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APPLICATION NUMBER	PATENT NUMBER	GROUP ART UNIT	REQUEST ID
16/535,940	10529052	2618	115890

PAIR Correspondence Address/Fee Address Change

The following fields have been changed to Customer Number 204 on 07/02/2020 via Private PAIR in view of the certification copied below that authorized the change.

- Maintenance Fee Address

The address for Customer Number 204 is:
204
COMPUTER PACKAGES, INC.
414 HUNGERFORD DRIVE
ROCKVILLE, MD 20850

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

An attorney or Agent of Record registered to practice before the Patent and Trademark Office who has been given power of attorney in this application

Signature:	/D. Benjamin Esplin/
Name:	D. Benjamin Esplin
Registration Number:	58297

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APPLICATION NUMBER	PATENT NUMBER	GROUP ART UNIT	REQUEST ID
16/535,940	10529052	2618	105844

PAIR Correspondence Address/Fee Address Change

The following fields have been changed to Customer Number 204 on 02/19/2020 via Private PAIR in view of the certification copied below that authorized the change.

- Maintenance Fee Address

The address for Customer Number 204 is:
204
COMPUTER PACKAGES, INC.
414 HUNGERFORD DRIVE
ROCKVILLE, MD 20850

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

An attorney or Agent of Record registered to practice before the Patent and Trademark Office who has been given power of attorney in this application

Signature:	/D. Benjamin Esplin/
Name:	D. Benjamin Esplin
Registration Number:	58297

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/535,940	01/07/2020	10529052	46DG-026055	9986

137002 7590 12/18/2019

Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008

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):

David A. Newman, San Diego, CA;
GoPro, Inc., San Mateo, CA;
Joshua Edward Bodinet, San Diego, CA;
Otto Kenneth Sievert, Oceanside, CA;
Timothy MacMillan, La Honda, CA;

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Electronic Acknowledgement Receipt

EFS ID:	37915528
Application Number:	16535940
International Application Number:	
Confirmation Number:	9986
Title of Invention:	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING
First Named Inventor/Applicant Name:	David A. Newman
Customer Number:	137002
Filer:	D. Benjamin Esplin/Chelsea Pearsall
Filer Authorized By:	D. Benjamin Esplin
Attorney Docket Number:	46DG-026055
Receipt Date:	03-DEC-2019
Filing Date:	08-AUG-2019
Time Stamp:	16:12:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1000
RAM confirmation Number	E2019B3G13166762
Deposit Account	602731
Authorized User	Chelsea Pearsall

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 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	Issue Fee Payment (PTO-85B)	46DG-026055_Issue_Fee_Transmittal_FINAL.pdf	86973 2c3ea1ba6f3fd833f57759d07944a98810da9630	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30622 608276e394bbd35b545830f47a7d5af677698b2b	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	117595		

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.

Electronic Patent Application Fee Transmittal

Application Number:	16535940
Filing Date:	08-Aug-2019
Title of Invention:	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING
First Named Inventor/Applicant Name:	David A. Newman
Filer:	D. Benjamin Esplin/Chelsea Pearsall
Attorney Docket Number:	46DG-026055

Filed as Large 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	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1000**

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

137002 7590 10/22/2019

Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/535,940	08/08/2019	David A. Newman	46DG-026055	9986

TITLE OF INVENTION: VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	01/22/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
AMIN, JWALANT B	2618	345-620000

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 03-09 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 OR, alternatively,
(2) The name of a single firm (having as a 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.

1 Esplin & Associates, PC
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: GoPro, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): San Mateo, California

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ☒ Corporation or other private group entity ❑ Government

4a. Fees submitted: ☒ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /D. Benjamin Esplin/ Date December 3, 2019

Typed or printed name D. Benjamin Esplin Registration No. 58297

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United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/535,940	08/08/2019	David A. Newman	46DG-026055

CONFIRMATION NO. 9986

137002
Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008

PUBLICATION NOTICE

OC00000012994675

Title:VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING

Publication No.US-2019-0362464-A1
Publication Date:11/28/2019

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S213	4	lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 distort$3 near5 center$2 near5 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:19
S212	4	lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 location near10 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:19
S211	4	lens near5 distortion near10 (frame "sub-frame" "sub frame") same location near10 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:19
S210	5	lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 size near10 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:19
S209	6	S208 and @ad< = "20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:19
S208	26	lens near5 distortion near10 (frame "sub-frame" "sub frame") same size near10 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:19
S207	30	S206 not S204	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:19
S206	49	S205 and @ad< = "20150520"	US-PGPUB;	OR	ON	2019/10/15

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			14:19
S205	72	distortion same (frame "sub-frame" "sub frame") same location same size same (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:19
S204	19	S203 and @ad<="20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:19
S203	26	lens near5 distortion same (frame "sub-frame" "sub frame") same location same size same (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:19
S202	4	input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") same ((field near2 view) FOV) near5 size same (location position) near5 (frame (sub adj frame) "sub-frame")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:19
S226	14	S225 and S223	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:20
S225	33	S224 and (lens near10 (center$2 centre$2) near10 view$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:20
S224	561	distort$3 near2 lens same (another different) near5 distort$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:20
S223	81828	(G06T3/0018, G06T3/00, G06T3/40, G06T5/006, G06T2207/10004, G06T2207/10016, G06T2207/20021, G06T2210/22).CPC.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2019/10/15 14:20

			IBM_TDB			
S222	42	S221 and @ad<="20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:20
S221	49	(identif$4 determin$3 detect$3) near10 input near5 lens near5 distortion near10 image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:20
S220	28	S219 and @ad<="20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:20
S219	41	map$4 near10 (lens camera) near5 distort$3 near10 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/10/15 14:20
S218	1	(input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 ((field near2 view) FOV)) and (input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 size) and (input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 (location position) near5 (frame (sub adj frame) "sub-frame"))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:20
S217	6	S216 and @ad<="20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:20
S216	13	(distort$3 near10 center$2 near5 (FOV (field near2 view)) same location near5 (FOV (field near2 view)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:20
S215	63	S214 and @ad<="20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:20
S214	96	(identif$4 determin$3 detect$3) near10	US-PGPUB;	OR	ON	2019/10/15

		lens near5 distortion near10 (frame "sub-frame" "sub frame")	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			14:20
S227	166	("0000030" | "0000059" | "0000088" | "0000117" | "0000146" | "20040128317" | "20050025454" | "20070173296" | "20070204310" | "20070230461" | "20080044155" | "20080123976" | "20080152297" | "20080163283" | "20080177706" | "20080208791" | "20080253735" | "20080313541" | "20090213270" | "20090274339" | "20090327856" | "20100045773" | "20100064219" | "20100086216" | "20100104261" | "20100183280" | "20100231730" | "20100245626" | "20100251295" | "20100278504" | "20100278509" | "20100281375" | "20100281386" | "20100287476" | "20100299630" | "20100321471" | "20110025847" | "20110069148" | "20110069189" | "20110075990" | "20110093798" | "20110109774" | "20110134240" | "20110173565" | "20110206351" | "20110211040" | "20110258049" | "20110293250" | "20110320322" | "20120014673" | "20120027381" | "20120030029" | "20120057852" | "20120123780" | "20120127169" | "20120206565" | "20120311448" | "20130024805" | "20130044108" | "20130058532" | "20130063561" | "20130078990" | "20130127636" | "20130142384" | "20130151970" | "20130166303" | "20130191743" | "20130195429" | "20130197967" | "20130208134" | "20130208942" | "20130215220" | "20130259399" | "20130263002" | "20130283301" | "20130287214" | "20130287304" | "20130300939" | "20130308921" | "20130318443" | "20130343727" | "20140026156" | "20140064706" | "20140072285" | "20140093164" | "20140096002" | "20140105573" | "20140161351" | "20140165119" | "20140169766" | "20140176542" | "20140212107" | "20140219634" | "20140226953" | "20140232818" | "20140232819" | "20140245336" | "20140300644" | "20140328570" | "20140341528" | "20140366052" | "20140376876" | "20150015680" | "20150022355" | "20150029089" | "20150049220" | "20150058709" | "20150085111" | "20150154452" | "20150178915" | "20150186073" | "20150220504" | "20150254871" | "20150256746" | "20150256808" | "20150271483" | "20150287435" | "20150294141"	US-PGPUB; USPAT	OR	ON	2019/10/15 14:24

		"20150318020" | "20150375117" | "20150382083" | "20160005435" | "20160005440" | "20160026874" | "20160027470" | "20160027475" | "20160029105" | "20160055885" | "20160088287" | "20160098941" | "20160119551" | "20160180501" | "20160217325" | "20160225405" | "20160225410" | "20160234345" | "20160358603" | "20160366330" | "20170006214" | "5130794" | "6337683" | "6593956" | "7222356" | "7483618" | "8446433" | "8611422" | "8718447" | "8730299" | "8763023" | "8910046" | "8988509" | "9032299" | "9036001" | "9077956" | "9111579" | "9142253" | "9151933" | "9204039" | "9208821" | "9245582" | "9253533" | "9317172" | "9423944" | "9473758" | "9479697" | "9564173").PN.				
S228	0	S227 and (lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 size near10 (FOV (field near2 view)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:30
L2	0	l1 and (lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 size near10 (FOV (field near2 view)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:43
L1	172	("0000030" | "0000059" | "0000088" | "0000117" | "0000146" | "20020044153" | "20040128317" | "20050025454" | "20060122842" | "20070173296" | "20070204310" | "20070229665" | "20070230461" | "20080044155" | "20080123976" | "20080152297" | "20080163283" | "20080177706" | "20080208791" | "20080253735" | "20080313541" | "20090213270" | "20090274339" | "20090327856" | "20100045773" | "20100064219" | "20100086216" | "20100104261" | "20100183280" | "20100231730" | "20100245626" | "20100251295" | "20100278504" | "20100281375" | "20100281386" | "20100287476" | "20100299630" | "20100318660" | "20100321471" | "20110025847" | "20110069148" | "20110069189" | "20110075990" | "20110093798" | "20110109774" | "20110134240" | "20110173565" | "20110206351" | "20110211040" | "20110249153" | "20110258049" | "20110293250" | "20110320322" | "20120014673" | "20120027381" | "20120030029" | "20120057852" | "20120123780" | "20120127169" | "20120206565" |	US-PGPUB; USPAT	OR	ON	2019/10/15 14:43

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L4	0	l3 and (lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 size near10 (FOV (field near2 view)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/10/15 14:53
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		"20130259399" | "20130263002" |					
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		"20160358603" | "20160366330" |					
		"20170006214" | "5130794" | "6337683"					

		| "6593956" | "7222356" | "7483618" | "8446433" | "8611422" | "8718447" | "8730299" | "8763023" | "8910046" | "8988509" | "9032299" | "9036001" | "9077956" | "9111579" | "9142253" | "9151933" | "9204039" | "9208821" | "9245582" | "9253533" | "9317172" | "9423944" | "9473758" | "9479697" | "9564173").PN.				

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S239	2	S229 and (lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 location near10 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:21
S238	1	S229 and (lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 distort$3 near5 center$2 near5 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:21
S237	4	S229 and ((identif$4 determin$3 detect$3) near10 lens near5 distortion near10 (frame "sub-frame" "sub frame")).clm.	USPAT	OR	ON	2019/10/15 14:21
S236	1	S229 and (distort$3 near10 center$2 near5 (FOV (field near2 view)) same location near5 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:21
S235	0	S229 and (input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 ((field near2 view) FOV)).clm. and (input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 size).clm. and (input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 (location position) near5 (frame (sub adj frame) "sub-frame")).clm.	USPAT	OR	ON	2019/10/15 14:21
S234	1	S229 and (map$4 near10 (lens camera) near5 distort$3 near10 (FOV (field near2 view))).clm.	USPAT	OR	OFF	2019/10/15 14:21
S233	5	S229 and ((identif$4 determin$3 detect$3) near10 input near5 lens near5 distortion near10 image).clm.	USPAT	OR	ON	2019/10/15 14:21
S232	0	S229 and (distort$3 near2 lens same (another different) near5 distort$3).clm. and (lens near10 (center$2 centre$2) near10 view$3).clm.	USPAT	OR	ON	2019/10/15 14:21
S231	1	S229 and (map$4 near10 (lens camera) near5 distort$3 near10 (FOV (field near2 view))).clm.	USPAT	OR	OFF	2019/10/15 14:21
S230	2	S229 and (input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") same ((field near2 view) FOV) near5 size same (location position) near5 (frame (sub adj frame) "sub-frame")).clm.	USPAT	OR	ON	2019/10/15 14:21
S229	12722	(G06T3/0018,00,40; G06T5/006; G06T2207/10004,10016,20021; G06T2210/22).CPC.	USPAT	OR	ON	2019/10/15 14:21

S257	2	(lens near5 distortion near10 (frame "sub-frame" "sub frame") same size near10 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:22
S256	3	(distortion same (frame "sub-frame" "sub frame") same location same size same (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:22
S255	2	(lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 size near10 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:22
S254	2	(lens near5 distortion near10 (frame "sub-frame" "sub frame") same location near10 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:22
S253	2	(lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 location near10 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:22
S252	1	(lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 distort$3 near5 center$2 near5 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:22
S251	6	((identif$4 determin$3 detect$3) near10 lens near5 distortion near10 (frame "sub-frame" "sub frame")).clm.	USPAT	OR	ON	2019/10/15 14:22
S250	2	(distort$3 near10 center$2 near5 (FOV (field near2 view)) same location near5 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:22
S249	0	(input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 ((field near2 view) FOV)).clm. and (input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 size).clm. and (input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 (location position) near5 (frame (sub adj frame) "sub-frame")).clm.	USPAT	OR	ON	2019/10/15 14:22
S248	4	(map$4 near10 (lens camera) near5 distort$3 near10 (FOV (field near2 view))).clm.	USPAT	OR	OFF	2019/10/15 14:22
S247	6	((identif$4 determin$3 detect$3) near10 input near5 lens near5 distortion near10 image).clm.	USPAT	OR	ON	2019/10/15 14:22
S246	0	(distort$3 near2 lens same (another different) near5 distort$3).clm. and (lens near10 (center$2 centre$2) near10 view$3).clm.	USPAT	OR	ON	2019/10/15 14:22
S245	4	(map$4 near10 (lens camera) near5 distort$3 near10 (FOV (field near2 view))).clm.	USPAT	OR	OFF	2019/10/15 14:22
S244	2	(input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") same ((field near2 view) FOV) near5 size same (location position) near5 (frame (sub adj frame) "sub-frame")).clm.	USPAT	OR	ON	2019/10/15 14:22
S243	2	S229 and (lens near5 distortion near10 (frame "sub-frame" "sub frame") same size near10 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:22
S242	3	S229 and (distortion same (frame "sub-frame" "sub frame") same location same size	USPAT	OR	ON	2019/10/15 14:22

		same (FOV (field near2 view))).clm.				
S241	2	S229 and (lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 size near10 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:22
S240	2	S229 and (lens near5 distortion near10 (frame "sub-frame" "sub frame") same location near10 (FOV (field near2 view))).clm.	USPAT	OR	ON	2019/10/15 14:22

10/ 15/ 2019 2:54:31 PM
C:\ Users\ jamin\ Documents\ EAST\ Workspaces\ 16535940.wsp

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/535,940	Newman et al.
	Examiner	Art Unit
	JWALANT B AMIN	2618

CPC								
Symbol							Type	Version
G06T	/	3	/	0018			F	2013-01-01
G06T	/	5	/	006			I	2013-01-01
G06T	/	3	/	00			I	2013-01-01
G06T	/	3	/	40			I	2013-01-01
G06T	/	2207	/	20021			A	2013-01-01
G06T	/	2207	/	10004			A	2013-01-01
G06T	/	2207	/	10016			A	2013-01-01
G06T	/	2210	/	22			A	2013-01-01

CPC Combination Sets								
Symbol					Type	Set	Ranking	Version
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/JWALANT AMIN/ Primary Examiner, Art Unit 2618	15 October 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

U.S. Patent and Trademark Office — Part of Paper No.: 20191015

Insta360
Exhibit 1003 Page 20

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/535,940	Newman et al.
	Examiner	**Art Unit**
	JWALANT B AMIN	2618

INTERNATIONAL CLASSIFICATION					
CLAIMED					
G06T	/	3	/	00	

NON-CLAIMED					
	/		/		

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE (Assistant Examiner) (Date)	**Total Claims Allowed:** 20	
/JWALANT AMIN/ Primary Examiner, Art Unit 2618 (Primary Examiner) 15 October 2019 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 6

U.S. Patent and Trademark Office Part of Paper No.: 20191015

Insta360
Exhibit 1003 Page 21

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/535,940	Newman et al.
	Examiner	**Art Unit**
	JWALANT B AMIN	2618

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19										
	2		11		20										
	3		12												
	4		13												
	5		14												
	6		15												
	7		16												
	8		17												
	9		18												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/JWALANT AMIN/ Primary Examiner, Art Unit 2618	15 October 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

U.S. Patent and Trademark Office — Part of Paper No.: 20191015

Insta360
Exhibit 1003 Page 22

Bibliographic Data

Application No: 16/535,940

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /JWALANT AMIN/ Examiner's Signature | Initials

Title: VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
08/08/2019	345	2618	46DG-026055
RULE			

APPLICANTS

GoPro, Inc., San Mateo, CA,

INVENTORS

David A. Newman San Diego, CA, UNITED STATES

Joshua Edward Bodinet San Diego, CA, UNITED STATES

Otto Kenneth Sievert Oceanside, CA, UNITED STATES

Timothy MacMillan La Honda, CA, UNITED STATES

CONTINUING DATA

This application is a CON of 16229512 12/21/2018 PAT 10395338

16229512 is a CON of 15157207 05/17/2016 PAT 10186012

15157207 has PRO of 62164409 05/20/2015

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

08/20/2019

STATE OR COUNTRY

UNITED STATES

ADDRESS

Esplin & Associates (GoPro)

5411 Avenida Encinas

Suite 100

Carlsbad, CA 92008

UNITED STATES

FILING FEE RECEIVED

$1,720

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/535,940	Newman et al.
	Examiner	Art Unit
	JWALANT B AMIN	2618

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor name searched	10/15/2019	JA

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
G06T	3/0018,00,40	10/15/2019	JA
G06T	5/006	10/15/2019	JA
G06T	2207/10004,10016,20021	10/15/2019	JA
G06T	2210/22	10/15/2019	JA

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Exhibit 1003 Page 24

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NOTICE OF ALLOWANCE AND FEE(S) DUE

137002 7590 10/22/2019

Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008

EXAMINER	
AMIN, JWALANT B	
ART UNIT	PAPER NUMBER
2618	

DATE MAILED: 10/22/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/535,940	08/08/2019	David A. Newman	46DG-026055	9986

TITLE OF INVENTION: VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	01/22/2020

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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

137002 7590 10/22/2019

Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/535,940	08/08/2019	David A. Newman	46DG-026055	9986

TITLE OF INVENTION: VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	01/22/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
AMIN, JWALANT B	2618	345-620000

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 03-09 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 OR, alternatively,
(2) The name of a single firm (having as a 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.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

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Exhibit 1003 Page 26

UNITED STATES PATENT AND TRADEMARK OFFICE

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

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16/535,940	08/08/2019	David A. Newman	46DG-026055	9986

137002 7590 10/22/2019

Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008

EXAMINER	
AMIN, JWALANT B	
ART UNIT	PAPER NUMBER
2618	

DATE MAILED: 10/22/2019

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.

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Exhibit 1003 Page 27

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 30 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.

Notice of Allowability	Application No. 16/535,940	Applicant(s) Newman et al.	
	Examiner JWALANT B AMIN	Art Unit 2618	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY 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.

1. ☑ This communication is responsive to communication filed on 10/3/2019.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-20 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

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 Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/JWALANT AMIN/
Primary Examiner, Art Unit 2618

INFORMATION DISCLOSURE STATEMENT BY APPLICANT		
	Application Number	16/535,940
	Filing Date	08/08/2019
	First Named Inventor	David A. Newman
	Art Unit	2618
Page 1 of 7	**Matter Number**	46DG-026055

U.S. PATENT/PUBLICATION DOCUMENTS					
Initials	**Cite No.**	**Document Number**	**Issue/Publication Date**	**First Named Inventor**	**Relevant Pages, Columns, etc.**
	1	5130794	07/14/1992	Kurtis J. Ritchey	
	2	6337683	01/08/2002	Scott Gilbert	
	3	6593956	07/15/2003	Steven L. Potts	
	4	7222356	05/22/2007	Hiroki Yonezawa	
	5	7483618	01/27/2009	Jeffrey L. Edwards	
	6	8446433	05/21/2013	Ronald Mallet	
	7	8611422	12/17/2013	Yagnik	
	8	8718447	05/06/2014	Gyung-hye Yang	
	9	8730299	05/20/2014	Dmitry Kozko	
	10	8763023	06/24/2014	Jeromey Russell Goetz	
	11	8910046	12/09/2014	Ken Matsuda	
	12	8988509	03/24/2015	Timothy Macmillan	
	13	9032299	05/12/2015	Charles Lyons	
	14	9036001	05/19/2015	Daniel B. Chuang	
	15	9077956	07/07/2015	Mark Glyn Morgan	
	16	9111579	08/18/2015	Brian Meaney	
	17	9142253	09/22/2015	Randy Ubillos	
	18	9151933	10/06/2015	Muneyuki Sato	
	19	9204039	12/01/2015	Zhen He	
	20	9208821	12/08/2015	Matt Evans	
	21	9245582	01/26/2016	Michael Wayne Shore	
	22	9253533	02/02/2016	Mark Glyn Morgan	
	23	9317172	04/19/2016	Charles Lyons	
	24	9423944	08/23/2016	Aaron M. Eppolito	
	25	9473758	10/18/2016	Jieyi Long	
	26	9479697	10/25/2016	Francisco AGUILAR	
	27	9564173	02/07/2017	Anne Swenson	
	28	20040128317	07/01/2004	Sanghoon Sull	
	29	20050025454	02/03/2005	Nakamura	

Examiner Signature	/JWALANT AMIN/ (10/15/2019)	**Date Considered**	10/15/2019

Examiner: Please initial if citation considered, whether or not citation is in conformance with MPEP Section 609. Please draw a line through the citation if it is not in conformance and it is not considered. Please include a copy of this form with the next communication to the applicant.

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U.S. PATENT/PUBLICATION DOCUMENTS					
Initials	**Cite No.**	**Document Number**	**Issue/Publication Date**	**First Named Inventor**	**Relevant Pages, Columns, etc.**
	30	20060122842	06/08/2006	Tilman Herberger	
	31	20070173296	07/26/2007	Kazutoshi Hara	
	32	20070204310	08/30/2007	Hua	
	33	20070230461	10/04/2007	Harkirat Singh	
	34	20080044155	02/21/2008	David Kuspa	
	35	20080123976	05/29/2008	Coombs	
	36	20080152297	06/26/2008	Randy Ubillos	
	37	20080163283	07/03/2008	Angelito Perez Tan	
	38	20080177706	07/24/2008	Yuen	
	39	20080208791	08/28/2008	Madirakshi Das	
	40	20080253735	10/16/2008	David Kuspa	
	41	20080313541	12/18/2008	Peter Shafton	
	42	20090213270	08/27/2009	Ismert	
	43	20090274339	11/05/2009	Charles Cohen	
	44	20090327856	12/31/2009	Jean-Pierre M. Mouilleseaux	
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	46	20100064219	03/11/2010	Ron Gabrisko	
	47	20100086216	04/08/2010	Lee	
	48	20100104261	04/29/2010	Liu	
	49	20100183280	07/22/2010	Gerald Thomas Beauregard	
	50	20100231730	09/16/2010	Yuka Ichikawa	
	51	20100245626	09/30/2010	Woycechowsky	
	52	20100251295	09/30/2010	Brian Amento	
	53	20100278504	11/04/2010	Charles Lyons	
	54	20100278509	11/04/2010	Kae Nagano	
	55	20100281375	11/04/2010	Colleen Pendergast	
	56	20100281386	11/04/2010	Charles Lyons	
	57	20100287476	11/11/2010	Ryutaro Sakai	
	58	20100299630	11/25/2010	David McCutchen	

Examiner Signature	/JWALANT AMIN/ (10/15/2019)	**Date Considered**	10/15/2019

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U.S. PATENT/PUBLICATION DOCUMENTS					
Initials	**Cite No.**	**Document Number**	**Issue/Publication Date**	**First Named Inventor**	**Relevant Pages, Columns, etc.**
	59	20100318660	12/16/2010	Balsubramanian	
	60	20100321471	12/23/2010	Mark Casolara	
	61	20110025847	02/03/2011	Youngchoon Park	
	62	20110069148	03/24/2011	Peter W. J. Jones	
	63	20110069189	03/24/2011	Kartik Venkataraman	
	64	20110075990	03/31/2011	Mark Kenneth Eyer	
	65	20110093798	04/21/2011	Behzad Shahraray	
	66	20110109774	05/12/2011	Kenichi Onomura	
	67	20110134240	06/09/2011	Robert J. Anderson	
	68	20110173565	07/14/2011	Eyal Ofek	
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	70	20110211040	09/01/2011	Pierre-Alain Lindemann	
	71	20110258049	10/20/2011	Jorey Ramer	
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	73	20110320322	12/29/2011	Thomas K. Roslak	
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	80	20120206565	08/16/2012	Jason Villmer	
	81	20120311448	12/06/2012	Maha Achour	
	82	20130024805	01/24/2013	Seunghee In	
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	84	20130058532	03/07/2013	Marvin S White	
	85	20130063561	03/14/2013	Karel Paul Stephan	
	86	20130078990	03/28/2013	Mikyung Kim	
	87	20130127636	05/23/2013	Rameen Aryanpur	

Examiner Signature	/JWALANT AMIN/ (10/15/2019)	Date Considered	10/15/2019

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U.S. PATENT/PUBLICATION DOCUMENTS					
Initials	**Cite No.**	**Document Number**	**Issue/Publication Date**	**First Named Inventor**	**Relevant Pages, Columns, etc.**
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	89	20130142384	06/06/2013	Eyal Ofek	
	90	20130151970	06/13/2013	Maha Achour	
	91	20130166303	06/27/2013	Walter Chang	
	92	20130191743	07/25/2013	Glenn Reid	
	93	20130195429	08/01/2013	Todor Fay	
	94	20130197967	08/01/2013	James Joseph Anthony Pinto	
	95	20130208134	08/15/2013	Matti Sakari Hamalainen	
	96	20130208942	08/15/2013	Davis	
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	100	20130283301	10/24/2013	Narbeh Avedissian	
	101	20130287214	10/31/2013	Barbara Resch	
	102	20130287304	10/31/2013	Atsushi Kimura	
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	105	20130318443	11/28/2013	Bachman	
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	107	20140026156	01/23/2014	David Deephanphongs	
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	109	20140072285	03/13/2014	Shynar	
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	111	20140096002	04/03/2014	Aaron Dey	
	112	20140105573	04/17/2014	Hanckmann	
	113	20140161351	06/12/2014	Yagnik	
	114	20140165119	06/12/2014	Liu	
	115	20140169766	06/19/2014	Siu-Leong Yu	
	116	20140176542	06/26/2014	Makoto Shohara	

Examiner Signature	/JWALANT AMIN/ (10/15/2019)	Date Considered	10/15/2019

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U.S. PATENT/PUBLICATION DOCUMENTS					
Initials	**Cite No.**	**Document Number**	**Issue/Publication Date**	**First Named Inventor**	**Relevant Pages, Columns, etc.**
	117	20140193040	07/10/2014	Gonen Bronshtein	
	118	20140212107	07/31/2014	Felipe Saint-Jean	
	119	20140219634	08/07/2014	David McIntosh	
	120	20140226953	08/14/2014	Taylor Hou	
	121	20140232818	08/21/2014	G. Peter K. Carr	
	122	20140232819	08/21/2014	Charles Robert Armstrong	
	123	20140245336	08/28/2014	M. Lewis II Kirk	
	124	20140300644	10/09/2014	Clive Henry Gillard	
	125	20140328570	11/06/2014	Cheng	
	126	20140341528	11/20/2014	Shakeel M. Mahate	
	127	20140366052	12/11/2014	Ives	
	128	20140376876	12/25/2014	Michael Bentley	
	129	20150015680	01/15/2015	Yuan-Kang Wang	
	130	20150022355	01/22/2015	Hai D. Pham	
	131	20150029089	01/29/2015	Hyun-woo Kim	
	132	20150049220	02/19/2015	Kohji KUWATA	
	133	20150058709	02/26/2015	Michael E. Zaletel	
	134	20150085111	03/26/2015	Richard J Lavery	
	135	20150154452	06/04/2015	Michael Bentley	
	136	20150178915	06/25/2015	Monique Chatterjee	
	137	20150186073	07/02/2015	Mihnea Calin Pacurariu	
	138	20150220504	08/06/2015	Tobias M. Bocanegra Alvarez	
	139	20150254871	09/10/2015	Timothy Macmillan	
	140	20150256746	09/10/2015	Timothy Macmillan	
	141	20150256808	09/10/2015	Timothy Macmillan	
	142	20150271483	09/24/2015	Yajie Sun	
	143	20150287435	10/08/2015	Peter Jarred Land	
	144	20150294141	10/15/2015	James Molyneux	
	145	20150318020	11/05/2015	Alexis Juri Pribula	

Examiner Signature	/JWALANT AMIN/ (10/15/2019)	**Date Considered**	10/15/2019

Examiner: Please initial if citation considered, whether or not citation is in conformance with MPEP Section 609. Please draw a line through the citation if it is not in conformance and it is not considered. Please include a copy of this form with the next communication to the applicant.

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Initials	**Cite No.**	**Document Number**	**Issue/Publication Date**	**First Named Inventor**	**Relevant Pages, Columns, etc.**
	146	20150339324	11/26/2015	Mark E. Westmoreland	
	147	20150375117	12/31/2015	Thompson	
	148	20150382083	12/31/2015	Zhibo Chen	
	149	20160005435	01/07/2016	Scott Patrick Campbell	
	150	20160005440	01/07/2016	Andrew Peter Gower	
	151	20160026874	01/28/2016	Nick Hodulik	
	152	20160027470	01/28/2016	David A. Newman	
	153	20160027475	01/28/2016	Nick Hodulik	
	154	20160029105	01/28/2016	David A. Newman	
	155	20160055885	02/25/2016	Nick Hodulik	
	156	20160088287	03/24/2016	Sajid Sadi	
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FOREIGN PATENT DOCUMENTS						
Initials	**Cite No.**	**Document Number**	**Publication Date**	**Country**	**Relevant Pages, Columns, etc.**	**T**
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	169	2009146319A1	12/03/2009	WO		

Examiner Signature	/JWALANT AMIN/ (10/15/2019)	**Date Considered**	10/15/2019

Examiner: Please initial if citation considered, whether or not citation is in conformance with MPEP Section 609. Please draw a line through the citation if it is not in conformance and it is not considered. Please include a copy of this form with the next communication to the applicant.

SyncIDS.com ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.A./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT		
	Application Number	16/535,940
	Filing Date	08/08/2019
	First Named Inventor	David A. Newman
	Art Unit	2618
Page 7 of 7	**Matter Number**	46DG-026055

OTHER DOCUMENTS			
Initials	**Cite No.**	**Author, Title, Date, Pages, etc.**	**T**
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Examiner Signature	/JWALANT AMIN/ (10/15/2019)	**Date Considered**	10/15/2019

Examiner: Please initial if citation considered, whether or not citation is in conformance with MPEP Section 609. Please draw a line through the citation if it is not in conformance and it is not considered. Please include a copy of this form with the next communication to the applicant.

SyncIDS.com

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.A./

Electronic Patent Application Fee Transmittal

Application Number:	16535940
Filing Date:	08-Aug-2019
Title of Invention:	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING
First Named Inventor/Applicant Name:	David A. Newman
Filer:	D. Benjamin Esplin/Milanka Trang
Attorney Docket Number:	46DG-026055

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**160**

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16535940

Filing Date: 08-Aug-2019

Applicant/Patent under Reexamination: Newman

Electronic Terminal Disclaimer filed on October 3, 2019

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	37358970
Application Number:	16535940
International Application Number:	
Confirmation Number:	9986
Title of Invention:	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING
First Named Inventor/Applicant Name:	David A. Newman
Customer Number:	137002
Filer:	D. Benjamin Esplin/Milanka Trang
Filer Authorized By:	D. Benjamin Esplin
Attorney Docket Number:	46DG-026055
Receipt Date:	03-OCT-2019
Filing Date:	08-AUG-2019
Time Stamp:	15:42:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$160
RAM confirmation Number	E201903F42523141
Deposit Account	602731
Authorized User	Milanka Trang

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 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	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	37189 1e9900d944daef69dc99546460fbc605b7a6a786	no	3
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30739 82ca46c3095729cc89cf04f8b6488394c439b98e	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	67928		

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.

Doc Code: DIST.E.FILE **Document Description: Electronic Terminal Disclaimer - Filed**	PTO/SB/25 PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION AND TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	16535940
Filing Date	08-Aug-2019
First Named Inventor	David Newman
Attorney Docket Number	46DG-026055
Title of Invention	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
GOPRO, INC.	100 %

The owner(s) of percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending reference Application Number(s)

16535911 filed on 08/08/2019

16535886 filed on 08/08/2019

as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the reference application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term of any patent granted on said reference application, "as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application," in the event that any such patent granted on the pending reference application: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant.

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

10186012

10395338

as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

○ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.

Applicants claims the following fee status:

○ Small Entity

○ Micro Entity

◉ Regular Undiscounted

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application

Registration Number 58297

○ A sole inventor

○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application

○ A joint inventor; all of whom are signing this request

Signature	/D. Benjamin Esplin/
Name	D. Benjamin Esplin

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. 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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/535,940	Filing Date 08/08/2019	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

	(Column 1)	(Column 2)			
FOR	NUMBER FILED	NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 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. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	10/03/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/CHANTAE S DESSAU/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

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.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Attorney Docket: 46DG-026055

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE PATENT APPLICATION OF	:	David A. Newman, *et al.*
SERIAL NO.	:	16/535,940
FILING DATE	:	August 8, 2019
ART UNIT	:	2618
EXAMINER	:	AMIN, JWALANT B
FOR	:	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING

RESPONSE TO NON-FINAL OFFICE ACTION

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

Dear Commissioner:

In response to the Non-Final Office Action dated **September 20, 2019** ("Office Action"), please consider the following amendments and remarks in the above-identified application:

Amendments to the Claims are reflected in the listing of claims beginning on page **2** of this paper.

Remarks/Arguments begin on page **8** of this paper.

It is believed no extensions of time or fees for net addition of claims are required beyond those which may otherwise be provided for in documents accompanying this paper. However, if additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned for under 37 C.F.R. § 1.136(a), and any fees required therefore (including fees for net addition of claims) are hereby authorized to be charged to our Deposit Account No. 602731 (Ref. No. 46DG-026055).

REMARKS

By this paper, no claims are amended, added, or cancelled. Accordingly, claims 1-20 are all of the pending claims. Applicant expressly reserves the right to prosecute the subject matter of the unamended and/or cancelled claims, or any other subject matter supported by the Specification, in one or more continuation applications. In view of the foregoing amendments and the following remarks, reconsideration and allowance of all the pending claims is anticipated.

Provisional Double Patenting Rejection

Claims 1-5, 9, 11-15 and 19 currently stand provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being allegedly unpatentable over claims 1, 6-7, 9-11 and 16-17, and 19-20 of U.S. Patent Application No. 16/535,911 ("the '911 application"). Claims 1-5, 11-15 currently stand provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being allegedly unpatentable over claims 1-5 and 11-15 of U.S. Patent Application No. 16/535,886 ("the '886 application"). Solely in an effort to expedite prosecution and without acknowledging the propriety of the alleged rejections, a Terminal Disclaimer executed by the undersigned the Applicant's representative in compliance with 37 C.F.R. § 1.321(c) is submitted herewith to disclaim the term of a patent resulting from the present application from extending beyond that of patent granted on the '911 application and patent granted on the '886 application. Accordingly, Applicant requests that the above obviousness-type double patent rejection be withdrawn.

Double Patenting Rejection

Claims 1, 3, 11, and 13 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 4 and 17 of U.S. Patent No. 10,186,012 ("the '012 patent") and over claims 1, 4, and 17 of U.S. Patent No. 10,395,338 ("the '338 patent"). Solely in an effort to expedite prosecution and without acknowledging the propriety of the alleged rejections, a Terminal Disclaimer executed by the undersigned the Applicant's representative in compliance with 37 C.F.R. § 1.321(c) is submitted herewith to disclaim the term of a patent resulting from the present application from extending beyond that of the '012 patent and the '338

patent. Accordingly, Applicant requests that the above obviousness-type double patent rejection be withdrawn.

The Terminal Disclaimer fee required under 37 C.F.R. § 1.20(d) is hereby authorized to be charged to our Deposit Account No. 602731 (Ref. No. 46DG-026055).

Allowable Subject Matter

Applicant appreciates the Office Action's acknowledgment that claims 6-8, 10, 16-18, and 20 include allowable subject matter.

CONCLUSION

Having addressed each of the foregoing objections and rejections, it is submitted that a full and complete response has been made to the outstanding Office Action and, as such, the application is in condition for allowance. Notice to that effect is anticipated.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Date: October 3, 2019

Respectfully submitted,

By: /D. Benjamin Esplin/
D. Benjamin Esplin
Reg. No. 58,297

Customer No. 137002

ESPLIN & ASSOCIATES, PC

5411 Avenida Encinitas, Suite 100
Carlsbad, CA 92008
(760) 249-2133

CLAIM AMENDMENTS

This **listing of claims** will replace all prior versions, and listings, of claims in the application:

1. (Original) A system that simulates image distortion of a virtual lens in a video, the system comprising:

one or more processors; and

a non-transitory computer-readable storage medium storing instructions that when executed cause the one or more processors to perform steps including:

accessing input images, the input images including fields of view of a scene captured through a lens of a camera, the input images depicting the scene with an input lens distortion centered in the fields of view;

selecting sub-frames representing portions of the input images, the sub-frames including reduced fields of view of the scene smaller than the fields of view of the input images, the sub-frames including different lens distortion effects as a function of the input lens distortion present in the input images, different positions of areas of the input images included within the reduced fields of view, and a size of the areas of the input images included within the reduced fields of view; and

generating output images based on a desired lens distortion and the different lens distortion effects in the sub-frames, the desired lens

distortion and the input lens distortion exhibiting consistent lens characteristics, wherein the output images include the sub-frames remapped from the input lens distortion centered in the fields of view of the input images to the desired lens distortion centered in the reduced fields of view to transform the different lens distortion effects present in the sub-frames to the desired lens distortion such that portions of the scene depicted in the sub-frames appear to have been captured using the reduced fields of view.

2. (Original) The system of claim 1, wherein image stabilization is applied to the input images.

3. (Original) The system of claim 1, wherein the sub-frames are selected based on metadata associated with the input images.

4. (Original) The system of claim 3, wherein the metadata indicates motion of the camera that captured the input images.

5. (Original) The system of claim 3, wherein the metadata indicates orientation of the camera that captured the input images.

6. (Original) The system of claim 1, wherein the output images are combined as video frames of an output video.

7. (Original) The system of claim 6, wherein remapping of the sub-frames from the input lens distortion centered in the fields of view of the input images to the desired lens distortion centered in the reduced fields of view results in the output video having consistent frame-to-frame lens characteristics.

8. (Original) The system of claim 7, wherein the different positions of the areas of the input images included within the reduced fields of view simulate virtual re-pointing of the camera using the reduced fields of view.

9. (Original) The system of claim 8, wherein the one or more processors and the non-transitory computer-readable storage medium are included in the camera.

10. (Original) The system of claim 9, wherein the lens includes a wide angle lens, and lens characteristics of the wide angle lens causes straight lines in the scene to appear as curved lines near edges of the input images.

11. (Original) A method for simulating image distortion of a virtual lens in a video, the method comprising:

accessing input images, the input images including fields of view of a scene captured through a lens of a camera, the input images depicting the scene with an input lens distortion centered in the fields of view;

selecting sub-frames representing portions of the input images, the sub-frames including reduced fields of view of the scene smaller than the fields of view of the input images, the sub-frames including different lens distortion effects as a function of the input lens distortion present in the input images, different positions of areas of the input images included within the reduced fields of view, and a size of the areas of the input images included within the reduced fields of view; and

generating output images based on a desired lens distortion and the different lens distortion effects in the sub-frames, the desired lens distortion and the input lens distortion exhibiting consistent lens characteristics, wherein the output images include the sub-frames remapped from the input lens distortion centered in the fields of view of the input images to the desired lens distortion centered in the reduced fields of view to transform the different lens distortion effects present in the sub-frames to the desired lens distortion such that portions of the scene depicted in the sub-frames appear to have been captured using the reduced fields of view.

12. (Original) The method of claim 11, wherein image stabilization is applied to the input images.

13. (Original) The method of claim 11, wherein the sub-frames are selected based on metadata associated with the input images.

14. (Original) The method of claim 13, wherein the metadata indicates motion of the camera that captured the input images.

15. (Original) The method of claim 13, wherein the metadata indicates orientation of the camera that captured the input images.

16. (Original) The method of claim 11, wherein the output images are combined as video frames of an output video.

17. (Original) The method of claim 16, wherein remapping of the sub-frames from the input lens distortion centered in the fields of view of the input images to the desired lens distortion centered in the reduced fields of view results in the output video having consistent frame-to-frame lens characteristics.

18. (Original) The method of claim 17, wherein the different positions of the areas of the input images included within the reduced fields of view simulate virtual re-pointing of the camera using the reduced fields of view.

19. (Original) The method of claim 18, wherein the method is performed by one or more processors included in the camera.

20. (Original) The method of claim 19, wherein the lens includes a wide angle lens, and lens characteristics of the wide angle lens causes straight lines in the scene to appear as curved lines near edges of the input images.

Electronic Acknowledgement Receipt

EFS ID:	37359676
Application Number:	16535940
International Application Number:	
Confirmation Number:	9986
Title of Invention:	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING
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Petition:				
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(71) Applicant: HOTV INC. [US/US]; 11455 El Camino Real, Suite 350, San Diego, CA 92130 (US).

(72) Inventors: SHAH, Mehul; 12633 El Camino Real #3408, San Diego, CA 92130 (US). SRINIVASAN, Anand; 12718 Torrey Bluff Drive, #155, San Diego, CA 92130 (US). SHASTRI, Vijnan; 12664 Torrey Bluff Drive, #216, San Diego, CA 92130 (US).

(74) Agent: BOYS, Donald, R.; P.O. Box 187, Aromas, CA 95004 (US).

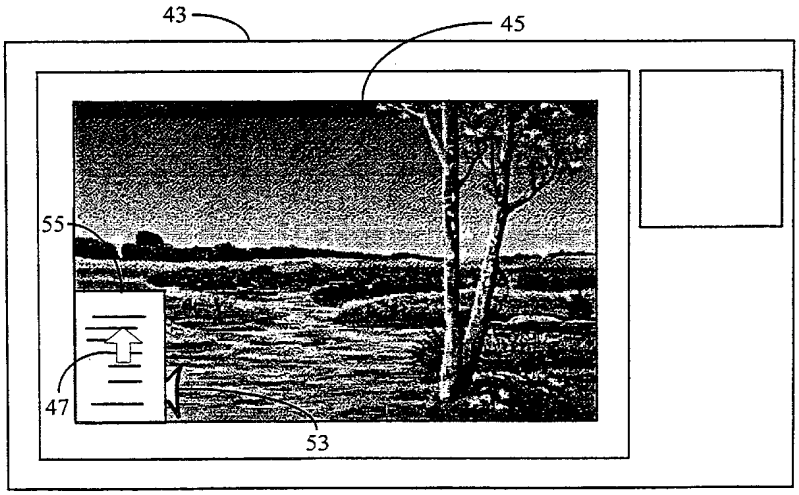
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(57) Abstract: An interactive video display system includes a content provider streaming a primary video stream, an annotation data stream, and a viewing station having a video display apparatus for displaying both the primary video stream and annotation data stream. The annotation stream comprises an animated graphic (51) in a suitable graphic format such as (GIF). The animated graphic may move in the display in any direction, directed by data in the annotation stream, and may be associated with an entity (49) displayed from the primary video stream and moves with the image entity. In response to user interaction with an animated graphic hyperlink, alternative display entities may be sent in the annotation data stream. These alternative display entities may alternatively be sent along with the primary display entities with a specification as to how they would be displayed on the basis of user interaction.

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Method and Apparatus for Integrating Animation in Interactive Video

Field of the Invention

The present invention is in the field of interactive video, and pertains more particularly to apparatus and methods for authoring and enabling animation in interactive video user interfaces.

Background of the Invention

With continuing development of new and better ways of delivering television and other video presentations to end users coupled with parallel development of computerized information systems such as the Internet, there have been concerted efforts to integrate various systems to provide enhanced information delivery and entertainment systems. For example, developers are introducing integrated systems combining TVs with computer subsystems, so a TV may be used as a WEB browser, or a PC may be used for enhanced TV viewing.

