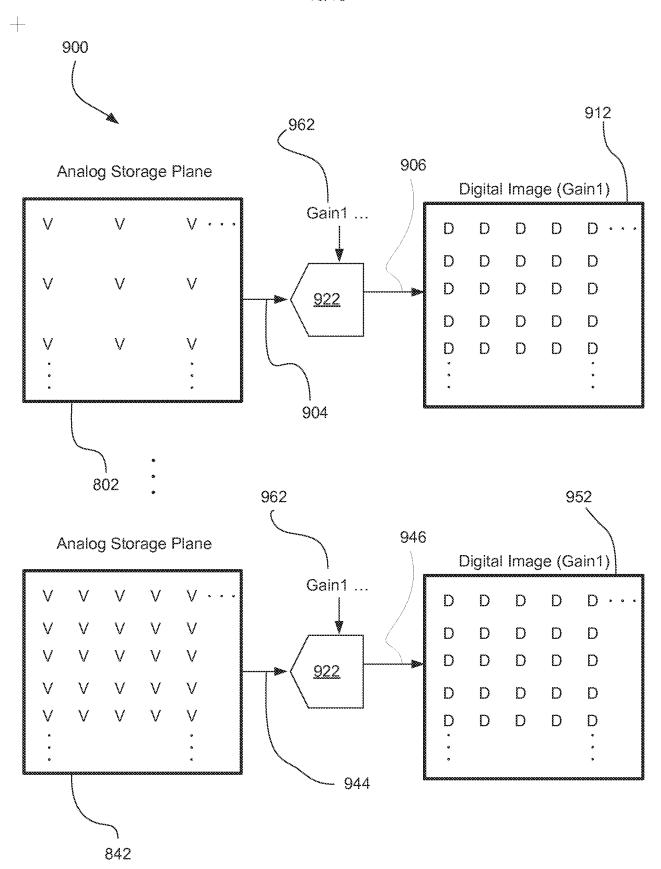


Figure 9

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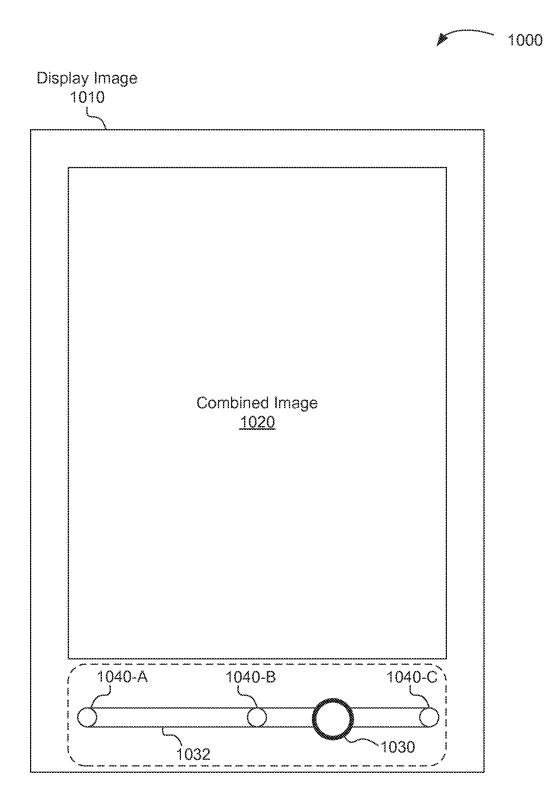