In some systems, computer elements such as a CPU, memory, and the like, are built into the familiar chassis of a TV set. In such a system, the TV screen becomes the display monitor in the computer mode. In such a system, conventional TV elements and circuitry are incorporated along with the computer elements, and capability is provided for a user to switch modes, or to view recorded or broadcast video with added computer interaction. One may thus, with a properly equipped system, select to view analog TV programs, digital TV programs, conventional cable TV, satellite TV, pay TV from various sources, video delivered on the Internet, and to browse the WWW as well, displaying WEB pages and interacting with on-screen fields and relational systems for jumping to related information,

databases, and other WEB pages. The capabilities are often integrated into a single display, that is, one may view a broadcast presentation and also have a window on the display for WEB interaction.

In some other systems, computer elements are provided in an enclosure separate from the TV, often referred to in the art as a set-top box. Set-top box systems have an advantage for providers in that they may be connected to conventional television sets, so end users don't have to buy a new TV along with the computer elements.

In such integrated systems, whether in a single enclosure or as set-top box systems, user input is typically through a hand-held device quite similar to a familiar remote controller, usually having infra-red communication with the set-top box or a receiver in the integrated TV. For computer modes, such as WEB browsing, a cursor is displayed on the TV screen, and cursor manipulation is provided by buttons or other familiar pointer apparatus on the remote. Select buttons are also provided in the remote to perform the familiar function of such buttons on a pointer device, like a mouse or trackball more familiar to computer users.

Set-top boxes and computer-integrated TVs adapted as described above typically have inputs for such as a TV antenna (analog), cable TV (analog or digital), more recently direct-satellite TV (digital), to Internet ports, and may also connect to video cassette recorders and to mass storage devices such as hard disk drives and CD-ROM drives to provide a capability for uploading video data from such devices and presenting the dynamic result as a display on the TV screen.

The present inventors have noted that with the coupling of computer technology with TV, many capabilities familiar to computer users have been made available to TV users. For example, ability to provide text annotation for TV presentations is considerably enhanced. Computer techniques such a Pix-on-Pix are now available, wherein separate TV presentations may be made in separate windows, or overlaid windows on the display screen. Separate windows may also support display from separate sources, such as an analog TV program in one window, a computer game in another, and a video conference in a third.

In typical prior art video authoring systems, end users receive a single video stream that contains the video data and any added annotated data such as subtitling, sponsor logos, information blocks, and the like. However, it is desirable to build upon the goal stated in the preceding paragraph above, by having separate streams, one containing video data, and the other containing annotative data, that may arrive at and end user's location via different delivery media and be displayed synchronously on a suitable display screen.

In a system known to the inventors, hyper-video authoring is possible wherein a wide variety of added, often interactive, content is made available to viewers having an active connection to a video feed and an Internet connection for facilitating delivery of interactive results. The system known to the inventor uses separate authoring stations or systems for use in what is termed hyper-video authoring by the inventor. Hyper-video authoring includes creating hot spots (interactive hyperlinks) in a video, providing interactive regions for tracked objects (methods known to the inventor), inserting URL's for user interaction, providing interactive banner ads, providing interactive icons for launching instant replays of short video clips, adding audio/text annotation, and so on.

Annotated content may, in some instances, be delivered via alternate paths (typically the Internet) and synchronized with a main video stream being viewed at the user's end. In other instances, added content is combined at the provider end and delivered as one stream (typically cable or digital feed) to the viewer. As a viewer interacts with provided content, Internet capability is utilized for the purpose of delivering stored information associated with the viewers interaction that may be viewed on the same display containing the offered video such as by a PIX on PIX method and so on. In some cases users, if so equipped, may elect to save and store Internet delivered content to suitable data storage apparatus. In other aspects, such material may be saved and stored on-line at a server adapted for the purpose. In this case, a viewer may at a later time retrieve the material at his or her discretion.

One of the capabilities of the above-described system is the ability to provide tracking coordinates for an object in the video. By tracking the movement of an image in a video presentation, an interactive region or hot spot may be embedded and caused

to follow a target image in the video presentation by virtue of the tracking-coordinate data included in an authored steam or embedded within a main video stream. The interactive region may be of the form of a halo surrounding an image, a semi-transparent area covering an Image, a portion of the image that has been altered in some way to indicate that it is interactive, and so on.

By clicking on the interactive portion or region associated with an image entity, a viewer may obtain, by virtue of Internet or WAN connection, additional information about the image. Such information may be delivered to a viewer in the form of a WEB page, an order form, text information, additional interactive links, or other conventions designed to further engage the viewer regarding the selected image. The authoring consists of identifying, creating, and embedding the tracking coordinates (path of the image) into the video data so that a subsequent author may associate a hyper-link or interactive region with the moving image.

In the present invention a similar capability to the tracking and selection of image entities as hyperlinks is provided, but it not necessary that the hyperlinks follow moving entities in a video presentation. This new capability provides new animated entities in the displayed video with new and non-obvious functions.

It is known in the art that animated graphics files are used by artists to create and display with animation on such as Internet Web pages. One format used for this purpose is called Graphics Interchange Format (GIF). GIF files are just one of several formats that may be used for animation, and are referred to here as representative and exemplary of all such formats. An animated GIF or other animated graphic is typically embedded in a web page. An animated graphic may play according to instruction when the web page is loaded, and others may have interactive links or animated graphics on user interaction like mouse over or mouse click. Such animations may run in a same physical location, or may be programmed to move across a screen or display either on loading or on user interaction. A GIF typically has an 8-bit construction and an excellent compression method termed LZW. This makes it easy to transmit GIFs over the bandwidth-limited Internet and to display them on a suitable screen without

using excessive bandwidth or memory. Other suitable graphic file formats other than the GIF format may also be used for such interactive content.

Providing an executable animated graphic in a manner to be integrated with a primary video stream would allow authors to provide interactive graphic content on top of the video in an entertaining form without being limited to providing interaction capability to an image already in a main video. Such interactive overlaid content may be used for interactive advertisements.

What is clearly needed is a method and apparatus for embedding and interactively linking animated graphics into a main video or authored control stream such that the graphics would change or move on the screen or appear and disappear within the video automatically and/or by virtue of user participation such as mouse or keyboard interaction. Such a method and apparatus would expand prospects for interactive advertising and other information display.

Summary of the Invention

In a preferred embodiment of the present invention a video system is provided comprising a content provider streaming a primary video stream and an annotation data stream; and a viewing station having a video display apparatus for displaying both the primary video stream and the annotation data stream. The annotation data stream comprises one or more animated graphics in a format such as the Graphics Interchange Format (GIF) which is synchronized and displayed on the video.

In some embodiments the animated graphic moves in one or both of vertical or horizontal direction, or any other trajectories in the display, directed by data in the annotation data stream, and may be associated with an image entity displayed from the primary video stream, moving with the image entity.

The viewing station may further comprise a user input device for cursor control such as a mouse, and the animated graphic may be displayed as a hyperlink. User interaction with the animated graphic may either send a back-link signal to the content

provider or may execute some other action as per information in the annotation data stream.

If an action is specified in the annotation data stream in response to user interaction - a back link signal may or may not be used. Such actions on user interaction specified in the primary annotation data stream could be displaying an alternative graphic content, changing the motion of the graphic content, making the graphic content appear or disappear from the video or display other specific information in text or graphic format. Such content may be used for interactive gaming kind of applications to invite more participation from the user while he is watching the video. The advantage of specifying data about the action to be performed on user interaction in the primary annotation data stream is that a back-link signal is not required and the information about response to user interaction can be sent simultaneously to all users without requiring a separate communication channel for each user.

If the user interaction is sent to the content provider as a back-link signal, the content provider may, as a response, stream an alternative annotation stream, providing an alternative display on the video display apparatus at the viewing station. In this case the alternative annotation stream which contains the response to the user interaction is sent specifically to users who interact with the content.

In some cases the viewing station comprises a first high-bandwidth dedicated connection for receiving the primary video stream, and an Internet connection for receiving the annotation video stream, and the content provider comprises a first facility for streaming the primary video stream via the first connection, and an Internet-connected server for streaming the annotation video stream via the Internet. In these systems the annotation data stream first provides a first displayable indicia as a hyperlink, and in response to a backlink signal to the Internet-connected server initiated by user interaction with the first displayable indicia, the server provides additional information about the action to be performed such as displaying a web page or displaying other graphics on the video.

In some embodiments the first displayable indicia responds to a user interaction such as a mouse-over to display other animated graphics which in turn respond to user interaction to display other graphics or textual content or send a second backlink signal. In some of these embodiments the server responds to the second backlink signal by sending a third displayable indicia in the annotation data stream.

In another aspect of the invention an interactive video system is provided, comprising a computerized display system comprising a video display apparatus, receiving apparatus for receiving and displaying both a primary video stream and an annotation stream on the display apparatus, a user input apparatus for a user to interact with display entities, and a mechanism for sending backlink signals from the computerized display system; and an Internet-connected server for providing at least the annotation data stream and connected to the computerized display system in a manner to receive the backlink signals. The annotation data stream provides a first displayable indicia as a hyperlink, and the server responds to a backlink signal resulting from user interaction with the first displayable indicia by providing in the annotation data stream a second displayable indicia.

In embodiments from this the second displayable indicia may also be a hyperlink. Also in these embodiments the first displayable hyperlink may send a first backlink signal as a result of a mouse-over, and the second display able indicia may then send a second backlink signal as a result of a mouse click. The second displayable indicia may be a company logo, which may display for a pre-determined time period and then disappear, and the annotation data stream from the server then provides a third displayable indicia. One of the first and second displayable indicia may comprise an animated Graphics Image Format (GIF) display. In this case the second GIF may persist in the display for a pre-determined time period, then disappear, and the annotation data stream from the server then provides a third displayable indicia.

In these embodiments the first and second displayable indicia may move in one or both of vertical and horizontal directions in the display, directed by data in the annotation data stream, and may also be associated with an image entity in the primary video stream, and move with the image entity.

In addition to the apparatus of the invention in multiple embodiments, as described generally above, methods for practicing the invention using the apparatus are taught as well, all in enabling detail below. The functionality taught for video display systems according to embodiments of the invention provides new ways of advertising, and new ways of presenting information to viewers with viewer participation in interactive video systems, and also provides new ways of doing an e-commerce transaction by introducing interactive advertising .

Brief Description of the Drawing Figures

Fig. 1 is an overview diagram of a video authoring and delivery system in an embodiment of the present invention.

Fig. 2 is a block diagram illustrating components of the authoring station of Fig. 1.

Fig. 3A is a plan view of an interactive PC/TV illustrating display and viewer interaction with a first animated graphic according to an embodiment of the present invention.

Fig. 3B is a plan view of the PC/TV of Fig. 3A illustrating a second animated graphic invoked in Fig. 4A.

Fig. 3C is a plan view of the PC/TV of Fig. 3A illustrating viewer interaction with the second animated graphic of Fig. 3B according to an embodiment of the present invention.

Fig. 3D is a plan view of the PC/TV of Fig. 3A illustrating a third animated graphic invoked in Fig. 3C.

Description of the Preferred Embodiments

It is an object of the present invention to provide a method and apparatus that enables an author annotating a primary video stream, which may be either digital or analog, to create and provide interactive animated graphics in video presentations. In embodiments of the invention animated graphics, for example graphics in a GIF format, may be used in concert with hyperlinks of various sorts to provide activity sequences in an interactive video displays. The method and apparatus is described in enabling detail below.

Fig. 1 is a block diagram illustrating an exemplary overview of a video authoring and delivery system 9 as known to the Inventor and suitable for practicing the present invention. System 9 is exemplary of a system known to the inventor for receiving, authoring and sending video content to viewers who subscribe to a service defined by this capability. Exemplary components of system 9 include a broadcast system 11, a video head end 13, an authoring station 15, a wide-area-network (WAN) 19 having an Internet Service Provide (ISP) including modems 24 and a server 26, and a plurality of subscribed viewers 17a through 17n.

Video head end 13 is defined as a source for live or pre-stored video feeds for the purpose of video authoring before delivery to viewers such as viewers 17a-n. Video head-end 13 delivers video feed 21, which, in this embodiment, is diverted to authoring station 15 for the purpose of providing annotative and interactive content that will ultimately be displayed on equipment maintained by viewers 17a-n. Such content will either be combined or muxed into feed 21 and be displayed from one stream delivered to viewers, or may be delivered as a separate stream to be combined or caused to display in synchronous mode on a viewer's system.

Feed 21 may be either an analog feed or a digital feed. If feed 21 is analog, it is converted to digital format for the purpose of authoring. Feed 21 may continue on to viewers as an analog feed. In another embodiment, feed 21 may be converted to digital format and remain as such for delivery to viewers 17a-n. Such variations in video format, delivery methods of feed 21, and delivery methods of authored content

will depend, in part, on system architecture and customer equipment capability, and in part on the nature of added content and the intent of providers. There are many possible variations.

In this example, broadcast system 11 is capable of video delivery in digital or analog format over a cable connection, a satellite connection, or by any other high-bandwidth dedicated medium. The connections illustrated between viewers 17a-n and broadcast station 11 illustrate logical connections only. As previously described, video feed 21 is diverted in this instance, to station 15 for authoring.

Authoring station 15 is enhanced with a software application 22 which enables an author to provide video annotation to the primary video stream. The video annotation provided may be of a variety of sorts as described in the related prior application under the heading above "Cross-reference to related Documents". Such annotation includes, for example, associating a moving image entity (for example, a specific player in a sports event) in a primary video with a hyperlink by tracking the image and including coordinates of the image entity in the annotation data. Displayable graphics, such as icons, may be annotated to primary video streams and be displayed either as fixed icons or moving with tracked entities, and such icons may be rendered as hyperlinks, such that selecting an icon initiates a backlink signal to a server, just as a hyperlink works in a WEB page.

In some cases in the present invention animated GIFs are provided by an author through software 22 to be integrated with a primary video stream and used in ways more fully described below. Such animated GIFs may be created at the authoring station or retrieved from another source, inserted as metadata in a primary stream or in a separate stream to be later coordinated with the primary stream, and displayed as hyperlinks at a user's facility.

In the case of a pre-stored analog video, authoring may, of course, be performed off-line at the authors convenience. In this case, created content including animated GIFs may be timed to stream at the same time of the main video, unless, of course, the content is made part of the main video by virtue of VBI or HBI inserted metadata. In some cases authored content may be delivered ahead of a primary video

and later coordinated (synchronized) with the video. All analog video is converted to digital format at station 15 before authoring. Separate control streams remain digital and must be synchronized either at station 15, or at the viewer's end before successful display of an annotated presentation.

Because VBIs and HBIs in analog video streams are limited in capacity for inserted data, and may be overwritten by downstream processes, it is preferred that metadata including any animated GIFs be delivered in a separate digital control stream to be synchronized to the associated primary video at authoring station 15, at station 11 or at each viewer's location.

A feed 21a is illustrated as output from authoring station 15. Feed 21a represents the analog or digital video feed 21 after leaving station 15. A control stream 23, illustrated as output from station 15, represents a combined control stream containing any GIF metadata and, perhaps other forms of annotation metadata inserted by one or a plurality of authors. A control stream 23a represents stream 23 being integrated with main feed 21 for combining or synchronization at station 11. This operation may alternatively be performed within station 15, in which case, only one feed would be output to station 11. Control stream 23 may also (and preferably) be delivered through WAN 19 to viewers by virtue of separate WAN connections maintained by viewers 17a –17n. WAN 19 may, in preferred embodiments, be the Internet.

WAN 19 is shown, as briefly described above, having a representative server 26 and modem bank 24 constituting an Internet Service Provider (ISP) accessed by users 17a-n through a public-switched telephone network represented by line 23. In practice separate users may have separate ISPs which may each access server 26. In embodiments of the invention software 28 at server 26 in conjunction with stored or otherwise accessible content provides displayable entities, including animated GIF entities, to users 17 a-n in response to backlink signals as a result of users interacting with hyperlinks provided by metadata integrated with or coordinated with a primary video stream displayed at a user's station.

System 9 as illustrated herein may deliver analog or digital video content to viewer's 17a-n along with separate digital control streams that may arrive via alternate paths. System 9 may be altered with respect to architecture to facilitate many alternative embodiments as long as the main or basic components exist without departing from the spirit and scope of the present invention.

Fig. 2 is a block diagram illustrating components of authoring station 15 of Fig. 1 according to an embodiment of the present invention. Station 15 may have a plurality of authors 1-4 and an authoring server 27. Authors 1-4 are preferably operating separate computerized control stations. There may be more or fewer authors operating at station 15 without departing from the spirit and scope of the present invention. The inventor deems these four as adequate for the purpose of illustrating the present invention. Some of authors 1-4 may be automated stations and unmanned by live persons whereas persons assigned to specific authoring assignments may man some other stations.

This example supports real-time authoring as demonstrated by the architecture of authors 1-4. Video stream 21 is fed simultaneously in to each authoring station 1-4. If feed 21 is analog, it is converted to digital format either before arriving to, or at the location of each station 1-4. Each author 1-4 outputs a control stream 25a- 25d respectively. Each control stream 25a-d contains metadata particular to a particular authoring assignment. For example, stream 25a contains animated GIF metadata. Streams 25b-d may contain other types of authored metadata. In this example, all the control streams are combined in an authoring server 27 and are output as one control stream 23, which is analogous to stream 23 of Fig. 1.

Stream 21 re-merges after exiting control stations 1-4 (authors). In some embodiments, stream 21 is passed through server 27 for the purposed of synchronizing it with the combined control stream 23, however, this is not required to practice the present invention, as other methods for stream synchronization are known to the inventor and may be practiced at the provider end or at the viewers end.

In this case, main video 21 and control stream 23 are separate but synchronized streams as they exit authoring station 15. In alternative embodiments, as previously

described, there may be only one combined stream leaving station 15. The animated GIF metadata is included in stream 23 with other annotation.

In this embodiment, authoring station 1 creates and prepares annotation that will be associated with animated GIFs. If the authoring at station 1 includes animated GIFs then the author retrieves such GIFs from a library or other content provider, and inserts these as metadata into control stream 25a in real time. In many cases this first annotation will be a transparent hyperlink to a moving image entity in the primary video, as described above, or a static, displayable graphic, or icon. The initial authoring also includes adding interactive metadata, which provides hyperlink capability according to viewer initiation such as a mouse-over or a click or double-click in a viewer's interface, described in further detail below. In many cases of the present invention, viewer interaction with a first hyperlink provided by the authoring capability described provides a second display, which may be an animated GIF, connection to additional information, or even further changes in display and action. In the case of such further display resulting from an initial interaction, the further metadata annotation may provided by server 26 (Fig. 1) for example, in response to a backlink signal resulting from a user interacting with a hyperlink.

User interaction with hyperlinks whether or not the hyperlinks are associated with animated graphics is provided by conventional methods such as through pointer operation, keyboard input or other known input techniques.

Fig.'s 3A-3D are exemplary displays on an interactive PC/TV at a viewer's premise illustrating various stages of viewer interaction with animated GIFs during a presentation of a video.

In Fig. 3A, an exemplary video presentation 45 is being displayed on a viewer's PC/TV 43. For the purpose of discussion and example, the primary video is a short video clip sponsored by a travel agency. Presentation 45 illustrates a sequence from a vacation location being offered by the travel agency for the purpose of attracting vacation prospects to the area.

As presentation 45 displays on PC/TV 43, a first animated GIF 49 appears as a dorsal fin of a fish swimming up and down a stream in the video. The path instruction

for GIF 49 has been programmed by an author at an authoring station into an annotation stream as described above, the annotation stream being sent to the user's station via server 26, such that GIF 49 appears to swim within the stream boundaries in the video sequence containing the stream. Gif 49 is provided as a hyperlink. To progress to a next level, a viewer moves a cursor to the GIF.

There are several ways one may interact with a hyperlink. Activation may occur by a mouse-over, which means moving the screen cursor over the hyperlink area, by a click, by a double-click, or by combinations.

In Fig. 3B the dorsal GIF 49 is terminated as a result of the mouse-over, which sends a backlink signal to server 26 (Fig. 1), which responds by sending a new annotation data stream to the user's station. The new annotation stream provides a second GIF 51 in the form of a full-bodied fish. Alternatively the GIF 51 may be sent along with GIF 49 in the primary annotation stream along with information about displaying GIF 51 as a result of user interaction to GIF 49. GIF 51 is programmed to jump in and out of the stream staying within the stream's boundaries. GIF 51 may continue to display throughout the video waiting on a viewer's response, or may be timed to terminate automatically if the viewer does not respond. In one embodiment, when a scene change occurs from, for example, a sequence showing the stream to, perhaps a sequence showing a cabin offered for rent, GIF 51 will terminate and a new interactive and animated GIF associated with the next sequence (cabin) may automatically appear. If a viewer chooses, he or she may obtain additional information by clicking on the second GIF (51) before the scene changes.

In Fig. 3C, the viewer has elected to click on GIF 51 in order to proceed to a next level. Clicking on GIF 51, in this example terminates the second GIF and executes yet a third GIF. In Fig. 3D, a third GIF 53 in the form of a full bodied fish executes as described above, and immediately jumps to a sidebar area or to another specified location in the video where upon reaching it's destination, an information block 55 automatically pops up. Information block 55 contains text information associated with the vacation spot such as accommodation availability and pricing,

travel directions and optimum season information, available guide information for fishing in the stream, or any other imaginable information that may be provided.

In addition to simple text information, block 55 may contain interactive links in the form of text or graphics leading to additional sources of information such as to a WEB page hosted by the travel agency containing booking arrangements and the like. There are many possible arrangements. Block 55 may, in some embodiments, be an animated GIF with animation in the form of moving text. The use of a vacation video and travel agency as a host is an isolated example used simply to describe one possible application that may be provided in the practice of the present invention. Such an application may, perhaps, be provided in conjunction with a special interactive channel such as a travel channel where such interactive vacation videos regularly air.

In a preferred embodiment of the invention authoring at authoring stations of authoring system 15 of Fig. 1 includes associating complete packages of icons, GIFs and the like with a primary video stream. For example, the sequential displays described with reference to Figs. 3A-3C above are pre-authored as a related package and associated with the primary video at the same time. The alternative forms are all present in the annotation stream, and server 26 is programmed to provide the first form until a hyperlink is activated by a first method (mouse-over), then the second form in response to a second signal, and so forth.

It will be apparent to one with skill in the art that a very wide variety of desirable effects may be provided by the techniques of the present invention in different embodiments. For example, a first interactive hyperlink may be provided as an icon static anywhere in a displayed video. upon a mouse-over, the icon may show a text annotation, such as "click for local weather". Upon clicking, the icon may be replaced by an annotated GIF according to the weather; a blue sky with moving clouds for clear weather; a storm cloud with rain falling for stormy weather, and so on.

As another example, a first annotated display may provide an icon with a text script "weather update". A mouseover causes the icon to change temporarily to a Starbucks™ logo. After a short time, the logo disappears and a weather update appears in a sidebar or other window, or by an animated GIF showing the weather, as

described above. In this manner, short advertisements may be provided in the process of performing other functions.

In another example, a GIF may be provided in a primary video of such as a basketball game informing viewers that there are tickets available for an upcoming game. Clicks can be processed in a manner that the first 100 respondents, or even numbered respondents of the first 200 for example, will be eligible to buy the 100 available tickets. The respondents identities are known, as the service is a subscription service, and the responses are by backlink from selecting a hyperlink. Applications to purchase may then be mailed to the lucky respondents, or there may be provision made for online purchase, or purchase may be automatic and billed on the subscriber's account.

In yet another embodiment animated graphics may take the form of animated company logos or brands, and user interaction may result in any number of responses, including such as downloading coupons for discounts and the like.

Applications may be conceived for virtually any type of video presentation wherein an advertiser or sponsor may gain benefit by providing graphics such as GIFs and information associated with them. In other embodiments, animated GIFs may be prepared and used purely for entertainment or educational value instead of for selling products or for other advertisement purposes. Therefore, the method and apparatus of the present invention should be afforded the broadest scope. The spirit and scope of the present invention is limited only by the claims that follow.

What is claimed is:

1. A video system comprising:

a content provider streaming a primary video stream and an annotation data stream; and

a viewing station having a video display apparatus for displaying both the primary video stream and the annotation data stream;

wherein the annotation data stream comprises at least a first animated graphic which displays on the video display.

2. The system of claim 1 wherein the first animated graphic moves in the display as directed by data in the annotation data stream.

3. The system of claim 2 wherein the moving first animated graphic is associated with an image entity displayed from the primary video stream, and moves with the image entity.

4. The system of claim 1 wherein the viewing station further comprises a user input pointer device for cursor control and wherein user interaction by the pointer device with the first animated graphic causes a change in the animated graphic display.

5. The system of claim 4 wherein user interaction with newly-appearing animated graphics causes additional animated graphics to appear.

6. The system of claim 4 wherein user interaction with the first animated graphic produces a back-link signal, and in response to the backlink signal the content provider streams an alternative annotation stream, providing an alternative display on the video display apparatus at the viewing station.

7. The system of claim 1 wherein the viewing station comprises a first high-bandwidth dedicated connection for receiving the primary video stream, and an Internet connection for receiving the annotation video stream, and the content provider comprises a first facility for streaming the primary video stream via the first connection, and an Internet-connected server for streaming the annotation video stream via the Internet.

8. The system of claim 7 wherein the annotation data stream first provides a first displayable indicia as a hyperlink, and in response to a backlink signal to the Internet-connected server initiated by user interaction with the first displayable indicia, the server provides in the annotation data stream an animated graphic as a hyperlink.

9. The system of claim 8 wherein the first displayable indicia responds to a user interaction such as mouse-over to send the backlink signal, and wherein the animated graphic provided in response in turn responds to user interaction to send a second backlink signal.

10. The system of claim 9 wherein the server responds to the second backlink signal by sending a third displayable indicia in the annotation data stream.

11. An interactive video system comprising:

a computerized display system comprising a video display apparatus, receiving apparatus for receiving and displaying both a primary video stream and an annotation stream on the display apparatus, a user input apparatus for a user to interact with display entities, and a mechanism for sending backlink signals from the computerized display system; and

an Internet-connected server for providing at least the annotation data stream and connected to the computerized display system in a manner to receive the backlink signals;

wherein the annotation data stream provides a first displayable indicia as a hyperlink, and the server responds to a backlink signal resulting from user interaction with the first displayable indicia by providing in the annotation data stream a second displayable indicia.

12. The system of claim 11 wherein the second displayable indicia is also a hyperlink.

13. The system of claim 12 wherein the first displayable hyperlink sends a first backlink signal as a result of a mouse-over, and the second display able indicia sends a second backlink signal as a result of a mouse click.

14. The system of claim 13 wherein the second displayable indicia is a company logo.

15. The system of claim 14 wherein the company logo displays for a pre-determined time period followed by a third displayable indicia.

16. The system of claim 13 wherein one of the first and second displayable indicia comprises an animated graphic in Graphics Image Format (GIF).

17. The system of claim 13 wherein the second displayable indicia comprises a Graphics Image Format (GIF) display, which persists in the display for a pre-determined time period, then disappears, and the annotation data stream from the server then provides a third displayable indicia.

18. The system of claim 11 wherein one or both of the first and second displayable indicia move in the display, directed by data in the annotation data stream.

19. The system of claim 18 wherein one or both of the first and second displayable indicia is associated with an image entity in the primary video stream, and moves with the image entity.

20. A method for providing annotated data entities in a displayed video, comprising steps of:

(a) streaming a primary video stream and an annotation data stream by a content provider;

(b) displaying both the primary video stream and the annotation data stream at a viewing station connected to the content provider by at least one data link; and

(c) providing an animated graphic which displays on the video display from the data in the annotation data stream.

21. The method of claim 20 wherein, in step (c), the animated graphic moves in the display, directed by data in the annotation data stream.

22. The method of claim 21 wherein the moving graphic is associated with an image entity displayed from the primary video stream, and moves with the image entity.

23. The method of claim 20 wherein the animated graphic displays as a hyperlink, and comprising a further step for interacting with the hyperlink by a user input pointer device for cursor control, such that user interaction with the animated graphic causes a second animated graphic to display. .

24. The method of claim 23 wherein interacting with newly appearing animated graphics causes additional animated graphics to display.

25. The method of claim 23 comprising a further step wherein interaction with an animated graphic causes a back-link signal, and, in response to the backlink signal, the content provider streams an alternative annotation stream, providing an alternative display on the video display apparatus at the viewing station.

26. The method of claim 20 wherein the viewing station comprises a first high-bandwidth dedicated connection for receiving the primary video stream, and an Internet connection for receiving the annotation video stream, and the content provider comprises a first facility for streaming the primary video stream via the first connection, and an Internet-connected server for streaming the annotation video stream via the Internet.

27. The method of claim 26 wherein the annotation data stream first provides a first displayable indicia as a hyperlink, and in response to a backlink signal to the Internet-connected server initiated by user interaction with the first displayable indicia, the server provides in the annotation data stream an animated GIF as a hyperlink.

28. The method of claim 27 wherein the first displayable indicia responds to a mouse-over to send the backlink signal, and wherein the animated graphic provided in response to the backlink signal responds to a mouse click to send a second backlink signal.

29. The method of claim 28 wherein the server responds to the second backlink signal by sending a third displayable indicia in the annotation data stream.

30. A method for providing annotated data entities in a displayed video, comprising steps of:

(a) streaming a primary video stream to a computerized video display system by a first streaming facility;

(b) streaming an annotation data stream to the computerized video display system by an Internet-connected server enabled to receive backlink signals;

(c) displaying both the primary video stream and the annotation data stream at the computerized video display system, the annotation data stream providing a first displayable indicia as a hyperlink;

(d) responding by the Internet-connected server to a backlink signal from user interaction with the first hyperlink by providing in the annotation data stream a second displayable indicia.

31. The method of claim 30 wherein, in step (d), the second displayable indicia is also a hyperlink.

32. The method of claim 31 wherein, in step (d) the first displayable hyperlink sends a first backlink signal as a result of a mouse-over, and the second display able indicia sends a second backlink signal as a result of a mouse click.

33. The method of claim 31 wherein the second displayable indicia is a company logo.

34. The method of claim 33 wherein the company logo displays for a pre-determined time period and then disappears, and the annotation data stream from the server then provides a third displayable indicia.

35. The method of claim 30 wherein one of the first and second displayable indicia comprises an animated graphic in a suitable format.

36. The method of claim 32 wherein the second displayable indicia comprises an animated graphic display, which persists in the display for a pre-determined time period, then disappears, and the annotation data stream from the server then provides a third displayable indicia.

37. The method of claim 30 wherein one or both of the first and second displayable indicia move in the display directed by data in the annotation data stream.

38. The method of claim 37 wherein one or both of the first and second displayable indicia is associated with an image entity in the primary video stream, and moves with

the image entity.

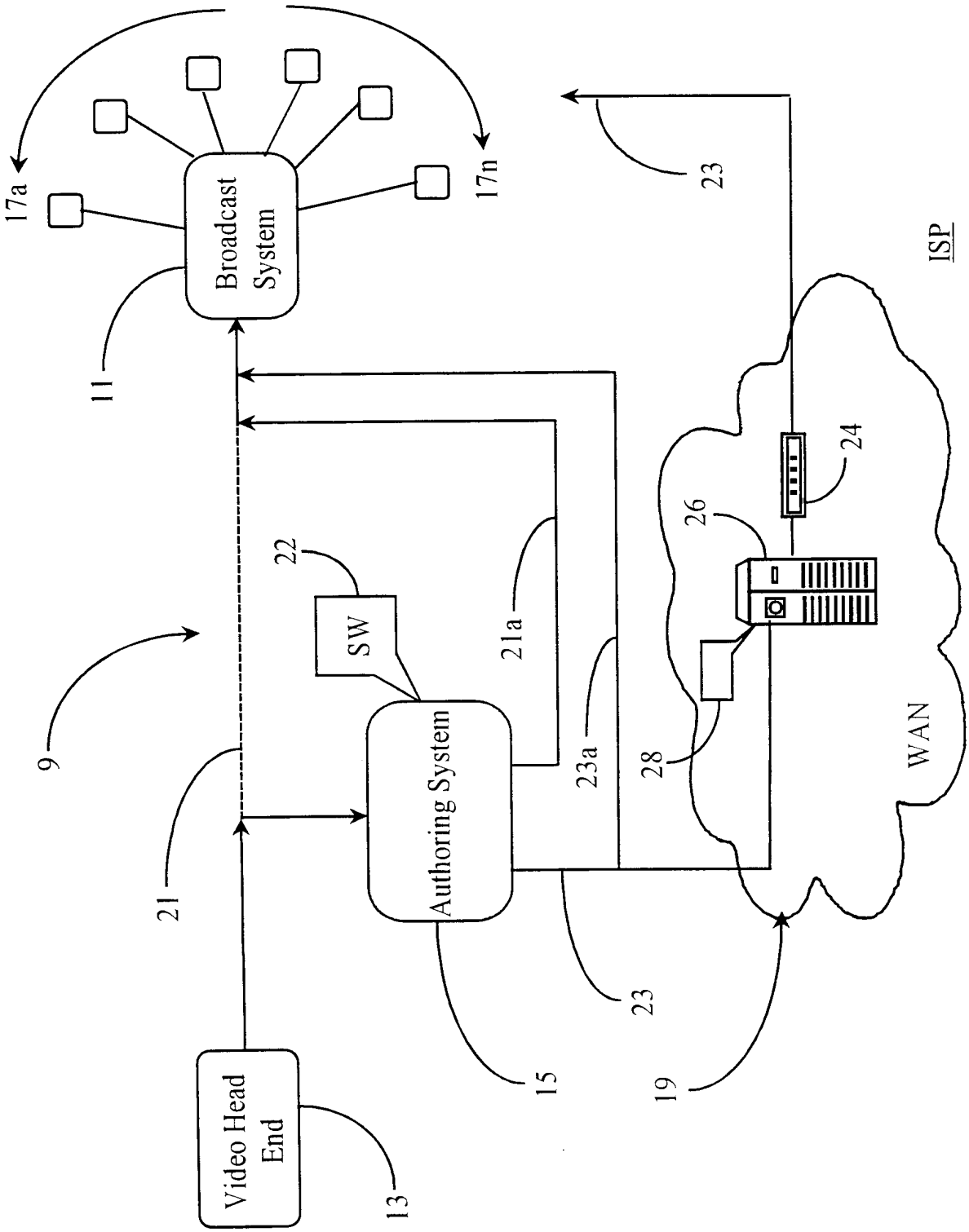

17a
17n
Broadcast System
11
23
ISP
24
26
22
SW
21a
9
Authoring System
23a
28
WAN
21
23
15
19
Video Head End
13

Fig. 1

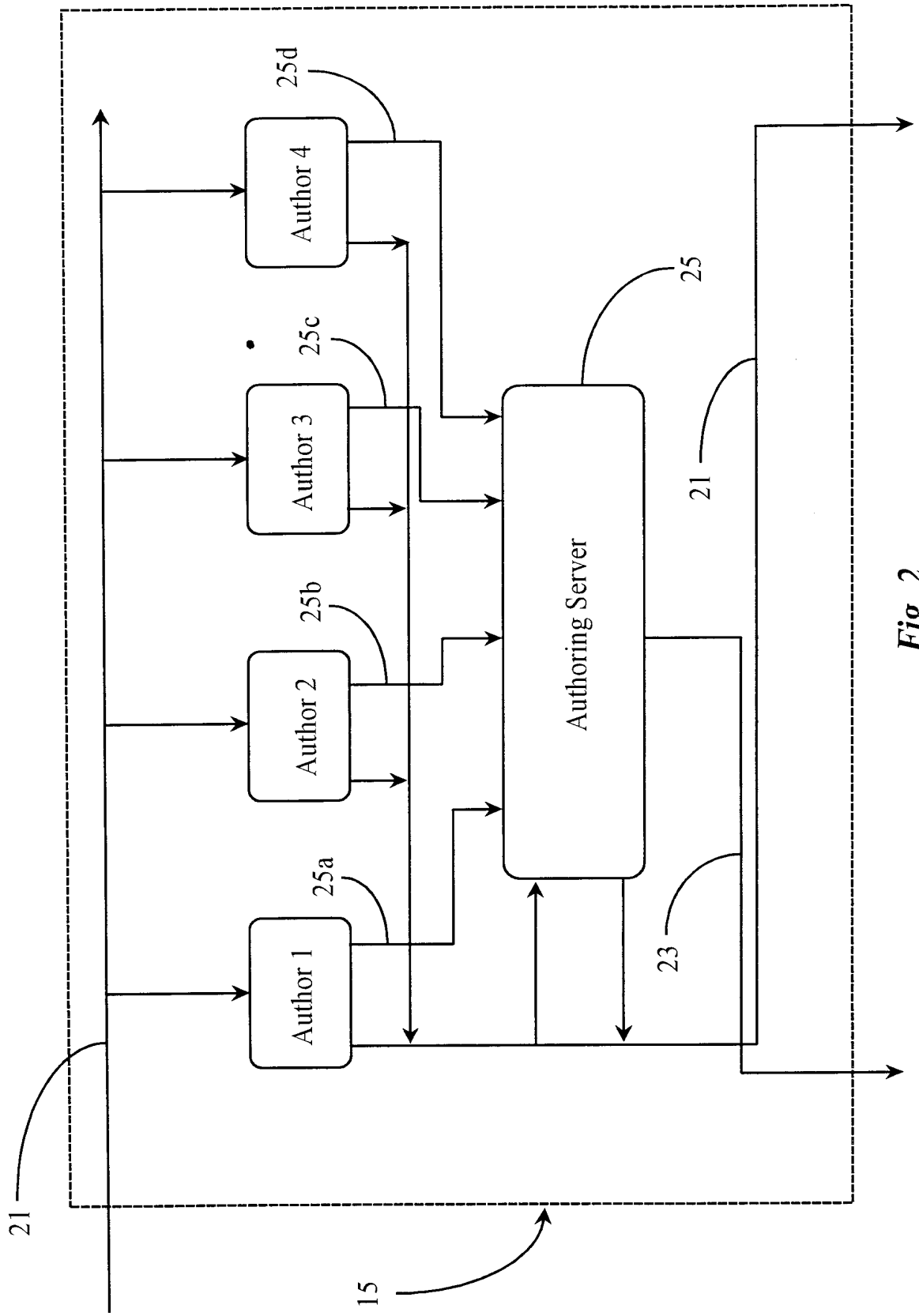

Author 4
Author 3
Author 2
Author 1
Authoring Server
25d
25c
25b
25a
25
21
23
21
15