Figure 10

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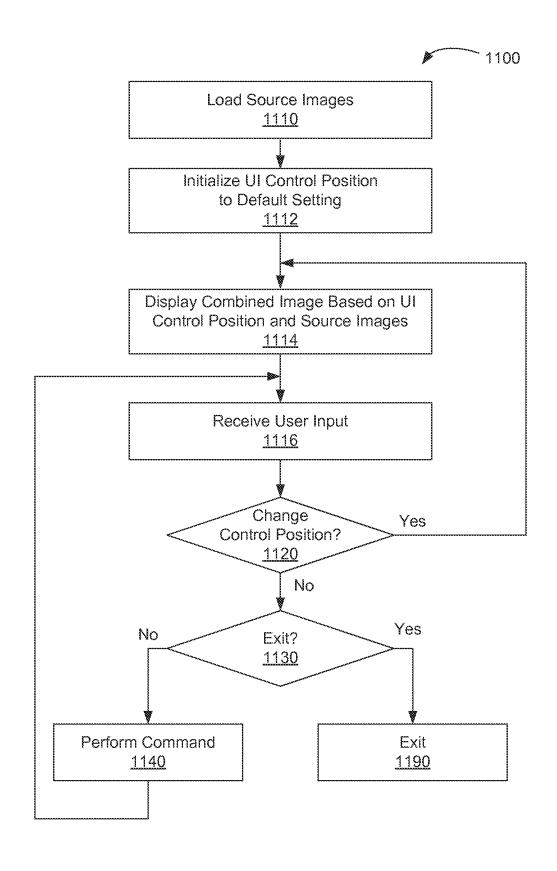
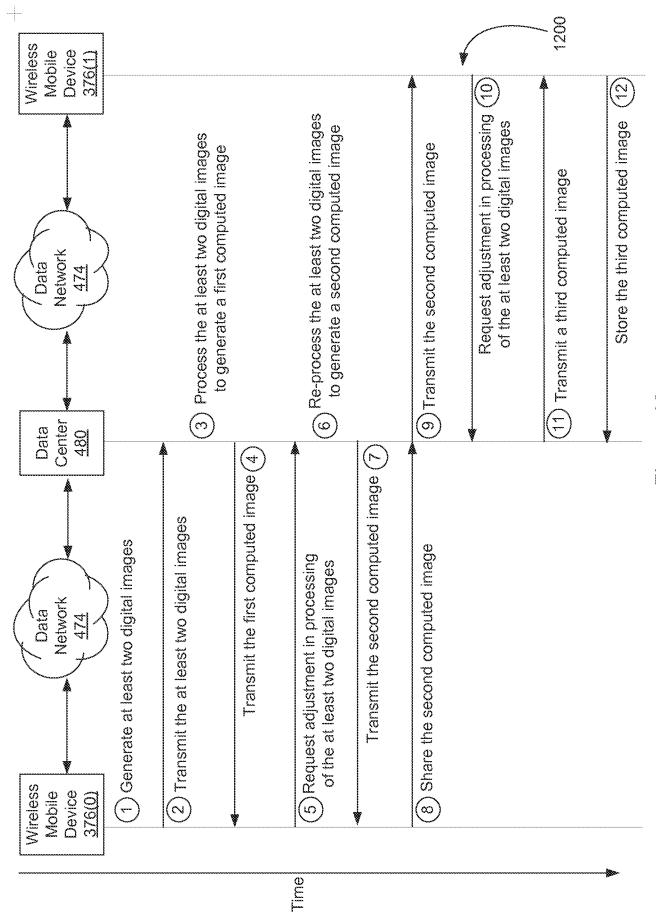


Figure 11

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Attorney Docket No.: DUELP010/DL017

COMBINED DECLARATION (37 C.F.R. 1.63) AND ASSIGNMENT FOR UTILITY APPLICATION USING AN APPLICATION DATA SHEET (37 C.F.R. 1.76)

Title of Invention: IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE

As the below named inventor, I hereby declare that:
This declaration is directed to the attached application, or (if following box is checked) United States application or PCT international application number, filed on
The above-identified application was made or authorized to be made by me.
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.
I hereby state that I have reviewed and understand the contents of the above identified application, including the claims.
I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37 CFR § 1.56.
Whereas, I the undersigned inventor have invented certain new and useful improvements as set forth in the above-identified patent application and further identified by the Attorney Docket Number provided above in the header of this document.
For good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, I the undersigned inventor hereby:
1) Sell(s), assign(s) and transfer(s) to <u>Duelight LLC</u> , a California limited liability company having a place of business at 105° Rockefeller Dr., Sunnyvale, CA 94087, (hereinafter referred to as ("ASSIGNEF"), the entire right title and interest in any and al improvements and inventions disclosed in, application(s) based upon, and Patent(s) (including foreign patents) granted upon the information which is disclosed in the above referenced application.
2) Authorize and request the Commissioner of Patents to issue any and all Letters Patents resulting from said application or any division(s), continuation(s), substitutes(s) or reissue(s) thereof to the ASSIGNEE.
3) Agree to execute all papers and documents and, entirely at the ASSIGNEE's expense, perform any acts which are reasonably necessary in connection with the prosecution of said application, as well as any derivative and applications thereof, foreign applications based thereon, and/or the enforcement of patents resulting from such applications.
4) Agree that the terms, covenants and conditions of this assignment shall inure to the benefit of the Assignee, its successors, assign and other legal representative, and shall be binding upon the inventor(s), as well as the inventor's heirs, legal representatives an assigns.
5) Warrant and represent that I have not entered, and will not enter into any assignment, contract, or understanding that conflicts with this assignment.
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine comprisonment of not more than five (5) years, or both.
Signed on the date indicated beside my signature.
Legal Name of Inventor: William Rivard
Signature: 0 = Date: 30 00+ 2014