Fig. 2

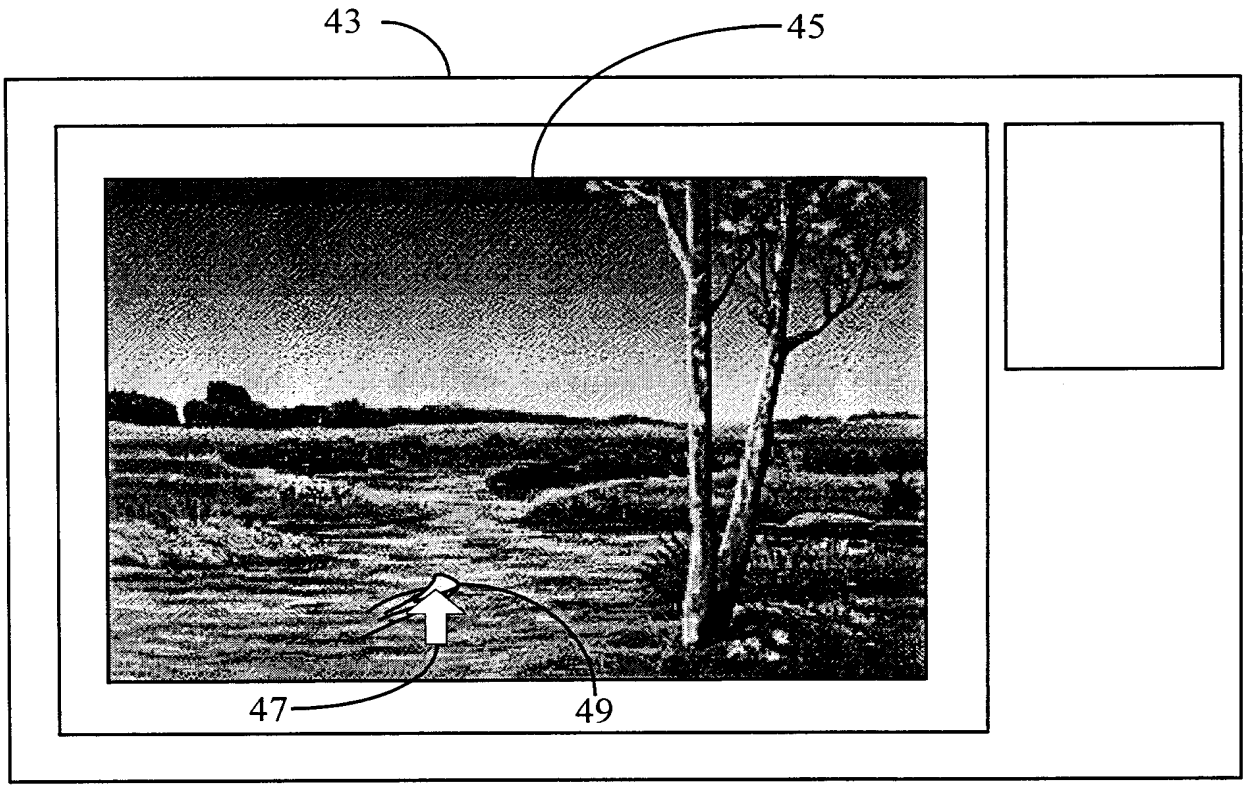


Fig. 3A

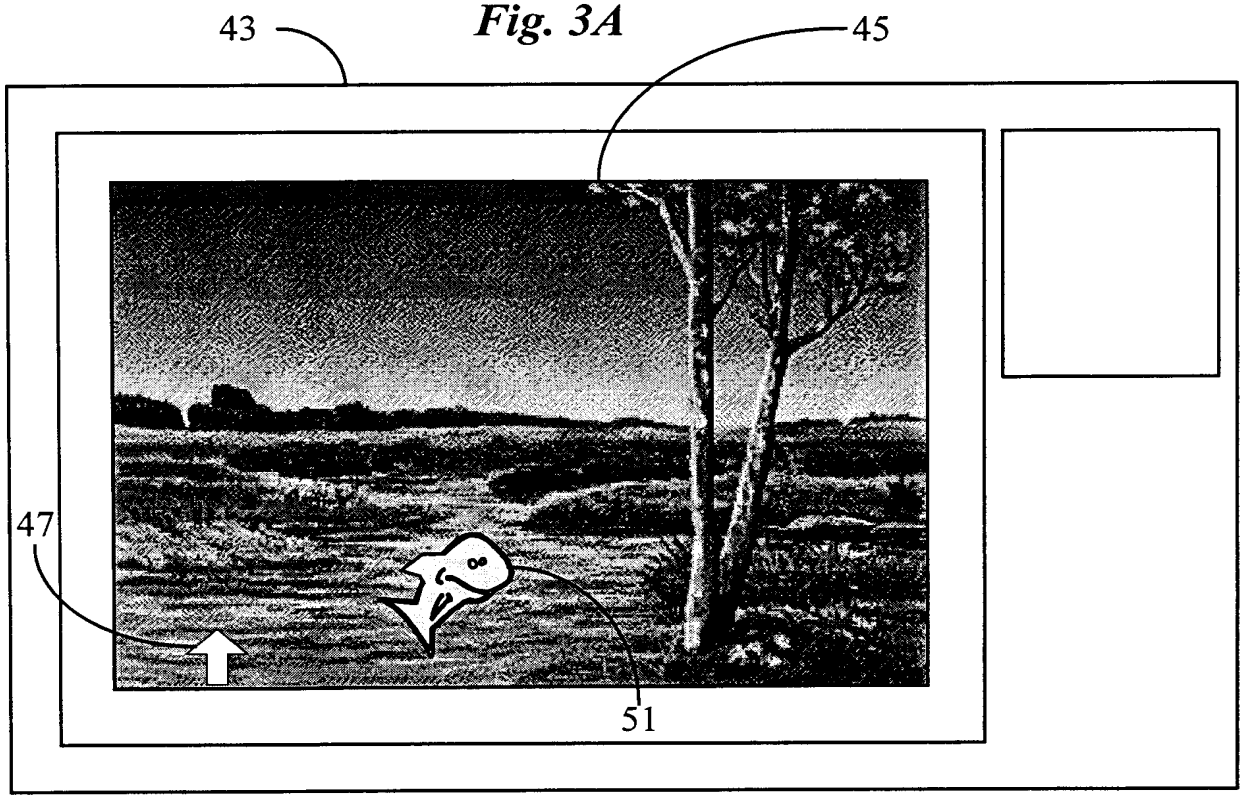


Fig. 3B

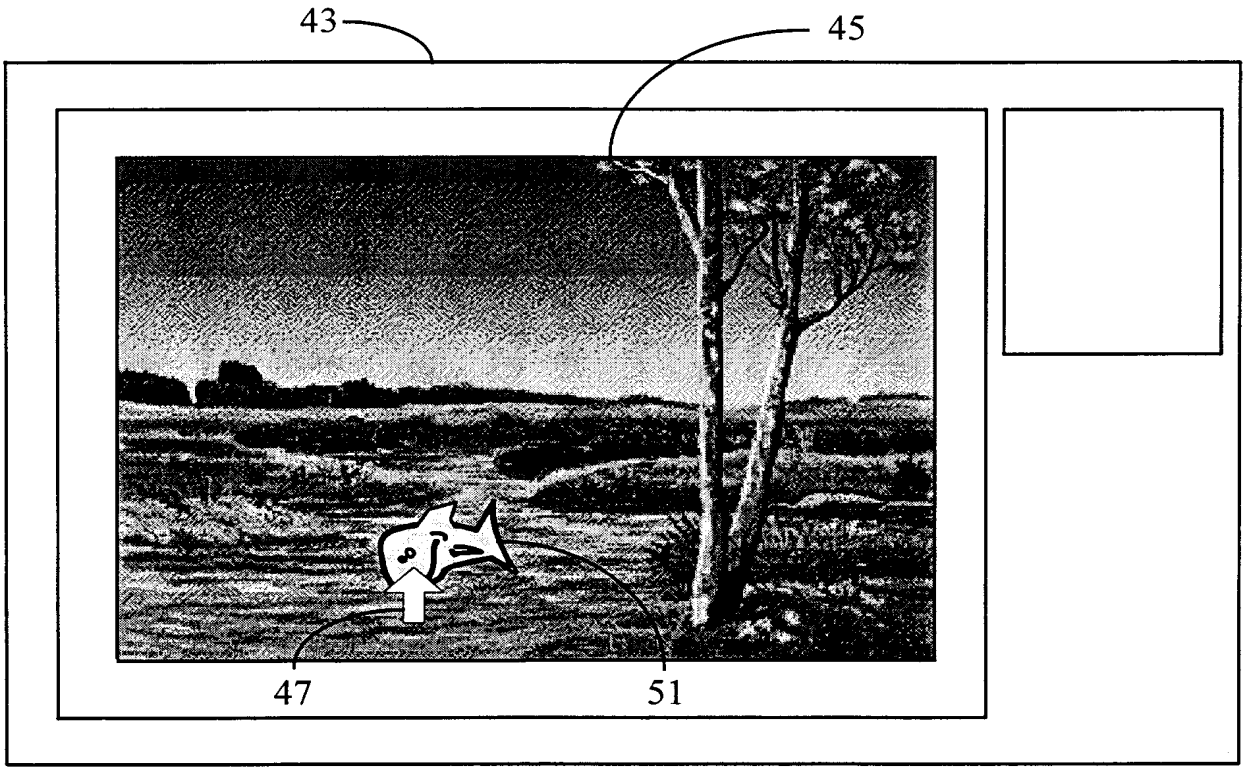


Fig. 3C

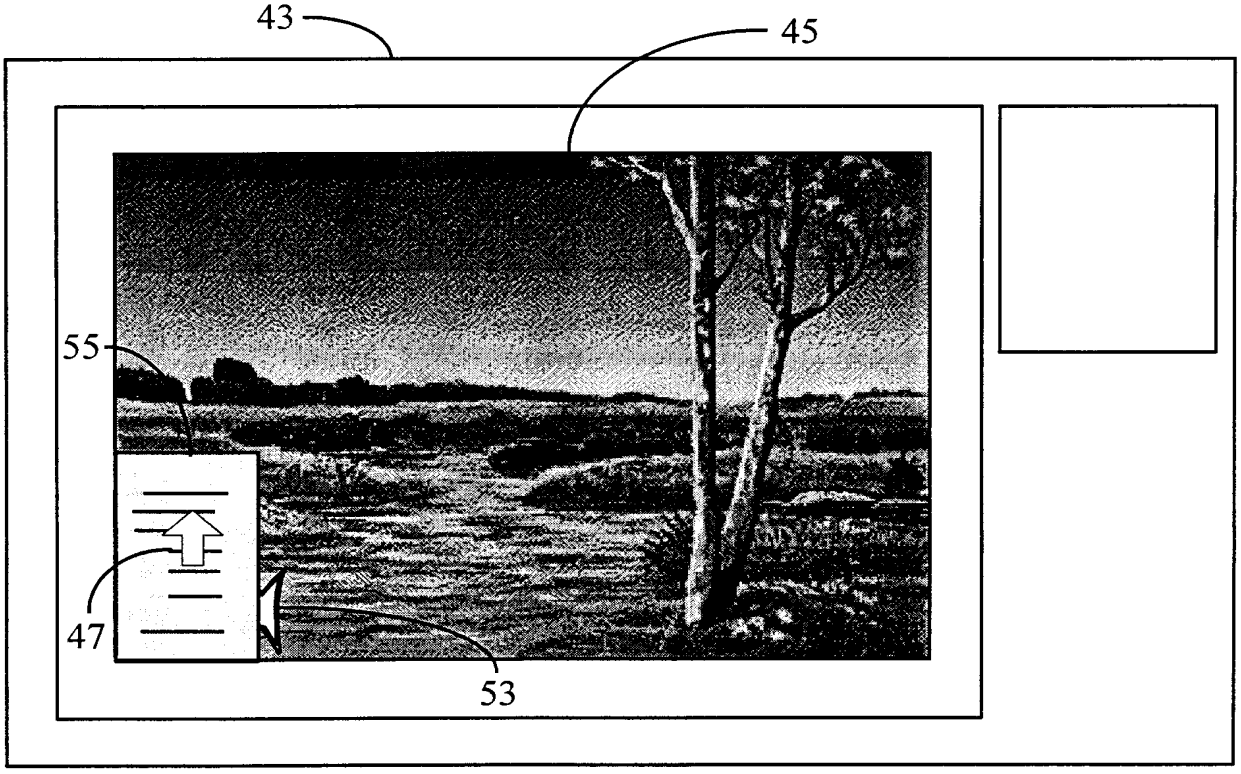


Fig. 3D

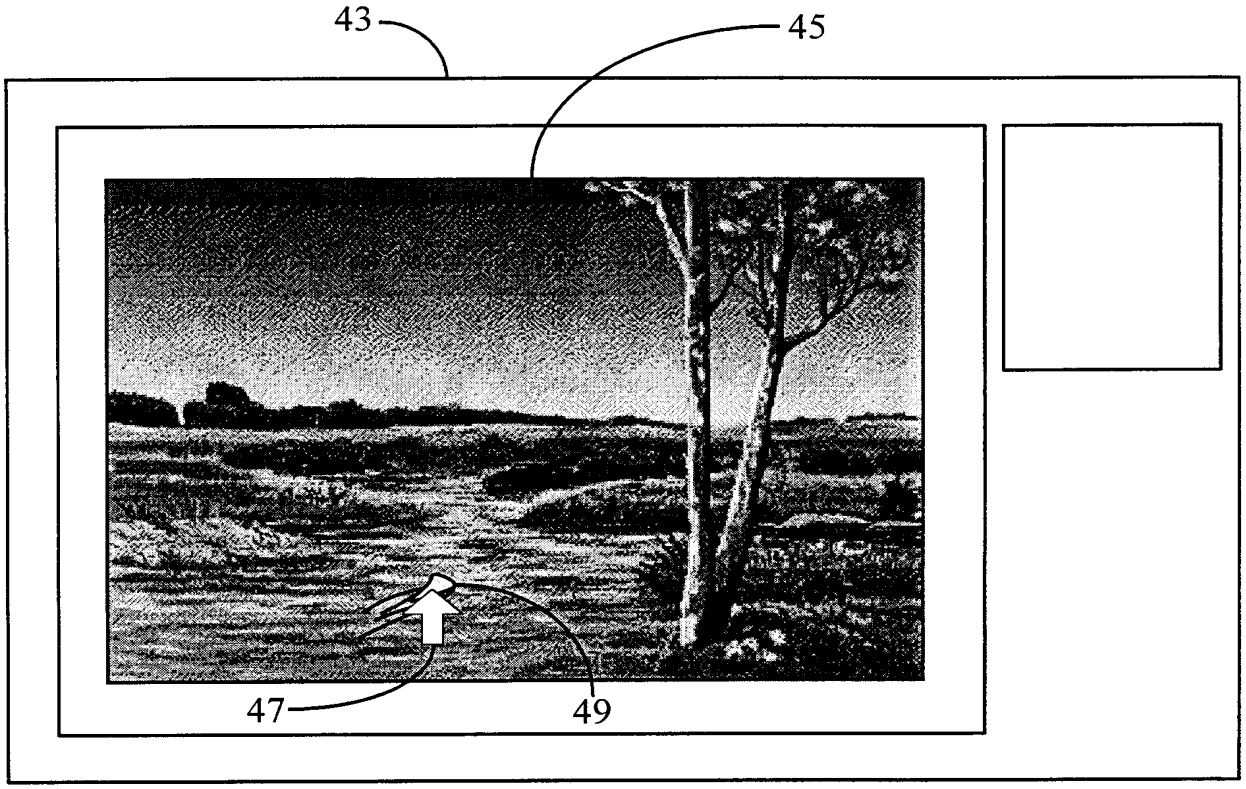


Fig. 4A

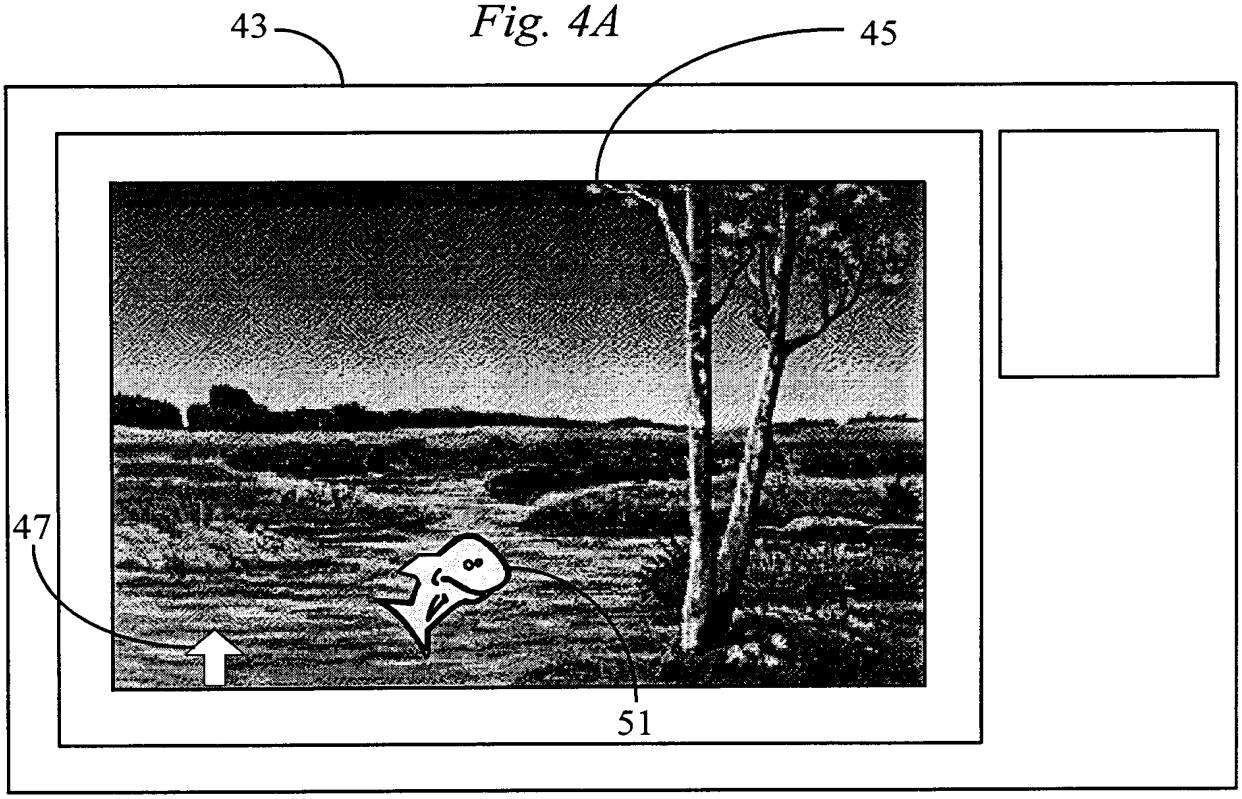


Fig. 4B

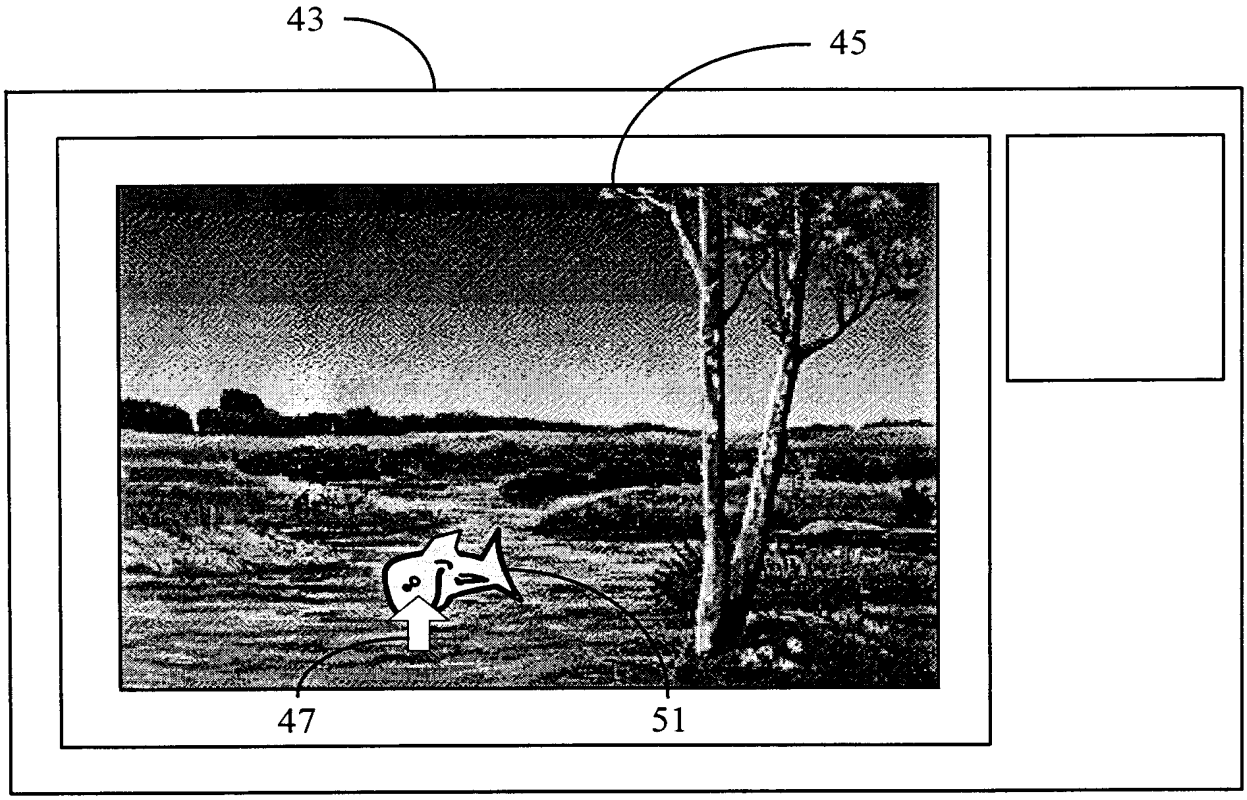


Fig. 4C

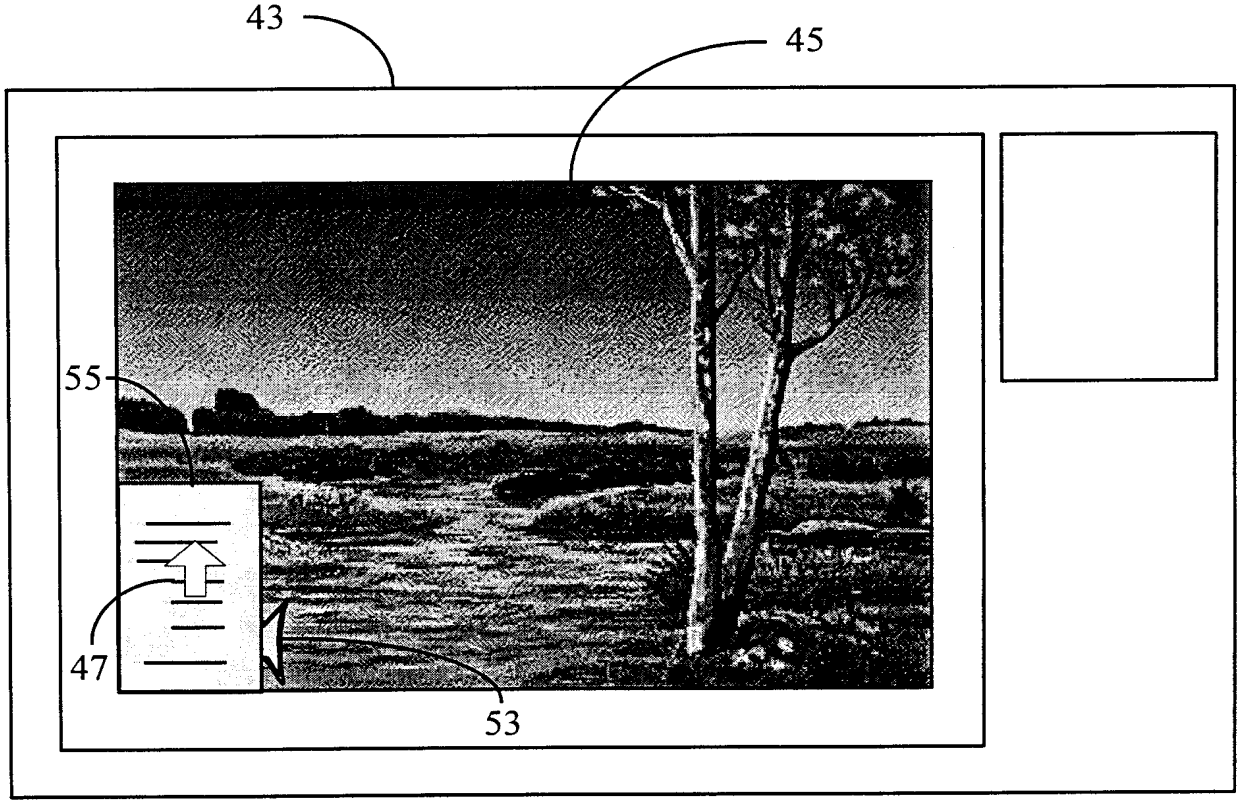


Fig. 4D

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/21707

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :GO6F 13/00; HO4N 7/173
US CL :725/41, 112; 348/473.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 725/41, 112; 348/473.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST
URL, hotspots, icon, or link; animated graphic

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,774,666 A (PORTUESI) 30 June 1998; Abstract; Fig. 2; Fog. 3; 3, lines 25-35; ciol. 4, lines 18-25;c ol. 8. lines 55-65.	1-38
Y	US 5,929,849 A (KIKINIS) 27 July 1999; Abstract; col. 9, lines 25-35; col. 3, lines 25-32.	1-38
Y	US 5,857,708 A (WOLFF) 08 December 1998; Fig. 2; col. 7, lines 28-45.	1-38
Y	US 5,880,731 A (LILES); 09 March 1999; Abstract, lines 1-5; col. 3, lines 4-45;	1-38
Y	US 5,883,621 A (IWAMURA) 16 March 1999; Abstract; col. 6, lines 15-18	1-38

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 20 NOVEMBER 2000	Date of mailing of the international search report 26 JAN 2001
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(71) Applicant *(for all designated States except US)*: **BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY** [GB/GB]; 81 Newgate Street, London Greater London EC1A 7AJ (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **CAMERON, Ian Ross** [GB/GB]; 316 Norwich Road, Ipswich Suffolk IP1 4HD (GB). **PALMER, Alex Stephen John** [GB/GB]; 24 Thomas Crescent, Kesgrave, Ipswich Suffolk IP5 2HN (GB).

(74) Agent: **WILLIAMSON, Simeon, Paul**; BT Group Legal Intellectual Property Department, PPC5A, BT Centre, 81 Newgate Street, London Greater London EC1A 7AJ (GB).

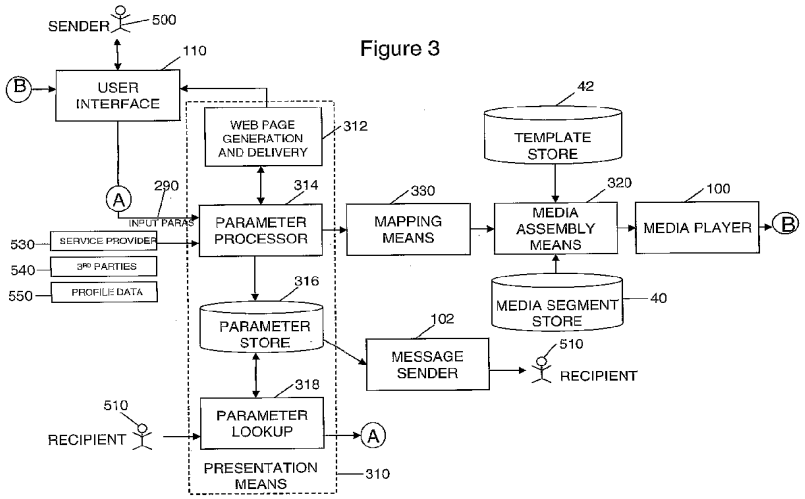
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(54) Title: MULTIMEDIA CONTENT ASSEMBLING FOR VIRAL MARKETING PURPOSES

Figure 3



(57) Abstract: Creating and editing time-varying media articles for viral marketing purposes is disclosed. The system comprises an user interface containing a parameter selection area and a presentation area. The user selects some general parameters of the video that he wants to generate and the system transforms those parameters into some more specific control parameters. These are then used to generate in a semi-automatic manner the video material from multiple segments stored on a server. A link is created referencing the selected parameters, allowing also the regeneration of the media article at any moment. Some of the control parameters can be set by default or localized e.g. accordingly to the user's geographical position. The link is sent to other recipients allowing them to modify the parameters and correspondingly the media articles. Some scenarios presenting the method application to marketing, sports and stories are disclosed.

WO 2009/040538 A1

MULTIMEDIA CONTENT ASSEMBLING FOR VIRAL MARKETING PURPOSES

Field of the Invention

The present invention relates to a media system and corresponding method. In particular, it relates to a system for assisting users in generating, editing and distributing media, especially video media, and will find particular application in so-called "viral marketing" activities.

Background to the invention

Viral Marketing

The phenomenon of so called "viral marketing" is becoming increasingly important to commercial enterprises having well known brands which they perceive as having significant commercial value. In brief, viral marketing involves the creation of content (often short videos, but also simple messages, stories, photos, video games, etc.) which are passed around within a social network (usually using technical means such as the Internet) because the people in the social network find the content interesting or amusing. The marketing aspect results from the fact that the content itself is usually produced by or on behalf of a commercial enterprise and that it, in some way, seeks to enhance the brand value of a brand associated with the enterprise. This in turn is believed to increase the overall profitability of the commercial enterprise (e.g. by increasing overall sales and/or margin levels, etc.) and such commercially oriented content may be termed viral adverts.

In general, viral adverts use communications media like email, SMS texts, MMS multimedia messages, or IM (instant messaging) to spread text, graphics or video between friends, colleagues, and other social groupings. The text form has been around since the beginnings of email. Graphics are sent as attachments or as links. Video is almost always sent as links.

The basic idea, as mentioned above, is that a person finds a funny, interesting, or clever item, and passes it on to his/her friends, who pass it on to their friends, etc, etc. The passing on is almost always of the original, unaltered item (usually because few people have the ability to make meaningful changes).

For text, however, some people will make edits to the text by adding something of their own creation, or making an edit, or adding a comment or deleting some of the text or someone else's previous comment(s), etc.

For graphics, edits are much rarer because of the difficulty of opening a graphic in a suitable editing program and then making a meaningful change (which requires skill or craft ability), then saving the edited file and re-attaching it for subsequent passing on to another recipient (which requires knowledge of email or texting systems).

For video, the problems pertinent for graphics are multiplied (the editing software is less immediately available, harder to use, more skill or craft ability is required, harder to save in a suitable form without detailed technical knowledge, harder to attach because of file size limits, etc.) and the vast majority of videos are never edited and passed on – instead the link to the video is sent on unedited, with perhaps a comment made by the passer-on. Because of the nature of video material, additional comments tend to be overlooked because recipients tend to click on the link and then watch the video without reading the text contents of the associated message, so any comments made by the sender tend to be ignored – the video is so compelling in comparison to text that the video is watched, and associated text in the email or text message is not noticed.

Commercial viral marketing deliberately produces suitably funny, interesting or clever material, normally with an embedded branding message, and makes them available to people to send to their friends, colleagues or other social groupings. It thus exploits the ad-hoc social sending of items for commercial advertising purposes.

Video Editing/Creation

Systems are known which assist users in creating video media. WO 04/025508, applied for by the present applicants, describes a system to automate or semi-automate the construction of a media article (especially a video media article) from a collection of media segments each of which is associated with corresponding "meta data" which can be analysed and processed to obtain a desired video article.

More recently, other examples of systems which enable somewhat personalised videos to be created have appeared. For example Volkswagon on their US website have introduced a facility to specify various options associated with one of their car models and then to see a "personalised" video which is specific to the various options requested by the user.

US patent application having publication No. US 2002/0049783 describes a similar arrangement in which a user is invited to generate a personalised multimedia composition by conducting an "interview" to provide information about the user which is then used to create a personalised multimedia composition formed from a selection of stored pieces of media (or media clips) etc. This personalised multimedia composition may then be shared with others in a variety of different ways but it cannot subsequently be edited by other users (although other users can of course create their own personalised multimedia composition by conducting their own interview, etc.).

International patent application with publication number WO 99/26415 describes a similar system in which a piece of multimedia may be personalised for consumption by a particular viewer so as to provide adverts of particular relevance to the viewer. The viewer is invited to answer some questions which are used by the system to first classify the user to one of a plurality of different categories and then the adverts corresponding to the selected category are merged into the personalised media content prior to unicasting to that viewer. Any potential viewer may use the facility to go from the original content to special personalised content in this way.

International patent application with publication number WO 01/99403 describes a video processing system in which a user's video footage (e.g. taken by the user with a camcorder of some sort) is captured and digitized (if necessary) and then processed in order to identify scene changes in the captured video. The video footage is then made available for the user to view on-line over the Internet where they are able to perform various editing tasks, mostly in terms of producing a piece of multimedia from the captured footage by selecting a number of the detected scenes and placing them in a desired order, as well as possibly deleting undesired frames from some of the selected scenes and possibly performing some other basic video editing (e.g. changing colour or brightness levels etc.). Having performed this editing, the user may then elect to have the finalised "album" published (which involves rendering it as a high quality (e.g. high resolution) video stream – e.g. in MPEG 2 – and burning this onto a DVD which can then be posted to the user). Furthermore, the user may elect to "share" the album with other users.

Unfortunately the document is a little unclear as to exactly what happens when a user elects to share an album with others. However, it appears that when an album is selected for sharing a url is provided to the user which can be passed on to and subsequently used

by invited guests to view the shared album (possibly also requiring a password to be entered to avoid uninvited users from accessing the shared album). The primary aim seems to be to enable such guests to view the album and, if they like it, to purchase a copy (provided to them on a dvd). However, there is additionally a suggestion that the guests could further edit the album and then purchase and possibly even share the further edited "album". By analogy with on-line digital photo printing service web-sites, it seems reasonable to suppose that such features are provided only to other registered users who have some available data storage space in which to store such further modified albums, in which case the edited album is simply stored in their (i.e. the guest's) allocated store. In any event, it further seems reasonable to suppose that the guest only gets access to the content contained within the shared album. Thus, as is discussed below, the system is not ideal for use as a viral video mechanism.

To date, therefore, to the best of the Applicant's knowledge, no-one has considered developing a system for editing and/or creating content for use in viral marketing.

Summary of the Invention

According to a first aspect of the present invention, there is provided a system for creating and editing time-varying media articles, the system comprising:

a sender user device and a recipient user device both having a user interface including a media presenting means and a parameter editing means;

media assembly means for assembling a media article based on a set of parameter values such that different sets of parameter values will cause correspondingly different media articles to be assembled; and

media segment storage means for storing a plurality of media segments suitable for combining together to form a media article; wherein

the user interface includes means for generating a reference associated with or including a set of parameter values suitable for use by the assembly means in assembling a media article, the reference being suitable for electronic distribution from the sender user device to the recipient user device and such that, when provided to the media assembly means, it permits assembly of the media article and presentation thereof within the media presenting means of either the sender or recipient user interface, and wherein, upon receipt of the reference by the recipient user device, a new reference may be created, based on the received reference, by modifying one or more of the parameter

values to generate a new set of parameter values using the parameter editing means of the user interface.

Preferably, the system further includes a mapping means for mapping simple parameters to control parameters which permits a user to control the values of only a relatively small number of simple parameters via the user interface, which are then mapped by the mapping means to control parameters which more directly control the operation of the media assembly means in its assembly of the media article.

Preferably, the user interface is a web-page run within a standard web-browser application running on the sender/recipient user device provided by a web-server which includes or is connected to the media assembly and media segment storage means. The web-page preferably includes an area for displaying the video output of a standard media player also running on the user device as a "plug-in" application associated with the web-browser.

To use the system, an original content provider creates or selects (and, if necessary, annotates – i.e. associates meta data with) a number of media segments and generates a series of parameters (and values or ranges of values which those parameters may take) In preferred embodiments, the content provider additionally provides the rules for the mapping means which specify how the simple parameters exposed to end users are to be mapped to the control parameters used to drive the media assembly means. At least some of these (simple) parameters are then exposed to users via the user interface (in a preferred embodiment, the user interface is presented to the user as a web page which may be accessed by the user in a suitable web-browser from a remote computer connected to the Internet). A user may then select desired values for the exposed parameters in order to "create" a media article (in fact, in preferred embodiments, all that is created at this time is a simple list of parameter values).

In order to "view" (it should be borne in mind that the media may be purely audio in which case it will be heard rather than seen) a media article an option to do this is selected by the user via the user interface and the selected parameter values are fed either directly to the media assembly means (for embodiments not including a mapping means) or to the mapping means which generates control parameters from the input (simple) parameters and these control parameters are then fed to the media assembly means. In preferred embodiments, a media article is then assembled (on the fly) by the media assembly means and directly streamed to the user's device (e.g. a computer running web browser software) for presentation to the user via the user interface's presentation means (typically

this will just be a small window located within the web-page displayed by the user's web browser).

In this way a first user may "create" a video media article using the system of the present invention by simply selecting desired values for a number of fairly simple parameters provided by the original content provider. Furthermore, having "created" a media article, a reference to this article may then be distributed to further users (typically by incorporating an HTML "link" into an email or instant message, etc. or by posting it on a bulletin board, etc.) which, if presented to the media assembly means (which in preferred embodiments is simply a web server hosting the centralised portions of the system, and the presentation simply involves a user clicking on the provided "link"), causes the media article (or a similar one – see below) to be presented to the recipient of the reference within a new instance of the user interface (within the media presentation means). At the same time, the parameter editing means also presents the parameters (and in particular the values of these parameters selected by the sender which cause the media article to take the particular form viewed by the recipient) to the new recipient so that s/he may change any or all of these parameter values and send on a new reference (with the altered list of parameters) to subsequent recipients, etc.

Preferably, the set of parameters used by the media assembly means (or the mapping means) includes some parameters which are not exposed to users but instead are controllable by other parties or automatically by the system. These can be used, for example to permit the media article to be tailored to a particular geographical location of the user initiating the presentation, or to the time of day or day of week, etc.

Using a set of parameters to control the generation of a media article provides a large number of technical advantages over other possible mechanisms for creating media articles, especially when the created media articles are intended to be used for viral marketing purposes. In particular, there are at least three main benefits from using a set of parameters: firstly, each user has the power to explore the entire range of media articles which the exposed parameter set grants access to (compare with say the system of WO 01/99403 where a guest only has the possibility to create a new media article based on the content selected by the originally creating user) regardless of the particular configuration selected by a sender of the media article (however, the original media article content creator/designer – who designs the parameters – still keeps control over the range of possible articles which may be created); secondly, each slight variant of a media article can be stored and/or transmitted very compactly in its own right as a simple set of

parameter values – this is especially important for a viral marketing campaign where it is to be hoped that a successful campaign will generate many thousands of individual articles (at least one for each sender); and thirdly it provides a very simple mechanism by which a media article can be "tweaked" – i.e. edited only very slightly by a recipient before sending on to further recipients. Furthermore, using parameters to control the creation of a media article lends itself very well to the preferred arrangement in which some of the parameters are not exposed to a user but are placed under the control of the system or the original content creator/parameter list designer, such that a simple and common system is used to enable user creativity and to enable a certain amount of geographical or other variation to be performed automatically by automatically selecting values for certain unexposed parameters, etc. which then also impacts on the final media article created for a particular receiver of a media article.

Preferably, the media assembly means comprises a media assembly means as described in WO 04/025508 the contents of which are hereby incorporated by reference.

Preferably, the media assembly means includes an encoded audio/video clip assembler as described in co-pending European patent application Nos 08251026.4 and 08251012.4 both filed on 14 march 2008, the contents of which are hereby incorporated herein by reference, in which audio/video clips (which have been pre-encoded into a compressed format suitable for transmission over a limited bandwidth connection, preferably using a process in which the clip is encoded from an expanded raw audio video clip containing more audio and video frames than actually desired in the final clip, and then the excess audio and video frames are removed from the encoded clip such that the encoded audio and video streams have approximately the same duration) are concatenated together and wherein at each concatenation operation, the overall audio and video stream durations of the composition are compared and if they are unequal excess audio and/or video frames are trimmed off the end, or extra frames are added (e.g. silence audio frames may be added, or repeating last video frames may be added, etc.) to ensure that the composition remains substantially in audio/video synchronisation throughout the finally transmitted composition.

It should be noted that many of the functions of the present invention may be performed on different pieces of hardware located at different positions within the overall network, or they may be distributed over a number of different devices. In some cases it will be advantageous to have the media segments (most preferably video segments, audio segments and/or audio/video segments) stored in a distributed manner over a number of

different devices scattered throughout the Internet. Similarly, the system preferably includes web server functionality which a user's web browser will be connected to upon clicking on a link providing a reference to a set of parameters associated with a particular media article. This web server functionality is preferably distributed over a number of different web servers. The web server functionality may perform all of the functions of providing the user interface (i.e. it may be a web application with a "thin client" comprised solely of a standard web browser application operating on a user's device); alternatively, the user's device could include a somewhat "thicker" client application performing more of the required functionality. In particular, where the network connection to the user device (in fact between the serving web server and the user device) is of relatively low bandwidth, it may be advantageous to have the media segments stored (or cached) more locally to the client device and to have the user device include the media assembly means functionality as a locally running application which can more readily access and compile multiple media segments into a complete media article.

Preferably the user interface displays the media presenting area and the parameter editing area simultaneously in different parts of the total viewable area available to the user, however alternatives in which the user can toggle between two separate views or in which they are overlapping or partially overlapping, and can be moved around relative to one another in separate re-sizeable windows, etc. are all possible as will be appreciated by a person skilled in the art of computer user interfaces.

Note that one of the advantages of the present invention is that individual media articles (individual "user tailorisations" represented by the set of values chosen by a user for the exposed parameters to which he/she has access) can be stored as a set of parameter values rather than having to store an entire media article. Of course, as part of normal caching mechanisms employed by servers and routers etc. located in the network, whole media articles may be cached in the system from time to time, but they do not need to be persisted and so the impact on memory is very small since if the memory is needed it will be overwritten in the normal manner that this is done in caching systems.

According to a second aspect of the present invention, there is provided a method of creating and editing time-varying media articles, the method comprising:

causing a user interface on a user device associated with a sending user to display a media presenting area and a parameter editing area;

responding to user inputs from the sending user via the user interface to set a plurality of values for parameters displayed in the parameter editing area;

responding to further user inputs from the sending user via the user interface to cause a message to be sent to a user device associated with a recipient user including a reference to the values for the parameters selected by the sending user; and, in response to either the sending user selecting to preview the media article or the recipient user selecting to view the media article by referring to the received reference:

assembling a plurality of media segments, stored in a media segment storage means, in dependence upon the set values for the parameters displayed in the parameter editing area, or referred to by the reference, in order to generate a media article; and

causing the generated media article to be played within the user interface of either the sending user or the recipient user respectively; wherein, when the recipient uses the reference to view a media article, the user interface of the recipient user device is caused to provide the same functionality as was provided to the sending user so the recipient user can view the parameter choices made by the sender user to cause the particular media article to be assembled and may further edit the parameter values to cause a different media article to be assembled and to permit the recipient to generate and forward on to further recipient users a new reference to the possibly edited set of parameter values.

According to a third aspect of the present invention, there is provided a method of assembling a media article comprising receiving a set of parameters, each parameter in the set taking one of a finite, predetermined number of possible options, selecting one of a predetermined set of stored possible playlists based on the received set of parameters and assembling the media article from pre-processed and stored media components selected in dependence upon the playlist.

Preferably the third aspect of the present invention is further characterised by storing a plurality of media components having no overlapping content and associating each of these components with two or more parameters such that two or more parameters are required to specify a media component. Alternatively or additionally, the method is further characterised by obtaining some of the parameters from a web-site form filled in by a user and obtaining some of the parameter values automatically based on temporal or geographical considerations associated with the time and/or date, or the location of the device, on which the media article is to be displayed or a user thereof.

According to a fourth aspect of the present invention, there is provided a method of creating and editing time-varying media articles, the method comprising:

causing a user interface on a user device associated with a sending user to display a media presenting area and a parameter editing area;

responding to user inputs from the sending user via the user interface to set a plurality of values for parameters displayed in the parameter editing area;

responding to further user inputs from the sending user via the user interface to cause a message to be sent to a user device associated with a first recipient user including a reference to the values for the parameters selected by the sending user; and, in response to the first recipient user selecting to view the media article by referring to the received reference:

assembling a plurality of media segments, stored in a media segment storage means, in dependence upon the set values for the parameters referred to by the reference, in order to generate a media article;

causing the generated media article to be played within the user interface of the first recipient user;

causing the user interface of the first recipient user to display a media presenting area and a parameter editing area;

responding to user inputs from the first recipient user via the user interface to set a plurality of values for parameters displayed in the parameter editing area;

responding to further user inputs from the first recipient user via the user interface to cause a message to be sent to a user device associated with a second recipient user including a reference to the values for the parameters selected by the first ricipient user; and, in response to the second recipient user selecting to view the media article by referring to the received reference:

assembling a plurality of media segments, stored in a media segment storage means, in dependence upon the set values for the parameters referred to by the reference, in order to generate a media article; and

causing the generated media article to be played within the user interface of the second recipient user.

Further aspects of the present invention provide corresponding computer programs and carrier means, especially tangible carrier means such as magnetic or optical storage disks or non-volatile solid state memory devices carrying such computer programs.

Brief Description of the Drawings

In order that the present invention may be better understood, embodiments thereof will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic diagram of an example computer network embodying an aspect of the present invention;

Figure 2 is a schematic diagram of a user device of the network of Figure 1 in greater detail; and

Figure 3 is a schematic illustration of the main functional elements of an embodiment of the present invention and their interactions, independently of the hardware elements on which these functions are performed.

Specific Description of Embodiments of the Invention

Figure 1 shows user devices 10, 11, 12 running web browser applications which display user interfaces 110, 111, 112 to the respective users; the user devices 10, 11, 12 are connected to the Internet 20 which in turn is connected to a web server 30, which includes presentation means 310, media assembly means 320 and mapping means 330, and which in turn is connected to a media segment data store 40.

Figure 2 schematically shows the user device 10 in greater detail. In particular, it shows how the user interface 110 (which is provided as an interactive web-page provided by the web server 30) presents to the user a video viewing area 120 and a parameter editing area 130 which, in this embodiment, includes a set of drop-down menu items enabling the user to select from one of the drop down options for each parameter. Additionally, the user interface includes a preview video button 125 and a send button 135. Upon selecting the preview button 125 the video is assembled (by the media assembly means 320) and played (using, for example a plug-in media player associated with the web browser 100) in the video viewing area of the user interface 110. Upon selecting the send button 135 an email client application is opened and a new email message is generated including an HTML link which can be used by recipients of the email to view the video article

associated with the currently selected values (which will take the values specified by the sender unless changed by the current (recipient) user or default values unless otherwise positively set by the user if creating the video from scratch – see discussion below) for the user selectable parameters. Note that in alternative embodiments, the user interface could display a video in the full screen available when the preview button is selected rather than in a small window, and then, for example, automatically move to a screen presenting the parameter list 131 to the user and the various other options, including the options to preview 125 or send 135 the video article.

In order to assist the reader in understanding the overall operation of the above system, some typical usage scenarios are now described.

Scenario 1

A "Service Provider" offers a viral marketing service allowing multimedia content to be generated and manipulated by their Community of Interest (CoI) (e.g. fans, customers, suppliers, associates, employees, general public, etc.). CoI members ("Senders") interact with the service to create a personalised piece of content which they can preview and re-edit as required. Content is chosen and personalised by the Sender by entering and/or selecting a number of Parameters. Additional Parameters can be chosen (in advance or at the time of creation) by the Service Provider or other third parties.

Once the sender is happy with the content they can send this to their friends ("Recipients"). The System generates and permits the user to send a personalised HyperText Markup Language (HTML) Universal Resource Locator (URL) link to the recipients (rather than the multimedia content itself). This URL Link (in the present embodiment) refers to the array of Parameters which was used to create the content (though in alternative embodiments it could explicitly include the array of parameters). In other words, the URL or "link" is a reference associated with or including a set of parameter values suitable for use by the assembly means in assembling a media article, the reference being suitable for electronic distribution from the sender user device to the recipient user device (e.g. by email) and such that, when provided to the media assembly means, it permits assembly of the media article and presentation thereof within the media presenting means of either the sender or recipient user interface. The link can be sent via a variety of means including e-mail (which is the default mechanism), Instant Messenger (IM) message, Short Message Service (SMS) message, Multimedia Message Service (MMS) message, or by publishing the link to a bulletin board or blog or other similar type of web site.

Upon receipt and activation of the URL Link (e.g. by clicking on the link), the recipient is redirected to the System which generates personalised Content for that recipient at that time. The content will be generated using a combination of the original Parameters and any new Parameters chosen by the System, Service Provider or 3rd Party. In addition, the original parameters could be modified by the System based on Service Provider, 3rd Party or other factors such as randomisation, adaptation to the Recipient's device, bandwidth or location. Content could be modified in a number of ways, for example, if the word "tomorrow" appeared as a parameter value, it may be changed to "today" or "yesterday" depending on the date on which the Recipient played the content relative to the date on which the Sender created it. Potentially Recipients could receive a shortened version of the content before deciding whether to view in full length, possibly for an additional charge.

The recipient also has the ability to easily further modify the Content by changing the Parameters themselves. This is possible as the original parameters (rather than the finalised multimedia content) are available to the System and the Sender and these parameter values are passed to the recipient when s/he clicks on the received URL and these selected values are dispayed to the recipient in the parameter editing area. Only if the recipient chooses to modify any of these parameter values will they be changed to something else. Recipients who change content in this way become Senders themselves, and they are able to forward this content (again as a URL Link) to their friends etc. Indeed, in the present embodiment, the first time a user selects either the preview or the send button a new array of (simple) parameters and a new associated reference ID is created and stored in the web server 30 based on the current values of the parameters displayed to the user, even if they are unchanged entirely from the received parameter values, and any subsequent time that either of these buttons is selected the array is updated with the current values of the parameters.

Note that instead of saving a complete array of values each time the preview or send button is selected, the web server could alternatively save a reference to the reference ID originally received by the user and details only of any changed parameter values. Generally such a system would only be useful where the parameter values themselves could occupy significant amounts of storage space, which is not generally expected to be the case since if an earlier array of parameter values (from which a later reference is storing changes only) should be edited by a user, either a new reference would have to be generated for the edited set of (earlier) parameter values or all subsequent reference ID

referring to the earlier array would have to be modified as well, etc. However, in such a case if the parameter values remained unchanged between a recipient receiving a reference and then becoming a sender and sending out a link to a second recipient, then the reference could remain unchanged and new reference would need to be created. Another possibility would be to create a new reference for each new set of parameter values, but to re-use that same reference for any subsequent time that that exact same set of parameter values is selected by a user. Such a system would be optimal where each parameter has a relatively small number of values which it may take. In cases where some of the parameters are restricted in this way, but others are not (e.g. if they are free text entry parameters, such as to enable a person to enter a name, etc.) then some hybrid solution might be appropriate where those parameters which have only a small number of possible combinations of values are each given a unique code for each possible combination of values while other vlues are stored explicitly, etc.

System Operation

Turning now to Figure 3, the operation and interaction of the various components of the system of Figures 1 and 2 (including some components and sub-components not illustrated in Figures 1 and 2) will now be described.

Input parameters 290 are received from:

a) the Sender 500 via the user interface 110 (in this embodiment by transmitting these values in an HTML form embedded in the web page supplied by a web page generation and delivery module 312 of the presentation means 310 of the web server 30);

b) the service provider 530;

c) third parties 540 such as advertising networks, sponsors, etc.; and/or

d) other sources of profile data 550 such as web cookies or behavioural, contextual or publisher data.

Any of the Input Parameters could be manually or automatically entered – e.g. a Sender's online profile data could be used to automatically generate parameters (and in turn, media) or a Service Provider could automatically generate customised video for each viewer which can then be sent to their CoI.

The Input Parameters 290 may include (but are not limited to):

Message options:

Names and messages for recipients (filtering of the input text to remove swearing or other objectionable words is achieved using a look-up table approach), content to be included, duration of media, etc.;

Recipient address(es);

Techno-graphic data:

Local time: versions suited to time of day and day of week;
Location: regional versions including language and accent;
Context: content based on the web page where the ad appears;
Technology Attitude: versions for technophiles and technophobes;
Repeat visits: evolving stories for repeat visits;
Browser type: adapting content to suit the device capabilities;
Bandwidth: optimising quality based on connection bandwidth;

Behavioural data:

age, gender, tastes, etc. provided by ad-serving networks;

Publisher data:

registered customer data, interests and preferences, advertising messages, sponsorship details, age rating of content, etc.

The Input Parameters include destination address information for the recipient(s) of the media to allow the media to be sent to the recipients.

The Input Parameters are processed by the Parameter Processor 314 of the presentation means 310 of the web server 30 to produce an array of Name-value pairs for each parameter and a unique identification reference for the parameter array. The array is stored in the Parameter Store 316 of the presentation means 310 against this Unique ID.

The output parameters from the parameter processor 314 are passed to the mapping means 330 which processes these simple parameters to generate control parameters which are usable by the media assembly means 320 in order to generate a media article. The mapping of the simple control parameters to narrative features is achieved by the use of a software map that allows the simple control parameters to be mapped to one or more control parameters within a template or "storyboard" such as the two-layer (storyboard plus story-fragments) approach as disclosed in WO 04/025508. Typically a simple control parameter will be mapped to either a specific Template storyboard, or a Template storyboard and one or more control parameters, or to one or more control parameters.

Preferably, the template is produced using a template creation software application which permits a template such as that described in WO 2004/025508 to be created. Such a template can have any number of slots (though with a minimum of at least one slot) to be filled and each slot includes one or more queries which are processed by the system to identify one or more suitable media clips to fill the slot (each slot may take one or more media clips). The search is carried out by examining the metadata associated with each stored media clip and comparing this with the search query to identify matching clips. The query can take into account multiple issues such as the nature of the content (e.g. the subject matter of the content of the clip, the actors/characters taking part, whether it is classified as an intro or an "outro", etc.) , or more technical details about the content (e.g. the duration of the clip, the resolution of the clip, etc.) Additionally, the template can include queries (or constraints) which cover multiple slots (e.g. a query could specify that the total duration of the clips contained in slots 2, 3 and 4 should be no more than 1minute, etc.). In general any item of data which may be specified in the metadata associated with a clip can be used as part of the query. Preferably the metadata has a number of distinct fields (e.g. "duration of the clip" "actors/characters featuring in the clip", etc and a query can specify details about the values which these fields should take, on a field by field basis, or it could generally search through all of the metadata regardless of which field a particular search term appears in, etc.

The abstraction provided by the mapping allows a concept like 'Feature this person' to be translated into appropriate control parameters to determine the content of clips which are assembled to produce the output video. To control features which change the narrative, then a different storyboard will be used, or a combination of a storyboard plus a control parameter. For example, the original content creator might decide that if the parameter value for a parameter specifying which character should be mainly featured specifies a football manager, then a template specifying a more documentary style narrative might be appropriate, whereas if a player is selected, then a more chopping and changing music video style might be more appropriate, and these could employ different storyboards/templates. In addition, it would also change the search queries in individual slots to require that a featured actor/character should generally include the selected character (the manager or player respectively). Thus it can be seen that the simple parameter can effect more than one search query term within a template and can even vary which template is selected. Sometimes more than one parameter might be required t odecide say exactly which template should be used, etc.

The Media Assembler 320 uses the control Parameters (output from the mapping means 330) to select an appropriate Template from a template store 42 into which appropriate media segments from the media segment store 40 are to be inserted. The templates and media segments (and any other Content included in alternative embodiments such as interactive animations or video game segments, etc.) are generally prepared in advance by a service provider (or operator of the service or another content provider). Media and other content can comprise a variety of elements including, for example:

Video clips;
Audio clips;
Audio/video clips;
Graphics / Images;
Text elements;
User interactivity instructions;
Sequencing and timing instructions;
Scripts (e.g. Flash® code); and/or
"Nested" components of other media and template elements allowing sub-sequences to be combined.

Media can also be dynamically created (e.g. new media can be inserted in the store 40 for inclusion as it becomes available such as latest news footage, sports highlights or user generated content).

A variety of media production and Assembly techniques could be employed in the System. For example, the Smart Content Realisation assembly technique described in WO 04/025508 is the most preferred technique for use in the present invention. The Media Assembly function also converts text fields into animated video graphics that are then placed in the video, at appropriate points and in context.

Once assembled, media is viewed on a Media Player which in the present embodiment comprises a plug-in for the web browser 100. The media player is generally a pre-installed application on the viewing device (e.g. Flash Player, Widows Media Player, QuickTime Player, etc.) though custom applications could also be used.

It should be noted that the Media Assembler and Media Player could be implemented in either the viewing device, or on a server within the network, or a combination of these locations.

The Sender 500 can preview the content and if required can modify the Input Parameters to change the resulting content to meet their requirements by manipulating, for example, a set of drop down menu items 131; note that the web page generation and delivery module 312 which forms part of the presentation means 310 of the web server 30 is responsible for generating the appropriate web page including these various interactive elements by which the sender 500 can modify the parameters. Once the Sender is satisfied with the content they can instruct the System to send the content to their chosen recipient(s) 510. The Message Sender 102 accesses the recipient address(es) either by selection of this (these) from the user's contacts list associated with and using the user's default email client application in the normal manner. Alternatively, the system can automatically generate and send a suitable message without further interaction from the user using data from the Parameter Store 316 if this information has been included in the parameter array by the sender 500. The message sender 102 or the delegated email – or SMS, IM, etc. client application - constructs a message containing a link to the System, which link includes the Unique ID of the Parameter List Name-Value pair Array. As noted above, the message may be sent via e-mail, SMS message, MMS message, or published to a bulletin board, blog or web site via a suitable gateway service over a network.

The recipients 510 can activate the link in the message they receive to view the content. The link directs the Recipient's browser device to the Web server 30 (or to a mirror server closer to the user's location where appropriate) where a parameter lookup module 318 performs a parameter lookup operation using the received Unique ID sent to it as part of activating the link (as part of an HTTP request) to lookup the corresponding parameter list array from the parameter store 316. This produces output parameters which are treated as the input parameters from a user to allow the content to be viewed ultimately (after possibly adding or changing some local parameters, mapping the parameters to control parameters and using these in the media assembly means to generate a media article which is ultimately played by the media player (forming part of the web browser) 100. In other words, the generation of content for the recipient is identical to that for the Sender with the exception that the Input Parameters are pre-defined rather than entered manually.

The content viewed by the Recipient could be identical to that produced by the Sender, or it could be modified based on the Input Parameters at the time the Recipient views the content. For example, the Service Provider 530 could enter input parameters to modify the advertising message or other aspects of the content at the time it is viewed by the

Recipient 510, either to show, for example, a more up-to-date advertising message or to show one which is specific to the recipient's geographical location, if this is known to the system or if an educated guess about it can be made by the system, perhaps based on the recipient's IP address or email address, etc. In one preferred aspect the advertising message is only appended to the content when first viewed by a recipient and is not added when being previewed (by having pressed the preview button) either by a recipient contemplating forwarding on the video, or by an initial sender. Once the Recipient has viewed the content they can manually modify the parameters themselves and forward the resulting content to a new group of Recipients.

Note that in a preferred embodiment, the media article for playing by the media player which is located on the user's device is streamed using a streaming protocol which enables the media playing to be commenced before the entire media article has been received. In this case it is possible for the media assembly means to start streaming the article to the user's device (in particular to the web browser or media player running on that device) before the article has finished being assembled, as soon as the first few media segments have been selected. In this way the delay between a user selecting to view a media article and the commencement of viewing can be minimised.

It will be appreciated that the above described embodiment provides a mechanism for distributing multimedia as an abstracted set of controlling parameters rather than as finished media; and which permits multimedia to be dynamically adapted after it has been produced by the originator, at the time of playout of the media. It also provides a mechanism for allowing recipients of the multimedia to quickly, simply and easily re-edit the content of the multi-memdia. It also permits content to be distributed in a variety of formats (as determined by the parameters); furthermore, the media assembler is able to convert media segments from multiple different formats into a single format appropriate for playing by a target media player at the time of assembling the media article and thus the media segments can also be created or selected in multiple different formats.

Scenario 2

To further clarify the operation of the above described system, consider a second usage scenario.

According to the second usage scenario, a football club (hereinafter referred to as "Club A") is providing a "viral video" service to users of the web-site, especially registered fans

of the club (in fact, the viral video service is provided to Club A by the viral video service provider and Club A in turn then provides this service to its customers). In overview, the service permits a user to easily generate a small audio/video media article (of 30 or 60 seconds duration) which is based on Club A's historical video footage but which can be personalised in a number of ways (described below) and then a link to this can easily be sent to a friend, family member or colleague, etc. who in turn can further edit/personalise the audio/video media article for subsequent forwarding on to further recipients etc.

A prospective user of the service is invited to use the service by an email sent by Club A. Initially at least this will be sent to registered fans who have provided the club with their email details and requested receipt of emails from the club informing them of offers, news etc. The email describes the video-messaging service, and it contains a URL link which points to a 'Landing Page' on viral video service web-site specific to the service being offered to Club A. The Landing Page describes the video messaging service, and invites the user to create their own video message by moving to the next page.

Link Format

The URL link is in the format:

<URL>?<ident>

The <ident> is an index into a database of subscribers owned by Club A that contains the names and email addresses of subscribers to Club A's web-site. In the present embodiment, the servers running the viral video service are different to those running Club A's web-site and they are owned and administered by a separate company (which provides the service to Club A). Therefore, Club A does not give the viral video server administrator direct access to its subscriber database, but nonetheless, the ident allows the viral video web server to reconstruct a sub-set of that database by using the information that the users enter in order to create a video message. It also allows the viral video web server (or its administrators) to monitor how the invite emails are distributed. Once a user has received an email invite and has created a video, the ident is used to create an entry in the viral video service's database that contains the name and email address of the invited user (assuming that the first user is the recipient of the original invite email). If that user then sends the invite email to someone else, then when that other person creates a video message, the same ident will be used and our database will show two names and two email addresses.

In other applications, the ident could be used to check that the name and email address matched Club A's database and this could then be used by the viral video web server to prevent anyone other than the original recipient using the video messaging service. Alternatively, it could be used to detect changes of email address.

Stage 1: *Creating Your Video*

Once the user has clicked on the button which links to the next page, then that web-page opens. This is stage 1 of the three stages which are required to create a video message, and the page is a form which the user needs to complete. The user fills in the details in the form, the top part of which includes their name, their email address, and the name of the recipient of the video message. The lower part of the form contains the details which are used to control the video contents as well as to control the overlays; the overlays allow text and graphics to be overlaid over the underlying video so that the video is seen playing in the background with the overlay graphics and/or text shown in the foreground. The settings/selections entered/made by the user are mapped to appropriate parameters in the request which will be sent to the viral video service web server.

The details include: the message duration (which is used to select media articles of appropriate durations); the message subject text (which will appear as overlay text in the video using, in the present embodiment, a Flash overlay animation); the personal message text (which will appear as overlay text in the video); the 'Special Date' (which is used as an index to a list of dated events, news items and trivia supplied by Club A); the Favourite Legend player (which allows a player to be selected from a drop-down list of candidates); the Favourite Current Player (which again allows a player to be selected from a drop-down list of candidates); the Rival Football Club (which allows a rival football club to be chosen from a drop-down list); and the Message Soundtrack (which allows a music track to be chosen from a drop-down list and which is played as a background track in addition to the audio associated with the selected audio/video clips).

When all the details have been entered into the form, the user may press the 'Preview Your Video Message' button at the foot of the page. From a user's perspective, this then takes the user onto the second stage of the process described below (provided s/he has filled out the form sufficiently – see below).

From the system's perspective, pressing the preview button causes the contents of the form to be pre-processed. In the present embodiment there are two stages to this pre-processing. Initially a Javascript running on the user's client browser (the Javascript is part of the HTML of the form-entry page) looks for empty fields in the form and requests completion from the user if any are found.

A second stage of pre-processing is performed by the web server; thus, the information entered into the form is sent to the viral video service web server and there a PHP script checks the free text fields (the user's name and the recipient's name) against a 'swear list' text file supplied by Club A. The swear list is a text file containing proscribed swear words selected by Club A. The PHP script checks for any instances of the words in the swear list in the free text fields, and if any match is found, then the word is replaced by four asterisk ('*') characters. The remaining details are converted into numeric form using look-up tables for each of the selectable parameters in the video. These numbers are used as the values for the selectable parameters in a parameter list message which is then sent from the web-server (which in the present embodiment acts basically as an interface between the user device and the delivery server) to the viral video service delivery server – the delivery server is kept separate from the web server in the present embodiment since they perform rather different functions, however these functions could be combined into a single device (alternatively the different functions could be further distributed between

different devices depending on the overall number of connections which the solution needs to support etc.). The delivery server comprises most of the functions shown in Figure 3 apart from basic web-server functions, i.e. the delivery server performs the parameter processing, store and lookup functions, and provides the media assembler and the template store and the media and content store. Thus, in overview, the web server receives the form info, and converts it into a suitable form for passing to the delivery server and then it sends this information to the delivery server for further processing.

As an aside, In the present embodiment, when the delivery server receives a set of parameters for the first time from a respective user, it stores these in a look-up table together with a reference to the entry in the table which is then passed back to the user device (via the web server) and can thus be used by the user-device either for generating a subsequent preview or as the reference for sending on to one or more subsequent recipients of the video article message (discussed later in the scenario as viewed from the user's perspective).

Returning now to the user's perspective, as mentioned above, once the user has successfully completed and submitted the form by clicking the preview button, s/he is moved to a new web page corresponding to Stage 2 of the process.

Stage 2: Previewing your video

From a user's perspective, at this point the video specified by the various options selected by the user is then displayed to the user. The processes performed by the delivery server to enable this are described in more detail in a separate section below entitled "Assembling the Media Article".

During the preview stage, as well as being able to interact with the video itself (e.g. to mute the sound, pause the video, rewind, fast-forward, etc.), the user can select one of two options, namely to "Re-edit the Video" (this takes the user back to the form-entry, "Stage 1" page where s/he can change the options selected to generate a new media article) or to "Send the Video" in which case the user is moved to a new web-page associated with Stage 3 of the process.

Stage 3: Sending your video

Upon the user selecting to "Send the Video" s/he is moved to a new web-page where the user's information (name and email address) is re-iterated together with the recipient's

name. It also includes empty fields to be completed by the user for the email address of the recipient, plus additional pairs of of name and address fields for additional people to be copied in on the video message (each generating in due course a new impression – see the discussion of media article assembly below). There is also a tick box allowing the user to subscribe to further offers from Club A. Having filled in at least the email address of the main recipient, the user clicks on a send button which then takes the user to a final closing web page.

Closing Web Page

Having clicked on the send button (again provided that at least the main recipient email address has been filled in and no additional recipients have been specified without valid email addresses, etc.) the user is moved to the closing web page where s/he sees an acknowledgement that the video message(s) has (have) been sent. The user additionally has options now to either submit feedback on the experience (which generates a feedback form) or to create a new message, in which case they are returned to stage 1.

Recipient Experience

Recipients of a video message receive an "acknowledgement" email which contains a link to a special video playback web page provided by the web server. This web page includes a display area where the Media article "created" by the sender is displayed to the recipient (with the normal video playback controls such as mute, rewind etc.). In addition the web page provides two selectable options (i.e. "buttons") to enable the recipient to select one of two main options (in addition to the video playback controls), namely to submit feedback (in which case a feedback form is generated) or to "create your own video" in which case the recipient is sent to the Stage 1 web page, but, in the present embodiment, with the various media article composition affecting parameters preselected in the form such that the recipient can select to modify only those parameters that s/he wishes to change. In an alternative embodiment however, the values would simply revert back to the default (and blank for free text entry fields) values presented to an initial creator of a media article.

Upon completion of the playback of the media article, the two options are still open to the recipient, but in addition the recipient is displayed a dynamic "Call to Action" (CTA) which is based on profiling information available at the time that the media article is played to the

recipient. The dynamic CTA shows different "Calls" depending on the profile of the recipient. So someone who is not a subscriber to Club A might receive an invitation to subscribe while someone who is a subscriber but not a season ticket holder might be invited to become one, etc. Note that the original creator of the message does not see this CTA – they see a simple playback complete message instead. By not showing any CTA in the preview stage during creation of the message an advertiser is given a fairly free reign to place any desired CTA at the end of the playback by a recipient without giving rise to adverse reactions from the users (i.e. senders and recipients) resulting from a sender feeling initially that he had "control" or visibility at least over this aspect of the article and then finding out subsequently that s/he didn't.

Media Assembly

In the present embodiment, there are two main processes involved in permitting media to be rapidly assembled and delivered to a user over a network connection. The first is a pre-publishing process, and the second is an assembly and delivery process.

The pre-publishing process is performed over a period of time by human editors using a set of creation tools including a creation tools database. This process involves determining a set of playlists for each given set of possible input parameter values and pre-processing each possible required audio/video component as much as possible to minimise the amount of work needed to be done by the assembler.

Thus, as a pre-publishing stage, the delivery server has identified at least one playlist for each possible combination of the selectable options (the free text entry options are handled using a FLASH overlay mechanism which takes as in input parameter some free text to be included in the overlay – other input parameters required by the FLASH overlay mechanism (e.g. font, size of text, duration, etc.) are pre-set as part of the pre-publishing playlist generation step). Therefore, when the delivery server receives a parameter list (possibly after some pre-processing by the parameter processor 314), in overview, it looks up the pre-published playlist, obtains the audio/video clips specified in the playlist, and then the media assembler combines the different video or audio/video clips together to generate the media article for subsequent download back to the user (Note some of the audio/video components will need to be concatenated along the timeline – e.g. audio/video clips, whilst some will act as parallel layers to be "displayed" in parallel with one another – for example, a separate audio backing track could be interleaved within the

FLV format file after any separate video or audio/video clips have been concatenated together along the timeline; similarly any text or graphics to be overlaid over the video are merged as a parallel layer at the assembly stage). In this way, the final media article for download and display to the user is generated.

In order to identify an appropriate playlist for each combination of selectable parameters as a pre-publishing stage, in the present embodiment, there are four key selectable parameters namely a favourite legendary player parameter, a favourite current player parameter, a rival football team parameter and a soundtrack parameter. In the present embodiment there are 4, 3, 4 and 3 user selectable possibilities given for each of these options respectively. Each possible combination of favourite player and rival team, and of the legendary player and rival team is mapped to a set of video clips showing classic footage (usually goals being scored) involving the selected player when playing in a match against the selected rival team (where such clips are available – otherwise the clips mapped to are just classic clips containing the selected player irrespective of the opposition team). Typically for each player/team combination there are two or three clips of different durations which may be concatenated together to generate mini-assemblies, etc. This quickly leads to a large number of possible combinations of clips to be concatenated to form the overall video – however, as a pre-publishing stage in the present embodiment, each possible combination (for a given single set of user-selectable options) is examined for overall duration and only two are chosen, one which most closely matches a 30 second duration and one which most closely matches a 60 second duration (since these are the two user selectable options in the present embodiment), and then the corresponding playlists to these combinations are selected.

Each such combination of the main selectable parameter options may however contain a number of separate playlists in order to provide further customisation options which are not controlled directly by the user selectable options such as the bandwidth of the network connection of the user device to which the media article is to be downloaded, etc. as discussed below.

Thus, when the delivery server receives either a request message specifying a set of parameter values selected by a user generating a media article for the first time (this set of parameter values is referred to as a parameter list) or a request message containing a reference (in which case it extracts the corresponding parameter list from its lookup table) this parameter list may in some embodiments in fact be only a partial list with some empty placeholders for some values which need to be added after some additional actions have

been taken by the delivery server. In such cases, the delivery server performs these additional actions in order to complete the parameter list (e.g. measuring the bandwidth of the device to which the article is to be sent – see below, obtaining any geographical or current date and time information or additional system information about the user's device which may be additionally required, etc.) and uses the completed parameter set to choose the appropriate playlist, and this is then used to assemble and deliver the audio/video media article to the client as a progressive video download.

As a final stage of customisation of the media article, additional inputs could be provided by, for example, the Football Club A (in the present embodiment). This could for example be done remotely via a secure web-interface and may specify an additional or alternative clip or animation to include in or after the media article (this could therefore allow dynamic changes to be made to the video or graphical or audio overlay content etc, for example for promotional or advertising properties, etc.). In particular a new CTA can be provided by the Football Club and indeed this can be presented as a separate download – i.e. not as part of the media article at all, but simply a new web page, etc.

In the present embodiment, Flash animation overlays and audio/video synchronisation information is all packaged in the assembled audio/video media article sent to the client, however, in alternative embodiments additional information could be sent to the clients to control the text and graphic overlays, as well as the synchronisation of the audio and video components that are downloaded.

The process of downloading the content to the client involves a number of stages in the present embodiment, namely:

1. Flash 'Wrapper' download (the main client application) (if not already loaded into the user's computer);

2. FLV Player Flash Component download (used to check bandwidth); and

3. AV media article file download (Video, Audio, Overlay information).

The AV file could be in a number of forms. In the present embodiment, it is a closed 'video' file encoded using a codec which generates the Flash-native .FLV encoded audio/video file format, however, in alternative embodiments it could be an open abstracted control file like .SMIL with separate audio/video, image, animation and/or text files etc. enclosed, referenced or linked to, etc., or some other proprietary multimedia format, etc.

The 'Wrapper' application (e.g. a Flash player plugin for a web browser) provides the client-side windowing, control, download of files, synchronisation of video playback with audio tracks and with the overlays etc., as well as the monitoring of user activity (pause, play, mute, etc.) at the client side (in accordance with the information contained in the media article.

In the present embodiment prior to downloading the media article (stage 3 of the download process enumerated above), a bandwidth measurement is made by downloading a file of a known length (the FLV Player Flash component in the present embodiment) from the delivery server to the client over the network connection, and timing the duration of the download. This bandwidth measurement is then used to determine which of a number of delivery options are used, namely either:

1. A graphical alternative (in this case the media article comprises just a Flash animation which requires much less data than a media article containing real video footage (albeit after compression));

2. A default quality video media article (where the bandwidth is sufficient for this – this option represents the normal case for most users having an average broadband network connection); or

3.A high quality video media article (where less compression (so as to maintain higher quality) is used and/or video with a greater number of pixels (to produce a greater video display area size for a given display resolution) is used – this option is used for users having a very high bandwidth network connection to provide them with an excellent quality).

These different delivery options are realised in the present embodiment by assembling different media articles based on the measured bandwidth – in other words, the measured bandwidth forms another parameter value used in the selection of a playlist. In the present embodiment, having made a bandwidth measurement for a particular user device, this is stored and it is not performed again for subsequent deliveries of a media article to the same user during the same session.

During playback of the media article, the user interface monitors (in the present embodiment) any interactions by the user and passes this information back to the delivery server. This includes mouse clicks on the play/pause button, the rewind button, the mute button, the volume controller and the video window itself, as well as any other control buttons in the in the client window. All of these interactions are passed as events to the

delivery server, where they are time-stamped and stored in an impression database, along with additional information about the delivery of the video to that client, as explained below.

The impression database tries to fully characterise each "impression" of a complete delivery process as experienced by a user of the delivered media article – each individual delivery of an article is treated as a unique instance or impression and is uniquely logged – in the present embodiment – in the impression database. The logging includes details of the playlist used to generate the clips (and thus of the clips making up the media article) the parameter options selected including details such as the user's name and email address, the recipient's name and email address. it also includes timestamps for each aspect of the delivery of the article and any user interaction information (including timestamps for these); this means that if a user mutes the audio, rewinds some video or carries out any other click behaviour at a point or points in the video, then the video, audio and any overlays playing to the user at that or those instants can be determined from an analysis of the impression log (for example if a user terminates playback before the media article is finished, the place of playback within the article is noted for posterity). This impression information can be analysed to obtain useful information for Football Club A (or whoever the client using the service for their customers or potential customers is).

The database can be interrogated using a report generator, which produces detailed reports based on analysing the available data in a number of ways ranging from simple activity reports, through to reports showing the numbers of recipients who watched specific segments of a specific video. These reports can be used to refine the video and audio content that is delivered (the Creation Tools are used to change the content metadata or templates/storyboards, and these changes are then published and passed to the delivery server.) Reports are also available to stake-holders like brands, ad agencies, and content owners (in this case, this would be Football Club A and their ad agency).

Notes

In the current implementation, the Sender's setting of parameters in the 'Edit' page (Stage 1) to control the video takes place in a client application running on the Sender's computer, with the web pages being served from a remote server computer, and with a network connection connecting the two computers. Other implementations, like running the 'client' application remotely on the server, could be used to provide similar functionality

where the Sender's computing power is limited. Similar options exist for the Recipient's computer.

Regardless of how the parameters are captured, the function of the 'Edit' page remains the same: to enable the Sender to set a number of parameters which are then used to control the content, duration, or other aspects of the video that is served by the server. The mapping of these parameters to controllers within the Adaptive Media delivery system need not be one-to-one or straight-forward. So if there is a requirement to deliver a 30 second video and a 60second video, then the 30/60 selection parameter could be used to choose between two storyboards (one of 30 seconds duration, the other of 60 seconds duration), or alternatively could be used to influence a number of different sections in a single storyboard to produce the same control over duration of the final output video. Similarly, a parameter that is used to select a legendary player can be used more than once in different contexts inside the storyboard to provide control over an establishing shot of the legendary player, a close-up action shot of the legendary player, and a closing face shot of the legendary player. The same controller can be used in different ways in different storyboards, so a legendary player control might be used to select appropriate shots in a storyboard featuring that legendary player, or could be used to select a commentary featuring that player as the audio backdrop to a montage of scenes, or could be used to insert the legendary player in a storyboard giving an overview of the history of the football club.

The parameters are thus a simplified and abstracted way for a Sender to 'Edit' the video that is produced (and subsequently sent to the recipient). Once the Sender has chosen the parameters to control the duration, messages, overlays and content to be included in the video, then these parameters are stored in a database on the server side, and a unique reference to that database entry is then used to refer to that set of parameters.

This replacement of the list of parameters by a reference to a record in a database means that the list of parameters is not revealed when a Sender (or Recipient) plays a video, plus it eases the tracking of the delivery of specific playlists by reducing the amount of information that needs to be stored.

When the Sender has set the parameters from the 'Edit' page, they can then move to the 'Preview' page. The 'Preview" page takes the parameters stored in the record in the database, and uses them to select a playlist that matches those parameters (there may be several playlists that match the parameters) and then fetches the relevant video clips from the playlist and assembles them into the final output video. So the user can now see the

video which is produced in response to the parameters that they have set. If the user does not like the video, then they can return (go back) to the 'Edit' page and change the parameters, then move back to the 'Preview' page and review the newly changed video output.

Publishing is used to optimise the delivery system at the expense of additional processing of content. When the process of producing adaptive media in the Creation Tools is complete, then the publishing process creates the playlists, and also carries out a number of optimisations on the media content. The optimisations can only take place once the playlists have been locked or frozen at the end of the creation stage, because it is only when the playlists are no longer being edited that the exact usage of clips can be determined. If optimisation was done before the playlists had been locked, then an edit to a storyboard might mean that a new video clip was used, and that new video clip would then have to be optimised and added to the delivery system storage.

The publishing process uses the playlists to identify the video clips which are actually used by the delivery system to assemble the final output videos. For example, a trailer for a movie might only use a few minutes of material from a 90 minute movie, and so it makes no sense to store the complete movie when only a few minutes of material are required. When the video clips have been identified, then they are extracted from the source material as individual files. These individual files are then processed so that they have a key-frame at the beginning and their length is adjusted to enable audio synchronisation. These individual files are then stored, ready to be used by the video assembler to assemble the output video.

Scenario 3

To further clarify the operation of the above described system, consider a third usage scenario.

Thus, consider a template to be a story, and the control parameters to be assigned to elements within that story. So a templated story might be 'Goldilocks and the Three Bears' with a control parameter that might be used to control the number of bears - resulting in 'Goldilocks and the n Bears', where n could be any number from 0 to 10, as set by the control parameter. The video elements that would be used for the various settings of the control parameters might include the title video clip ('Goldilocks and no Bears', 'Goldilocks

and the Bear', 'Goldilocks and the 2 Bears', 'Goldilocks and the 3 Bears', 'Goldilocks and the 4 Bears', 'Goldilocks and the 5 Bears'...), and key scenes where the bears need to be visible as a group. Close-up video clips of two specific bears could be used for any setting of the control parameter greater than 1; whilst video clips containing a third specific bear could only be used for control parameter settings of 3 or more.

The relationships which connect the parameters and the clips are as described in WO 04/025508, and include metadata matching, clip sequencing, and cause-effect linkages. In this case, metadata matching would be used to provide appropriately marked-up clips for specific control parameters. So clips of 2 specific bears (Mummy and Baby) would be marked up with a metadata value of '2', but also marked up with values of '3', '4', '5'... since they can be used for any setting of the control parameter other than 0 or 1. Clips of 3 specific bears (Mummy, Daddy and Baby) would have metadata markup of '3', '4', '5'... Clip sequencing might be used here to determine the order in which scenes are presented to the viewer, and so the metadata applied to the video clips might have values like 'Goldilocks alone in the woods', 'Goldilocks finds the cottage', 'Goldilocks and the chair', "Goldilocks and the porridge', 'Goldilocks and the bed', 'The Bears return', 'The Bears examine the broken chair', 'The Bears examine the empty porridge bowl', 'The Bears find Goldilocks asleep in the bed', and 'Goldilocks awakes and meets the Bears'. Cause-effect relationships could be used to set linkages between items and video clips, so a control parameter might allow selection of which items in the cottage Goldilocks interacts with.

So the 'Goldilocks eats porridge' control parameter would be linked via appropriate metadata to clips where she eats the porridge, and these could then be linked via cause-effect linkages to the related scenes where the Bears discover the empty porridge bowl. So if the cause is set to the eating, whilst the effect is the discovery, then selecting 'Goldilocks eats porridge' would result in video clips showing both her eating the clips AND the Bears discovering the empty bowl. But selecting the 'discovery' clips would not result in the 'eating' clips because of the way that the cause-effect linkages are set.

An alternative story Template might present the story as a series of flashbacks, where the Bears discover the broken chair, and we see a flashback of Goldilocks breaking it, the Bears discover the empty bowl, and we see a flashback of Goldilocks eating the porridge, etc. In this case, the cause-effect linkages would be set with the cause being the discovery of the item, and the effect being Goldilocks interacting with the item. The clip sequencing would be set differently here as well to reflect the flashback structure.

Metadata could also be used to control the length of the video clips which are shown, as well as their significance to telling the story. A 'Length' control parameter might be used to determine if short, medium length or long clips are used (in practice, a finer degree of control over the clips could be provided) and video clips would be marked up with metadata reflecting their duration, thus allowing a control parameter to determine the duration of the story. Video clips could also be marked up with 'plot values' reflecting their importance to telling the story, thus allowing a control parameter to determine the depth of detail presented in the story.

By choosing short clips with high plot values, then the story will be presented in a short summary form, where the length and the depth of detail can be adjusted to suit the preference of the viewer. So a very brief summary of the story of 'Goldilocks and the Three Bears' might contain just three brief video clips: 1. Goldilocks discovering the cottage in the woods. 2. Goldilocks and the Bears see each other! 3. Goldilocks runs out of the cottage. An 'in depth' study of 'Goldilocks and the Three Bears' might start with a long establishing shot zooming in to the path leading in the woods as Goldilocks skips happily along it in the bright sunshine, with her quaintly pretty house receding into the distance behind her. As she goes deeper into the woods, the atmosphere might darken, the music might become less bouncy and more gloomy, and various cutaways to scuttling or attentively watching woodland creatures would be included... As can be imagined, it might take half an hour of screen time just for Goldilocks to get to the cottage, if a skilled director is in charge, out of a total running time of over two hours.

Different Templates might be used to produce different versions of the story, using video clips from a common pool, and perhaps adding in additional clips for specific purposes. So 'Goldilocks and Godzilla' might only require the Bears to be replaced with Godzilla for a simple version, but a more sophisticated version might replace the cottage with a Japanese setting. 'Goldilocks and the Three Godzillas' then requires just video clips of two more mutated lizards to be added. Complete localisation to a Japanese orientation might require the porridge to be replaced with sushi, the chair with a tatami mat, and the bed with a bedroll and hard pillow, and perhaps a change of hair colour for the leading lady!

The use of Templates, metadata and relationships means that simple control parameters can be used to enable an end user to control the story, characters, length, depth of detail, and many other narrative features, without needing to know anything other than how to interpet a control parameter name and change the setting. In contrast, trying to provide a

method for an end user to control the complex inter-relationships between the various elements in a video story would require detailed knowledge of continuity, editing, story-telling and other skills.

An MP3 player's playlist facility provides the ability to sequence tracks in a specific order and so share the resulting list with others, and might be seen as being, in some way, analogous to the description above. But this invention provides multi-dimensional abstraction of the controls from the resulting media experience which are not available in a simple playlist. The component video clips are not in a simple list, rather they are assembled depending on the Template's story, the sequencing ordering, the control parameter settings for length, plot value, etc, and any linkages and cause-effect relationships.

The above scenario is now further expanded upon by considering some example possibilities for the simple parameters which the user and/or third parties can manipulate to obtain different media articles and the mapping rules which convert these into control parameters which are directly useable by the media assembly means in order to generate a corresponding media article (at run-time).

Adjustable parameters

User controls presented to a user could include a choice of animals for Goldilocks to meet, food items to be consumed, and furniture items that can be interacted with. Because the actual assembly of the video is carried out at the time of delivery of the video, these parameters are not required to be finalised until that delivery takes place, and so placeholders can be used that are only resolved at the time of delivery. (For simplicity this 'time of delivery' variability is shown in the following lists as 'Local', meaning that the value is determined by time, location, or another contextual parameter relevant at the time of delivery of the video.)

So a list of 'Animals to be interacted with' could be:

1. Bears
2. Mice
3. Godzillas
4. <Local Animals tbc>

Where option 4 can be changed to suit the local requirements at the time of delivery, which could be time-based (Owls at night, Pidgeons during the daytime), location-based

(Pandas for China, Eagles for the USA, Badgers for the UK...), context-sensitive (Donkeys for Blackpool, Cows for Surrey, Dogs for Crufts), or advertiser-based ad placement (The Cadbury's Caramel rabbit girl, or the Churchill dog, or a Ratatouie rat).

The 'food items to be consumed' could thus include:

1. Quaker oats
2. Kellogg's Cornflakes
3. Jordan's Crunch
4. <Local basic food tbc>
5. <Local speciality tbc

The 'furniture items to be interacted with' could include:

1. Sleeprite mattress
2. Ikea Bodun bed
3. <Local utility furniture tbc>
4. <Local speciality furniture tbc>
5. <Local dealer of branded furniture tbc>

Item 5 in the 'furniture list' provides two levels of abstraction: the brand of the furniture, plus the name of the dealer. This abstraction can be extended to suit complex chains of sponsorship, franchises, dealerships, partnerships and many other trading relationships and marketing arrangements.

In a similar way, the initial parameters may be pre-defined, or made 'local':

1. <Local minimum time tbc>
2. <Half way between local minimum and maximum tbc>
3. <Local maximum time tbc)

The delivery system will take the time control parameter shown here, convert the <expression> to a real value, and assemble a video with that as the duration parameter. (Limits on acceptable values for these locally determined parameters will need to be set during the design stage of the adaptive media.)

Mapping Rules

The 'animals' control parameter could control video clips within a template, so that each time an animal clip is defined in the template, then a video clip with the animal set in the control parameter is included in the video delivery, so bears could become mice or Godzillas or whatever the locally appropriate animal is. Alternatively, this parameter could choose templates so that different stories are told. In the case of Bears, then Goldilocks is slightly smaller than the bears, and is probably threatened by them, but for the case of Mice, then Goldilocks is much larger than them, and the mice are likely to feel threatened by Goldilocks, and so the story would be very different.

The 'food' and 'furniture' control parameters might be used differently in different templates, and so the Bears case might have a long shot of the bears throwing the empty porridge bowl across the kitchen, whilst the Mice might have a close-up of the mice scuttling around the empty bowl. Goldilocks might be able to almost fit into the Baby Bear's chair, but would squash a Mouse's chair.

The content creation tools used to produce the video clips, assign metadata, and add relationships need to take these inter-relationships into account as part of the design and creation process. This is similar to the existing accessibility and acceptability criteria in video production - like testing for compatibility on monochrome televisions, looking for political incorrectness, providing sub-titles or signing for the deaf, providing spoken commentaries for the blind, etc.

More generally, the initial parameters (for example animals: bears, mice, godzillas) are intuitive controls for human users or for simple broad sweep manipulation by either human users or simple automated processes whilst the control parameters resulting from the mapping means are parameters such as <large animal template> and <in depth length> to enable the media assembly means to select an actual template (e.g. the in-depth, large animal story template) and then to select actual media segments for insertion into specific placeholders provided by the selected template (e.g. 3(or 2 or 1 or 0)-bear scenes, atmosphere scenes, etc.) as discussed in WO 04/025508. Once the actual desired media segments have been selected they are assembled together in an order which also depends upon meta-data contained in the media segments which gives an indication of the correct ordering of these segments, etc..

CLAIMS

1. A system for creating and editing time-varying media articles, the system comprising:

a sender user device and a recipient user device both having a user interface including a media presenting means and a parameter editing means;

media assembly means for assembling a media article based on a set of parameter values such that different sets of parameter values will cause correspondingly different media articles to be assembled; and

media segment storage means for storing a plurality of media segments suitable for combining together to form a media article; wherein

the user interface includes means for generating a reference associated with or including a set of parameter values suitable for use by the assembly means in assembling a media article, the reference being suitable for electronic distribution from the sender user device to the recipient user device and such that, when provided to the media assembly means, it permits assembly of the media article and presentation thereof within the media presenting means of either the sender or recipient user interface, and wherein, upon receipt of the reference by the recipient user device, a new reference may be created, based on the parameter values associated with the received reference, by modifying one or more of the parameter values to generate a new set of parameter values using the parameter editing means of the user interface.

2. A system according to claim 1 further comprising mapping means for mapping initial parameters to control parameters which permits a user to control the values of only a relatively small number of initial parameters via the user interface, which are then mapped by the mapping means to control parameters which more directly control the operation of the media assembly means in its assembly of the media article.

3. A system according to either one of the preceding claims wherein the media assembly means is operable to select and combine media segments stored in the media segment storage means in accordance with a set of control parameters which include, or are derived from, parameter values set by a user in combination with parameter values determined by a third party or in dependence upon contextual variables.

4. A system as claimed in any of the preceding claims wherein the media articles are audio video media streams suitable for playing by a media player embedded in a web-browser of a user device.

5. A method of creating and editing time-varying media articles, the method comprising:

causing a user interface on a user device associated with a sending user to display a media presenting area and a parameter editing area;

responding to user inputs from the sending user via the user interface to set a plurality of values for parameters displayed in the parameter editing area;

responding to further user inputs from the sending user via the user interface to cause a message to be sent to a user device associated with a recipient user including a reference to the values for the parameters selected by the sending user; and, in response to either the sending user selecting to preview the media article or the recipient user selecting to view the media article by referring to the received reference:

assembling a plurality of media segments, stored in a media segment storage means, in dependence upon the set values for the parameters displayed in the parameter editing area, or referred to by the reference, in order to generate a media article; and

causing the generated media article to be played within the user interface of either the sending user or the recipient user respectively; wherein, when the recipient uses the reference to view a media article, the user interface of the recipient user device is caused to provide the same functionality as was provided to the sending user so the recipient user can view the parameter choices made by the sender user to cause the particular media article to be assembled and may further edit the parameter values to cause a different media article to be assembled and to permit the recipient to generate and forward on to further recipient users a new reference to the possibly edited set of parameter values.

6. A method according to claim 5 further including the step of mapping the parameter values set by the sending user to a set of control parameters which are then used directly to assemble the plurality of media segments.