Attorney Docket No.: DUELP010/DL017

COMBINED DECLARATION (37 C.F.R. 1.63) AND ASSIGNMENT FOR UTILITY APPLICATION USING AN APPLICATION DATA SHEET (37 C.F.R. 1.76)

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As the below named inventor, I hereby declare that:
This declaration is directed to the attached application, or (if following box is checked) United States application or PCT international application number, filed on
The above-identified application was made or authorized to be made by me.
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.
Thombs start have reviewed and understand the contents of the above identified application, including the clause.
I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 1000 1100 1100 1100 1100 1100 1100 11
CFR § 1.56. Whereas, I the undersigned inventor have invented certain new and useful improvements as set forth in the above-identified patent whereas, I the undersigned inventor have invented certain new and useful improvements as set forth in the above-identified patent application and further identified by the Attorney Docket Number provided above in the header of this document.
The most and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, I the undersigned inventous and
1) Sell(s), assign(s) and transfer(s) to <u>Duelight LLC</u> , a California limited liability company having a piace of trustices at 100 Rockefeller Dr., Sunnyvale, CA 94087, (hereinafter referred to as ("ASSIGNEE"), the entire right title and interest in any and all improvements and inventions disclosed in, application(s) based upon, and Patent(s) (including foreign patents) granted upon the information which is disclosed in the above referenced application.
2) Authorize and request the Commissioner of Patents to issue any and all Letters Patents resulting from said application or any discion(s), continuation(s), substitutes(s) or reissue(s) thereof to the ASSIGNEE.
3) Agree to execute all papers and documents and, entirely at the ASSIGNEE's expense, perform any acts which are reasonably necessary in connection with the prosecution of said application, as well as any derivative and applications thereof, foreign applications based thereon, and/or the enforcement of patents resulting from such applications.
4) Agree that the terms, covenants and conditions of this assignment shall inure to the benefit of the Assignee, its successors, assigns and other legal representative, and shall be binding upon the inventor(s), as well as the inventor's heirs, legal representatives and assigns.
 Warrant and represent that I have not entered, and will not enter into any assignment, contract, or understanding that conflicts with this assignment.
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.
Signed on the date indicated beside my signature.
Legal Name of Inventor: Adam Feder Signature: Date: 10/50/14

Attorney Docket No.: DUELP010/DL017

COMBINED DECLARATION (37 C.F.R. 1.63) AND ASSIGNMENT FOR UTILITY APPLICATION USING AN APPLICATION DATA SHEET (37 C.F.R. 1.76)

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The above-identified application was made or authorized to be made by me.
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.
I hereby state that I have reviewed and understand the contents of the above identified application, including the claims.
I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, CFR § 1,56.
Whereas, I the undersigned inventor have invented certain new and useful improvements as set forth in the above-identified patent application and further identified by the Attorney Docket Number provided above in the header of this document.
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3) Agree to execute all papers and documents and, entirely at the ASSIGNEE's expense, perform any acts which are reasonably necessary in connection with the prosecution of said application, as well as any derivative and applications thereof, foreign applications based thereon, and/or the enforcement of patents resulting from such applications.
4) Agree that the terms, covenants and conditions of this assignment shall inure to the benefit of the Assignee, its successors, assigns and other legal representative, and shall be binding upon the inventor(s), as well as the inventor's heirs, legal representatives and assigns.
5) Warrant and represent that I have not entered, and will not enter into any assignment, contract, or understanding that conflicts with this assignment.
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.
Signed on the date indicated beside my signature.
Legal Name of Inventor: Brian Kindle
Signature:

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NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

Application Number		Unassigned				
Filing Date		Herewith				
First Named Inventor		William Rivard				
Title		IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE				
Art Unit		Unassigned				
Examiner Name		Unassigned				
Attorney Docket Number		DUELP010/DL017				
SIGNATURE of Applicant or Patent Practitioner						
Signature	/JAMIE ROSS	51/	Date	November 6, 2014		
Name Jamie L. Ros		61	Telephone	408-971-2573		
Registration Number 56,875						
NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications.						
*Total of 1 forms are submitted.						