7. A computer program or programs for carrying out the method of either of claims 5 or 6.

8. Carrier means carrying the computer program or programs of claim 7.

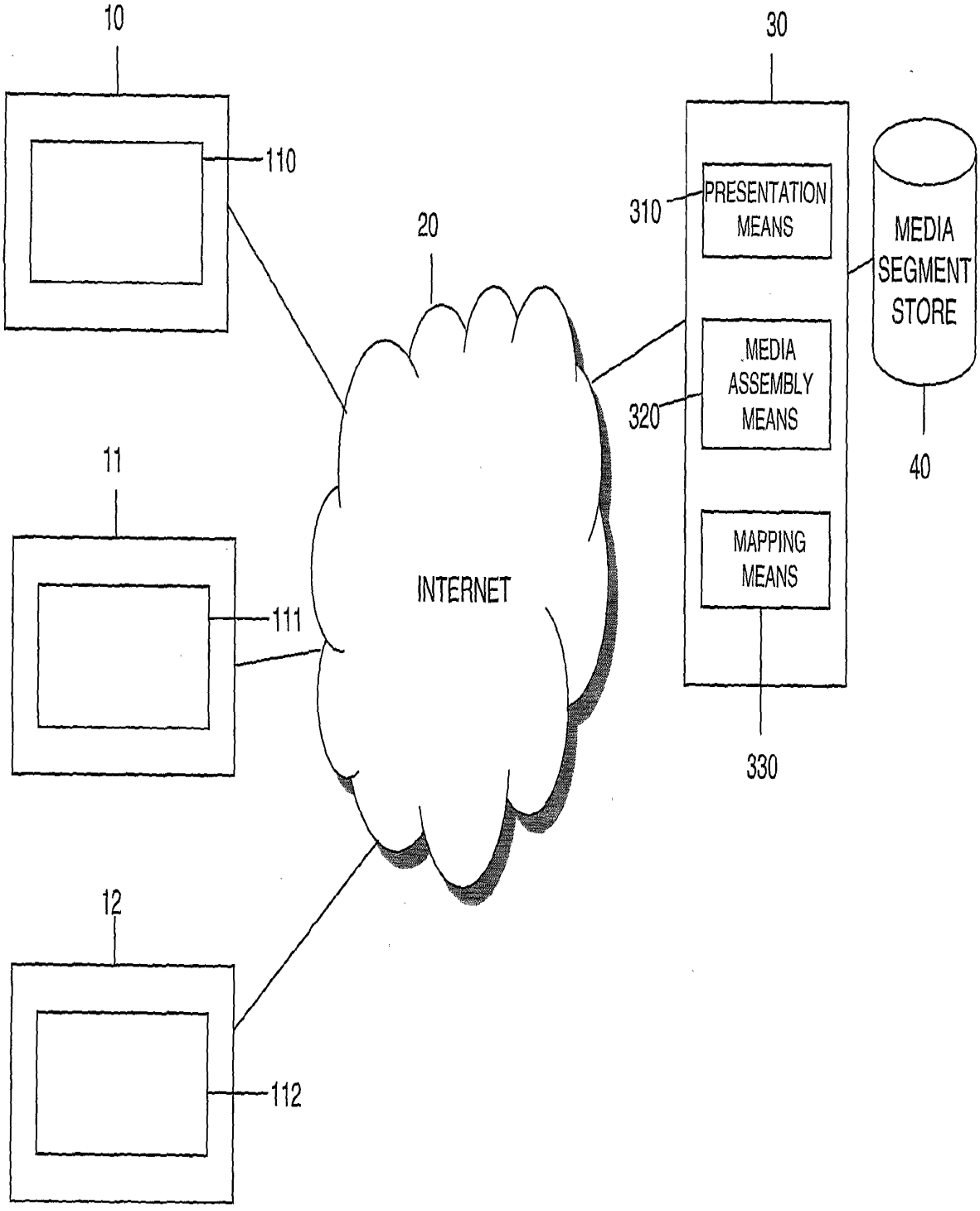

10
110
20
30
310
PRESENTATION MEANS
MEDIA SEGMENT STORE
MEDIA ASSEMBLY MEANS
320
40
MAPPING MEANS
330
INTERNET
11
111
12
112

Figure 1

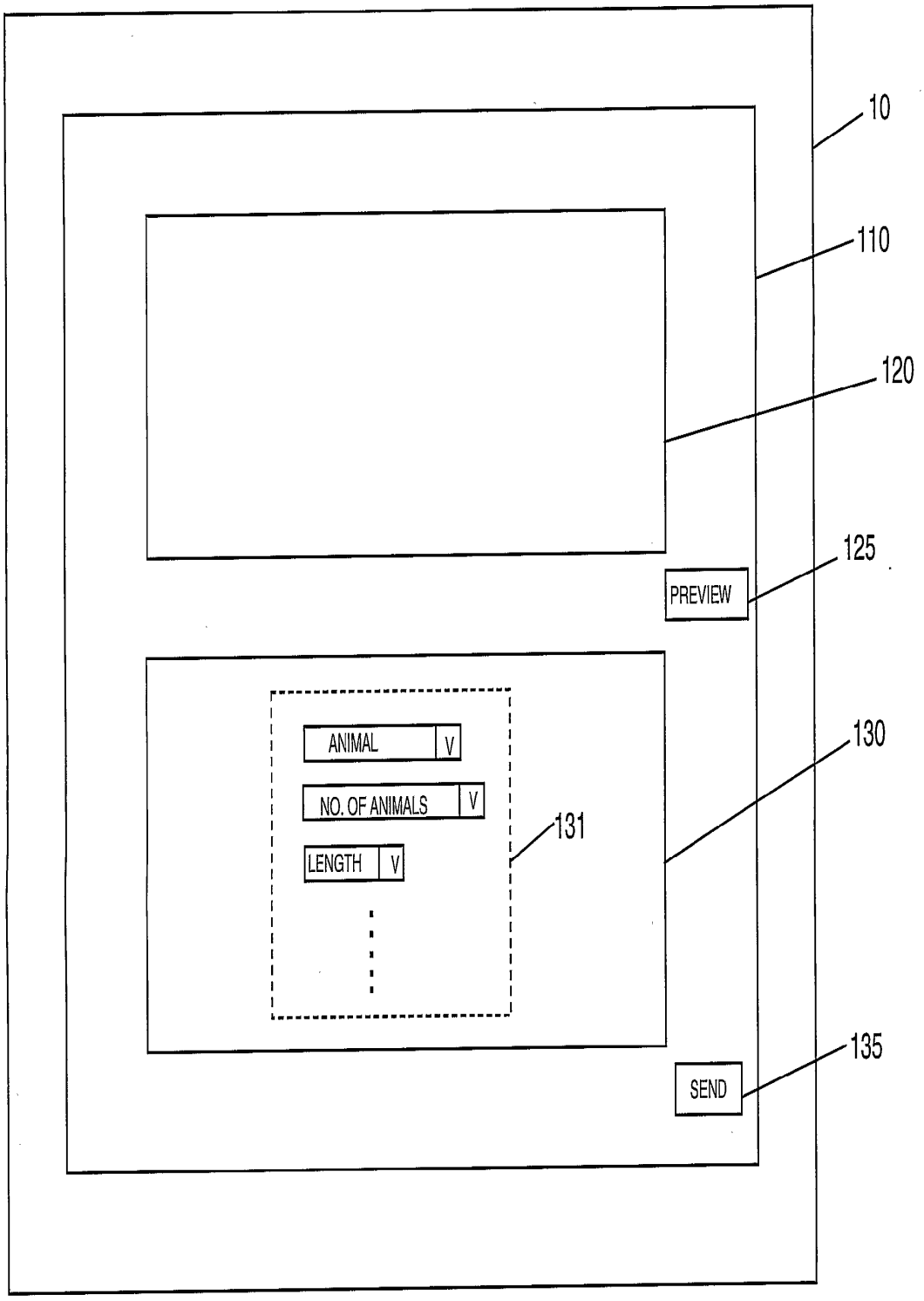

10
110
120
125
PREVIEW
130
ANIMAL
V
NO. OF ANIMALS
V
131
LENGTH
V
135
SEND

Figure 2

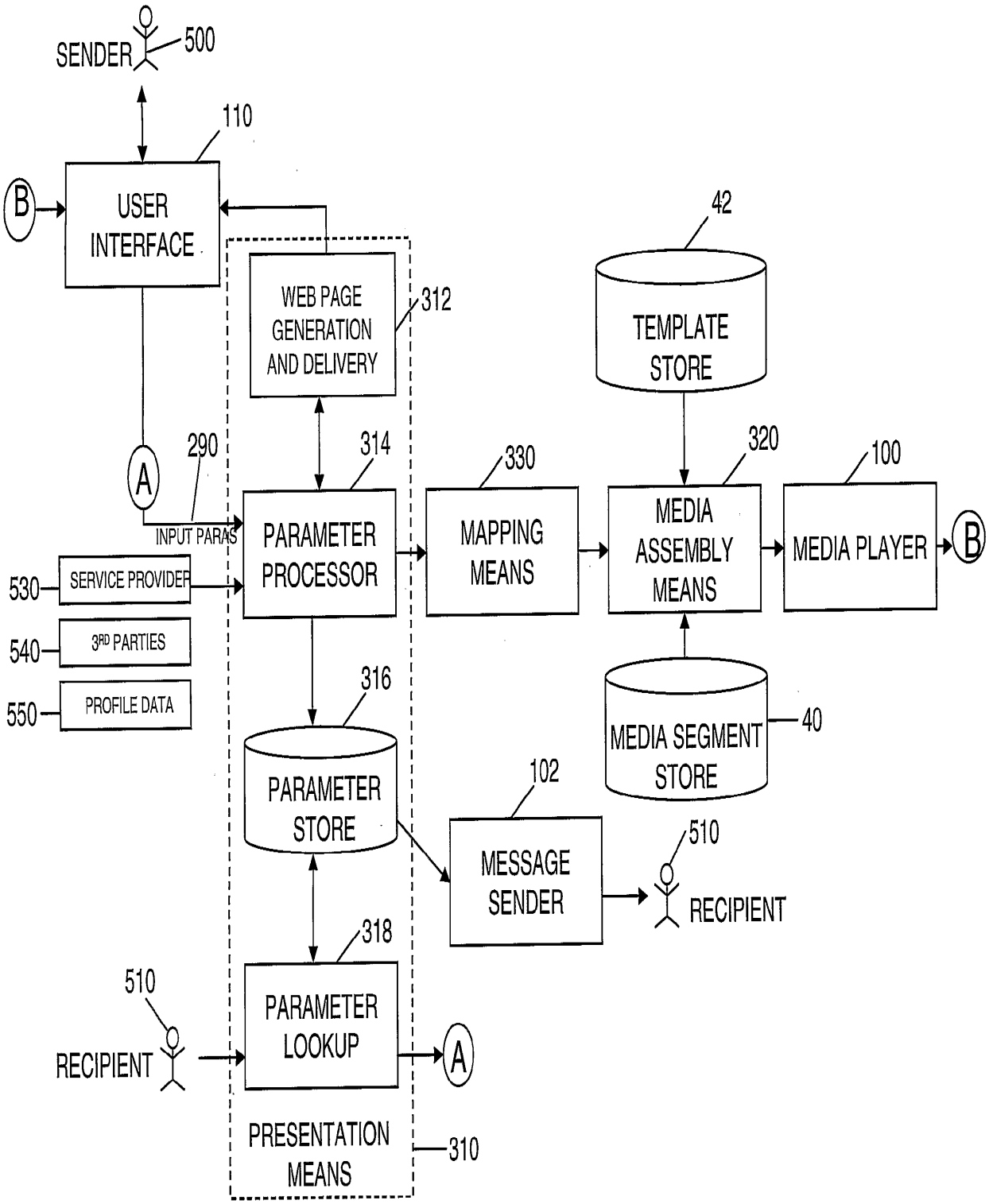

SENDER
500
110
USER INTERFACE
B
WEB PAGE GENERATION AND DELIVERY
312
42
TEMPLATE STORE
290
314
320
100
330
A
INPUT PARAS
PARAMETER PROCESSOR
MAPPING MEANS
MEDIA ASSEMBLY MEANS
MEDIA PLAYER
B
530
SERVICE PROVIDER
540
3RD PARTIES
550
PROFILE DATA
316
MEDIA SEGMENT STORE
40
PARAMETER STORE
102
MESSAGE SENDER
510
RECIPIENT
318
510
RECIPIENT
PARAMETER LOOKUP
A
PRESENTATION MEANS
310

Figure 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2008/003264

A. CLASSIFICATION OF SUBJECT MATTER
INV. G11B27/034 G06Q30/00 H04N7/173

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G11B G06Q H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/093790 A1 (LOGAN JAMES D [US] ET AL) 15 May 2003 (2003-05-15) abstract paragraph [0092] - paragraph [0108] paragraph [0117] - paragraph [0127] paragraph [0209] paragraph [0221] - paragraph [0232] paragraph [0257] - paragraph [0258] paragraph [0270] paragraph [0311] - paragraph [0312] paragraph [0319] - paragraph [0320] figures 3-5 ----- -/--	1-8

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 December 2008	17/12/2008

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Luca, Mihai Bogdan

Form PCT/ISA/210 (second sheet) (April 2005)

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Exhibit 1003 Page 136

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002/049783 A1 (BERK STEVEN N [US] ET AL) 25 April 2002 (2002-04-25) abstract paragraph [0008] - paragraph [0011] paragraph [0025] - paragraph [0027] paragraph [0032] - paragraph [0036] paragraph [0044] figures 2-4	1-8
A	WO 99/26415 A (SCIDEL TECHNOLOGIES LTD [IL]; BAR EL DAN [IL]) 27 May 1999 (1999-05-27) figure 1 page 10, line 3 - page 11, line 5 page 11, line 20 - page 12, line 15	1-8
A	WO 01/99403 A (YESVIDEO COM [US]; FU SAI WAI [US]; SIT HON PUN [US]; AHMAD SUBUTAI [U) 27 December 2001 (2001-12-27) page 23, line 23 - page 25, line 23 figures 1,3,4b-5b,5h-8	1-8
A	WO 2004/025508 A (BRITISH TELECOMM [GB]; STEVENS TIMOTHY SEAN [GB]; PALMER ALEX STEVEN J) 25 March 2004 (2004-03-25) cited in the application page 22, line 20 - line 30 figures 2,3,8,17,22 claims 1-4	1-8
A	WO 03/098932 A (KONINKL PHILIPS ELECTRONICS NV [NL]; KELLY DECLAN P [NL]; VAN GASSEL J) 27 November 2003 (2003-11-27) the whole document	1-8
A	US 2005/102324 A1 (SPRING LESLIE [US] ET AL SPRING LESLIE [US] ET AL) 12 May 2005 (2005-05-12) the whole document	1-8

3

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Exhibit 1003 Page 137

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2008/003264

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 2003093790	A1	15-05-2003	NONE		
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			JP	2005526331 T	02-09-2005
			US	2006059260 A1	16-03-2006
US 2005102324	A1	12-05-2005	US	2008183760 A1	31-07-2008

Electronic Acknowledgement Receipt

EFS ID:	37235940
Application Number:	16535940
International Application Number:	
Confirmation Number:	9986
Title of Invention:	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING
First Named Inventor/Applicant Name:	David A. Newman
Customer Number:	137002
Filer:	Vadim Polonichko/Sandra Streams
Filer Authorized By:	Vadim Polonichko
Attorney Docket Number:	46DG-026055
Receipt Date:	23-SEP-2019
Filing Date:	08-AUG-2019
Time Stamp:	01:00:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	GP-46DG-026055_SyncIDS-Form.pdf	96958 5142fbf50c83f9850881cfe2555749d4d18a1b81	no	7

Warnings:

Information:					
This is not an USPTO supplied IDS fillable form					
2	Transmittal Letter	GP-46DG-026055_Transmittal-Letter.pdf	505200 1dafb610ec1dadaf6e81958392fbda4602f4d5f4	no	1
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3	Foreign Reference	GP-46DG-026055-Foreign-167.pdf	2282834 a73898b13ff25c8c86d2571820c536706d66b1c4	no	31
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4	Foreign Reference	GP-46DG-026055-Foreign-168.pdf	2470650 4fa130aee263332f1428730e51017af2d9e65cc0	no	46
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5	Foreign Reference	GP-46DG-026055-Foreign-169.pdf	1641887 f04fc0f1cf1d6dd91d7dcce6d377a8bd69287e71	no	37
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6	Non Patent Literature	GP-46DG-026055-NPL-170.pdf	1441569 982d6c1c24b5b97fffb7c5eaf9dfb4e2ba81ac53	no	16
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7	Non Patent Literature	GP-46DG-026055-NPL-171.pdf	2043481 6898d24233b8a25868062a742a2a8d170e9f44f9	no	24
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8	Non Patent Literature	GP-46DG-026055-NPL-172.pdf	630986 405d21d4d27fa817ae3de877279f8db3ccf4c5f3	no	15
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Information:					

9	Non Patent Literature	GP-46DG-026055-NPL-173.pdf	400404 5eeed5dd29d78207cf78f276950299ec1c62f439	no	9
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Information:					
10	Non Patent Literature	GP-46DG-026055-NPL-174.pdf	1471706 e9284b2edea104229ffb48d817fbdc492b942c3b	no	14
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Information:					
11	Non Patent Literature	GP-46DG-026055-NPL-175.pdf	1650063 1d4dda2b52311bef0b4e42b6a564ed8834c360ea	no	12
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12	Non Patent Literature	GP-46DG-026055-NPL-176.pdf	1123460 7e5c12396423ab4a887d2f1c31bf7789b3ebdfdc	no	9
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13	Non Patent Literature	GP-46DG-026055-NPL-177.pdf	1743765 6ba15b11242dce0fbc4e705817a9875fced3a576	no	11
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14	Non Patent Literature	GP-46DG-026055-NPL-178.pdf	965992 3849da4a1247f8433d16afa3fb1ef1b65da3025e	no	12
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15	Other Reference-Patent/App/Search documents	GP-46DG-026055-NPL-179-Other.pdf	765868 6902dda96bc41581ebc51ed5cca05e67e22875fb	no	10
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16	Other Reference-Patent/App/Search documents	GP-46DG-026055-NPL-180-Other.pdf	103399 dbaa4de68e229e8d26b579cd3608efc62d540112	no	2
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17	Other Reference-Patent/App/Search documents	GP-46DG-026055-NPL-181-Other.pdf	824269 afc0a35aa2d9548b5b80ed9c62a863a1af21e24c	no	7
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18	Other Reference-Patent/App/Search documents	GP-46DG-026055-NPL-182-Other.pdf	4033507 5452ab068569e48b2c77c7e8f82b640291cc4bc9	no	26
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19	Other Reference-Patent/App/Search documents	GP-46DG-026055-NPL-183-Other.pdf	465236 eedd0da9616fcb8d5f1d2aaabbf6084228c108af	no	14
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20	Other Reference-Patent/App/Search documents	GP-46DG-026055-NPL-184-Other.pdf	179081 3c381f4fabf5a74165540bee2624b19c28e6a54e	no	4
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21	Other Reference-Patent/App/Search documents	GP-46DG-026055-NPL-185-Other.pdf	462584 22c5e9a4e0c3ef022a9d187cdccc9e596f3c2342	no	7
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Information:					
22	Other Reference-Patent/App/Search documents	GP-46DG-026055-NPL-186-Other.pdf	209905 737bb2e87f4896050a73627c788d3d94bfd7cfd6	no	2
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23	Other Reference-Patent/App/Search documents	GP-46DG-026055-NPL-187-Other.pdf	462584 edf2a74ab271e44295fc090ec15d16d8d9896771	no	7
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Information:					
24	Non Patent Literature	GP-46DG-026055-NPL-188.pdf	1420209 d33603558a1e7e5b90961438409d8ed5743301ab	no	6
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26	Non Patent Literature	GP-46DG-026055-NPL-190.pdf	943041 f2dfdc9906ce368263eb310dde1f58cc49223c5a	no	9
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		Total Files Size (in bytes):	30613254		

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 COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: JASON E. AMSEL
FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

RECEIVED
PATENT DOCKETING
JUN 22 2015
Fenwick & West

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing *(day/month/year)*	16 JUN 2015
Applicant's or agent's file reference: 27672/PCT 23769 –	FOR FURTHER ACTION See paragraphs 1 and 4 below
International application No.: PCT/US 15/18538	International filing date *(day/month/year)*: 03 March 2015 (03.03.2015)
Applicant: GOPRO, INC.	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   How? Directly to the International Bureau of WIPO preferably through ePCT or on paper to, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest *and* the decision thereon to the designated Offices.

   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

   Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

   Within **19 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Lee W. Young PCT Helpdesk: 571-272-4300 Telephone No. PCT OSP: 571-272-7774

Form PCT/ISA/220 (July 2014)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 27672/PCT	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below
International application No. PCT/US 15/18538	International filing date *(day/month/year)* 03 March 2015 (03.03.2015)	(Earliest) Priority Date *(day/month/year)* 04 March 2014 (04.03.2014)
Applicant GOPRO, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

   a. the figure of the **drawings** to be published with the abstract is Figure No. 6

   ☒ as suggested by the applicant.

   ☐ as selected by this Authority, because the applicant failed to suggest a figure.

   ☐ as selected by this Authority, because this figure better characterizes the invention.

   b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 15/18538

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H04N 13/04 (2015.01)
CPC - G06T 2207/10016, G06T 7/0022, G06T 3/0062, G06T 3/0043, H04N 5/2259
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8):H04N 13/04 (2015.01)
CPC:G06T 2207/10016; G06T 7/0022; G06T 3/0062; G06T 3/0043; H04N 5/2259

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC(8):H04N 13/04 (2015.01)
CPC:G06T 2207/10016; G06T 7/0022; G06T 3/0062; G06T 3/0043; H04N 5/2259; USPC: 348/211.9

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Patbase, Google Patents, Google Scholar Search Terms Used: Spherical, 360, image, photo, video, panoramic, metadata, time, timestamp, location, position, coordinates, crop, zoom, subframe, portion, edit, view, frame, stitch, join, distance, match, threshold, find, identify, track, face, person, object, subject, hemispherical, two, sec

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 2010/045773 A1 (RITCHEY) 25 February 2010 (25.02.2010) para [0050]-[0051], [0074], [0086]-[0088], [0102], [0114]-[0115], [0117]	41, 48, 49, 56, 57 --- 1, 2, 4, 5, 7-9, 11, 12, 14-16, 18, 19, 21-40, 42-47, 50-55, 58-60
-- A		--- 3, 6, 10, 13, 17, 20
Y -- A	US 2011/0173565 A1 (OFEK et al.) 14 July 2011 (14.07.2011), para [0037], [0041], [0043], [0044], [0046]-[0050], [0054]	1, 2, 4, 5, 7-9, 11, 12, 14-16, 18-19, 21-40 --- 3, 6, 10, 13, 17, 20
Y	US 2011/0211040 A1 (LINDEMANN et al.) 01 September 2011 (01.09.2011), para [0091]-[0093]	42, 43, 50, 51, 56, 59
Y	US 2009/0274339 A9 (COHEN et al.) 05 November 2009 (05.11.2009), para [0006], [0062], [0177], [0229]	44-46, 52-54
Y	US 6,583,956 B1 (POTTS et al.) 15 July 2003 (15.07.2003), col 6, ln 25-43 col 8, ln 8-30	4, 11, 18, 47, 55, 60
Y	US 2013/0208134 A1 (HAMALAINEN) 15 August 2013 (15.08.2013), para [0004], [0032]	26, 33, 40
A	US 2012/0127169 A1 (BARCAY et al.) 24 May 2012 (24.05.2012) para [0081]	3, 10, 17
A	US 2013/0287304 A1 (KIMURA) 31 October 2013 (31.10.2013) para [0066]-[0067], [0084]	6, 13, 20

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 May 2015 (12.05.2015)	16 JUN 2015
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: JASON E. AMSEL
FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	16 JUN 2015
Applicant's or agent's file reference 27672/PCT	FOR FURTHER ACTION See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 15/18538	03 March 2015 (03.03.2015)	04 March 2014 (04.03.2014)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H04N 13/04 (2015.01)
CPC - G06T 2207/10016; G06T 7/0022; G06T 3/0062; G06T 3/0043; H04N 5/2259

Applicant GOPRO, INC.

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1 *bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	12 May 2015 (12.05.2015)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (January 2015)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/18538

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/18538

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-40, 42-47, 50-55, 58-60	YES
	Claims	41, 48, 49, 56, 57	NO
Inventive step (IS)	Claims	3, 6, 10, 13, 17, 20	YES
	Claims	1, 2, 4, 5, 7-9, 11, 12, 14-16, 18, 19, 21-60	NO
Industrial applicability (IA)	Claims	1-60	YES
	Claims	NONE	NO

2. Citations and explanations:

Claims 41, 48, 49, 56 and 57 lack novelty under PCT Article 33(2) as being anticipated by US 2010/0045773 A1 (Ritchey).

Regarding claim 41, Ritchey teaches a method for generating an output video from spherical video content, the method comprising: storing, by a video server, a first spherical video comprising a sequence of spherical video frames, each having a spherical field of view and one or more audio tracks (para [0083], [0086], [0102], [0117] 'the objective fisheye lenses 7a and 7b are situated in a back to back manner such that they have overlapping adjacent hemispherical FOV coverage such that a spherical FOV is achieved' 'the frame may be a still image or from consecutive video image frames' 'reading out the resultant image and audio signal' 'in operation the camera transmits an entire frame with, say images 10a and 10b, to the host server 139'); processing, by the video server, the first spherical video to identify a target feature of interest meeting one or more audio or visual criteria (para [0086]-[0087], [0117] 'similarly, Region of Interest ROI firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on the frame' 'in operation the camera transmits an entire frame with, say images 10a and 10b, to the host server 139'); determining, by the video server, a first range of frames of the first spherical video having the target feature of interest (para [0086]-[0087], [0119] 'control signals from within the camera, remote wireless camera control device, or connected computer can be used to communicate to the camera means which portion or portions of the composite spherical FOV images are readout' 'the panoramic images may be associated in the associated camera 1, panoramic adapter 100, remote control device 104, 109, host server 139, client computer 143'); determining, by the video server, a first sequence of sub-frames from each of the first range of frames, each of the first sequence of sub-frames having a non-spherical field of view, and each of the first sequence of sub-frames including a spatial region around the target feature of interest (para [0086]-[0088], [0117] 'portion or portions of the composite spherical FOV images are readout' 'multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer' 'the panoramic images may be associated in the associated camera 1, panoramic adapter 100, remote control device 104, 109, host server 139, client computer 143'); generating, by the video server, a first portion of an output video including the sequence of sub-frames; and outputting the output video (para [0087]-[0088] 'multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer. 'then the image 10a is ROI processed such that it is enlarged for viewing on the display 16').

Regarding claim 48, Ritchey teaches the method of claim 41, further comprising, storing, by the video server, a second hemispherical video comprising a sequence of spherical video frames each having a spherical field of view and one or more audio tracks (para [0102], [0104], [0117] 'reading out the resultant image and audio signal' 'The spherical panoramic image processing operations 129 laid out in Fig. 23 for manipulating wide angle hemispherical images, such as images 10a and 10b, according to the present invention are known in the industry and may be accomplished using the below mentioned software' 'in operation camera 1 transmits an entire frame with, say images 10a and 10b, to the host server 139'); processing, by the video server, the second hemispherical video to identify the target feature of interest meeting the one or more audio or visual criteria (para [0101], [0114]-[0115], [0119] 'An SP auto-parser is used to grab the hemispherical images 10a and 10b recorded by the present lens adapter and process (translate, rotate, reverse, and stitch the two hemispherical images frame after frame) the specific portion of the image designated by the operator/viewer of the scene is integrated into the software' 'The panoramic images may be processed in the associated camera 1, panoramic adapter 100, remote control device 104, 109, host server 139'); determining, by the video server, a second range of frames of the second spherical video having the target feature of interest(para [0119]-[0120] 'using camera and processing so that he or she can select which portions of the spherical FOV image he or she wishes to manipulate and view' 'The panoramic images may be processed in the associated camera 1, panoramic adapter 100, remote control device 104, 109, host server 139'); determining, by the video server, a second sequence of sub-frames from each of the second range of frames, each of the second sequence of sub-frames having a non-spherical field of view, and each of the second sequence of sub-frames including a spatial region around the target feature of interest (para [0101], [0114]-[0115] 'Spherical panoramic image processing operations 129 in the form of computer programs in a compatible language to a given computer system to manipulate image 10a, 10b, 10c, or 10d or portions of those images'); and generating, by the video server, a second portion of the output video including the second sequence of sub-frames(para [0088], [0119]-[0120] 'In contrast, in Fig. 7 the ROI is divided between image 10a and image 10b. Fig. 17 graphically illustrates an instance where the image of a person is captured in a small portion of the image 10a shown in the viewfinder 16' 'The panoramic images may be processed in the associated camera 1, panoramic adapter 100, remote control device 104, 109, host server 139, client computer 143. once the image reaches the client computer 143 the image is transmitted to a display device').

--please see continuation on supplemental page--

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:
Box No. V.2. Citations and Explanations:

Regarding claim 49, Ritchey teaches a non-transitory computer-readable storage medium storing instructions for generating an output video from spherical video content (para [0101], [0104] 'The conventional computer processing means my be integrated into camera 1, the adapter 100, wireless remote control device 109, 109a, 109b, a cell phone, laptop computer, personal computer, personal digital assistant (PDA), or other device well know in the industry that can typically include memory, processing circuitry, wiring, input means, electrical power means, processing means, and display means typical to any conventional computer processing system or modern electronic device' 'The spherical panoramic image processing operations 129 laid out in Fig. 23 for manipulating wide angle hemispherical images'), the instructions when executed by one or more processors causing the one or more processors to perform steps including: storing a first spherical video comprising a sequence of spherical video frames each having a spherical field of view and one or more audio tracks (para [0083], [0086], [0101]-[0102] 'the objective fisheye lenses 7a and 7b are situated in a back to back manner such that they have overlapping adjacent hemispherical FOV coverage such that a spherical FOV is achieved' 'the frame may be a still image or from consecutive video image frames' 'finally reading out the resultant image and audio signal for presentation to the viewer'); processing the first spherical video to identify a target feature of interest meeting one or more audio or visual criteria (para [0086]-[0087] 'similarly, Region of Interest ROI firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on the frame'); determining a first range of frames of the first spherical video having the target feature of interest (para [0086]-[0088] 'control signals from within the camera, remote wireless camera control device, or connected computer can be used to communicate to the camera means which portion or portions of the composite spherical FOV images are readout'); determining a first sequence of sub-frames from each of the first range of frames, each of the first sequence of sub-frames having a non-spherical field of view, and each of the first sequence of sub-frames including a spatial region around the target feature of interest (para [0087]-[0088] 'portion or portions of the composite spherical FOV images are readout' 'multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer'); generating a first portion of an output video including the sequence of sub-frames (para [0087]-[0088] 'multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer'); and outputting the output video (para [0087]-[0088] 'multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer').

Regarding claim 56, Ritchey teaches the non-transitory computer-readable storage medium of claim 49, further comprising storing a second hemispherical video comprising a sequence of spherical video frames each having a spherical field of view and one or more audio tracks (para [0102]), [0104], [0117] 'reading out the resultant image and audio signal' 'The spherical panoramic image processing operations 129 laid out in Fig. 23 for manipulating wide angle hemispherical images, such as images 10a and 10b, according to the present invention are known in the industry and may be accomplished using the below mentioned software' 'In operation camera 1 transmits an entire frame with, say images 10a and 10b, to the host server 139'); processing the second hemispherical video to identify the target feature of interest meeting the one or more audio or visual criteria (para [0101], [0114]-[0115], [0119]) 'An SP auto-parser is used to grab the hemispherical images 10a and 10b recorded by the present lens adapter and process (translate, rotate, reverse, and stitch the two hemispherical images frame after frame) the specific portion of the image designated by the operator/viewer of the scene is integrated into the software' 'The panoramic images may be processed in the associated camera 1, panoramic adapter 100, remote control device 104, 109, host server 139'), determining a second range of frames of the second spherical video having the target feature of interest(para [0119]-[0120]) 'using camera and processing so that he or she can select which portions of the spherical FOV image he or she wishes to manipulate and view' 'The panoramic images may be processed in the associated camera 1, panoramic adapter 100, remote control device 104, 109, host server 139'); determining a second sequence of sub-frames from each of the second range of frames, each of the second sequence of sub-frames having a non-spherical field of view, and each of the second sequence of sub-frames including a spatial region around the target feature of interest (para [0101], [0114]-[0115] 'Spherical panoramic image processing operations 129 in the form of computer programs in a compatible language to a given computer system to manipulate image 10a, 10b, 10c, or 10d or portions of those images'); and generating a second portion of the output video including the second sequence of sub-frames(para [0088], [0101], [0114]-[0115], [0119]-[0120]) 'In contrast, in Fig. 7 the ROI is divided between image 10a and image 10b. Fig. 17 graphically illustrates an instance where the image of a person is captured in a small portion of the image 10a shown in the viewfinder 16' 'The panoramic images may be processed in the associated camera 1, panoramic adapter 100, remote control device 104, 109, host server 139, client computer 143' 'once the image reaches the client computer 143 the image is transmitted to a display device').

Regarding claim 57, Ritchey teaches a video server for generating an output video from spherical video content (para [0104], [0119] 'The spherical panoramic image processing operations 129 laid out in Fig. 23 for manipulating wide angle hemispherical images, such as images 10a and 10b, according to the present invention are known in the industry and may be accomplished using the below mentioned software' 'The panoramic images may be processed in the associated camera 1, panoramic adapter 100, remote control device 104, 109, host server 139'), the video server comprising: one or more processors (para [0117], [0119] 'Signal processing means typically includes both image and audio processing capabilities'); and a non-transitory computer-readable storage medium storing instructions that when executed by the one or more processors causing the one or more processors to perform steps para [0101], [0104] 'The conventional computer processing means my be integrated into camera 1, the adapter 100, wireless remote control device 109, 109a, 109b, a cell phone, laptop computer, personal computer, personal digital assistant (PDA), or other device well know in the industry that can typically include memory, processing circuitry, wiring, input means, electrical power means, processing means, and display means typical to any conventional computer processing system or modern electronic device') including: storing a first spherical video comprising a sequence of spherical video frames each having a spherical field of view and one or more audio tracks (para [0086], [0101]-[0102] 'the objective fisheye lenses 7a and 7b are situated in a back to back manner such that they have overlapping adjacent hemispherical FOV coverage such that a spherical FOV is achieved' 'the frame may be a still image or from consecutive video image frames' 'finally reading out the resultant image and audio signal for presentation to the viewer'); processing the first spherical video to identify a target feature of interest meeting one or more audio or visual criteria (para [0086]-[0087] 'Similarly, Region-of-Interest (ROI) firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on a frame'); determining a first range of frames of the first spherical video having the target feature of interest (para [0086]-[0088] 'Similarly, Region-of-Interest (ROI) firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on a frame' 'Fig. 17 graphically illustrates an instance where the image of a person is captured in a small portion of the image 10a shown in the viewfinder 16 of the camera 1'); (continued)

--please see continuation on supplemental page--

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:
Box No. V.2. Citations and Explanations:

(continued) determining a first sequence of sub-frames from each of the first range of frames, each of the first sequence of sub-frames having a non-spherical field of view, and each of the first sequence of sub-frames including a spatial region around the target feature of interest (para [0087]-[0088] 'control signals from within the camera, remote wireless camera control device, or connected computer can be used to communicate to the camera means which portion or portions of the composite spherical FOV images are readout'); generating a first portion of an output video including the sequence of sub-frames (para [0087]-[0088] 'multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer'); and outputting the output video (para [0087]-[0088] 'multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer').

Claims 1, 2, 5, 7-9, 12, 14-16, 19, 21-25, 27-32 and 34-39 lack an inventive step under PCT Article 33(3) as being obvious over US 2011/0173565 A1 to Ofek et al. (hereinafter Ofek) in view of Ritchey.

Regarding claim 1, Ofek teaches a method for generating an output video from panoramic video content, the method comprising: storing, by a video server, a first video having first video content and first video metadata including location data pertaining to a location of a first camera capturing the first video content and timing data pertaining to a time of capture of the first video content (para [0040]-[0041], [0046] 'Server 510 may have access to a panoramic image dataset 520 and an additional media dataset 530' 'the metadata may include a geotag identifying the geographic location at which the panoramic image was captured' ; The metadata may alternatively or additionally indicate other parameters of an additional media object, such as its author, subject, and/or time at which it was captured'); receiving user metadata representing time stamped locations corresponding to a target (para [0046], [0060], [0066] 'To search for additional media objects that the user may wish to view, the user may enter a search query related to one or more parameters of the additional media objects, such as a location at which they were captured, a time at which they were captured, an author who captured them, or a subject they depict'); determining by the video server, based on the user metadata and the first video metadata, a first matching portion of the first panoramic video, the first matching portion of the first video, the first matching portion captured when the first camera was within a threshold vicinity of the target (para [0046], [0045], [0066] 'Matched points of interest represent likely mappings between features of a panoramic image and features of an additional media object frame that depict the same scene or physical subject. In the example of Fig. 6, matched points of interest, indicated by arrows 600, provide a likely mapping between additional media object frame 360 and panoramic image portion 315 that may be used to properly align the two depictions of building 300'); outputting the output video (para [0046], [0055] 'user interface 555 through which hybrid image data may be displayed to a user in a viewport panel 910'). Ofek does not teach the video content is spherical video content, or receiving user metadata representing a target path; determining a sequence of sub-frames by selecting, for each of a plurality of frames of the first matching portion of the first panoramic video, a sub-frame having content relevant to the target path, each of the sequence of sub-frames comprising a non-spherical field of view; combining the sequence of sub-frames to generate a first portion of the output video relevant to the target; and outputting the video. However Ritchey teaches spherical video content (para [0086] 'portion or portions of the composite spherical FOV images are readout'), receiving a target path (para [0086]-[0087] 'Similarly, Region-of-Interest (ROI) firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on a frame'), determining a sequence of sub frames by selecting for each of a plurality of frames of the matching portion of the spherical video, a sub frame having content relevant to the target path, each sequence of the sub frames comprising a non spherical field of view (para [0087]-[0088], the non spherical field of view illustrated in Figure 17 'Multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer processing capability that controls the sensor'), combining the sequence of sub frames to generate a first portion of the output video relevant to the target (para [0087] 'Multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer processing capability that controls the sensor. The ROI sensor is dynamically and selectively addressed depending on the view selected by the user 126, 126' or 126? of the interactive control device 144') and outputting the video (para [0063], [0088] 'And then the image 10a is ROI processed such that it is enlarged for viewing on the display 16 of the wireless camera control device 109'). It would have been obvious to a person having ordinary skill in the art to use the spherical video and sub frame outputs of Ritchey in the method of Ofek, so that the method would have comprised receiving user metadata representing a target path, the target path comprising a sequence of time stamped locations corresponding to the target, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 2, Ofek in view of Ritchey teaches the method of claim 1. Ritchey further teaches wherein two or more of the selected sub-frames correspond to different spatial regions in different frames of the first spherical video (para [0085]-[0086] 'Panoramic image processing in the present invention includes and comprises such functions of balancing chrominance and luminance and contrast between subset images and image segments, read out of images, stitching images, determining area the area of display, and panning and zooming around panoramic images for display').

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Regarding claim 5, Ofek in view of Ritchey teaches the method of claim 1. Ofek further teaches storing by video server a second video having second video content captured by a second camera and a second metadata (para [0041], [0044] 'Server 510 may also have access to an associations dataset 540, which may be implemented separately or contiguously with panoramic image dataset 520 and/or additional media dataset 530 on one or more computer-readable storage media'); determining by the video server, based on user metadata and video metadata a second matching portion of the second video, the second matching portion captured when the second camera was within a threshold vicinity of the target (para [0041], [0046] 'A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555, optionally filtered using any of various methods known in the art'), for each of a plurality of frames of the second matching portion of the second video, selecting a sub frame, the sub frame having content relevant to the target path (para [0044], [0046] 'At any given time, the viewport may display image data, received from server 510, representing a portion of a panoramic image 525 or a hybrid panoramic image in accordance with a particular view direction'); and combining the selected sub-frames to generate a second portion of the output video relevant to the target (para [0046] 'A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555, optionally filtered using any of various methods known in the art. In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555'); and combining the first portion of the output video with the second portion of the output video (para [0046], [0049]-[0050], [0054] 'In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555.'). Ofek does not teach a second spherical selecting a sub frame having a non spherical field of view. However Ritchey teaches spherical video (para [0086] 'composite spherical FOV images are readout'), and a sub frame having a non spherical view (para [0087]-[0088] 'Fig. 17 graphically illustrates an instance where the image of a person is captured in a small portion of the image 10a shown in the viewfinder 16 of the camera 1'). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, so that the method would have comprised storing a second spherical video, and selecting a sub frame having a non spherical field of view, the sub frame having content relevant to the target path, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 7, Ofek in view of Ritchey teaches the method of claim 1. Ofek further teaches the method further comprising: receiving the user metadata from a location tracking device tracking the target path of the target (para [0048]-[0050] 'Based on the geographic location identified by the metadata of additional media object image frame 360, panoramic image 310 (including image portion 315) is identified as corresponding to the closest panorama in the association data for the additional media object.').

Regarding claim 8, Ofek teaches a non-transitory computer-readable storage medium storing instructions for generating an output video from video content (para [0046], [0043], [0048] 'It should be appreciated that panoramic image dataset 520 and additional media dataset 531) may be implemented on a single computer-readable medium or on separate computer-readable media, and that each individual dataset may be implemented on a single or multiple computer-readable media' 'Server 510 may be programmed with computer-executable instructions to determine associations between additional media objects 535 and panoramic images 525'), the instructions when executed by one or more processors causing the one or more processors to perform (para [0043], [0049] 'Server 510 may be programmed with computer-executable instructions to determine associations between additional media objects 535 and panoramic images 525') steps including: storing a first video having first video content and first video metadata including location data pertaining to a location of a first camera capturing the first spherical video content and timing data pertaining to a time of capture of the first spherical video content (para [0040]-[0041], [0048], [0060] 'Server 510 may have access to a panoramic image dataset 520 and an additional media dataset 530' 'the metadata may include a geotag identifying the geographic location at which the panoramic image was capture' ; 'The metadata may alternatively or additionally indicate other parameters of an additional media object, such as its author, subject, and/or time at which it was captured'); receiving user metadata representing locations and times corresponding to a target (para [0046], [0060], [0066] 'To search for additional media objects that the user may wish to view, the user may enter a search query related to one or more parameters of the additional media objects, such as a location at which they were captured, a time at which they were captured, an author who captured them, or a subject they depict'); determining by the video server, based on the user metadata and the first video metadata, a first matching portion of the first panoramic video, the first matching portion of the first video, the first matching portion captured when the first camera was within a threshold vicinity of the target (para [0046], [0050], [0066] 'Matched points of interest represent likely mappings between features of a panoramic image and features of an additional media object frame that depict the same scene or physical subject. In the example of Fig. 6, matched points of interest, indicated by arrows 600, provide a likely mapping between additional media object frame 360 and panoramic image portion 315 that may be used to properly align the two depictions of building 300'); outputting the output video (para [0046], [0055] 'user interface 555 through which hybrid image data may be displayed to a user in a viewport panel 910'). Ofek does not teach the video content is spherical video content, or receiving user metadata representing a target path, determining a sequence of sub-frames by selecting, for each of a plurality of frames of the first matching portion of the first panoramic video, a sub-frame having content relevant to the target path, each of the sequence of sub-frames comprising a non-spherical field of view; combining the sequence of sub-frames to generate a first portion of the output video relevant to the target; and outputting the video. However Ritchey teaches spherical video content (para [0086] 'portion or portions of the composite spherical FOV images are readout'), receiving a target path (para [0086]-[0087] 'Similarly, Region-of-Interest (ROI) firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on a frame'), determining a sequence of sub frames by selecting for each of a plurality of frames of the matching portion of the spherical video, a sub frame having content relevant to the target path, each sequence of the sub frames comprising a non spherical field of view (para [0087]-[0088], the non spherical field of view illustrated in Figure 17 'Multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer processing capability that controls the sensor'); combining the sequence of sub frames to generate a first portion of the output video relevant to the target (para [0087] 'Multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer processing capability that controls the sensor. The ROI sensor is dynamically and selectively addressed depending on the view selected by the user 126, 126' or 126'' of the interactive control device 144') and outputting the video (para [0083], [0088] 'And then the image 10a is ROI processed such that it is enlarged for viewing on the display 16 of the wireless camera control device 109'). It would have been obvious to a person having ordinary skill in the art to use the spherical video and sub frame outputs of Ritchey in the method of Ofek, so that an entire surrounding scene may be recorded (see Ritchey, para [0003])
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Regarding claim 9, Ofek in view of Ritchey teach the non-transitory computer-readable storage medium of claim 8. Ritchey further teaches wherein two or more of the selected sub-frames correspond to different spatial regions in different frames of the first spherical video (para [0085]-[0086] 'Panoramic image processing in the present invention includes and comprises such functions of balancing chrominance and luminance and contrast between subset images and image segments, read out of images, stitching images, determining area the area of display, and panning and zooming around panoramic images for display').

Regarding claim 12, Ofek in view of Ritchey teach the non-transitory computer-readable storage medium of claim 8, Ofek further teaches the instructions when executed by the one or more processors further cause the one or more processors to perform steps including: storing, by the video server, a second video having second spherical video content captured by a second camera and second video metadata (para [0041], [0044] 'Server 510 may also have access to an associations dataset 540, which may be implemented separately or contiguously with panoramic image dataset 520 and/or additional media dataset 530 on one or more computer-readable storage media'); determining by the video server, based on user metadata and video metadata a second matching portion of the second video, the second matching portion captured when the second camera was within a threshold vicinity of the target (para [0041], [0046] 'A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555, optionally filtered using any of various methods known in the art'); for each of a plurality of frames of the second matching portion of the second video, selecting a sub frame, the sub frame having content relevant to the target path (para [0044], [0046] 'At any given time, the viewport may display image data, received from server 510, representing a portion of a panoramic image 525 or a hybrid panoramic image in accordance with a particular view direction'), and combining the selected sub-frames to generate a second portion of the output video relevant to the target (para [0046] 'A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555, optionally filtered using any of various methods known in the art. In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555'); and combining the first portion of the output video with the second portion of the output video (para [0046], [0049]-[0050], [0054] 'In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555.'). Ofek does not teach a second spherical selecting a sub frame having a non spherical field of view. However Ritchey teaches spherical video (para [0086] 'composite spherical FOV images are readout'), and a sub frame having a non spherical view (para [0087]-[0088] 'Fig. 17 graphically illustrates an instance where the image of a person is captured in a small portion of the image 10a shown in the viewfinder 16 of the camera 1'). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, so that the method would have comprised storing a second spherical video, and selecting a sub frame having a non spherical field of view, the sub frame having content relevant to the target path, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 14, Ofek in view of Ritchey teaches the non-transitory computer-readable storage medium of claim 8. Ofek further teaches the instructions when executed by the one or more processors further cause the one or more processors to perform steps including: receiving the user metadata from a location tracking device tracking the target path of the target (para [0048]-[0050], [0060], [0066] 'Based on the geographic location identified by the metadata of additional media object image frame 360, panoramic image 310 (including image portion 315) is identified as corresponding to the closest panorama in the association data for additional media object').