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PTO/SB/08a (01-10)

Approved for use through 07/31/2012. OMB 0651-0031

Mation Disclosure Statement (IDS) Filed

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number. Doc code: IDS Doc description: Information Disclosure Statement (IDS) Filed

	Application Number		
	Filing Date		
INFORMATION DISCLOSURE	First Named Inventor	Willia	m Rivard
STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Art Unit		
(Notion Submission under or or it not)	Examiner Name		
	Attorney Docket Number	er	DUELP010/DL017

				U.S.I	PATENTS	Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7760246		2010-07-20	Dalton et al.	
If you wisl	n to add a	additional U.S. Paten	t citatio	n information pl	ease click the Add button.	Add
	Remove					
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20100208099	A1	2010-08-19	Nomura Kenichiroh	
	2 20120262600		A1	2012-10-18	Velarde Ruben M. et al.	
	3	20130335596	A1	2013-12-19	Demandolx Denis et al.	
	4 20140176757 A		A1	2014-06-26	Rivard William Guie et al.	
	5 20120162465		A1	2012-06-28	Culbert Michael F. et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		
First Named Inventor	Willia	m Rivard
Art Unit		
Examiner Name		
Attorney Docket Number		DUELP010/DL017

	6		20120314100	A1	2012-12	2-13	Frank Michael				
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					FOREIG	SN PAT	ENT DOCUM	ENTS		Remove	
Examiner Initial*	Cite No		reign Document mber³	Country Code ²		Kind Code ⁴	Publication Date	Name of Patentee Applicant of cited Document		Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T 5
	1										
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Examiner Initials* Cite No Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.								T5			
1 Non-Final Office Action from U.S. Application No. 13/573,252, dated July 10, 2014											
	2	Not	ice of Allowance from	า U.S. Ap	plication	No. 13/5	73,252, dated C	October 22, 2014			
	3	FEC	DER et al., U.S. Appli	cation No	o. 13/999	,678, file	d March 14, 214	4			
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					EX	AMINE	R SIGNATURI	E			
Examiner	Signa	ture						Date Conside	red		
			if reference consider Formance and not c							Draw line through a to applicant.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		
First Named Inventor	Willian	m Rivard
Art Unit		
Examiner Name		
Attorney Docket Number	er	DUELP010/DL017

¹ See Kind Codes of USPTO Patent Documents at <u>www.USPTO.GOV</u> or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		
First Named Inventor	Willia	m Rivard
Art Unit		
Examiner Name		
Attorney Docket Numb	er	DUELP010/DL017

	CERTIFICATION STATEMENT							
Plea	ase see 37 CFR 1	.97 and 1.98 to make the appropr	riate selection(s):					
	That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).							
OR	1							
	That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).							
	See attached ce	rtification statement.						
	The fee set forth	in 37 CFR 1.17 (p) has been sub	mitted herewith.					
×	A certification sta	atement is not submitted herewith	l.					
	SIGNATURE A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the orm of the signature.							
Sigr	nature	/JAMIE ROSSI/	Date (YYYY-MM-DD)	2014-11-06				
Nan	ne/Print	Jamie L. Rossi	Registration Number	56,875				
			·	•				

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

- 1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.
- 2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
- 3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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Electronic Patent /	Applicatio	n Fee	Transmi	ttal	
Application Number:					
Filing Date:					
Title of Invention:				THOD FOR OBTAIN GRAPHIC SCENE	ING LOW-NOISE,
First Named Inventor/Applicant Name:	William Rivard				
Filer:	Jamie Lynn Rossi/Justin Bocchino				
Attorney Docket Number:	DUELP010/DL017				
Filed as Small Entity					
Track I Prioritized Examination - Nonprovision	onal Applica	ition (ınder 35 U	SC 111(a) Fili	ng Fees
Description	Fee C	ode	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:					
Utility filing Fee (Electronic filing)	401	11	1	70	70
Utility Search Fee	211	11	1	300	300
Utility Examination Fee	231	11	1	360	360
Request for Prioritized Examination	281	17	1	2000	2000
Pages:					
Claims:					
Miscellaneous-Filing:					