Regarding claim 15, Ofek teaches a video server for generating an output video from spherical video content, the video server comprising: one or more processors (para [0049] 'Such processing may be implemented by one or more processors'); and a non-transitory computer-readable storage medium storing instructions for generating an output video from spherical video content (para [0040], [0043] 'Which may be implemented using one or more computer-readable storage media' Server 510 may be programmed with computer- executable instructions'), the instructions when executed by the one or more processors causing the one or more processors to perform steps including: storing a first video having first video content and first video metadata including location data pertaining to a location of a first camera capturing the first spherical video content and timing data pertaining to a time of capture of the first spherical video content (para [0040]-[0041], [0048] 'Server 510 may have access to a panoramic image dataset 520 and an additional media dataset 530, which may be implemented using one or more computer-readable storage media' 'The metadata may include a geotag identifying the geographic location at which the panoramic image was capture' 'The metadata may alternatively or additionally indicate other parameters of an additional media object, such as its author, subject, and/or time at which it was captured'); receiving user metadata representing locations and times corresponding to a target (para [0046], [0060], [0066] 'User 560 may search for additional media objects to view based on any of various parameters, such as an author of additional media objects, a subject of additional media objects, a time at which additional media objects were captured, and/or a location at which additional media objects were captured'); determining by the video server, based on the user metadata and the first video metadata, a first matching portion of the first panoramic video, the first matching portion of the first video, the first matching portion captured when the first camera was within a threshold vicinity of the target (para [0046], [0048],[0050], [0066],' points of interest in additional media object image frame 360 may be matched to corresponding points of interest in panoramic image 310'); outputting the output video (para [0046], [0054] 'Hybrid image data 800, when provided by server 510 and displayed by client 550'). Ofek does not teach the video content is spherical video content, or receiving user metadata representing a target path, determining a sequence of sub-frames by selecting, for each of a plurality of frames of the first matching portion of the first panoramic video, a sub-frame having content relevant to the target path, each of the sequence of sub-frames comprising a non-spherical field of view; combining the sequence of sub-frames to generate a first portion of the output video relevant to the target; and outputting the video. However Ritchey teaches spherical video content (para [0086] 'portion or portions of the composite spherical FOV images are readout'), receiving a target path (para [0086]-[0087] 'Similarly, Region-of-Interest (ROI) firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on a frame'), determining a sequence of sub frames by selecting for each of a plurality of frames of the matching portion of the spherical video, a sub frame having content relevant to the target path, each sequence of the sub frames comprising a non spherical field of view (para [0087]-[0088], the non spherical field of view illustrated in Figure 17 'Multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer processing capability that controls the sensor'), combining the sequence of sub frames to generate a first portion of the output video relevant to the target (para [0087] 'Multiple ROI can be read out selectively and dynamically in any sequence that is programmed into the computer processing capability that controls the sensor. (continued)
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(continued)The ROI sensor is dynamically and selectively addressed depending on the view selected by the user 126, 126' or 126? of the interactive control device 144') and outputting the video (para [0083], [0086] 'And then the image 10a is ROI processed such that it is enlarged for viewing on the display 16 of the wireless camera control device 109'). It would have been obvious to a person having ordinary skill in the art to use the spherical video and sub frame outputs of Ritchey in the method of Ofek, so that the method would have comprised receiving user metadata representing a target path, the target path comprising a sequence of time stamped locations corresponding to the target, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 16, Ofek in view of Ritchey teaches the video server of claim 15. Ritchey further teaches wherein two or more of the selected sub-frames correspond to different spatial regions in different frames of the first spherical video (para [0085]-[0086] 'Panoramic image processing in the present invention includes and comprises such functions of balancing chrominance and luminance and contrast between subset images and image segments, read out of images, stitching images, determining area the area of display, and panning and zooming around panoramic images for display').

Regarding claim 19, Ofek in view of Ritchey teaches the video server of claim 15. Ofek further teaches wherein the instructions when executed by the one or more processors further cause the one or more processors to perform steps including: storing, by the video server, a second video having second spherical video content captured by a second camera and second video metadata (para [0041], [0044] 'Server 510 may also have access to an associations dataset 540, which may be implemented separately or contiguously with panoramic image dataset 520 and/or additional media dataset 530 on one or more computer-readable storage media'); determining by the video server, based on user metadata and video metadata a second matching portion of the second video, the second matching portion captured when the second camera was within a threshold vicinity of the target (para [0041], [0046] 'A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555, optionally filtered using any of various methods known in the art'); for each of a plurality of frames of the second matching portion of the second video, selecting a sub frame, the sub frame having content relevant to the target path (para [0044], [0046] 'At any given time, the viewport may display image data, received from server 510, representing a portion of a panoramic image 525 or a hybrid panoramic image in accordance with a particular view direction'); and combining the selected sub-frames to generate a second portion of the output video relevant to the target (para [0046] 'A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555, optionally filtered using any of various methods known in the art. In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555'); and combining the first portion of the output video with the second portion of the output video (para [0046], [0049]-[0050], [0054] 'In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555'). Ofek does not teach a second spherical selecting a sub frame having a non spherical field of view. However Ritchey teaches spherical video (para [0086] 'composite spherical FOV images are readout'), and a sub frame having a non spherical view (para [0087]-[0088] 'Fig. 17 graphically illustrates an instance where the image of a person is captured in a small portion of the image 10a shown in the viewfinder 16 of the camera 1'). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, so that the method would have comprised storing a second spherical video, and selecting a sub frame having a non spherical field of view, the sub frame having content relevant to the target path, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 21, Ofek teaches a method for managing media content generated from video, the method comprising: storing, by a video server, a plurality of videos (para [0040] 'Server 510 may have access to a panoramic image dataset 520 and an additional media dataset 530, which may be implemented using one or more computer-readable storage media'); receiving an edit map specifying for each frame time of an output video, an identifier of a video of the plurality of videos and a spatial location of a sub-frame in the identified spherical video (para [0044], [0047]-[0050], [0054] 'Alternatively, user 560 may elect to step through the video frame by frame to view it as individual embedded images. If the video was captured with a moving camera, different image frames of the video may be embedded in different relative positions within the same panoramic images, and/or may be embedded across different panoramic images, according to the different geographic locations at which different image frames were captured' 'matched points of interest, indicated by arrows 600, provide a likely mapping between additional media object frame 360 and panoramic image portion 315 that may be used to properly align the two depictions of building 300'), generating the output video based on the edit map, the output video including the subframe from the identified video specified for each frame time (para [0051], [0054] 'In addition, the matched points of interest may indicate with measurable precision the relative position at which additional media object frame 360 should optimally be embedded within panoramic image portion 315' 'server 510 may provide updated hybrid image data containing the appropriate portions of adjusted additional media object frame 700 and panoramic image 310 with the relative position and embedding maintained'); and outputting the output video (para [0046] 'server 510 may produce the appropriate hybrid image data and provide it for display'). Ofek does not teach the videos are spherical videos, or the sub frame having a non spherical field of view. However Ritchey teaches a spherical video (para [0086] 'composite spherical FOV images are readout'), and a sub frame having a non spherical field of view (para [0086] 'Similarly, Region-of-Interest (ROI) firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on a frame'). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

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Regarding claim 22, Ofek in view of Ritchey teaches the method of claim 21. Ritchey further teaches a spherical video comprises a first hemispherical video and a second hemispherical video captured in synchronization (para [0050] ,In the present example the two fisheye lenses 7a and 7b transmit two hemispherical images 10a and 10b representing greater than 180 degree field-of-view coverage to the optical plane 15.) and wherein generating the output video comprises: determining if a given sub-frame has a spatial region crossing a boundary between the first hemispherical video and the second hemispherical video (para [0051], [0088], [0103] ,then it can also be determined that certain locations along the hemispherical images 10a and 10b match-up according to step 131.); responsive to the given sub-frame having the spatial region crossing the boundary, stitching corresponding portions of the first hemispherical video and the second hemispherical video contained within the given sub-frame to generate a stitched sub-frame (para [0102]-[0103] ,Referring once again to Fig. 23, once the viewer has designated the ROI to be sampled out in step 137 of the process then steps 131-136 are typically performed to prepare the image for viewing. Steps 131-136 include matching image edges of image segments 132, translating image segments 132, reversing and inverting image segments 133, stitching image segments 134 . For example, once image 10a and 10b are found to be in a certain location within a frame as described in step 130, then it can also be determined that certain locations along the hemispherical images 10a and 10b match-up according to step 131.); and including the stitched sub-frame in the output video (para [0102] ,saving into memory the final image for display 135, and finally reading out the resultant image and audio signal for presentation to the viewer based on his or her input 136.).

Regarding claim 23, Ofek in view of Ritchey teach the method of claim 21. Ofek further teaches the method further comprising: receiving a user selection of a selected video from the plurality of videos on the video server (para [0044], [0046] ,User 560 may search for additional media objects to view based on any of various parameters, such as an author of additional media objects, a subject of additional media objects, a time at which additional media objects were captured, and/or a location at which additional media objects were captured.); receiving user inputs indicating selections of sub-frames; and generating the edit map based on the selections of the sub-frames (para [0046], [0048]-[0050], [0054] ,In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555. ,Matched points of interest represent likely mappings between features of a panoramic image and features of an additional media object frame that depict the same scene or physical subject.). Ofek does not teach the video is spherical video, displaying the selected spherical video in a spherical video viewer, or sub frames having a non spherical field of view for each of a plurality of frames of the selected video. However Ritchey teaches spherical video (para [0086] ,composite spherical FOV images are readout.), displaying selected spherical video in a spherical video viewer (para [0121] ,With these room-like systems the entire spherical field of view image that is derived from the camera 1 with adapter 100 records is preferably displayed on wall, ceiling, and floor on which the viewer is standing as a continuous scene.), and selecting subframes having a non spherical field of view for each of a plurality of frames (para [0086]-[0088] ,Similarly, Region-of-Interest (ROI) firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on a frame.). It would have been obvious to a person having ordinary skill in the art to use the spherical video and sub frames of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 24, Ofek in view of Ritchey teach the method of claim 23. Ofek further teaches wherein receiving the user selection of the selected video comprises: obtaining user metadata associated with a user, the metadata including at least time and location information (para [0040]-[0041] ,the metadata may include a geotag identifying the geographic location at which the panoramic image was captured. ,metadata may alternatively or additionally indicate other parameters of an additional media object, such as its author, subject, and/or time at which it was captured.); correlating the user metadata to video metadata associated with each of the plurality of videos to a identify a subset of the plurality of videos captured at a time and location corresponding to the user time and location information (para [0046], [0049]-[0050] ,User 560 may search for additional media objects to view based on any of various parameters, such as an author of additional media objects, a subject of additional media objects, a time at which additional media objects were captured, and/or a location at which additional media objects were captured. ,A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555.); providing a representation of the subset of the plurality of videos in a user interface accessible to the user (para [0046], [0054] ,A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555.); and receiving the user selection from the subset of the plurality of videos (para [0046] ,In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555.). Ofek does not teach the video is spherical video. However Ritchey teaches spherical video (para [0086] ,composite spherical FOV images are readout.). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 25, Ofek in view of Ritchey teach the method of claim 21. Ofek further teaches the method further comprising: correlating user metadata associated with a user to video data metadata associated with the plurality of videos to automatically identify sub-frames relevent to the user(para [0046], [0049]-[0050] ,User 560 may search for additional media objects to view based on any of various parameters, such as an author of additional media objects, a subject of additional media objects, a time at which additional media objects were captured, and/or a location at which additional media objects were captured. In response to receiving the user request, server 510 may utilize search engine 515 to query the metadata of additional media objects 535 in additional media dataset 530 for the appropriate parameters.); and automatically generating the edit map based on the automatically identified subframes (para [0046], [0049]-[0050], [0054] ,In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555. ,In the example of Fig. 6, matched points of interest, indicated by arrows 600, provide a likely mapping between additional media object frame 360 and panoramic image portion 315.). Ofek does not teach the videos are spherical videos. However Ritchey teaches spherical videos (para [0086]) It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

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Regarding claim 27, Ofek in view of Ritchey teach the method of claim 21. Ofek further teaches the method further comprising: indexing the plurality of videos based on metadata associated with the plurality of videos including at least time and location information representation a time and location of capture (para [0040]-[0041]. .Additional media objects 535 may be encoded with metadata, including geotagging metadata identifying the geographical locations at which additional media objects 535 were captured. The metadata may alternatively or additionally indicate other parameters of an additional media object, such as its author, subject, and/or time at which it was captured.). Ofek does not teach the video is spherical video. However Ritchey teaches spherical video (para [0086] .composite spherical FOV images are readout.). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 28, Ofek teaches a non-transitory computer-readable storage medium storing instructions for managing media content generated from video (para [0040], [0043] .Server 510 may have access to a panoramic image dataset 520 and an additional media dataset 530, which may be implemented using one or more computer-readable storage media. .Server 510 may be programmed with computer-executable instructions), the instructions when executed by one or more processors causing the one or more processors to perform steps including: storing, by a video server, a plurality of videos (para [0040] .Server 510 may have access to a panoramic image dataset 520 and an additional media dataset 530, which may be implemented using one or more computer-readable storage media.); receiving an edit map specifying for each frame time of an output video, an identifier of a video of the plurality of videos and a spatial location of a sub-frame in the identified spherical video (para [0044], [0047]-[0050], [0054] .Alternatively, user 560 may elect to step through the video frame by frame to view it as individual embedded images. If the video was captured with a moving camera, different image frames of the video may be embedded in different relative positions within the same panoramic images, and/or may be embedded across different panoramic images, according to the different geographic locations at which different image frames were captured. .matched points of interest, indicated by arrows 600, provide a likely mapping between additional media object frame 360 and panoramic image portion 315 that may be used to properly align the two depictions of building 300.); generating the output video based on the edit map, the output video including the subframe from the identified video specified for each frame time (para [0051], [0054] .In addition, the matched points of interest may indicate with measurable precision the relative position at which additional media object frame 360 should optimally be embedded within panoramic image portion 315. .server 510 may provide updated hybrid image data containing the appropriate portions of adjusted additional media object frame 700 and panoramic image 310 with the relative position and embedding maintained.); and outputting the output video (para [0046] .server 510 may produce the appropriate hybrid image data and provide it for display.). Ofek does not teach the videos are spherical videos, or the sub frame having a non spherical field of view. However Ritchey teaches a spherical video (para [0086] .composite spherical FOV images are readout.), and a sub frame having a non spherical field of view (para [0088] .Similarly, Region-of-Interest (ROI) firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on a frame.). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 29, Ofek in view of Ritchey teach the non-transitory computer-readable storage medium of claim 28. Ritchey teaches a spherical video comprises a first hemispherical video and a second hemispherical video captured in synchronization (para [0050] .In the present example the two fisheye lenses 7a and 7b transmit two hemispherical images 10a and 10b representing greater than 180 degree field-of-view coverage to the optical plane 15.) and wherein generating the output video comprises: determining if a given sub-frame has a spatial region crossing a boundary between the first hemispherical video and the second hemispherical video (para [0051], [0088],[0103] .then it can also be determined that certain locations along the hemispherical images 10a and 10b match-up according to step 131.); responsive to the given sub-frame having the spatial region crossing the boundary, stitching corresponding portions of the first hemispherical video and the second hemispherical video contained within the given sub-frame to generate a stitched sub-frame (para [0102]-[0103] .Referring once again to Fig. 23, once the viewer has designated the ROI to be sampled out in step 137 of the process then steps 131-136 are typically performed to prepare the image for viewing. Steps 131-136 include matching image edges of image segments 132, translating image segments 132, reversing and inverting image segments 133, stitching image segments 134. .For example, once image 10a and 10b are found to be in a certain location within a frame as described in step 130, then it can also be determined that certain locations along the hemispherical images 10a and 10b match-up according to step 131.); and including the stitched sub-frame in the output video (para [0102] .saving into memory the final image for display 135 , and finally reading out the resultant image and audio signal for presentation to the viewer based on his or her input 136.).

Regarding claim 30, Ofek in view of Ritchey teach the non-transitory computer-readable storage medium of claim 28. Ofek further teaches wherein the instructions when executed by the one or more processors further cause the one or more processors to perform steps including: receiving a user selection of a selected video from the plurality of videos on the video server (para [0044], [0046] .User 560 may search for additional media objects to view based on any of various parameters, such as an author of additional media objects, a subject of additional media objects, a time at which additional media objects were captured, and/or a location at which additional media objects were captured.); receiving user inputs indicating selections of sub-frames; and generating the edit map based on the selections of the sub-frames (para [0046], [0048]-[0050], [0054] .In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555. .Matched points of interest represent likely mappings between features of a panoramic image and features of an additional media object frame that depict the same scene or physical subject.). Ofek does not teach the video is spherical video, displaying the selected spherical video in a spherical video viewer, or sub frames having a non spherical field of view for each of a plurality of frames of the selected video. However Ritchey teaches spherical video (para [0086] .composite spherical FOV images are readout.), displaying selected spherical video in a spherical video viewer (para [0121] .With these room-like systems the entire spherical field of view image that is derived from the camera 1 with adapter 100 records is preferably displayed on wall, ceiling, and floor on which the viewer is standing as a continuous scene.), and selecting subframes having a non spherical field of view for each of a plurality of frames (para [0086]-[0088] .Similarly, Region-of-Interest (ROI) firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on a frame.). It would have been obvious to a person having ordinary skill in the art to use the spherical video and sub frames of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

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Regarding claim 31, Ofek in view of Ritchey teach the non-transitory computer-readable storage medium of claim 30. Ofek further teaches wherein receiving the user selection of the selected spherical video comprises: obtaining user metadata associated with a user, the metadata including at least time and location information (para [0040]-[0041] .the metadata may include a geotag identifying the geographic location at which the panoramic image was captured. .metadata may alternatively or additionally indicate other parameters of an additional media object, such as its author, subject, and/or time at which it was captured.); correlating the user metadata to video metadata associated with each of the plurality of videos to a identify a subset of the plurality of videos captured at a time and location corresponding to the user time and location information (para [0046], [0049]-[0050] .User 560 may search for additional media objects to view based on any of various parameters, such as an author of additional media objects, a subject of additional media objects, a time at which additional media objects were captured, and/or a location at which additional media objects were captured. .A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555.); providing a representation of the subset of the plurality of videos in a user interface accessible to the user (para [0046], [0054] .A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555.); and receiving the user selection from the subset of the plurality of videos (para [0046] .In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555.). Ofek does not teach the video is spherical video. However Ritchey teaches spherical video (para [0086] .composite spherical FOV images are readout.). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 32, Ofek in view of Ritchey teach the non-transitory computer-readable storage medium of claim 28. Ofek further teaches wherein the instructions when executed by the one or more processors further cause the one or more processors to perform steps including: correlating user metadata associated with a user to video data metadata associated with the plurality of videos to automatically identify sub-frames relevant to the user(para [0046], [0049]-[0050] User 560 may search for additional media objects to view based on any of various parameters, such as an author of additional media objects, a subject of additional media objects, a time at which additional media objects were captured, and/or a location at which additional media objects were captured. In response to receiving the user request, server 510 may utilize search engine 516 to query the metadata of additional media objects 535 in additional media dataset 530 for the appropriate parameters.); and automatically generating the edit map based on the automatically identified subframes (para [0046], [0049]-[0050], [0054] .In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555. .In the example of Fig. 6, matched points of interest, indicated by arrows 600, provide a likely mapping between additional media object frame 360 and panoramic image portion 315.). Ofek does not teach the videos are spherical videos. However Ritchey teaches spherical videos (para [0086]). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 34, Ofek in view of Ritchey teach the non-transitory computer-readable storage medium of claim 28. Ofek further teaches wherein the instructions when executed by the one or more processors further cause the one or more processors to perform steps including: indexing the plurality of videos based on metadata associated with the plurality of videos including at least time and location information representing a time and location of capture (para [0040]-[0041]. .Additional media objects 535 may be encoded with metadata, including geotagging metadata identifying the geographical locations at which additional media objects 535 were captured. The metadata may alternatively or additionally indicate other parameters of an additional media object, such as its author, subject, and/or time at which it was captured.). Ofek does not teach the video is spherical video. However Ritchey teaches spherical video (para [0086] .composite spherical FOV images are readout.). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 35, Ofek teaches a video server for managing media content generated from video (para [0040] .Server 510 may have access to a panoramic image dataset 520 and an additional media dataset 530.), the video server comprising: one or more processors (para [0049] .such processing may be implemented by one or more processors.) and a non-transitory computer-readable storage medium storing instructions for managing media content generated from spherical video (para [0040], [0043] .which may be implemented using one or more computer-readable storage media. .Server 510 may be programmed with computer-executable instructions.), the instructions when executed by one or more processors causing the one or more processors to perform steps including: storing a plurality of videos (para [0040] .Server 510 may have access to a panoramic image dataset 520 and an additional media dataset 530, which may be implemented using one or more computer-readable storage media.); receiving an edit map specifying for each frame time of an output video, an identifier of a video of the plurality of videos and a spatial location of a sub-frame in the identified video (para [0044], [0047]-[0050], [0054] .Alternatively, user 560 may elect to step through the video frame by frame to view it as individual embedded images. If the video was captured with a moving camera, different image frames of the video may be embedded in different relative positions within the same panoramic images, and/or may be embedded across different panoramic images, according to the different geographic locations at which different image frames were captured. .matched points of interest, indicated by arrows 600, provide a likely mapping between additional media object frame 360 and panoramic image portion 315 that may be used to properly align the two depictions of building 300.); generating the output video based on the edit map, the output video including the subframe from the identified video specified for each frame time (para [0051], [0054] .In addition, the matched points of interest may indicate with measurable precision the relative position at which additional media object frame 360 should optimally be embedded within panoramic image portion 315. .server 510 may provide updated hybrid image data containing the appropriate portions of adjusted additional media object frame 700 and panoramic image 310 with the relative position and embedding maintained.); and outputting the output video (para [0046] .server 510 may produce the appropriate hybrid image data and provide it for display.). Ofek does not teach the videos are spherical videos, or the sub frame having a non spherical field of view. However Ritchey teaches a spherical video (para [0086] .composite spherical FOV images are readout.), and a sub frame having a non spherical field of view (para [0086] .Similarly, Region-of-Interest (ROI) firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1" within the camera to selectively or dynamically readout only portions of the image or images displayed on a frame.). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, to allow an an entire surrounding scene to be recorded (para [0003]). -please see next supplemental box-

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Regarding claim 36, Ofek in view of Ritchey teaches the video server of claim 35. Ritchey teaches a spherical video comprises a first hemispherical video and a second hemispherical video captured in synchronization (para [0050] 'In the present example the two fisheye lenses 7a and 7b transmit two hemispherical images 10a and 10b representing greater than 180 degree field-of-view coverage to the optical plane 15') and wherein generating the output video comprises: determining if a given sub-frame has a spatial region crossing a boundary between the first hemispherical video and the second hemispherical video (para [0051], [0088], [0103] 'then it can also be determined that certain locations along the hemispherical images 10a and 10b match-up according to step 131'); responsive to the given sub-frame having the spatial region crossing the boundary, stitching corresponding portions of the first hemispherical video and the second hemispherical video contained within the given sub-frame to generate a stitched sub-frame (para [0102]-[0103] 'Referring once again to Fig. 23, once the viewer has designated the ROI to be sampled out in step 137 of the process then steps 131-136 are typically performed to prepare the image for viewing. Steps 131-136 include matching image edges of image segments 132, translating image segments 132, reversing and inverting image segments 133, stitching image segments 134' 'For example, once image 10a and 10b are found to be in a certain location within a frame as described in step 130, then it can also be determined that certain locations along the hemispherical images 10a and 10b match-up according to step 131'); and including the stitched sub-frame in the output video (para [0102] 'saving into memory the final image for display 135, and finally reading out the resultant image and audio signal for presentation to the viewer based on his or her input 136').

Regarding claim 37, Ofek in view of Ritchey teaches the video server of claim 35. Ofek further teaches wherein the instructions when executed by the one or more processors further cause the one or more processors to perform steps including: receiving a user selection of a selected video from the plurality of videos on the video server (para [0044], [0046] 'User 560 may search for additional media objects to view based on any of various parameters, such as an author of additional media objects, a subject of additional media objects, a time at which additional media objects were captured, and/or a location at which additional media objects were captured'); receiving user inputs indicating selections of sub-frames; and generating the edit map based on the selections of the sub-frames (para [0048], [0048]-[0050], [0054] 'In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555' 'Matched points of interest represent likely mappings between features of a panoramic image and features of an additional media object frame that depict the same scene or physical subject'). Ofek does not teach the video is spherical video, displaying the selected spherical video in a spherical video viewer, or sub frames having a non spherical field of view for each of a plurality of frames of the selected video. However Ritchey teaches spherical video (para [0086] 'composite spherical FOV images are readout'), displaying selected spherical video in a spherical video viewer (para [0121] 'With these room-like systems the entire spherical field of view image that is derived from the camera 1 with adapter 100 records is preferably displayed on wall, ceiling, and floor on which the viewer is standing as a continuous scene'), and selecting subframes having a non spherical field of view for each of a plurality of frames (para [0086]-[0088] 'Similarly, Region-of-Interest (ROI) firmware is embedded into the camera 100 to cause the processing means (firmware and hardware) 1' within the camera to selectively or dynamically readout only portions of the image or images displayed on a frame'). It would have been obvious to a person having ordinary skill in the art to use the spherical video and sub frames of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Regarding claim 38, Ofek in view of Ritchey teaches the video server of claim 37. Ofek further teaches wherein receiving the user selection of the selected spherical video comprises: obtaining user metadata associated with a user, the metadata including at least time and location information (para [0040]-[0041] 'the metadata may include a geotag identifying the geographic location at which the panoramic image was captured' 'metadata may alternatively or additionally indicate other parameters of an additional media object, such as its author, subject, and/or time at which it was captured'); correlating the user metadata to video metadata associated with each of the plurality of videos to a identify a subset of the plurality of videos captured at a time and location corresponding to the user time and location information (para [0046], [0049]-[0050] 'User 560 may search for additional media objects to view based on any of various parameters, such as an author of additional media objects, a subject of additional media objects, a time at which additional media objects were captured, and/or a location at which additional media objects were captured' 'A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555'); providing a representation of the subset of the plurality of videos in a user interface accessible to the user (para [0046], [0054] 'A list of matching additional media objects may then be provided to user 560 in the information panel of user interface 555'); and receiving the user selection from the subset of the plurality of videos (para [0048] 'In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555'). Ofek does not teach the video is spherical video. However Ritchey teaches spherical video (para [0086] 'composite spherical FOV images are readout'). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

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Regarding claim 39, Ofek in view of Ritchey teaches the video server of claim 35. Ofek further teaches wherein the instructions when executed by the one or more processors further cause the one or more processors to perform steps including: correlating user metadata associated with a user to video data metadata associated with the plurality of videos to automatically identify sub-frames relevant to the user(para [0048], [0049]-[0050] User 560 may search for additional media objects to view based on any of various parameters, such as an author of additional media objects, a subject of additional media objects, a time at which additional media objects were captured, and/or a location at which additional media objects were captured. In response to receiving the user request, server 510 may utilize search engine 515 to query the metadata of additional media objects 535 in additional media dataset 530 for the appropriate parameters"); and automatically generating the edit map based on the automatically identified subframes (para [0046], [0048]-[0050], [0054] "In response to user 560 selecting an additional media object from the list, server 510 may produce the appropriate hybrid image data and provide it for display in the viewport of user interface 555" "In the example of Fig. 6, matched points of interest, indicated by arrows 660, provide a likely mapping between additional media object frame 360 and panoramic image portion 315"). Ofek does not teach the videos are spherical videos. However Ritchey teaches spherical videos (para [0066]). It would have been obvious to a person having ordinary skill in the art to use the spherical video of Ritchey in the method of Ofek, because the spherical video of Ritchey allows an entire surrounding scene to be recorded (para [0003]).

Claims 42, 43, 50, 51, 58 and 59 lack an inventive step under PCT Article 33(3) as being obvious over Ritchey in view of US 2011/0211040 A1 to Lindemann et al. (hereinafter Lindemann).

Regarding claim 42, Ritchey teaches the method of claim 41. Ritchey teaches spherical video (para [0011], "record spherical FOV content using their conventional video camera"). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing a facial recognition algorithm on the first video to identify spatial locations of one or more faces depicted in the first video. However Lindemann teaches processing a video to identify target features comprises performing a facial recognition algorithm on the video to identify spatial locations of one or more faces depicted in the first video (para [0091]-[0093] "Automatic blurring of faces is achieved by a face recognition algorithm. Using image tracking software known in the art, each individual face is identified and tracked throughout any sequence of images"). It would have been obvious to a person having ordinary skill in the art to use the facial recognition of Lindemann in the method of Ritchey, so that the facial recognition algorithm would have been used in the spherical video, because the disclosure of Lindemann ensures avoiding infringement on privacy rights of subjects of the images (para [0093]).

Regarding claim 43, Ritchey teaches the method of claim 41. Ritchey teaches spherical video (para [0011], "record spherical FOV content using their conventional video camera"). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing an object recognition algorithm on the first spherical video to identify spatial locations of one or more objects depicted in the first spherical video. However Lindemann teaches performing an object recognition algorithm on the first video to identify locations of the one or more objects depicted in the video (para [0091]-[0093]). It would have been obvious to a person having ordinary skill in the art to use the object recognition of Lindemann in the method of Ritchey, so that the object recognition would have been used in the spherical video, because the disclosure of Lindemann ensures avoiding infringement on privacy rights of subjects of the images (para [0093]).

Regarding claim 50, Ritchey teaches the non-transitory computer-readable storage medium of claim 49. Ritchey teaches spherical video (para [0011], "record spherical FOV content using their conventional video camera"). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing a facial recognition algorithm on the first spherical video to identify spatial locations of one or more faces depicted in the first spherical video. However Lindemann teaches processing a video to identify target features comprises performing a facial recognition algorithm on the video to identify spatial locations of one or more faces depicted in the first video (para [0091]-[0093] "Automatic blurring of faces is achieved by a face recognition algorithm. Using image tracking software known in the art, each individual face is identified and tracked throughout any sequence of images"). It would have been obvious to a person having ordinary skill in the art to use the facial recognition of Lindemann in the method of Ritchey, so that the facial recognition algorithm would have been used in the spherical video, because the disclosure of Lindemann ensures avoiding infringement on privacy rights of subjects of the images (para [0093]).

Regarding claim 51, Ritchey teaches the non-transitory computer-readable storage medium of claim 49. Ritchey teaches spherical video (para [0011], "record spherical FOV content using their conventional video camera"). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing an object recognition algorithm on the first spherical video to identify spatial locations of one or more objects depicted in the first spherical video. However Lindemann teaches performing an object recognition algorithm on the first video to identify locations of the one or more objects depicted in the video (para [0091]-[0093]). It would have been obvious to a person having ordinary skill in the art to use the object recognition of Lindemann in the method of Ritchey, so that the object recognition would have been used in the spherical video, because the disclosure of Lindemann ensures avoiding infringement on privacy rights of subjects of the images (para [0093]).

Regarding claim 58, Ritchey teaches the video server of claim 57. Ritchey teaches spherical video (para [0011], "record spherical FOV content using their conventional video camera"). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing a facial recognition algorithm on the first spherical video to identify spatial locations of one or more faces depicted in the first spherical video. However Lindemann teaches processing a video to identify target features comprises performing a facial recognition algorithm on the video to identify spatial locations of one or more faces depicted in the first video (para [0091]-[0093] "Automatic blurring of faces is achieved by a face recognition algorithm. Using image tracking software known in the art, each individual face is identified and tracked throughout any sequence of images"). It would have been obvious to a person having ordinary skill in the art to use the facial recognition of Lindemann in the video server of Ritchey, so that the facial recognition algorithm would have been used in the spherical video, because the disclosure of Lindemann ensures avoiding infringement on privacy rights of subjects of the images (para [0093]).

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Box No. V.2. Citations and Explanations:
Regarding claim 59, Ritchey teaches the video server of claim 57. Ritchey teaches spherical video (para [0011], 'record spherical FOV content using their conventional video camera'). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing an object recognition algorithm on the first spherical video to identify spatial locations of one or more objects depicted in the first spherical video. However Lindemann teaches performing an object recognition algorithm on the first video to identify locations of the one or more objects depicted in the video (para [0091]-[0093]). It would have been obvious to a person having ordinary skill in the art to use the object recognition of Lindemann in the video server of Ritchey, so that the object recognition would have been used in the spherical video, because the disclosure of Lindemann ensures avoiding infringement on privacy rights of subjects of the images (para [0093]).

Claims 44-46 and 52-54 lack an inventive step under PCT Article 33(3) as being obvious over Ritchey in view of US 2009/0274339 A9 to Cohen et al. (hereinafter Cohen).

Regarding claim 44, Ritchey teaches the method of claim 41. Ritchey further teaches spherical video (para [0011], 'record spherical FOV content using their conventional video camera'). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing a motion analysis algorithm on the first spherical video to identify spatial locations of an object depicted in the first video meeting predefined motion parameters. However Cohen teaches performing a motion analysis algorithm on video to identify spatial locations of an object meeting predefined motion parameters (para [0006], [0062], 'This enables the system to recognize such motions as the various human motion gaits (if the links are legs), the throwing of an object (if the links are arms), or any other type of motion and orientation' 'Within the field of view of one or more standard video cameras'). It would have been obvious to a person having ordinary skill in the art to use the motion analysis of Cohen in the method of Ritchey, so that identifying the target feature would have comprised performing motion analysis on the first spherical video, because the disclosure of Cohen can make critical surveillance observations of locations without personnel, or which are too dangerous (para [0220]).

Regarding claim 45, Ritchey teaches the method of claim 41. Ritchey further teaches spherical video (para [0011], 'record spherical FOV content using their conventional video camera'). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing a motion analysis algorithm on the first spherical video to identify spatial locations of an object depicted in the first video meeting predefined motion parameters. However Cohen teaches performing a motion analysis algorithm on video to identify spatial locations of an object meeting predefined motion parameters (para [0006], [0062], 'This enables the system to recognize such motions as the various human motion gaits (if the links are legs), the throwing of an object (if the links are arms), or any other type of motion and orientation' 'Within the field of view of one or more standard video cameras'). It would have been obvious to a person having ordinary skill in the art to use the motion analysis of Cohen in the method of Ritchey, so that identifying the target feature would have comprised performing motion analysis on the first spherical video, because the disclosure of Cohen can make critical surveillance observations of locations without personnel, or which are too dangerous (para [0220]).

Regarding claim 46, Ritchey teaches the method of claim 41. Ritchey further teaches spherical video (para [0011], 'record spherical FOV content using their conventional video camera'). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing a gesture recognition algorithm on the first spherical video to identify spatial locations of an individual performing a particular gesture depicted in the first spherical video. However Cohen teaches performing a gesture recognition algorithm on video to identify spatial locations of an individual performing a particular gesture depicted in the video (para [0062], [0177] 'Within the field of view of one or more standard video cameras' 'The gesture recognition algorithms are located in the Identification Module. This module uses the position and velocity information provided by the sensor module to identify the gesture'). It would have been obvious to a person having ordinary skill in the art to use the gesture recognition of Cohen in the method of Ritchey, so that the method would have comprised performing a gesture recognition algorithm on the first spherical video, because the disclosure of Cohen can make critical surveillance observations of locations without personnel, or which are too dangerous (para [0220]).

Regarding claim 52, Ritchey teaches the non-transitory computer-readable storage medium of claim 49. Ritchey further teaches spherical video (para [0011], 'record spherical FOV content using their conventional video camera'). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing a motion analysis algorithm on the first spherical video to identify spatial locations of an object depicted in the first spherical video meeting predefined motion parameters. However Cohen teaches performing a motion analysis algorithm on video to identify spatial locations of an object meeting predefined motion parameters (para [0006], [0062], 'This enables the system to recognize such motions as the various human motion gaits (if the links are legs), the throwing of an object (if the links are arms), or any other type of motion and orientation' 'Within the field of view of one or more standard video cameras'). It would have been obvious to a person having ordinary skill in the art to use the motion analysis of Cohen in the method of Ritchey, so that identifying the target feature would have comprised performing motion analysis on the first spherical video, because the disclosure of Cohen can make critical surveillance observations of locations without personnel, or which are too dangerous (para [0220]).

Regarding claim 53, Ritchey teaches the non-transitory computer-readable storage medium of claim 49. Ritchey further teaches spherical video (para [0011], 'record spherical FOV content using their conventional video camera'). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing a motion analysis algorithm on the first spherical video to identify spatial locations of an object depicted in the first spherical video meeting predefined motion parameters. However Cohen teaches performing a motion analysis algorithm on video to identify spatial locations of an object meeting predefined motion parameters (para [0006], [0062], 'This enables the system to recognize such motions as the various human motion gaits (if the links are legs), the throwing of an object (if the links are arms), or any other type of motion and orientation' 'Within the field of view of one or more standard video cameras'). It would have been obvious to a person having ordinary skill in the art to use the motion analysis of Cohen in the method of Ritchey, so that identifying the target feature would have comprised performing motion analysis on the first spherical video, because the disclosure of Cohen can make critical surveillance observations of locations without personnel, or which are too dangerous (para [0220]).

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/16538

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
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Box No. V.2. Citations and Explanations:
Regarding claim 54, Ritchey teaches the non-transitory computer-readable storage medium of claim 49. Ritchey further teaches spherical video (para [0011], 'record spherical FOV content using their conventional video camera'). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing a gesture recognition algorithm on the first spherical video to identify spatial locations of an individual performing a particular gesture depicted in the first spherical video. However Cohen teaches performing a gesture recognition algorithm on video to identify spatial locations of an individual performing a particular gesture depicted in the video (para [0062], [0177] 'Within the field of view of one or more standard video cameras.' 'The gesture recognition algorithms are located in the Identification Module. This module uses the position and velocity information provided by the sensor module to identify the gesture'). It would have been obvious to a person having ordinary skill in the art to use the gesture recognition of Cohen in the method of Ritchey, so that the method would have comprised performing a gesture recognition algorithm on the first spherical video, because the disclosure of Cohen can make critical surveillance observations of locations without personnel, or which are too dangerous (para [0220]).

Claims 47, 55 and 60 lack an inventive step under PCT Article 33(3) as being obvious over Ritchey in view of US 6,593,956 B1 to Potts et al. (hereinafter Potts).

Regarding claim 47, Ritchey teaches the method of claim 41. Ritchey teaches spherical video (para [0011], 'record spherical FOV content using their conventional video camera'). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing an audio analysis on an audio track of first spherical video to identify a direction between an audio source and a camera capturing the first spherical audio; and identifying a spatial location of the audio source in the first spherical video meeting based on the direction between the audio source and the camera. However Potts teaches performing an audio analysis to identify a direction between an audio source and a camera (col 6, ln 25-43 'Generally, a location of the speaker relative to camera 14 can be characterized by two values: a direction of the speaker relative to camera 14, which may be expressed by a vector, and a distance of the speaker from camera 14'); and identifying a spatial location of the audio source in video based on the direction between the audio source and the camera (col 6, ln 25-43 'Video conferencing system 10 uses the audio signals and video images to determine a location of the speaker(s) relative to a reference point, for example, camera 14 or the center of rotation of camera positioning device 16. Based on that direction, video conferencing system 10 can then pan, tilt, or zoom in or out camera 14 to obtain a better image of the speaker(s).'). It would have been obvious to a person having ordinary skill in the art to use the audio analysis of Potts in the method of Ritchey, so that identifying the target feature would have comprised performing an audio analysis on an audio track of first spherical video, because the disclosure of Potts allows better images of audio sources (col 6, ln 25-43)

Regarding claim 55, Ritchey teaches the non-transitory computer-readable storage medium of claim 49. Ritchey teaches spherical video (para [0011], 'record spherical FOV content using their conventional video camera'). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing an audio analysis on an audio track of first spherical video to identify a direction between an audio source and a camera capturing the first spherical audio; and identifying a spatial location of the audio source in the first spherical video meeting based on the direction between the audio source and the camera. However Potts teaches performing an audio analysis to identify a direction between an audio source and a camera (col 6, ln 25-43 'Generally, a location of the speaker relative to camera 14 can be characterized by two values: a direction of the speaker relative to camera 14, which may be expressed by a vector, and a distance of the speaker from camera 14'), and identifying a spatial location of the audio source in video based on the direction between the audio source and the camera (col 6, ln 25-43 'Video conferencing system 10 uses the audio signals and video images to determine a location of the speaker(s) relative to a reference point, for example, camera 14 or the center of rotation of camera positioning device 16. Based on that direction, video conferencing system 10 can then pan, tilt, or zoom in or out camera 14 to obtain a better image of the speaker(s).'). It would have been obvious to a person having ordinary skill in the art to use the audio analysis of Potts in the method of Ritchey, so that identifying the target feature would have comprised performing an audio analysis on an audio track of first spherical video, because the disclosure of Potts allows better images of audio sources (col 6, ln 25-43)

Regarding claim 60, Ritchey teaches the video server of claim 57. Ritchey teaches spherical video (para [0011], 'record spherical FOV content using their conventional video camera'). Ritchey does not teach wherein processing the first spherical video to identify the target feature comprises: performing an audio analysis on an audio track of first spherical video to identify a direction between an audio source and a camera capturing the first spherical audio; and identifying a spatial location of the audio source in the first spherical video meeting based on the direction between the audio source and the camera. However Potts teaches performing an audio analysis to identify a direction between an audio source and a camera (col 6, ln 25-43 'Generally, a location of the speaker relative to camera 14 can be characterized by two values: a direction of the speaker relative to camera 14, which may be expressed by a vector, and a distance of the speaker from camera 14'), and identifying a spatial location of the audio source in video based on the direction between the audio source and the camera (col 6, ln 25-43 'Video conferencing system 10 uses the audio signals and video images to determine a location of the speaker(s) relative to a reference point, for example, camera 14 or the center of rotation of camera positioning device 16. Based on that direction, video conferencing system 10 can then pan, tilt, or zoom in or out camera 14 to obtain a better image of the speaker(s).'). It would have been obvious to a person having ordinary skill in the art to use the audio analysis of Potts in the video server of Ritchey, so that identifying the target feature would have comprised performing an audio analysis on an audio track of first spherical video, because the disclosure of Potts allows better images of audio sources (col 6, ln 25-43)

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
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Box No. V.2. Citations and Explanations:

Claims 4, 11 and 18 lack an inventive step under PCT Article 33(3) as being obvious over Ofek in view of Ritchey and further in view of Potts.

Regarding claim 4, Ofek in view of Ritchey teaches the method of claim 1. Ofek further teaches selecting a sub frame based on first video metadata and user metadata (para [0048], [0051] 'Based on the geographic location identified by the metadata of additional media object image frame 360, panoramic image 310 (including image portion 315) is identified' 'In addition, the matched points of interest may indicate with measurable precision the relative position at which additional media object frame 360 should optimally be embedded within panoramic image portion 315'). Ofek in view of Ritchey does not teach wherein selecting the sub-frame comprises: determining for a given frame of the first spherical video, a direction of the target relative to the first camera based on the first video metadata and the user metadata; and selecting the sub-frame based on the direction. However Potts teaches determining a direction of a target relative to a camera based on metadata (col 6, ln 25-43. Potts teaches determining a direction using a camera position). It would have been obvious to a person having ordinary skill in the art to use the direction of Potts in the method of Ofek in view of Ritchey, so that the direction would have been determined using video metadata and user metadata, and selecting a sub frame based on the direction, because the disclosure of Potts allows better images of audio sources (col 6, ln 25-43).

Regarding claim 11, Ofek in view of Ritchey teaches the non-transitory computer-readable storage medium of claim 8. Ofek further teaches selecting a sub frame based on first video metadata and user metadata (para [0048], [0051] 'Based on the geographic location identified by the metadata of additional media object image frame 360, panoramic image 310 (including image portion 315) is identified' 'In addition, the matched points of interest may indicate with measurable precision the relative position at which additional media object frame 360 should optimally be embedded within panoramic image portion 315'). Ofek in view of Ritchey does not teach wherein selecting the sub-frame comprises: determining for a given frame of the first spherical video, a direction of the target relative to the first camera based on the first video metadata and the user metadata; and selecting the sub-frame based on the direction. However Potts teaches determining a direction of a target relative to a camera based on metadata (col 6, ln 25-43. Potts teaches determining a direction using a camera position). It would have been obvious to a person having ordinary skill in the art to use the direction of Potts in the method of Ofek in view of Ritchey, so that the direction would have been determined using video metadata and user metadata, and selecting a sub frame based on the direction, because the disclosure of Potts allows better images of audio sources (col 6, ln 25-43)

Regarding claim 18, Ofek in view of Ritchey teaches the video server of claim 15. Ofek further teaches selecting a sub frame based on first video metadata and user metadata (para [0048], [0051] 'Based on the geographic location identified by the metadata of additional media object image frame 360, panoramic image 310 (including image portion 315) is identified' 'In addition, the matched points of interest may indicate with measurable precision the relative position at which additional media object frame 360 should optimally be embedded within panoramic image portion 315'). Ofek in view of Ritchey does not teach wherein selecting the sub-frame comprises: determining for a given frame of the first spherical video, a direction of the target relative to the first camera based on the first video metadata and the user metadata; and selecting the sub-frame based on the direction. However Potts teaches determining a direction of a target relative to a camera based on metadata (col 6, ln 25-43. Potts teaches determining a direction using a camera position). It would have been obvious to a person having ordinary skill in the art to use the direction of Potts in the method of Ofek in view of Ritchey, so that the direction would have been determined using video metadata and user metadata, and selecting a sub frame based on the direction, because the disclosure of Potts allows better images of audio sources (col 6, ln 25-43)

Claims 26, 33 and 40 lack an inventive step under PCT Article 33(3) as being obvious over Ofek in view of Ritchey and further in view of US 2013/0208134 A1 (Hamalainen).