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)			
Publ. Fee- Early, Voluntary, or Normal	1504	1	0	0			
PROCESSING FEE, EXCEPT PROV. APPLS.	2830	1	70	70			
Petition:							
Patent-Appeals-and-Interference:							
Post-Allowance-and-Post-Issuance:							
Extension-of-Time:							
Miscellaneous:							
Total in USD (\$)							

Electronic Acknowledgement Receipt					
EFS ID:	20632319				
Application Number:	14535279				
International Application Number:					
Confirmation Number:	1035				
Title of Invention:	IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE				
First Named Inventor/Applicant Name:	William Rivard				
Customer Number:	28875				
Filer:	Jamie Lynn Rossi/Justin Bocchino				
Filer Authorized By:	Jamie Lynn Rossi				
Attorney Docket Number:	DUELP010/DL017				
Receipt Date:	06-NOV-2014				
Filing Date:					
Time Stamp:	21:38:52				
Application Type:	Utility under 35 USC 111(a)				

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$2800
RAM confirmation Number	7000
Deposit Account	501351
Authorized User	ZILKA, KEVIN J

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

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Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	TrackOne Request	DUELP010_Track1Request_11- 06-2014.pdf	131152 aa07c62b381c551946ad0354b9f34c95b34 b147b	no	1
Warnings:				I	
Information:					
2		DUELP010_ApplicationAsFiled_	1483750	yes	97
_		11-06-2014.pdf	b5046960e98cb7bbf8c423415566a4d4478 05c7e	,	
	Multip	art Description/PDF files in .	zip description		
	Document Des	scription	Start	E	nd
	Transmittal of New	Application	1		1
	Specificati	2	ϵ	58	
	Claims	69	69 72		
	Abstrac	73	73		
	Drawings-only black and v	white line drawings	74	92	
	Oath or Declara	tion filed	93	Ğ	95
	Transmittal l	_etter	96	Ğ	96
	Power of Att	orney	97	Ğ	97
Warnings:					
Information:					
3	Application Data Sheet	DUELP010_ADS_11-06-2014.	1561189	no	7
		pdf	4c9a33cb0d22e04d364df179d06c1494ac6 dee33		
Warnings:				<u>'</u>	
Information:					
4	Information Disclosure Statement (IDS)	DUELP010_PRC_IDS_11-06-201	612189	no	5
	Form (SB08)	4.pdf	558574c7b979ee3348c69a36a39e1d837b4 cf1c7		
Warnings:					

Information:					
5	Non Patent Literature	DUELP003_NOA_10-22-14.pdf	818184	no	18
3	Non atent Elerature	BOLLI 005_140A_10 22 14.pdf	4ff00633766a114375383fd715469b2f0d80 8baf	110	10
Warnings:					
Information:					
6	Non Patent Literature	DUELP003_OA_07-10-2014.pdf	373233	no	11
o Non atent	World atent Enclature	B0221 003_0/_0/ 10 2011.ipa1	381123d31a93cf6a2c29d50350e4bfaafa79 c265		
Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	40462		2
,	ree worksheet (3500)	ice iiio.pai	1e85e71005a0420dad7696464cf9737b64d 3ab0c	no	-
Warnings:					
Information:					
		Total Files Size (in bytes)	50	20159	

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Acknowledgement Receipt					
EFS ID:	20632319				
Application Number:	14535279				
International Application Number:					
Confirmation Number:	1035				
Title of Invention:	IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE				
First Named Inventor/Applicant Name:	William Rivard				
Customer Number:	28875				
Filer:	Jamie Lynn Rossi/Justin Bocchino				
Filer Authorized By:	Jamie Lynn Rossi				
Attorney Docket Number:	DUELP010/DL017				
Receipt Date:	06-NOV-2014				
Filing Date:					
Time Stamp:	21:38:52				
Application Type:	Utility under 35 USC 111(a)				

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$2800
RAM confirmation Number	7000
Deposit Account	501351
Authorized User	ZILKA, KEVIN J

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)	
1	TrackOne Request	DUELP010_Track1Request_11- 06-2014.pdf	131152 aa07c62b381c551946ad0354b9f34c95b34 b147b	no	1	
Warnings:				I		
Information:						
2		DUELP010_ApplicationAsFiled_	1483750	yes	97	
_		11-06-2014.pdf	b5046960e98cb7bbf8c423415566a4d4478 05c7e	,		
	Multip	art Description/PDF files in .	zip description			
	Document Des	scription	Start	E	nd	
	Transmittal of New	Application	1		1	
	Specificati	2	ϵ	58		
	Claims	69	72			
	Abstrac	Abstract				
	Drawings-only black and v	white line drawings	74	92		
	Oath or Declara	tion filed	93		95	
	Transmittal l	_etter	96		96	
	Power of Att	orney	97	Ğ	97	
Warnings:						
Information:						
3	Application Data Sheet	DUELP010_ADS_11-06-2014.	1561189	no	7	
		pdf	4c9a33cb0d22e04d364df179d06c1494ac6 dee33			
Warnings:				<u>'</u>		
Information:						
4	Information Disclosure Statement (IDS)	DUELP010_PRC_IDS_11-06-201	612189	no	5	
	Form (SB08)	4.pdf	558574c7b979ee3348c69a36a39e1d837b4 cf1c7			
Warnings:						

Information:					
5	Non Patent Literature	DUELP003_NOA_10-22-14.pdf	818184	no	18
3	Non atent Elerature	BOLLI 005_140A_10 22 14.pdf	4ff00633766a114375383fd715469b2f0d80 8baf	110	10
Warnings:					
Information:					
6	Non Patent Literature	DUELP003_OA_07-10-2014.pdf	373233	no	11
o Non atent	World atent Enclature	B0221 003_0/_0/ 10 2011.ipa1	381123d31a93cf6a2c29d50350e4bfaafa79 c265		
Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	40462		2
,	ree worksheet (3500)	ice iiio.pai	1e85e71005a0420dad7696464cf9737b64d 3ab0c	no	-
Warnings:					
Information:					
		Total Files Size (in bytes)	50	20159	

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New Applications Under 35 U.S.C. 111

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New International Application Filed with the USPTO as a Receiving Office

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OBC COMP. PA

POWER OF ATTORNEY BY APPLICANT

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	Application Number Filing Date
Z hereby and	the The boxes above may be left blank if interruption is provided on term FT On A-82A. point the Patient Pracificorers associated with the following customer Number as myour attorneys or agentity, and all business in the United States Patient and Trademark Office conjected thereaft for the application referenced in a transmittal lefter Com FTC/AIA/62A or destribed above. 28675
all business	out Practicents) raised in the attached (SLIGHT PTO/ALAIZE) as involved domeys or agentis, and to transact in the United States Patent and Trademark Office connected therewith for the patent application elemented in the remitted enter of the PTO/ALAIZE.
letter or the boxe	or change the correspondence address for the application identified in the attached transmittal s above to: s associated with the spove-mentioned Customer Number
The address OR First or	associated with Customer Number
Individual No Address	
City Country Leiephone	State Zip Email
	he Applicant is a juristic entity. list the Applicant name in the box)
Duelight LL	aint Inventor (title not required below)
Assigned or P	entative of a Deceased or Legally Incapacitated Inventor (title not required below) erson to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a junctic entity) otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the a concurrently being title with this document) (provide signer's title if applicant is a juristic entity) SIGNATURE of Applicant for Patent
The undersigned over Signature Name Title	Date (Onlora) (EO
NOTE: Sension Th	I be torn must be signed by the applicant in accordance with 37 CFR 1-33. See 37 CFR 1-4 for signature requirement one than one applicant, use multiple forms.
Ctal of Seedon servicinal or a	gams are submitted. A property of the company of t