Regarding claim 26, Ofek in view of Ritchey teaches the method of claim 21. Ofek further teaches performing video processing specified by the edit map (para [0048], [0049]-[0050] 'Matched points of interest represent likely mappings between features of a panoramic image and features of an additional media object frame that depict the same scene or physical subject. In the example of Fig. 6, matched points of interest, indicated by arrows 600, provide a likely mapping between additional media object frame 360 and panoramic image portion 315 that may be used to properly align the two depictions of building 300'). Ofek in view of Ritchey does not teach the one or more video processing functions including at least one of: an image stabilization function and a rolling shutter artifact reduction. However Hamalainen teaches performing an image stabilization function (para [0004]). It would have been obvious to a person having ordinary skill in the art to use the image stabilization of Hamalainen in the method of Ofek in view of Ritchey, because the image stabilization of Hamalainen can account for extreme camera movement (para [0032]).

Regarding claim 33, Ofek in view of Ritchey teaches the non-transitory computer-readable storage medium of claim 28. Ofek further teaches wherein generating the output video comprises: performing one or more video processing functions specified by the edit map (para [0048], [0049]-[0050] 'Matched points of interest represent likely mappings between features of a panoramic image and features of an additional media object frame that depict the same scene or physical subject. In the example of Fig. 6, matched points of interest, indicated by arrows 600, provide a likely mapping between additional media object frame 360 and panoramic image portion 315 that may be used to properly align the two depictions of building 300'). Ofek in view of Ritchey does not teach the one or more video processing functions including at least one of: an image stabilization function and a rolling shutter artifact reduction. However Hamalainen teaches performing an image stabilization function (para [0004]). It would have been obvious to a person having ordinary skill in the art to use the image stabilization of Hamalainen in the method of Ofek in view of Ritchey, because the image stabilization of Hamalainen can account for extreme camera movement (para [0032]).

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Supplemental Box

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Box No. V.2. Citations and Explanations:
Regarding claim 40, Ofek in view of Ritchey teaches the video server of claim 35. Ofek further teaches wherein generating the output video comprises: performing one or more video processing functions specified by the edit map (para [0048], [0049]-[0050] 'Matched points of interest represent likely mappings between features of a panoramic image and features of an additional media object frame that depict the same scene or physical subject. In the example of Fig. 6, matched points of interest, indicated by arrows 600, provide a likely mapping between additional media object frame 360 and panoramic image portion 315 that may be used to properly align the two depictions of building 300'). Ofek in view of Ritchey does not teach the one or more video processing functions including at least one of: an image stabilization function and a rolling shutter artifact reduction. However Hamalainen teaches performing an image stabilization function (para [0004]). It would have been obvious to a person having ordinary skill in the art to use the image stabilization of Hamalainen in the method of Ofek in view of Ritchey, because the image stabilization of Hamalainen can account for extreme camera movement (para [0032]).

Claims 3, 8, 10, 13, 17 and 20 meet the criteria of PCT Articles 33(2)-(3)

The prior art for claims 3, 10 and 17 is exemplified by Ofek, Ritchey and US 2012/0127169 A1 Barcay et al. (hereinafter Barcay).

Regarding claim 3,
Ofek in view of Ritchey teaches the method of claim 1, but does not teach wherein determining the first matching portion of the first spherical video comprises: determining for each of a sequence of corresponding time points, distances between the target and the first camera based on the first video metadata and the user metadata; determining a time range over which the distances are less than a distance threshold; and determining the first matching portion based on the time range responsive to the time range exceeding a predefined time threshold.

Barcay teaches determining when distances are less than a distance threshold (para [0081])

There is no prior art on record that discloses the claimed subject matter, specifically determining for each of a sequence of corresponding time points, distances between the target and the first camera based on the first video metadata and the user metadata; determining a time range over which the distances are less than a distance threshold, and determining the first matching portion based on the time range responsive to the time range exceeding a predefined time threshold.

Regarding claim 10,
Ofek in view of Ritchey teaches the non-transitory computer-readable storage medium of claim 8, but does not teach wherein determining the first matching portion of the first spherical video comprises: determining for each of a sequence of corresponding time points, distances between the target and the first camera based on the first video metadata and the user metadata; determining a time range over which the distances are less than a distance threshold; and determining the first matching portion based on the time range responsive to the time range exceeding a predefined time threshold.

Barcay teaches determining when distances are less than a distance threshold (para [0081])

There is no prior art on record that discloses the claimed subject matter, specifically determining for each of a sequence of corresponding time points, distances between the target and the first camera based on the first video metadata and the user metadata; determining a time range over which the distances are less than a distance threshold, and determining the first matching portion based on the time range responsive to the time range exceeding a predefined time threshold.

Regarding claim 17,
Ofek in view of Ritchey teaches the video server of claim 15, but does not teach wherein determining the first matching portion of the first spherical video comprises: determining for each of a sequence of corresponding time points, distances between the target and the first camera based on the first video metadata and the user metadata;
determining a time range over which the distances are less than a distance threshold; and determining the first matching portion based on the time range responsive to the time range exceeding a predefined time threshold.

Barcay teaches determining when distances are less than a distance threshold (para [0081]).

There is no prior art on record that discloses the claimed subject matter, specifically determining for each of a sequence of corresponding time points, distances between the target and the first camera based on the first video metadata and the user metadata; determining a time range over which the distances are less than a distance threshold; and determining the first matching portion based on the time range responsive to the time range exceeding a predefined time threshold.

The prior art for claims 8, 13, 20 is exemplified by Ofek, Ritchey and US 2013/0287304 A1 (Kimura).

Regarding claim 8,
Ofek in view of Ritchey teaches a method of claim 1, but does not teach wherein combining the first portion of the output video with the second portion of the output video comprises: identifying a time overlap between the first portion of the output video and the second portion of the output video, and selecting between the first portion of the output video and the second portion of the output video during the time overlap based on proximity between the first camera and the target and between the second camera and the target.

Kimura teaches identifying a time overlap between a first portion of video and a second portion of video (para [0066], [0084]) and selecting between the first portion of the output video and the second portion of output video during the time overlap (para [0066]-[0067]).

There is no prior art on record that discloses the claimed subject matter, specifically selecting between the first and second portions of the output video based on proximity between the first camera and target and between the second camera and the target.
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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
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Box No. V.2. Citations and Explanations:
Regarding claim 13,
Ofek in view of Ritchey teaches the non-transitory computer-readable storage medium of claim 8, but does not teach wherein combining the first portion of the output video with the second portion of the output video comprises: identifying a time overlap between the first portion of the output video and the second portion of the output video; and selecting between the first portion of the output video and the second portion of the output video during the time overlap based on proximity between the first camera and the target and between the second camera and the target.

Kimura teaches identifying a time overlap between a first portion of video and a second portion of video (para [0066], [0084]) and selecting between the first portion of the output video and the second portion of output video during the time overlap (para [0086]-[0087]).

There is no prior art on record that discloses the claimed subject matter, specifically selecting between the first and second portions of the output video based on proximity between the first camera and target and between the second camera and the target.

Regarding claim 20,
Ofek in view of Ritchey teaches the video server of claim 15, but does not teach wherein combining the first portion of the output video with the second portion of the output video comprises: identifying a time overlap between the first portion of the output video and the second portion of the output video; and selecting between the first portion of the output video and the second portion of the output video during the time overlap based on proximity between the first camera and the target and between the second camera and the target.

Kimura teaches identifying a time overlap between a first portion of video and a second portion of video (para [0066], [0084]) and selecting between the first portion of the output video and the second portion of output video during the time overlap (para [0086]-[0087]).

There is no prior art on record that discloses the claimed subject matter, specifically selecting between the first and second portions of the output video based on proximity between the first camera and target and between the second camera and the target.

Claims 1-66 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

SEARCH HISTORY

Application Number	PCT/US 15/18538
Search Conducted By	EU
Search Approved By	ADS

US/IPC Classifications Searched	IPC(8): H04N 13/04 (2015.01) CPC: G06T 2207/10016; G06T 7/0022; G06T 3/0062; G06T 3/0043; H04N 5/2259
Date Conducted	12 May 2015 (12.05.2015)

Documentation Searched	IPC(8): H04N 13/04 (2015.01) CPC: G06T 2207/10016; G06T 7/0022; G06T 3/0062; G06T 3/0043; H04N 5/2259 USPC: 348/211.9
Search Terms Used	Spherical, 360, image, photo, video, panoramic, metadata, time, timestamp, location, position, coordinates, crop, zoom, subframe, portion, edit, view, frame, stitch, join, distance, match, threshold, find, identify, track, face, person, object, subject, hemispherical, two, second, several, multiple, plurality, audio, analyze, examine, stabilize, camera, sensor, ccd, choose, choice, select, determine, overlay, overlap, proximity, close
Date Conducted	12 May 2015 (12.05.2015)

Electronic Database Searched	Patbase
Files Searched	Full-text: AU BE BR CA CH CN DE DK EP ES FI FR GB IN JP KR SE TH TW US WO Bibliographic: (Europe) AT BAKey BE BG CH CS CY CZ DD DK EE ES FI GE GR HR HU IE IS IT LT LU LV MC MD MT NL NO PL PT RO RS SE SI SK SM TR UA YU (Asia) EA GC HK ID IL IN KZ MN MY PH RU SG SU TH TJ TW UZ VN (North America) CA CR CU DO GT HN MX NI PA SV TT (South America) AR BR CL CO EC PE UY (Australasia) AU NZ (Africa) AP DZ EG KE MA MW OA ZA ZM ZW
Date Conducted	12 May 2015 (12.05.2015)

Search Logic:

1) pa=(gopro) (58)
2) inv=((macmillon timothy) or (adsumilli balineedu chowdary) or (campbell scott patrick)) (43)
3) inv=(newman david) (197)
4) 3 and ft=(imag* or video%) (77)
5) ic=(H04N13/04) (12631)
6) cpc=(G06T2207/10016 or G06T7/0022 or G06T3/0062 or G06T3/0043 or H04N5/2259)

(5580)
7) uc=(348/211.9) (155)
8) 5 or 6 or 7 (18287)
9) 8 and ft=((spheric* or 360) w5 (imag* or video% or camera%)) (631)
10) 9 and ft=(metadata w5 (location% or position% or coordinate%)) (7)
11) 9 and sp=(metadata and (location% or position% or coordinate%)) (25)
12) 11 not 10 (18)
13) 8 and ft=(((spheric* or cylindr*) w5 (imag* or video% or camera%)) or (360 w5 panoram*)) (553)
14) 13 and sp=(metadata and (location% or position% or coordinate%)) (13)
15) pn=(WO14162324) (1)
16) ctb 15 or ctf 15 (3)
17) pn=(EP2685707) (1)
18) ctb 17 or ctf 17 (10)
19) 13 and ft=((data% or metadata% or information%) w5 (location% or position% or coordinate%)) (217)
20) 19 and ft=((crop* or zoom* or portion% Or subframe%) w5 (target% or object% or subject%)) (55)
21) 20 not (14 or 11 or 10) (51)
22) pn=(US2011211040) (1)
23) ctb 22 or ctf 22 (55)
24) 19 and ft=(edit* w5 (view% or frame% or imag* or video%)) (29)
25) 24 not (20 or 14 or 11 or 10) (15)
26) 13 and ft=((edit* or crop* or zoom% or sub) w5 (view% or frame% or imag* or video%)) (183)
27) 26 and ft=((imag* or view* or pictur* or video%) w5 stitch*) (42)
28) 27 not (24 or 20 or 14 or 11 or 10) (21)
29) pn=(US2010045773) (1)
30) ctb 29 or ctf 29 (18)
31) 13 and sp=(distance% and match* and threshold%) (13)
32) 13 and ft=(hemispher* w5 (view% or image% or picture%)) (56)
33) 32 not (27 or 24 or 20 or 14 or 11 or 10) (39)
34) 13 and ft=((find* or identif* or track*) w5 (person% or face% or object% or target%)) (120)
35) 34 and ft=((edit* or crop* or zoom% or sub) w5 (view% or frame% or imag* or video%)) (66)
36) 35 not (32 or 27 or 24 or 20 or 14 or 11 or 10) (23)
37) ft=(((spheric* or cylindr*) w5 (imag* or video% or camera%)) or (360 w5 (panoram* or (degree% and view%)))) (29713)
38) 37 and sp=(metadata and (location% or position% or coordinate%)) (243)
39) 38 and sp=(metadata and (time% or timestamp%)) (147)
40) 39 and ft=((edit* or crop* or zoom% or sub) w5 (view% or frame% or imag* or video%)) (78)
41) 40 not (32 or 27 or 24 or 20 or 14 or 11 or 10) (69)
42) pn=(US2004/125121) (1)
43) ctb 42 or ctf 42 (146)
44) 37 and ft=(hemispher* w5 (view% or image% or picture%)) (444)
45) 44 and ft=((edit* or crop* or zoom% or sub) w5 (view% or frame% or imag* or video%)) (128)
46) 45 and ft=((find* or identif* or track*) w5 (person% or face% or object% or target%)) (56)
47) 46 not (40 or 32 or 27 or 24 or 20 or 14 or 11 or 10) (43)
48) 37 and ft=((data or informat*) w7 (location% or position% or coordinate%)) (5150)
49) 48 and ft=((data or informat*) w7 (time% or timestamp%)) (2514)
50) 49 and ft=((edit* or crop* or zoom% or sub) w5 (view% or frame% or imag* or video%)) (783)
51) 50 and ft=((find* or identif* or track*) w5 (person% or face% or object% or target%)) (423)
52) 51 and ft=((user% or operator% or person) w5 (input* or choos* or track* or data%)) (343)

53) 52 and ft=((output% or display%) w5 ((imag* or video% or photo* or view% or frame%) and (edit* or crop* or zoom*))) (23)
54) 51 and ft=((two or second% or several or plural* or multipl*) w5 (camera% or imag* or sensor%)) (410)
55) 54 and ft=((imag* or video% or view% or frame%) w5 (path% or sequenc*)) (274)
56) 55 and ft=((imag* or video% or view% or frame%) w5 (stitch*)) (55)
57) 56 not (46 or 40 or 32 or 27 or 24 or 20 or 14) (32)
58) 50 and ft=((find* or identif* or track*) w5 (gesture%)) (30)
59) 58 not (46 or 40 or 32 or 27 or 24 or 20 or 14) (16)
60) 50 and ft=((audio% or sound%) w5 (analy* or examin*)) (37)
61) 60 and ft=((audio% or sound%) w5 (locat* or position* or coordinate%)) (29)
62) pn=(US2011173565) (1)
63) ctb 62 or ctf 62 (45)
64) 13 and ft=((imag* or video% or photo*) w5 ((process* or edit*) and (stabili*))) (5)
65) 37 and ft=((imag* or video% or photo*) w5 ((processing or processor%) and (stabili*))) (25)
66) 37 and ft=(distance% w5 ((object% or target% or face%) and (camera% or sensor% or ccd% or imager%))) (343)
67) 66 and ft=(distance% w5 threshold%) (18)
68) 66 and ft=(time w5 (range% or elapse% or lapse% or length%)) (114)
69) 68 and ft=(threshold%) (83)
70) 37 and ft=((imag* or photo* or picture% or video%) w5 (overla* and time%)) (91)
71) 70 and ft=((choos* or choic* or determin* or select*) w5 (close* or distanc* or proximit*)) (37)
72) ft=((imag* or photo* or picture% or video%) w5 (stitch* or join*)) (46044)
73) 72 and ft=((imag* or photo* or picture% or video%) w5 ((overlap* or overlay*) and time%)) (182)
74) 73 and ft=((choos* or choic* or determin* or select*) w5 (close* or proximit*)) (26)
75) 74 not 71 (22)
76) 37 and ft=((calculat* or comput* or determin* or identif*) w5 direction*) (2578)
77) 76 and ft=((calculat* or comput* or determin* or identif*) w5 (direction* and (target% or object% or source%))) (155)
78) 77 and sp=((calculat* or comput* or determin* or identif*) and (direction*) and (data% or metadata% or information%)) (122)
79) 78 and ft=(metadata or meta data) (15)
80) 78 and ft=((audio% or sound%) w5 direction%) (19)
81) 80 not 79 (14)

Electronic Database Searched	Google Patents
Files Searched	
Date Conducted	12 May 2015 (12.05.2015)

Search Logic:

spherical (video OR photo OR image) (computer OR server) (object OR person) (track OR match OR identify)
About 486,000 results (0.44 seconds)

spherical (video OR photo OR image) (computer OR server) (object OR person) (track OR match OR identify) (Crop OR edit OR process)
About 372,000 results (0.46 seconds)

spherical (video OR photo OR image) (computer OR server) (object OR person) (track OR match OR

identify) (Crop OR edit OR process) (output OR display)
About 361,000 results (0.48 seconds)

spherical (video OR photo OR image) (computer OR server) (object OR person) (track OR match OR identify) hemispherical
About 58,700 results (0.56 seconds)

(images OR pictures OR video) (target OR object OR subject) (track OR find OR identify) threshold distance time
About 5,210,000 results (0.45 seconds)

video distance between (object OR subject) camera threshold match time
About 2,820,000 results (0.43 seconds)

(images OR pictures OR video) (target OR object OR subject) (track OR find OR identify) threshold distance (camera OR imager OR sensor) time (range OR elapsed OR length)
About 3,530,000 results (0.70 seconds)

(video OR photo OR image) (overlap OR overlay) (choose OR determine) (proximity OR closeness)
About 1,330,000 results (0.35 seconds)

(video OR photo OR image) (stitch OR join) (overlap OR overlay) (choose OR determine) (proximity OR closeness)
About 619,000 results (0.43 seconds)

(video OR photo OR image) (object OR person OR source) (track OR match OR identify) direction
About 6,130,000 results (0.44 seconds)

(video OR photo OR image) (object OR person OR source) (track OR match OR identify) direction (edit OR crop OR sub frame OR portion)
About 2,130,000 results (0.43 seconds)

Electronic Database Searched	Google Scholar
Files Searched	All files excluding patents
Date Conducted	12 May 2015 (12.05.2015)

Search Logic:

spherical (video OR photo OR image) (computer OR server) (object OR person) (track OR match OR identify) (Crop OR edit OR process) About 93,900 results

hemispherical (video OR photo OR image) (computer OR server) (object OR person) (track OR match OR identify) (Crop OR edit OR process) About 10,100 results

spherical (video OR photo OR image) (computer OR server) (object OR person) (track OR match OR identify) (Crop OR edit OR process) (sequence OR path) (output OR display) About 78,000 results

(images OR pictures OR video) (target OR object OR subject) (track OR find OR identify) threshold distance time About 575,000 results
(images OR pictures OR video) (target OR object OR subject) (track OR find OR identify) threshold distance (camera OR imager OR sensor) time (range OR elapsed OR length) About 276,000 results

(video OR photo OR image) (stitch OR join) (overlap OR overlay) (choose OR determine) (proximity OR closeness) About 47,500 results

(video OR photo OR image) (object OR person OR source) (track OR match OR identify) direction (edit OR crop OR sub frame OR portion) metadata

Supplemental Search (SAO-ADS):

Electronic Database Searched	PatBase
Files Searched	Full-text: AU BE BR CA CH CN DE DK EP ES FI FR GB IN JP KR SE TH TW US WO Bibliographic: (Europe) AT BA BE BG CH CS CY CZ DD DK EE ES FI GE GR HR HU IE IS IT LT LU LV MC MD MT NL NO PL PT RO RS SE SI SK SM TR UA YU (Asia) EA GC HK ID IL IN KZ MN MY PH RU SG SU TH TJ TW UZ VN (North America) CA CR CU DO GT HN MX NI PA SV TT (South America) AR BR CL CO EC PE UY (Australasia) AU NZ (Africa) AP DZ EG KE MA MW OA ZA ZM ZW
Date Conducted	14 May 2015 (14.05.2015)

Search Logic:

1) cpc=(G06T2207/10016 OR G06T7/0022 OR G06T3/0062 OR G06T3/0043 OR H04N5/2259) (5610)
2) 1 AND spherical (360)
3) 2 AND (time W2 stamp*) (23)
4) 3 AND (sub W2 fram*) (2)
5) 3 AND traget (1)
6) 3 AND region* (17)
7) spherical W2 (imag* OR video*) (2412)
8) 7 AND (time W2 stamp*) (29)
9) 8 AND (sub W2 fram*) (1)
10) 4 OR 5 OR 6 OR 8 (44)

Electronic Database Searched	PubWest
Files Searched	USPT,PGPB,EPAB,JPAB
Date Conducted	14 May 2015 (14.05.2015)

Search Logic:

DB=PGPB,USPT,EPAB,JPAB; PLUR=YES; OP=OR
Date L6 L4 OR L2 17 L6 L6 L6
Date L5 L4 OR L2 17 L5 L5 L5
Date L4 L3 AND (time near2 point) 3 L4 L4 L4
Date L3 L1 AND (output near2 video) 33 L3 L3 L3
Date L2 L1 AND (time near2 stamp) 14 L2 L2 L2
Date L1 spherical near2 video 169 L1 L1 L1

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:
Kline, Adam D
GoPro Inc.
C/o Young Basile
3001 W. Big Beaver, Suite 624
Troy MI 48084
ETATS-UNIS D'AMERIQUE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference GPRO2100EPCT	Date of mailing *(day/month/year)* 1 August 2017 (01-08-2017) **FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US2017/034422	International filing date *(day/month/year)* 25 May 2017 (25-05-2017)
Applicant GOPRO, INC	

1. [X] The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the International Search Report.

   How? Directly to the International Bureau of WIPO, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Fascimile No.: (41-22) 338.82.70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 - 9.011.

2. [ ] The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. [ ] **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   [ ] the protest together with the decision thereon has been transmitted to the International Bureau together with any applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

   [ ] no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

   Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

   Within **19 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the International Searching Authority	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040 Fax: (+31-70) 340-3016	SCHALINATUS, Dana Tel: +49 (0)89 2399-8242

Form PCT/ISA/220 (July 2014)

RECD AUG 08 2017

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
GPRO2100EPCT		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US2017/034422	25 May 2017 (25-05-2017)	25 May 2016 (25-05-2016)
Applicant		
GOPRO, INC		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of:
      [X] the international application in the language in which it was filed
      [ ] a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. [ ] This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. [ ] With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. [ ] **Certain claims were found unsearchable** (See Box No. II)

3. [ ] **Unity of invention is lacking** (see Box No III)

4. With regard to the **title,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. 21
      [X] as suggested by the applicant
      [ ] as selected by this Authority, because the applicant failed to suggest a figure
      [ ] as selected by this Authority, because this figure better characterizes the invention
   b. [ ] none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/034422

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N19/56
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/290641 A1 (CRINON REGIS J [US] ET AL) 26 November 2009 (2009-11-26) paragraphs [0004] - [0007], [0017] - [0061]	1-23
Y	US 2013/021483 A1 (BENNETT JAMES [CZ] ET AL) 24 January 2013 (2013-01-24) paragraphs [0009] - [0076]	1-23
Y	US 2010/189179 A1 (GU CHUANG [US] ET AL) 29 July 2010 (2010-07-29) paragraphs [0005] - [0056]	1-23

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 July 2017	01/08/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Sanahuja, Francesc

1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2017/034422

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009290641 A1	26-11-2009	NONE	
US 2013021483 A1	24-01-2013	US 2013021483 A1	24-01-2013
		US 2013021484 A1	24-01-2013
		US 2013021488 A1	24-01-2013
		US 2013021489 A1	24-01-2013
		US 2013021490 A1	24-01-2013
		US 2013021491 A1	24-01-2013
		US 2013021504 A1	24-01-2013
		US 2013021512 A1	24-01-2013
		US 2013022116 A1	24-01-2013
US 2010189179 A1	29-07-2010	CA 2748374 A1	05-08-2010
		CN 102301717 A	28-12-2011
		EP 2382785 A2	02-11-2011
		IL 213567 A	26-02-2015
		JP 5410549 B2	05-02-2014
		JP 2012516645 A	19-07-2012
		KR 20110106423 A	28-09-2011
		US 2010189179 A1	29-07-2010
		WO 2010088031 A2	05-08-2010

Information on Search Strategy - Pilot phase (see OJ 2015, A86)
The type of information contained in this sheet may change during the pilot for improving the usefulness of this new service.

Application Number
PCT/US2017/034422

TITLE: IMAGE SIGNAL PROCESSING-BASED ENCODING HINTS FOR MOTION ESTIMATION

APPLICANT: GOPRO, INC

IPC CLASSIFICATION: H04N19/56

EXAMINER: Sanahuja, Francesc

CONSULTED DATABASES: EPODOC, INET, WPI, DOSYS

CLASSIFICATION SYMBOLS DEFINING EXTENT OF THE SEARCH:

IPC:

CPC: H04N19/436, H04N19/45, H04N19/51/LOW, H04N19/56, H04N19/521

FI/F-TERMS:

KEYWORDS OR OTHER ELEMENTS FEATURING THE INVENTION:
reuse, motion vectors, macroblock, camera, pre-processing, video encoder

EPO FORM P04A42

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2017/034422	25.05.2017	25.05.2016

International Patent Classification (IPC) or both national classification and IPC
INV. H04N19/56

Applicant
GOPRO, INC

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465	see form PCT/ISA/210	Sanahuja, Francesc Telephone No. +49 89 2399-0

Form PCT/ISA/237 (Cover Sheet) (January 2015)

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	2, 5, 11, 12, 18, 19
	No:	Claims	1, 3, 4, 6-10, 13-17, 20-23
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-23
Industrial applicability (IA)	Yes:	Claims	1-23
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

1 **Prior Art**

1.1 Reference is made to the following documents:

D1 US 2009/290641 A1 (CRINON REGIS J [US] ET AL) 26 November 2009 (2009-11-26)

D2 US 2013/021483 A1 (BENNETT JAMES [CZ] ET AL) 24 January 2013 (2013-01-24)

D3 US 2010/189179 A1 (GU CHUANG [US] ET AL) 29 July 2010 (2010-07-29)

2 **Novelty (Art. 33(1) and (2) PCT)**

2.1 The present application does not meet the requirements of Article 33(1) PCT because the subject-matter of claims 1, 3, 4, 6-11, 13-17 and 20-23 is not new within the meaning of Article 33(2) PCT.

2.2 Regarding **claim 1**, document D1 discloses (the references in parentheses applying to this document):

A non-transitory computer-readable storage medium, comprising executable instructions that, when executed by a processor, facilitate performance of operations, comprising:

- obtaining, by an image signal processor, from an image sensor, an input image signal (par. [0006], "[...] Video frames are captured by the camera which also computes a motion vector associated with a block in the frame [...]"; par. [0020], [0027]);

- obtaining, by the image signal processor, an input image portion of an input image from the input image signal (par. [0006], "[...] Video frames are captured by the camera which also computes a motion vector associated with a block in the frame [...]"; par. [0020], [0021], [0027]);

- generating, by the image signal processor, motion information for the input image portion (par. [0006], "[...] Video frames are

captured by the camera which also computes a motion vector associated with a block in the frame [...]"; par. [0020], [0021], [0027]);

- generating, by the image signal processor, a processed image portion by processing the input image portion based on the motion information (implicit from par. [0004], "[...] Pre-processing can be performed for basic parameters such as luminance and chrominance samples and also for more complex supporting features such as face tracking. However, the pre-processing is limited in that the webcam generates specific motion vectors which are only used in the system to support these functions [...]"; par. [0028]);

- including, by the image signal processor, the processed image portion in processed image data (implicit after pre-processing the captured image in par. [0004], [0028]);

- outputting, by the image signal processor, the processed image data, such that the processed image data is accessible by an encoder (par. [0027], "[...] The data of each frame 404 in the video stream can be sent separately from the motion vector 104 and metadata 202, or can all be multiplexed together. Again, this can be performed for each macroblock [...]"); and

- outputting, by the image signal processor, the motion information as an encoding hint (par. [0027]; Fig. 5), such that the motion information is accessible by the encoder for generating an encoded output bitstream by:

  - obtaining source image data for a frame, the source image data including the processed image data (implicit from par. [0004], [0029]; Fig. 5);

  - obtaining the motion information (par. [0029], "[...] the compression engine 108 further comprises a motion estimation component 504 for modifying the motion vector 104 according to the metadata 202 to produce the modified motion vector 302 [...]");

- obtaining a source image portion from the source image data, the source image portion corresponding to the processed image portion (implicit from par. [0004], [0029]; Fig. 5; the coding being based on macrolocks);

- generating a prediction portion for encoding the source image portion based on the motion information (par. [0029], "[...] the compression engine 108 further comprises a motion estimation component 504 for modifying the motion vector 104 according to the metadata 202 to produce the modified motion vector 302 [...]");

- generating encoded image data based on the prediction portion (par. [0029], "[...] The modified motion vector 302 is passed from the motion estimation component 504 to the compression engine 108 to the video bit stream for the frame 404, thereby producing the compressed frame 406 [...]"); and

- including the encoded image data in the encoded output bitstream (implicit in the encoder of par. [0006], [0029]).

These are the technical features of claim 1. The subject-matter of claim 1 is therefore not new (Article 33(1) and (2) PCT).

2.3 The subject-matter of independent **claims 10 and 17**, corresponds in terms of method steps and apparatus features to the non-transitory computer-readable storage medium with instructions of claim 1. The objections raised in respect to this latter claim, therefore, also apply, mutatis mutandis, to independent claims 10 and 17 which are thus not allowable under Article 33(1) PCT for lack of novelty of their subject-matter (Article 33(2) PCT).

2.4 Dependent **claims 3, 4, 6-9, 13-16 and 20-23** do not appear to contain any additional features which, in combination with the features of any claim on which they depend, meet the requirements of the PCT with respect to novelty:

Claim 3: obtaining the input image portion including obtaining a current input block from a current input frame; and generating the motion information including obtaining reference image data and generating a motion vector indicating a displacement between the input image portion

and the reference image data, see D1 (par. [0020], [0021], [0026], [0027]).

Claim 4: buffering at least a portion of the input image signal in an internal buffer of the image signal processor is a necessary step for performing motion estimation and therefore implicit from D1.

Claims 6, 13, 20: transmitting the processed image data to the encoder and omitting storing the processed image data in a shared memory unit; and receiving the processed image data from the image signal processor as the source image data, and omitting reading the processed image data from the shared memory unit, see D1 (Fig. 5).

Claims 7, 14, 21: storing the motion information in a shared memory unit accessible by the encoder, and reading the motion information from the shared memory, see D1 (par. [0033]; Fig 5).

Claims 8, 15, 22: generating the prediction portion for encoding the source image portion based on the motion information, wherein, in response to obtaining the motion information output by the image signal processor, generating the prediction portion for encoding the source image portion based on the motion information omits performing motion estimation, see D1 (par. [0030], [0040]).

Claims 9, 16, 23, : generating the prediction portion by performing motion estimation based on the motion information, see D1 (par. [0029], [0032]).

3 Inventive Step (Art. 33(1) and (3) PCT)

3.1 Dependent **claims 2, 5, 11, 12, 18 and 19** do not appear to contain any additional features which, either alone or in combination with the features of any claim on which they depend, meet the requirements of the PCT with respect to inventive step:

Claims 2, 11, 18: obtaining a first input image signal corresponding to a first input image; and obtaining a second input image signal corresponding to a second input image; obtaining a first input image portion from the first input image signal; and obtaining a second input image portion from the second input image signal; generating the processed image portion by combining the first input image portion and the second input image portion; and modifying the motion information in

accordance with combining the first input image portion and the second input image portion is obvious after common preprocessing strategies such as de-blurring or de-noising hinted by D1 (par. [0004], [0028]).

Claims 5, 12, 19: storing the processed image data in a shared memory unit accessible by the encoder, and reading the source image data from the shared memory is an obvious alternative to the direct transfer of document D1 (Fig. 5).

Re Item VII

1 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in documents D1-D3 is not mentioned in the description, nor are these documents identified therein.

2 Independent claims 1, 10 and 17 are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art being placed in the preamble (Rule 6.3(b)(i) PCT) and the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

3 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Re Item VIII

1 The application does not meet the requirements of Article 6 PCT, because claims 2, 3, 11, 15, 16, 18, 22 and 23 are not clear.

2 The vague wording of claim 2 leaves the person skilled in the art in the dark as to the type of processing to combine first and second image portions. The same applies to the modification of motion information after the said combination.

3 Claim 2 is drafted as further defining the step of obtaining of an input signal. However, this claim also appears to redefine other steps of claim 1 on which it depends. It is therefore unclear which method steps of claim 1 are redefined in claim 2.

4 Corresponding objections apply to claims 11 and 18.

5 The concept of reference image data in claim 3 is unclear because its nature is not defined. The concept of "previously processed image data" as used in the description (par. [0439]) may overcome this objection.

6 Claim 8 defines generating a prediction portion without using motion estimation. Claim 9, when depending on claim 8, defines performing motion estimation based on the motion information. Hence it is unclear whether, when or how motion estimation is performed.

7 Corresponding objections apply to claims 15, 16 and 22, 23.

8 The subject-matter described on paragraphs [0036] - [0431] does not fall within the scope of the claims. This inconsistency between the claims and the description leads to doubt concerning the matter for which protection is sought, thereby rendering the claims unclear, Article 6 PCT.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT		
	Application Number	16/535,940
	Filing Date	08/08/2019
	First Named Inventor	David A. Newman
	Art Unit	2618
Page 1 of 1	**Matter Number**	46DG-026055

GENERAL

Pursuant to 37 C.F.R. 1.97 and 1.98 and to the duty of disclosure set forth in 37 C.F.R. 1.56, the Examiner in charge of the above-identified application is requested to consider and make of record the references listed herewith. A copy of each listed reference, other than U.S. patents/applications and references cited in a parent application, is enclosed.

Although the information submitted herewith may be "material" to the Examiner's consideration of the subject application, this submission is not intended to constitute an admission that such information is "prior art" as to the claimed invention.

In accordance with 37 C.F.R. 1.97(g), the filing of this Information Disclosure Statement shall not be construed to mean that a search has been made.

TIMING

In accordance with 37 CFR 1.97(c), this Information Disclosure Statement is being filed after the period specified in 37 CFR 1.97(b) and before the mailing date of a Final Action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an Action that otherwise closes prosecution in the application.

CERTIFICATION STATEMENT

No certification statement is required. This Information Disclosure Statement is being filed in accordance with 37 CFR 1.97(c) and is accompanied by the fee set forth in 37 CFR 1.17(p).

FEE

The Director is hereby authorized to charge $240 (large entity) to Deposit Account No. 601896. Please reference attorney docket number 46DG-026055 for this transaction.

This Information Disclosure Statement is being filed in accordance with 37 CFR 1.97(c), and is not accompanied by one of the certification statements of 37 CFR 1.97(e). Therefore, this Information Disclosure Statement is subject to the $240 (large entity) fee set forth in 37 CFR 1.17(p).

ADDITIONAL COMMENTS

SIGNATURE

Signature	/ Vadim Polonichko /	**Date**	2019-09-23
Name	Vadim Polonichko	**Registration Number**	62769

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PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: ANTHONY JACOBSON
FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	17 DEC 2015
Applicant's or agent's file reference 26294/PCT	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 15/41624	22 July 2015 (22.07.2015)	23 July 2014 (23.07.2014)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H04N 9/80 (2015.01)
CPC - H04N 21/8549

Applicant GOPRO, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule *43bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1 *bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	05 November 2015 (05.11.2015)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (January 2015)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/41624

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

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Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has, within the applicable time limit:

   ☐ paid additional fees.

   ☐ paid additional fees under protest and, where applicable, the protest fee.

   ☐ paid additional fees under protest but the applicable protest fee was not paid.

   ☒ not paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is

   ☐ complied with.

   ☒ not complied with for the following reasons:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

Group I: Claims 1-42, directed to identifying scenes in captured video for inclusion in a video summary by using metadata associated with a video, identifying events of interest within the video, identifying a best scene in the video, and selecting one or more best scenes for inclusion in a video summary.

Group II: Claims 43-60, directed to generating a video summary using a video summary template by receiving a request for a video summary, selecting a video summary template comprising a plurality of template slots for use in generating the video summary, selecting, for each template slot, an associated candidate video clip, and generating the video summary by replacing each template slot in the video summary template with the associated selected candidate video clip.

Group III: Claims 61-78, directed to identifying scenes in captured video by capturing video, receiving, from a user during the capture of the video, input identifying an event of interest within the captured video, storing an indication of the event of interest in metadata, and identifying a video clip associated with the event of interest based on the metadata.

Group IV: Claims 79-99, directed to identifying activities in videos by accessing videos and video metadata, receiving an identification of an activity associated with a video, identifying metadata patterns associated with the identified activity, and associating a video with the identified activity.

Group V: Claims 100-120, directed to identifying scenes in captured video for inclusion in a video summary by accessing a video including a plurality of frames, identifying a motion value associated with each frame, identifying a differential motion value associated with each frame based on the motion value, determining a score for each frame based on the motion value and differential motion value, selecting one or more frames based on the scores, identifying a corresponding video scene, and selecting one or more scenes for inclusion in a video summary.

The groups of inventions listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical feature of the Group I invention is using metadata associated with a video, identifying events of interest within the video, identifying a best scene in the video, and selecting one or more best scenes for inclusion in a video summary, not required by Group II-V. (See Fig. 4 for example).

The special technical feature of the Group II invention is receiving a request for a video summary, selecting a video summary template comprising a plurality of template slots for use in generating the video summary, selecting, for each template slot, an associated candidate video clip, and generating the video summary by replacing each template slot in the video summary template with the associated selected candidate video clip, not required by Group I or III-V. (See Fig. 5 for example).

-- Continued in Supplemental Box --

4. Consequently, this opinion has been established in respect of the following parts of the international application:

   ☐ all parts.

   ☒ the parts relating to claims Nos. 1-42

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
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Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	6-9, 11, 15, 20, 27-30, 32, 36, 41	YES
	Claims	1-5, 10, 12-14, 16-19, 21-26, 31, 33-35, 37-40, 42	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-42	NO
Industrial applicability (IA)	Claims	1-42	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-5, 10, 12-14, 16-19, 21-26, 31, 33-35, 37-40 and 42 lack novelty under PCT Article 33(2) as being anticipated by US 2010/0104261 A1 to Liu, et al. (hereinafter 'Liu').

As to claims 1 and 22, Liu teaches a method for identifying scenes in captured video for inclusion in a video summary (para [0018]-[0021] - "systems and methods for video summarization"), the method comprising; accessing metadata associated with a video, the accessed metadata representative of capture of the video (para [0018]-[0021], [0024] - "temporal content variation and the spatial image salience"; "shot segmentation analyze the change in content like scene changes, object motion, and camera motion between subsequent video frames"); identifying a plurality of events of interest within the video based on the accessed metadata (para [0018]-[0021] - "the most interesting subshots are determined using both human-emulated salience scores and low-level scene-based changes"; "Shots 104a-h may each depict a distinct event or version of an event. That is, shots 104a-h may each show a distinct camera action"); for each identified event of interest, identifying a best scene in the video associated with the identified event of interest, the identified best scene comprising a threshold amount of video occurring before and after a video frame or portion corresponding to the identified event of interest (para [0018]-[0021], [0038] - "shots are split into subshots. K-means clustering is then applied to all subshots to detect and consolidate similar subshots. Next, content based importance values computed for all frames and are propagated to subshots and computed clusters"; "image salience is computed for the subshots with high importance values and the most salient segments are selected for summarization"); and selecting one or more identified best scenes for inclusion in a video summary (para [0018]-[0021] - "these video segments are sorted based on their time stamps and they are stitched together as the summarized video").

As to claims 2 and 23, Liu further teaches a method further comprising: receiving a request for a video summary from the user; and generating a video summary including a plurality of selected best scenes (para [0002]-[0003], [0018]-[0019], [0040]-[0042], [0045] - "summarization may be used to present the main theme of video sequences to a user"; "human evaluator").

As to claims 3 and 24, Liu further teaches a method wherein generating the video summary comprises concatenating the plurality of selected best scenes (para [0019]).

As to claims 4 and 25, Liu further teaches a method wherein the accessed metadata is generated by a camera during the capture of the video (para [0021], [0024]).

As to claims 5 and 26, Liu further teaches a method wherein the accessed metadata comprises telemetry data describing a motion of the camera during the capture of the video (para [0021], [0024] - "shots 104a-h may each show a distinct camera action (e.g., zoom, pan, etc.)"; "camera motion between subsequent video frames").

As to claims 10 and 31, Liu further teaches a method further comprising: ranking the identified best scenes based on a likelihood that the identified best scene will be of interest to a user; wherein the selected one or more best scenes are selected based on the ranking (para [0018]-[0019], [0038], [0041]-[0042] - "salience of an image is used to identify and score regions of an image that a human would find interesting"; "video summary may be created by allocating budgets for all clusters, allocating budges for subshots within each cluster, and picking the video segment from each subshot. First, all clusters are sorted based on their importance values").

As to claims 12 and 33, Liu teaches a system for identifying scenes in captured video for inclusion in a video summary (para [0018]-[0021]), the system comprising; a non-transitory computer-readable storage medium storing instructions (para [0050]-[0051] - "computer program instructions may be stored in a storage device 804 (e.g., magnetic disk, database, etc.) and loaded into memory 806 when execution of the computer program instructions") configured to, when executed: access metadata associated with a video, the accessed metadata representative of capture of the video (para [0018]-[0021], [0024]); identify a plurality of events of interest within the video based on the accessed metadata (para [0018]-[0021]); for each identified event of interest, identify a best scene in the video associated with the identified event of interest, the identified best scene comprising a threshold amount of video occurring before and after a video frame or portion corresponding to the identified event of interest (para [0018]-[0021], [0038]); and select one or more identified best scenes for inclusion in a video summary (para [0018]-[0021]); and a processor configured to execute the instructions (para [0050]-[0051] - "a processor 802 that controls the overall operation of the computer 800 by executing computer program instructions, which define such operation").

(See Continuation Box)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/41624

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box V.2. Citations and explanations:

As to claims 17 and 38, Liu teaches a non-transitory computer-readable storage medium storing instructions for identifying scenes in captured video for inclusion in a video summary (para [0018]-[0021], [0050]-[0051]), the instructions configured to, when executed: access metadata associated with a video, the accessed metadata representative of capture of the video (para [0018]-[0021], [0024]); identify a plurality of events of interest within the video based on the accessed metadata (para [0018]-[0021]); for each identified event of interest, identify a best scene in the video associated with the identified event of interest, the identified best scene comprising a threshold amount of video occurring before and after a video frame or portion corresponding to the identified event of interest (para [0018]-[0021], [0038]); and select one or more identified best scenes for inclusion in a video summary (para [0018]-[0021]).

As to claims 13, 18, 34 and 39, Liu further teaches a system (and corresponding computer-readable storage medium) wherein the instructions are further configured to: receive a request for a video summary from the user; and generate a video summary including a plurality of selected best scenes (para [0002]-[0003], [0018]-[0019], [0040]-[0042], [0045]).

As to claims 14, 19, 35 and 40, Liu further teaches a system (and corresponding computer-readable storage medium) wherein the accessed metadata is generated by a camera during the capture of the video and comprises one or more of: telemetry data describing a motion of the camera during the capture of the video, location data describing a location of the camera during the capture of the video, and biometric data describing characteristics of a user of the camera during the capture of the video (para [0021], [0024] - "shots 104a-h may each show a distinct camera action (e.g., zoom, pan, etc.)"; "camera motion between subsequent video frames").

As to claims 16, 21, 37 and 42, Liu further teaches a system (and corresponding computer-readable storage medium) wherein the instructions are further configured to: rank the identified best scenes based on a likelihood that the identified best scene will be of interest to a user; wherein the selected one or more best scenes are selected based on the ranking (para [0018]-[0019], [0038], [0041]-[0042]).

Claims 6, 8-9, 15, 20, 27, 29-30, 36 and 41 lack an inventive step under PCT Article 33(3) as being obvious over Liu in view of US 2012/0057852 A1 to Devleeschouwer, et al. (hereinafter 'Devleeschouwer').

As to claims 6 and 27, Liu teaches the methods of claim 4 and 25, respectively, but does not explicitly teach a method wherein the accessed metadata comprises location data describing a location of the camera during the capture of the video. However, Devleeschouwer does teach wherein the accessed metadata comprises location data describing a location of the camera during the capture of the video (para [0091] - "information about the location of object-of-interests has to be provided in real-time, e.g. based on the real time analysis of the signal captured by some audio-visual sensors"; "the space of candidate fields of view is defined by the position and control parameters of the PTZ camera"). Devleeschouwer further teaches detecting objects/persons of interest in video segments (para [0044]), assigning a level of interest to an object detected in a scene (para [0057]-[0058]), and producing a video report/summarization of an event based on concatenation of video segments captured by at set of cameras (para [0091], [0152], [0154]). It would have been obvious to one of ordinary skill in the art to utilize wherein the accessed metadata comprises location data describing a location of the camera during the capture of the video as taught by Devleeschouwer in order to provide systems and methods for video summarization as taught by Liu capable of improved access to location data for scene determination and analysis. Both Liu and Devleeschouwer are directed to systems and methods for video summarization.