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Application Data Sheet 37 CFR 1.76		1 76	Attorney Docket Number			DUELP010/DL017						
Application Data Sheet 37 CFR 1.76			1.70	Application	n Nu	ımbe	er					
Title of Inv	Title of Invention IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE							URES				
bibliographic This docume	data arranged in a nt may be comple	art of the provisional a format specified by eted electronically a ncluded in a paper f	the Un	ited States Pa mitted to the	tent ar	nd Tra	ademark (Office as ou	utlined in 37 (CFR 1.76.	•	
Secrecy	Order 37	CFR 5.2										
		oplication associa ilers only. Applic										suant to
nventor	Informati	on:										
Inventor	1								Re	emove		
Legal Nam	ie											
Prefix Gi	ven Name		М	iddle Name)			Family	y Name			Suffix
Wi	lliam							Rivard				
Residenc	e Information	(Select One)	∪s	Residency	0	No.	on US Re	esidency	O Activ	e US Mil	itary Service	<u> </u>
City Me	nlo Park		State/	Province	CA		Count	ry of Res	sidence ^j	US		
Mailing Add	dress of Inver	itor:										
Address 1		1062 Arbor Rd										
Address 2												
City	Menlo Park	<u> </u>				St	ate/Pro	vince	CA			
Postal Co	de	94025			Cou	untry	y i	US				
Inventor	2								Re	emove		
Legal Nam									<u> </u>			
Prefix Gi	ven Name		м	iddle Name	<u> </u>			Family	y Name			Suffix
	am			radic Harris	•			Feder	y Haine			Gainz
		(Select One)	O US	Residency	$\overline{}$	No.	on US Re			e US Mil	itary Service	
	untain View	· · ·		Province	CA				sidence i	US		
							- Journa	., 01 110	<u> </u>			
Mailing Add	dress of Inven	itor:										
Address 1		898 Windmill P	ark La	ne								
Address 2	<u> </u>											
City	Mountain Vi	ew				St	ate/Pro	vince	CA			
Postal Co	de	94043			Cou	untry	y i	US				
Inventor	3								Re	emove		
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		(Select One)	● US	Residency	0	No.	on US Re		○ Activ	e US Mil	itary Service	<u> </u>

	Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.											
Appli	cation Da	ta She	et 37 CFI	R 1.76	Attorney	Docket	Number	DUEL	P010/DL017	,		
	Application Number											
Title of	Title of Invention IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE						URES					
City	City Sunnyvale State/Province CA Country of Residence i US											
	Address of	Invente	or:									
Addre			1057 Rocke	feller Driv	re							
Addre	-											
City	Sunny	/vale	 				State/Pr	1	CA			
Postal			94087				itry i	US				
	ventors Must ated within the					ormatic	on blocks	may b	e 	Add]	
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	either Custo rther inform				the Corres	ponde	nce Info	rmation	section be	low.		
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Custo	mer Numbei	r	28875									
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Appl	ication Ir	nform	nation:									
Title o	f the Inventi	on			PPARATUS A			OR OBTA	INING LOW	-NOISE, HIG	H-SPE	ΞD
Attorn	ey Docket N	lumber	DUELP010)/DL017			Small E	ntity Sta	tus Claime	ed 🗙		
Applic	ation Type		Nonprovisi	onal								
Subje	ct Matter		Utility									
Total I	Number of D	rawing	Sheets (if	any)			Sugge	sted Fig	ure for Pub	lication (if	any)	
Filing	By Refer	ence :	•									
Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information"). For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).												
Application number of the previously filed application Filing date (YYYY-MM-DD) Intellectual Property Authority or Counting application					Country i							
Publ	Publication Information:											
R	Request Early Publication (Fee required at time of Request 37 CFR 1.219)											
☐ 35 st	Request No 5 U.S.C. 122 ubject of an aublication at 6	(b) and pplicati	certify that ion filed in a	the inve	ntion disclo	sed in t	the attacl	ned appli	cation has	not and wi	II not b	

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Application Da	sta Shoot 37 CED 1 76	Attorney Docket Number	DUELP010/DL017		
Application Data Sheet 37 CFR 1.76		Application Number			
Title of Invention	IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTUR OF A PHOTOGRAPHIC SCENE				

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.							
Please Select One:	Customer Number	US Patent Practitioner	Limited Recognition (37 CFR 11.9)				
Customer Number	28875						
Domestic Benefit/National Stage Information:							

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the application number blank.

Prior Application Status			Remove				
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)				
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.							

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)
Additional Foreign Priority Add button.	Add		

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	DUELP010/DL017		
		Application Number			
Title of Invention	IMAGE SENSOR APPARATU OF A PHOTOGRAPHIC SCE		IING LOW-NOISE, HIGH-SPEED CAPTURES		

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also
contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March
16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March
16, 2013, will be examined under the first inventor to file provisions of the AIA.

Authorization to Permit Access:

X Authorization to Permit Access to the Instant Application by the Participating Offices

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

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Application Data Sheet 37 CFR 1.76		Attorney Docket	Number	DUELP010/DL017				
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Title of Invention		OR APPARATU GRAPHIC SCEI	JS AND METHOD F	OR OBTAIN	ING LOW-NO	DISE, HIGH-	SPEED	CAPTURES
Applicant 1						F	Remove]
If the applicant is the in The information to be 1.43; or the name and who otherwise shows applicant under 37 CF proprietary interest) to identified in this section	provided in this s address of the a sufficient proprie R 1.46 (assigned gether with one	section is the na assignee, personatary interest in to be, person to who	ime and address of t in to whom the inven the matter who is the om the inventor is ob	he legal repi tor is under a applicant ui ligated to as	resentative w an obligation nder 37 CFR ssign, or pers	tho is the app to assign the 1.46. If the a on who othe	plicant u e invent applicar erwise sl	under 37 CFR ion, or person nt is an hows sufficient
Assignee		◯ Legal Re	epresentative under	35 U.S.C. 1	17	O Joint Ir	nventor	
Person to whom th	ne inventor is obli	gated to assign.	0	Person v	who shows si	ufficient prop	orietary	interest
If applicant is the leg	gal representati	ive, indicate th	e authority to file t	he patent a	pplication, t	he invento	r is:	
Name of the Decea	sed or Legally	Incapacitated	Inventor :					
If the Applicant is a	an Organizatior	check here.	<u> </u>					
Organization Name	e Duelight L	LC						
Mailing Address I	nformation:							
Address 1	1057	Rockefeller Driv	ve					
Address 2								
City	Sunn	yvale	St	ate/Provin	ce CA	.		
Country US			Po	stal Code	940	087		
Phone Number			Fa	x Number				
Email Address								
Additional Applicant	Data may be ge	nerated within	this form by selecti	ng the Add	button.		Add]
Assignee Info	ormation i	ncluding	Non-Applica	nt Assi	gnee Inf	ormatic	on:	
Providing assignment have an assignment re			not subsitute for con	npliance with	n any requirer	ment of part	3 of Titl	e 37 of CFR to
Assignee 1								
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.								
						Re	move	_
If the Assignee or I	Non-Applicant	Assignee is ar	n Organization che	ck here.		[

Application Data Sheet 37 CFR 1.76			Attorney Docket Number		DUELP	DUELP010/DL017		
			Application Number		+ - -			
			Application Number					
Title of Invent	Title of Invention IMAGE SENSOR APPARATUS AND METHOD FOR OBTAINING LOW-NOISE, HIGH-SPEED CAPTURES OF A PHOTOGRAPHIC SCENE						I-SPEED CAPTURES	
Prefix Gi		Give	en Name	Middle Nam	ne	Family Name		Suffix
Mailing Addre	ss Inforn	nation	For Assignee inc	cluding Non-A	Applicant As	signee:		
Address 1								
Address 2								
City					State/Province			
Country i				Postal Code		е		
Phone Number			Fax Number		er			
Email Address								
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.								
Signature:								
NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications								
Signature	/JAMIE RO	OSSI/	SI/			Date (YYYY-MM-DI	D) 2014-11-06
First Name	Jamie		Last Name	Rossi		Regist	ration Number	r 56875
Additional Signature may be generated within this form by selecting the Add button.								

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

- 1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
- 2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
- 3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
- 8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
- 9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Doc Code: TRACK1.REQ

Document Description: TrackOne Request

CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION

	51.521.101.01.1	(ago : 5. 1)	
First Named Inventor:	William Rivard	Nonprovisional Application Number (if known):	
Title of Invention:	IMAGE SENSOR APPARATUS AND METHOD FOR	OBTAINING LOW-NOISE, HIGH-SPEED CAPTUR	RES OF A PHOTOGRAPHIC SCENE

UNDER 37 CFR 1.102(e) (Page 1 of 1)

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

- 1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently \$0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.
- 2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.
- 3. The applicable box is checked below:

I. Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

- i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a).
 This certification and request is being filed with the utility application via EFS-Web.
 ---OR--
 - (b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.
- ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, <u>or</u> the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

- i. A request for continued examination has been filed with, or prior to, this form.
- ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
- iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
- iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
- v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature / JAMIE ROSSI/	_{Date} November 6, 2014		
Name (Print/Typed) Jamie L. Rossi	Practitioner Registration Number 56,875		
Note: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for Submit multiple forms if more than one signature is required.*	or signature requirements and certifications.		
*Total of forms are submitted.			

PTO/AIA/424 (04-14)