As to claims 8 and 29, Liu teaches the methods of claim 1 and 22, respectively, but does not explicitly teach a method wherein the accessed metadata is accessed from an external entity after the capture of the video. However, Devleeschouwer does teach wherein the accessed metadata is accessed from an external entity after the capture of the video (para [0208] - "results of the method may be transmitted to a further near or remote location"). It would have been obvious to one of ordinary skill in the art to utilize wherein the accessed metadata is accessed from an external entity after the capture of the video as taught by Devleeschouwer in order to provide systems and methods for video summarization as taught by Liu capable of improved video processing and summary generation by remotely located entities.

As to claims 9 and 30, Devleeschouwer further teaches a method wherein the accessed metadata comprises environment data describing characteristics of an environment in which the video was captured (para [0091], [0187]-[0193], [0201]-[0204], Fig. 4, Fig. 6 - "ability to (i) control field of view selection by individual camera, and (ii) select a best camera within a set of camera"; "personalize the viewpoint selection process according to individual user preferences. For example, in the context of a sport event, coaches (who prefer large viewpoints showing the entire game) have different expectations regarding viewpoint selection than common spectator (who prefer closer and emotionally richer images). Thus these preferences are directly related to technical parameters of how the cameras are controlled" - controlling camera viewpoint selection by using user preferences based on environmental characteristic data; foreground / background modelling for views).

As to claims 15, 20, 36 and 41, Liu teaches the systems and corresponding computer-readable storage media of claims 12, 17, 33 and 38, respectively, but does not explicitly teach a system (and corresponding computer-readable storage medium) wherein the accessed metadata is accessed from an external entity after the capture of the video and comprises environment data describing characteristics of an environment in which the video was captured. However, Devleeschouwer does teach wherein the accessed metadata is accessed from an external entity after the capture of the video (para [0208]) and comprises environment data describing characteristics of an environment in which the video was captured (para [0091], [0187]-[0193], [0201]-[0204], Fig. 4, Fig. 6). It would have been obvious to one of ordinary skill in the art to utilize wherein the accessed metadata is accessed from an external entity after the capture of the video and comprises environment data describing characteristics of an environment in which the video was captured as taught by Devleeschouwer in order to provide systems and methods for video summarization as taught by Liu capable of improved access to data associated with video capture location, as well as improved video processing and summary generation by remotely located entities.

(See Next Continuation Box)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/41624

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box V.2. Citations and explanations:

Claims 7 and 28 lack an inventive step under PCT Article 33(3) as being obvious over Liu in view of US 2010/0245626 A1 (Woycechowsky).

As to claims 7 and 28, Liu teaches the methods of claim 4 and 25, respectively, but does not explicitly teach a method wherein the accessed metadata comprises biometric data describing characteristics of a user of the camera during the capture of the video. However, Woycechowsky does teach wherein the accessed metadata comprises biometric data describing characteristics of a user of the camera during the capture of the video (para [0036] - "biometric data of the camera user (for example, voice detection for a voice activated camera)"). It would have been obvious to one of ordinary skill in the art to utilize wherein the accessed metadata comprises biometric data describing characteristics of a user of the camera during the capture of the video as taught by Woycechowsky in order to provide systems and methods for video summarization as taught by Liu capable of improved user identity verification and/or authentication. Both Liu and Woycechowsky are directed to systems and methods for using cameras to record and process video data.

Claims 11 and 32 lack an inventive step under PCT Article 33(3) as being obvious over Liu in view of US 2013/0318443 A1 to Bachman, et al. (hereinafter 'Bachman').

As to claims 11 and 32, Liu further teaches a method wherein selecting one or more identified best scenes comprises: presenting the identified best scenes to the user (para [0002]-[0003], [0018]-[0019], [0038], [0041]-[0042], [0045]); but does not explicitly teach receiving, from the user, a selection of one or more identified best scenes. However, Bachman does teach receiving, from the user, a selection of one or more identified best scenes (para [0003], [0020], [0023] - "receiving information from the user including a movie template selection and a selection of one or more video clips corresponding to desirable characteristics"). It would have been obvious to one of ordinary skill in the art to utilize receiving, from the user, a selection of one or more identified best scenes as taught by Bachman in order to provide systems and methods for video summarization as taught by Liu capable of improved user identity verification and/or authentication. Both Liu and Bachman are directed to systems and methods for video summarization.

Claims 1-42 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/41624

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box No. IV - Lack of unity of invention:

The special technical feature of the Group III invention is receiving, from a user during the capture of the video, input identifying an event of interest within the captured video, storing an indication of the event of interest in metadata, and identifying a video clip associated with the event of interest based on the metadata, not required by Group I-II or IV-V. (See Fig. 6 for example).

The special technical feature of the Group IV invention is accessing videos and video metadata, receiving an identification of an activity associated with a video, identifying metadata patterns associated with the identified activity, and associating a video with the identified activity, not required by Group I-III or V. (See Fig. 7 for example).

The special technical feature of the Group V invention is accessing a video including a plurality of frames, identifying a motion value associated with each frame, identifying a differential motion value associated with each frame based on the motion value, determining a score for each frame based on the motion value and differential motion value, selecting one or more frames based on the scores, identifying a corresponding video scene, and selecting one or more scenes for inclusion in a video summary, not required by Group I-IV.

Groups I, II and V share the technical features of, in various combination, utilizing a plurality of video segments / clips / frames, and generating a video summary.

However, these shared technical features fail to represent a contribution over the prior art of US 2014/0161351 A1 (Yagnik), which discloses utilizing a plurality of video segments / clips / frames (para [0025]-[0028] - "receiving a video 102, which is comprised of a number of frames"), and generating a video summary (para [0009], claim 1 - "combining selected scenes to produce the summary for the video").

Groups I, III and IV share the technical features of, in various combination, utilizing metadata associated with video, and identifying activities / scenes in captured video associated with events of interest / activities within captured video.

However, these shared technical features fail to represent a contribution over the prior art of US 2014/0093164 A1 to Noorkami et al. (hereinafter 'Noorkami'), which discloses utilizing metadata associated with video (para [0062]-[0064] - "the method 700 may then insert metadata into the video content"), and identifying activities / scenes in captured video associated with events of interest / activities (para [0062]-[0064], claim 1 - "the method 700 may examine all of the shots in the video content 34 and efficiently determine one or more scene boundaries at one or more target shots, where a new scene begins at each scene boundary"; "detecting a scene in video content") within captured video (para [0019] - "each of the frames (i-1), (i), (i+1), (i+2), etc. may represent an image captured by an image capture device, such as a video camera").

Groups I, III and V share the technical features of, in various combination, identifying activities / scenes in captured video, and an amount of video occurring before and after a video frame or portion corresponding to and identified event of interest.

However, these shared technical features fail to represent a contribution over the prior art of US 2013/0300939 A1 to Chou et al. (hereinafter 'Chou'), which discloses identifying activities / scenes (para [0013], [0050] - "scene recognition in a video/audio processing environment") in captured video (para [0033] - "embodiments of system 10 can operate on videos and audios captured from any capture system"), and an amount of video occurring before and after a video frame or portion corresponding to and identified event of interest (para [0019], [0022]-[0028], [0035], [0057] - "User 32 may search the example video for various scenes (e.g., Welcome Scene, Farewell Scene, etc.)"; "order scenes into a scene sequence"; "user 32 may be provided with options to click through to particular scenes of interest, or speakers of interest, as the case may be. Because each scene sequence 52 and speaker sequence 54 may include scenes tagged with scene identifiers, and speakers tagged with speaker identifiers, respectively, searching for particular scenes and/or speakers in report 24 may be effected easily").

Groups I, III, IV and V share the technical features of, in various combination, identifying activities / scenes in captured video.

However, these shared technical features fail to represent a contribution over the prior art of US 2014/0105573 A1 to Hanckmann et al. (hereinafter 'Hanckmann'), which discloses identifying activities / scenes (para [0019], [0021], [0072] - "Action type detector 14 is a device that detects which of a predetermined set of action types is seen to occur in a time range in a video stream"; "identify the subset of likely actions, and to subsequently describe them with a rule-based method that relates the actions to entities in the scene") in captured video (para [0018] - "Camera 10 is configured to generate a stream of data that represents a temporal sequence of video images, which is stored by video data storage device").

Thus, the inventions listed as Groups I-V lack unity of invention because they do not share a same or corresponding special technical feature providing a contribution over the prior art.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 27672/PCT	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US 15/18538	International filing date *(day/month/year)* 03 March 2015 (03.03.2015)	(Earliest) Priority Date *(day/month/year)* 04 March 2014 (04.03.2014)
Applicant GOPRO, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

☒ the international application in the language in which it was filed.

☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

a. the figure of the **drawings** to be published with the abstract is Figure No. 6

☒ as suggested by the applicant.

☐ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 15/18538

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H04N 13/04 (2015.01)
CPC - G06T 2207/10016; G06T 7/0022; G06T 3/0062; G06T 3/0043; H04N 5/2259
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8):H04N 13/04 (2015.01)
CPC:G06T 2207/10016; G06T 7/0022; G06T 3/0062; G06T 3/0043; H04N 5/2259

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC(8):H04N 13/04 (2015.01)
CPC:G06T 2207/10016; G06T 7/0022; G06T 3/0062; G06T 3/0043; H04N 5/2259; USPC: 348/211.9

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Patbase, Google Patents, Google Scholar Search Terms Used: Spherical, 360, image, photo, video, panoramic, metadata, time, timestamp, location, position, coordinates, crop, zoom, subframe, portion, edit, view, frame, stitch, join, distance, match, threshold, find, identify, track, face, person, object, subject, hemispherical, two, sec

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 2010/045773 A1 (RITCHEY) 25 February 2010 (25.02.2010) para [0050]-[0051], [0074], [0086]-[0088], [0102], [0114]-[0115], [0117]	41, 48, 49, 56, 57 --- 1, 2, 4, 5, 7-9, 11, 12, 14-16, 18, 19, 21-40, 42-47, 50-55, 58-60
-- A		--- 3, 6, 10, 13, 17, 20
Y -- A	US 2011/0173565 A1 (OFEK et al.) 14 July 2011 (14.07.2011), para [0037], [0041], [0043], [0044], [0046]-[0050], [0054]	1, 2, 4, 5, 7-9, 11, 12, 14-16, 18-19, 21-40 --- 3, 6, 10, 13, 17, 20
Y	US 2011/0211040 A1 (LINDEMANN et al.) 01 September 2011 (01.09.2011), para [0091]-[0093]	42, 43, 50, 51, 58, 59
Y	US 2009/0274339 A9 (COHEN et al.) 05 November 2009 (05.11.2009), para [0006], [0062], [0177], [0220]	44-46, 52-54
Y	US 6,593,956 B1 (POTTS et al.) 15 July 2003 (15.07.2003), col 6, ln 25-43 col 8, ln 8-30	4, 11, 18, 47, 55, 60
Y	US 2013/0208134 A1 (HAMALAINEN) 15 August 2013 (15.08.2013), para [0004], [0032]	26, 33, 40
A	US 2012/0127169 A1 (BARCAY et al.) 24 May 2012 (24.05.2012) para [0081]	3, 10, 17
A	US 2013/0287304 A1 (KIMURA) 31 October 2013 (31.10.2013) para [0066]-[0067], [0084]	6, 13, 20

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 May 2015 (12.05.2015)	16 JUN 2015
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

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(71) Applicant *(for all designated States except US)*: **ADOBE SYSTEMS INCORPORATED** [US/US]; 345 Park Avenue, San Jose, CA 95110 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **JIN, Hailin** [CN/US]; 2785 South Bascom Avenue, Apartment 36, Campbell, CA 95008 (US).

(74) Agent: **KOWERT, Robert, C.**; Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C., P.O. Box 398, Austin, TX 78767-0398 (US).

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[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR RENDERING IMAGES WITH AND WITHOUT RADIALLY SYMMETRIC DISTORTIONS

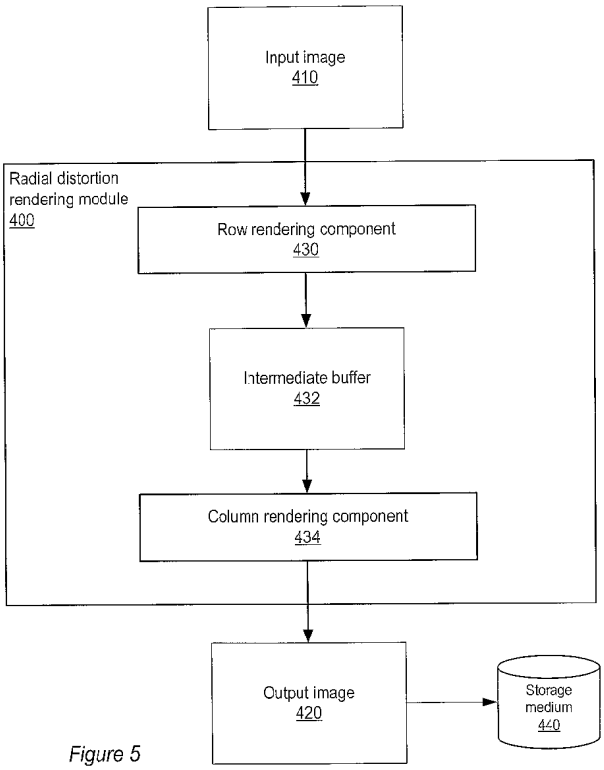


Figure 5

(57) Abstract: A method and apparatus for rendering images with and without radially symmetric distortions is described in which the forward and backward radial distortion rendering processes are decomposed into two stages. One-dimensional elements in one planar dimension (rows or columns) of an input image are rendered to generate an intermediate buffer, and then one-dimensional elements in the other planar dimension (columns or rows) of the intermediate buffer are rendered to generate an output image. Thus, one-dimensional sampling is performed, and interpolation may be performed in one planar dimension, rather than 2-D interpolation. An input row or column may be decimated, if necessary, before row or column interpolation is performed to generate an output row or column.

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OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

TITLE: METHOD AND APPARATUS FOR RENDERING IMAGES WITH AND WITHOUT RADIALLY SYMMETRIC DISTORTIONS

BACKGROUND

Description of the Related Art

[0001] Radially symmetric distortion, or simply radial distortion, is a particular type of image distortion that may be seen in captured images, for example as a result of the optical characteristics of lenses in conventional (film) and digital cameras. In addition to radial distortion being introduced into images by lenses during image capture, radial distortion may be applied as an effect to either natural images (images of the "real world" captured with a conventional or digital camera) or synthetic images (e.g., computer-generated, or digitally synthesized, images). Radial distortion may be classified into two types: barrel distortion and pincushion distortion. Figure 1A illustrates barrel distortion, and Figure 1B illustrates pincushion distortion. Note that barrel distortion is typically associated with wide-angle lenses, and pincushion distortion is typically associated with long-range or telescopic lenses.

[0002] In digital image processing, a forward radial distortion rendering process renders an image with either barrel or pincushion radial distortion from an image with little or no radial distortion. Figure 2A illustrates a forward rendering process 202 rendering an image with barrel distortion 200B from an input image with little or no distortion 200A. Figure 2B illustrates a forward rendering process 202 rendering an image with pincushion distortion 200D from an input image with little or no distortion 200C. A backward radial distortion rendering process renders an image with little or no barrel or pincushion radial distortion from an image with barrel or pincushion radial distortion. Figure 3A illustrates a backward rendering process rendering an image with little or no distortion 300B from an input image with barrel distortion 300A. Figure 3B illustrates a backward rendering process rendering an image with little or no distortion 300D from an input image with pincushion distortion 300C. Note that the images in Figures 2A, 2B, 3A and 3B may be images digitized from photographs or negatives captured with a conventional camera, images captured with a digital camera, digitally synthesized images, composite images from two or more sources, or in general images from any source.

[0003] Conventionally, in digital image processing, both forward and backward radial distortion rendering has been performed using a two-dimensional (2-D) sampling process. For example, in a conventional forward radial distortion rendering process, a grid may be set in the output image (the image with radial distortion). For each point in the grid, a corresponding location is found in the input image (the image with little or no radial distortion) by reverting the distortion equation. Since this location may not have integral coordinates, 2-D interpolation may be used to obtain the intensity value.

[0004] There are problems associated with these conventional radial distortion rendering algorithms. One problem is that the conventional algorithms are not very efficient; either the forward distortion equation or the backward distortion equation has to be solved for each point in the image. Another problem is that interpolation is done in two-dimensional (2-D) space, which is inefficient when sophisticated interpolation algorithms such as cubic interpolation are used. In addition, conventional radial distortion rendering algorithms may suffer from aliasing problems. Aliasing refers to a distortion or artifact that is caused by a signal being sampled and reconstructed as an alias of the original signal. An example of image aliasing is the Moiré pattern that may be observed in a poorly

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pixelized image of a brick wall. Conventional radial distortion rendering algorithms, which perform interpolation in 2-D space, may by so doing introduce aliasing artifacts into the output images.

SUMMARY

[0005] Various embodiments of a method and apparatus for rendering images with and without radially symmetric distortions are described. Embodiments decompose both the forward and backward radial distortion rendering processes into two stages. Embodiments render one-dimensional elements in one planar dimension (rows or columns) of an input image to generate an intermediate buffer, and then render one-dimensional elements in the other planar dimension (columns or rows) of the intermediate buffer to generate an output image. Thus, one-dimensional sampling is performed, and interpolation may be performed in one planar dimension, rather than 2-D interpolation. Implementations of embodiments of the method for rendering images with and without radially symmetric distortions may be referred to herein as a radial distortion rendering module.

[0006] Embodiments of the radial distortion rendering module may implement one or both of two radial distortion rendering algorithms or processes as components. A forward radial distortion rendering component renders images with radial distortion from images with little or no radial distortion. A backward radial distortion rendering component renders images with little or no radial distortion from images with radial distortion. In one embodiment, the radial distortion rendering module receive an input image, and iteratively renders rows in the input image to generate an intermediate buffer. The radial distortion rendering module then iteratively renders columns in the intermediate buffer to generate an output image. In another embodiment, column rendering may be performed first to generate the intermediate buffer, and then row rendering performed on the intermediate buffer to generate the output image.

[0007] Unlike conventional radial distortion rendering processes, embodiments decompose both the forward and backward radial distortion rendering processes into two stages. In each stage, only one row or one column of an image is rendered. In each stage, a simpler equation than the full distortion equation used in conventional methods is solved. Moreover, interpolation is performed in each stage in one-dimensional space (i.e., on one row or one column at a time), which is more efficient than 2-D interpolation, and reduces or eliminates aliasing artifacts that may be introduced in 2-D interpolation. Because embodiments perform one-dimensional (row or column) sampling, in both the forward and backward radial distortion rendering processes, an input row or column may be decimated, if necessary, before row or column interpolation is performed to generate an output row or column. Decimation is important in reducing or eliminating aliasing artifacts.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Figures 1A and 1B illustrate barrel distortion and pincushion distortion, respectively.

[0009] Figures 2A and 2B illustrate the forward radial distortion rendering process.

[0010] Figures 3A and 3B illustrate the backward radial distortion rendering process.

[0011] Figure 4 illustrates forward and backward rendering components of a radial distortion rendering module, according to one embodiment.

[0012] Figure 5 illustrates a radial distortion rendering module and shows a general, high-level architecture that may be shared by both the forward and backward rendering components, according to one embodiment.

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[0013] Figures 6A and 6B illustrate a method for rendering images with and without radially symmetric distortions, according to one embodiment.

[0014] Figure 7 illustrates a decimation process, according to one embodiment.

[0015] Figure 8 illustrates an exemplary computer system that may be used in embodiments.

[0016] While the invention is described herein by way of example for several embodiments and illustrative drawings, those skilled in the art will recognize that the invention is not limited to the embodiments or drawings described. It should be understood, that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the present invention. The headings used herein are for organizational purposes only and are not meant to be used to limit the scope of the description. As used throughout this application, the word "may" is used in a permissive sense (i.e., meaning having the potential to), rather than the mandatory sense (i.e., meaning must). Similarly, the words "include", "including", and "includes" mean including, but not limited to.

DETAILED DESCRIPTION OF EMBODIMENTS

[0017] Various embodiments of a method and apparatus for rendering images with and without radially symmetric distortions are described. Embodiments decompose both the forward and backward radial distortion rendering processes into two stages. Embodiments render one-dimensional elements in one planar dimension (rows or columns) of an input image to generate an intermediate buffer, and then render one-dimensional elements in the other planar dimension (columns or rows) of the intermediate buffer, to generate an output image. Thus, one-dimensional sampling is performed, and interpolation may be performed in one planar dimension, rather than 2-D interpolation. Embodiments of a method for rendering images with and without radially symmetric distortions may be implemented as or in a tool, module, library function, plug-in, stand-alone application, etc. For simplicity, implementations of embodiments may be referred to herein as a radial distortion rendering module.

[0018] Figure 4 illustrates forward and backward rendering components of a radial distortion rendering module, according to one embodiment. Various embodiments of the radial distortion rendering module 400 may implement one or both of two radial distortion rendering algorithms or processes, as described herein, as components. A forward radial distortion rendering component 402 renders images with radial distortion (e.g., images 420A and 420B) from images with little or no radial distortion (e.g., images 410A and 410B). A backward radial distortion rendering component 404 renders images with little or no radial distortion (images 420C and 420D) from images with radial distortion (images 410C and 410D). The radial distortion rendering algorithms implemented by components 402 and 404 are efficient and provide improved interpolation in sampling when compared to conventional radial distortion rendering processes. In addition, the radial distortion rendering algorithms reduce or eliminate aliasing, which is a problem in conventional radial distortion rendering processes.

[0019] Embodiments of a radial distortion rendering module 400 may be implemented on a computer system. An exemplary system on which embodiments may be implemented is illustrated in Figure 8. Radial distortion rendering module 400 may be implemented as or in a tool, module, library function, plug-in, stand-alone application, etc. Embodiments of the radial distortion rendering module may be implemented, for example, in various digital image processing applications. An exemplary application in which embodiments may be implemented is Adobe Photoshop®.

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[0020] Radial distortion rendering module 400 may provide a user interface that provides one or more textual and/or graphical user interface elements, modes or techniques via which a user may control various aspects of the radial distortion rendering process. For example, the user interface may include user interface elements that allow a user to select input and output files, to specify whether a forward or backward radial distortion rendering is to be performed, to specify the type of radial distortion (barrel or pincushion), to control the degree of radial distortion to be introduced or removed, and so on.

[0021] The input images 410 may be any type of images, for example images digitized from photographs or negatives captured with a conventional camera, digital images captured with a digital camera, digital images captured with a photosensor such as a charge-coupled device (CCD), digitally synthesized images, composite images from two or more sources, panoramic images, component images to be stitched into a panoramic image, images from a video stream, and so on.

[0022] Figure 5 illustrates a radial distortion rendering module and shows a general, high-level architecture that may be shared by both the forward and backward rendering components, according to one embodiment. Unlike conventional radial distortion rendering processes, embodiments of radial distortion rendering module 400 decompose both the forward and backward radial distortion rendering processes into two stages. In each stage, only one row or one column of an image is rendered. In each stage, a simpler equation than the full distortion equation is solved. Moreover, interpolation is performed in each stage in one-dimensional space (i.e., on one row or one column at a time), which is more efficient than 2-D interpolation, and reduces or eliminates aliasing artifacts that may be introduced in 2-D interpolation. Because embodiments perform one-dimensional (row or column) sampling, in both the forward and backward radial distortion rendering processes, an input row or column may be decimated, if necessary, before row or column interpolation is performed to generate an output row or column. Decimation is important in reducing or eliminating aliasing artifacts.

[0023] Referring to Figure 5, radial distortion rendering module 400 receives an input image 410. Row rendering component 430 iteratively renders rows in input image 410 to generate an intermediate buffer 432. Column rendering component 434 then iteratively renders columns in intermediate buffer 432 to generate an output image 420. Output image 420 may, for example, be stored to a storage medium 440, such as system memory, a disk drive, DVD, CD, etc. In one embodiment, column rendering may be performed first to generate intermediate buffer 432, and then row rendering performed on intermediate buffer 432 to generate output image 420.

[0024] Figures 6A and 6B illustrate a method for rendering images with and without radially symmetric distortions, according to one embodiment. The method may be implemented in both the forward and backward rendering components illustrated in Figure 4. Elements 504 through 516 of Figure 6A may be implemented in row rendering component 430 of Figure 5, while elements 522 through 534 of Figure 6B may be implemented in column rendering component 434 of Figure 5. While Figures 6A and 6B illustrate row rendering performed first, and then column rendering, in one embodiment, column rendering may be performed first, and then row rendering.

[0025] Referring to Figure 6A, as indicated at 500, an input image is obtained. The input image may either be an image with little or no distortion from which an image with radial distortion is to be generated in a forward rendering process, or an image with radial distortion from which an image with little or no radial distortion is to be generated in a backward rendering process.

[0026] As indicated at 502, an intermediate buffer may be allocated. The intermediate buffer may be allocated based on the dimensions of the input image. Note that the dimensions of the intermediate buffer may be

larger or smaller than the dimensions of the input image if the output image is to be larger or smaller than the input image.

[0027] As indicated at 504, a next row in the intermediate buffer is selected. The row rendering process starts at a first row. Which row the process starts with and in what order the rows are processed may not matter, but for simplicity it may be assumed that the process starts at the first or top row, and sequentially processes the rows.

[0028] As indicated at 506, a next pixel location p, q in the current intermediate buffer row is selected. The row rendering process starts at a first pixel location in the intermediate row. Which pixel location the process starts with and in what order the pixels are processed may not matter, but for simplicity it may be assumed that the process starts at the first pixel location, and sequentially processes the pixels. Note that q will be the same for the entire row.

[0029] As indicated at 508, corresponding coordinates for the current pixel location in the intermediate buffer row are computed in the input image. Note that the pixel coordinates are not necessarily integral; hence, an interpolation technique may be used to calculate pixel values in the intermediate buffer row from pixel values in the input image row.

[0030] As indicated at 510, the corresponding input image row (q) may be extracted, if necessary. The extracted input image row may be decimated, if necessary. Decimation may be necessary if the size of the rows in the intermediate buffer (and in the output image) are substantially smaller than the size of the rows in the input image. Also note that 510 (row extraction and decimation) may be performed only once for each row in the input image, e.g. when the first pixel in the intermediate buffer row is being calculated, and thus not performed for each pixel in the intermediate row.

[0031] As indicated at 512, 1-D (one dimensional) interpolation is applied to the extracted and possibly decimated input row to get the pixel value for the current pixel location in the intermediate row. Any of various interpolation techniques may be used, including, but not limited to, linear and cubic interpolation.

[0032] At 514, if there are more pixels in the intermediate buffer row to be calculated, the method returns to 506 to calculate the value for the next pixel in the row. If the intermediate buffer row has been fully rendered, i.e. if all pixel values for the row have been calculated, then at 516, if there are more rows in the intermediate buffer, the method returns to 504. If all rows in the intermediate buffer have been rendered, then the method goes to 520 of Figure 6B.

[0033] Referring to Figure 6B, as indicated at 520, an output image may be allocated, if necessary. Note that the output image may have been previously allocated, for example before element 504 of Figure 6A. The output image may be allocated based on the dimensions of the input image. Note that the dimensions of the output image may be the same as, larger or smaller than the dimensions of the input image.

[0034] As indicated at 522, a next column in the output image is selected. The column rendering process starts at a first column. Which column the process starts with and in what order the columns are processed may not matter, but for simplicity it may be assumed that the process starts at the first or leftmost column, and sequentially processes the columns.

[0035] As indicated at 524, a next pixel location p, q in the current output image column is selected. The column rendering process starts at a first pixel location in the output image column. Which pixel location the process starts with and in what order the pixels are processed may not matter, but for simplicity it may be assumed

that the process starts at the first pixel location, and sequentially processes the pixels. Note that p will be the same for the entire column.

[0036] As indicated at 526, corresponding coordinates for the current pixel location in the output image column are computed in the intermediate buffer. Note that the pixel coordinates are not necessarily integral; hence, an interpolation technique may be used to calculate pixel values in the output image column from pixel values in the intermediate buffer column.

[0037] As indicated at 528, the corresponding intermediate buffer column (p) may be extracted, if necessary. The extracted intermediate buffer column may be decimated, if necessary. Decimation may be necessary if the size of the columns in the output image are substantially smaller than the size of the columns in the input image. Also note that 528 (column extraction and decimation) may be performed only once for each column in the intermediate buffer, e.g. when the first pixel in the current output image column is being calculated, and thus not performed for each pixel in the output image column.

[0038] As indicated at 530, 1-D (one dimensional) interpolation is applied to the extracted and possibly decimated intermediate buffer column to get the pixel value for the current pixel location in the output image column. Any of various interpolation techniques may be used, including, but not limited to, linear and cubic interpolation.

[0039] At 532, if there are more pixels in output image column to be calculated, the method returns to 524 to calculate the value for the next pixel in the row. If the output image column has been fully rendered, i.e. if all pixel values for the column have been calculated, then at 534, if there are more columns in the output image, the method returns to 522. If all columns in the output image have been rendered, then the output image has been fully rendered. The output image may, for example, be stored to a storage medium, as illustrated in Figure 5.

[0040] While the high-level architecture illustrated in Figure 5 and the method flowcharted in Figures 6A and 6B are substantially similar in both the forward and backward rendering components, the particular implementation of the row rendering component 430 and the column rendering component 434 are somewhat different for the forward and backward rendering components, as described below.

Radial distortion rendering algorithms

[0041] The following provides more details on the forward and backward rendering processes according to one embodiment, provides exemplary formulas that may be used at the various steps of the forward and backward radial distortion rendering processes, and illustrates the differences in the two processes. Radially symmetric distortions may be effectively modeled by a fourth-order equation as follows:

$$[x, y] \rightarrow [x(1 + k_1(x^2 + y^2) + k_2(x^2 + y^2)^2),\ y(1 + k_1(x^2 + y^2) + k_2(x^2 + y^2)^2)]$$

where k is the distortion coefficient, assumed to be known. The last term may be denoted as $[x_d, y_d]$, where the subscript d denotes distortion. (x, y) is related to image coordinates (p, q) through the following:

$$x = \frac{p - c_x}{f}$$

$$y = \frac{q - c_y}{f}$$

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where f and $[c_x, c_y]$ are the focal length and the center of the image, respectively, and are assumed known. Likewise, (x_d, y_d) is related to image coordinates (p_d, q_d) through the following:

$$x_d = \frac{p_d - c_{xd}}{f_d}$$

$$y_d = \frac{q_d - c_{yd}}{f_d}$$

where f_d and $[c_{xd}, c_{yd}]$ are the focal length and the center of the image, respectively, and are assumed known.

[0042] The task of the forward radial distortion rendering process, which may be implemented by forward rendering component 402 of Figure 4, is to render an image (I_d) with coordinates (p_d, q_d) from an image (I) with coordinates (p, q), while the task of the backward radial distortion rendering process, which may be implemented by backward rendering component 404 of Figure 4, is to render an image (I) with coordinates (p, q) from an image (I_d) with coordinates (p_d, q_d). In general, in the following equations, (x, y) are used to designate input coordinates, and (p, q) are used to designate output coordinates. The subscript $_d$ is used to signify distortion.

[0043] While embodiments of the forward and backward radial distortion rendering processes are generally described as processing rows first and then processing columns, the processing may be reversed in some embodiments, processing columns first and then rows. Generally speaking, the input image may be rendered first in one planar (x or y) dimension (whether rows or columns) to generate an intermediate image or buffer, and then the intermediate image may be rendered in the other planar dimension to generate an output image.

Forward process ($I \rightarrow I_d$)

[0044] The following describes a forward radial distortion rendering algorithm which may be implemented by forward rendering component 402 of radial distortion rendering module 400, as illustrated in Figure 4, according to one embodiment. Both Figures 4 and 5 are referred to.

[0045] A 2-D temporary buffer of proper size is allocated based on the input image 410. This buffer corresponds to intermediate buffer 432 of Figure 5.

[0046] The following describes processing performed by row rendering component 430 of forward rendering component 402, as illustrated in Figure 5, according to one embodiment.

[0047] For each row in the intermediate buffer 432, row rendering component 430 of forward rendering component 402 performs the following. Let (p_d, q) be the coordinates for a pixel in the temporary row. Note that q would be the same for the entire row. Calculate (x_d, y) based on:

$$x_d = \frac{p_d - c_{xd}}{f_d}$$

$$y = \frac{q - c_y}{f}$$

[0048] x may be computed by solving the following equation:

$$x_d = x(1 + k_1(x^2 + y^2) + k_2(x^2 + y^2)^2)$$

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[0049] p may be calculated based on:

$$p = x * f + c_x$$

[0050] The input row buffer at position q is extracted. The input row buffer may be decimated, if necessary. Interpolation is performed at (p, q) to generate the row in the intermediate buffer 432.

[0051] The following describes processing performed by column rendering component 434 of forward rendering component 402, as illustrated in Figure 5, according to one embodiment.

[0052] For each column in the output image 420, column rendering component 434 of forward rendering component 402 performs the following. Let (p_d, q_d) be the coordinates for a pixel in the output column. Note that p_d would be the same for the entire column. (x_d, y_d) may be calculated based on:

$$x_d = \frac{p_d - c_{xd}}{f_d}$$

$$y_d = \frac{q_d - c_{yd}}{f_d}$$

[0053] ρ_d may be calculated based on:

$$\rho_d = \sqrt{x_d^{\,2} + y_d^{\,2}}$$

[0054] ρ may be computed by solving the following equation:

$$\rho_d = \rho(1 + k_1 \rho^2 + k_2 \rho^4)$$

[0055] y may be computed as follows:

$$y = \frac{y_d}{\left(1 + k_1 \rho^2 + k_2 \rho^4\right)}$$

[0056] q may be calculated based on:

$$q = y * f + c_y$$

[0057] The temporary column at position p_d may be extracted The extracted temporary column buffer may be decimated, if necessary. Interpolation may be performed at (p_d, q) to generate the column in the output image 420.

Backward process ($I_d \rightarrow I$)

[0058] The following describes a backward radial distortion rendering algorithm which may be implemented by backward rendering component 404 of radial distortion rendering module 400, as illustrated in Figure 4, according to one embodiment. Both Figures 4 and 5 are referred to.

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[0059] A 2-D temporary buffer of proper size is allocated based on the input image 410. This buffer corresponds to intermediate buffer 432 of Figure 5.

[0060] The following describes processing performed by row rendering component 430 of backward rendering component 404, as illustrated in Figure 5, according to one embodiment.

[0061] For each row in the intermediate buffer 432, row rendering component 430 of backward rendering component 404 performs the following. Let (p, q_d) be the coordinates for a pixel in the temporary row. Note that q_d would be the same for the entire row. (x, y_d) may be calculated based on:

$$x = \frac{p - c_x}{f}$$

$$y_d = \frac{q_d - c_{yd}}{f_d}$$

[0062] y may be calculated by solving the following equation:

$$y_d = y(1 + k_1(x^2 + y^2) + k_2(x^2 + y^2)^2)$$

[0063] A value ρ (rho) may be calculated as follows:

$$\rho = \sqrt{x^2 + y^2}$$

[0064] x_d may be calculated as follows:

$$x_d = x(1 + k_1\rho^2 + k_2\rho^4)$$

[0065] p_d may be calculated as follows:

$$p_d = x_d * f_d + c_{xd}$$

[0066] The input row buffer at position q_d may be extracted. The input row buffer may be decimated, if necessary. Interpolation is performed at (p_d, q_d) to generate the row in the intermediate buffer 432.

[0067] The following describes processing performed by column rendering component 434 of backward rendering component 404, as illustrated in Figure 5, according to one embodiment.

[0068] For each column in the output image 420, column rendering component 434 of backward rendering component 404 performs the following. Let (p, q) be the coordinates for a pixel in the output column. Note that p would be the same for the entire column. (x, y) may be calculated based on:

$$x = \frac{p - c_x}{f}$$

$$y = \frac{q - c_y}{f}$$

[0069] y_d may be calculated as follows:

$$y_d = y(1 + k_1(x^2 + y^2) + k_2(x^2 + y^2)^2)$$

[0070] q_d may be calculated based on:

$$q_d = y_d * f_d + c_{yd}$$

[0071] The temporary column at position p may be extracted. The extracted temporary column buffer may be decimated, if necessary. Interpolation may be performed at (p_d, q) to generate the column in the output image 420.

Solving for ρ

[0072] In one embodiment, ρ may be found from the following equation:

$$\rho_d = \rho * (1 + k_1 * \rho^2 + k_2 * \rho^4)$$

[0073] In one embodiment, the above equation may be solved iteratively as follows:

$$\rho_0 = \rho_d$$

$$\rho_{(i+1)} = \frac{\rho_d}{(1 + k_1 * \rho_i^{\,2} + k_2 * \rho_i^{\,4}}$$

Typically, the above converges in ~10 iterations. One embodiment may start ρ_0 with the following:

$$\rho_0 = \rho_d * (1 - k_1 * \rho_d^{\,2})$$

Solving for x

[0074] In one embodiment, x may be found from the following equation:

$$x_d = x(1 + k_1(x^2 + y^2) + k_2(x^2 + y^2)^2)$$

[0075] In one embodiment, the equation may be solved iteratively as follows:

$$x_0 = x_d$$

$$x_{(i+1)} \frac{x_d}{(1 + k_1(x_i^{\,2} + y^2) + k_2(x_i^{\,2} + y^2)^2)}$$

Typically, this converges in ~10 iterations.

[0076] Any of various interpolation methods, including but not limited to linear and cubic interpolation, may be used to perform interpolation to generate the rows in the intermediate buffer 432 and the columns in the output image 420 in both the forward and backward radial distortion rendering processes described above.

Decimation

[0077] Figure 7 illustrates a decimation process, according to one embodiment. Because embodiments perform one-dimensional (row or column) sampling, in both the forward and backward radial distortion rendering processes, and because the dimensions of the output image may be smaller than the dimensions of the input image, an input row or column may be decimated, if necessary, before row or column interpolation is performed to generate pixel values in an output row or column. Decimation is important in reducing or eliminating aliasing artifacts.

[0078] Figure 7 illustrates decimation of an exemplary input row to generate an exemplary output row, according to one embodiment, but a similar decimation may be performed on an input column to generate an output column. Input row 600 has twelve pixels (0,0) through (0,11), while output row 604 has four pixels (0,0) through (0,3). The pixel value for each pixel in output row 604 may be calculated from pixel values in the input row 600, as indicated at 602. In one embodiment, averaging may be used to calculate the pixel values for the pixels in the output row 604. In this example, the pixel values for the three pixels (0,0) through (0,2) of input row 600 may be averaged to get the pixel value for pixel (0,0) of output row 604, the pixel values for pixels (0,3) through (0,5) of input row 600 may be averaged to get the pixel value for pixel (0,1) of output row 604, and so on. Note that normalization may be performed in calculating the pixel values 602. Other embodiments may use other methods to calculate pixel values in output row 604 from pixel values in input row 604. Once output row 604 is generated, the pixel values in decimated output row 604 may be interpolated to generate pixel values in the intermediate buffer, as described herein. Again note that a similar decimation process may be applied when processing columns.

Exemplary applications

[0079] An exemplary application for embodiments of the radial distortion rendering module may be in a panoramic image stitching process in which a set of component images are to be stitched to form a panoramic image. In the process, a reference image is selected, and the other images are "warped" in accordance with the center of the reference image to create the panoramic image. Embodiments of the radial distortion rendering module as described herein may be used to first remove distortion, via the backward radial distortion rendering process, from each of the component images before warping/stitching the images to form the composite panoramic image.

[0080] Embodiments may also be used to simulate lens distortion, for example in composite panoramic images. It may be desirable to generate realistic images; in reality, scenes typically would have some distortion when captured with a camera and real lens. As an example, in a composite panoramic image process as described above, the natural distortion that would be expected may have been removed. Embodiments of the radial distortion rendering module, particularly the forward radial distortion rendering process, may be used to simulate what the distortion effect of a particular lens might be on such an image.

Exemplary System

[0081] Various components of embodiments of a radial distortion rendering module may be executed on one or more computer systems, which may interact with various other devices. One such computer system is illustrated by Figure 8. In the illustrated embodiment, computer system 700 includes one or more processors 710 coupled to a system memory 720 via an input/output (I/O) interface 730. Computer system 700 further includes a network interface 740 coupled to I/O interface 730, and one or more input/output devices 750, such as cursor control device 760, keyboard 770, audio device 790, and display(s) 780. In some embodiments, it is contemplated that embodiments may be implemented using a single instance of computer system 700, while in other embodiments multiple such systems, or multiple nodes making up computer system 700, may be configured to host different portions or instances of embodiments. For example, in one embodiment some elements may be implemented via one or more nodes of computer system 700 that are distinct from those nodes implementing other elements.

[0082] In various embodiments, computer system 700 may be a uniprocessor system including one processor 710, or a multiprocessor system including several processors 710 (e.g., two, four, eight, or another suitable number). Processors 710 may be any suitable processor capable of executing instructions. For example, in various embodiments, processors 710 may be general-purpose or embedded processors implementing any of a variety of instruction set architectures (ISAs), such as the x86, PowerPC, SPARC, or MIPS ISAs, or any other suitable ISA. In multiprocessor systems, each of processors 710 may commonly, but not necessarily, implement the same ISA.

[0083] System memory 720 may be configured to store program instructions and/or data accessible by processor 710. In various embodiments, system memory 720 may be implemented using any suitable memory technology, such as static random access memory (SRAM), synchronous dynamic RAM (SDRAM), nonvolatile/Flash-type memory, or any other type of memory. In the illustrated embodiment, program instructions and data implementing desired functions, such as those described above for a radial distortion rendering module, are shown stored within system memory 720 as program instructions 725 and data storage 735, respectively. In other embodiments, program instructions and/or data may be received, sent or stored upon different types of computer-accessible media or on similar media separate from system memory 720 or computer system 700. Generally speaking, a computer-accessible medium may include storage media or memory media such as magnetic or optical media, e.g., disk or CD/DVD-ROM coupled to computer system 700 via I/O interface 730. Program instructions and data stored via a computer-accessible medium may be transmitted by transmission media or signals such as electrical, electromagnetic, or digital signals, which may be conveyed via a communication medium such as a network and/or a wireless link, such as may be implemented via network interface 740.

[0084] In one embodiment, I/O interface 730 may be configured to coordinate I/O traffic between processor 710, system memory 720, and any peripheral devices in the device, including network interface 740 or other peripheral interfaces, such as input/output devices 750. In some embodiments, I/O interface 730 may perform any necessary protocol, timing or other data transformations to convert data signals from one component (e.g., system memory 720) into a format suitable for use by another component (e.g., processor 710). In some embodiments, I/O interface 730 may include support for devices attached through various types of peripheral buses, such as a variant of the Peripheral Component Interconnect (PCI) bus standard or the Universal Serial Bus (USB) standard, for example. In some embodiments, the function of I/O interface 730 may be split into two or more separate components, such as a north bridge and a south bridge, for example. In addition, in some embodiments some or all of the functionality of I/O interface 730, such as an interface to system memory 720, may be incorporated directly into processor 710.

[0085] Network interface 740 may be configured to allow data to be exchanged between computer system 700 and other devices attached to a network, such as other computer systems, or between nodes of computer system 700. In various embodiments, network interface 740 may support communication via wired or wireless general data networks, such as any suitable type of Ethernet network, for example; via telecommunications/telephony networks such as analog voice networks or digital fiber communications networks; via storage area networks such as Fibre Channel SANs, or via any other suitable type of network and/or protocol.

[0086] Input/output devices 750 may, in some embodiments, include one or more display terminals, keyboards, keypads, touchpads, scanning devices, voice or optical recognition devices, or any other devices suitable for entering or retrieving data by one or more computer system 700. Multiple input/output devices 750 may be present in computer system 700 or may be distributed on various nodes of computer system 700. In some

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embodiments, similar input/output devices may be separate from computer system 700 and may interact with one or more nodes of computer system 700 through a wired or wireless connection, such as over network interface 740.

[0087] As shown in Figure 8, memory 720 may include program instructions 725, configured to implement embodiments of a radial distortion rendering module as described herein, and data storage 735, comprising various data accessible by program instructions 725. In one embodiment, program instructions 725 may include software elements of a radial distortion rendering module as illustrated in the above Figures. Data storage 735 may include data that may be used in embodiments. In other embodiments, other or different software elements and data may be included.

[0088] Those skilled in the art will appreciate that computer system 700 is merely illustrative and is not intended to limit the scope of a radial distortion rendering module as described herein. In particular, the computer system and devices may include any combination of hardware or software that can perform the indicated functions, including computers, network devices, internet appliances, PDAs, wireless phones, pagers, etc. Computer system 700 may also be connected to other devices that are not illustrated, or instead may operate as a stand-alone system. In addition, the functionality provided by the illustrated components may in some embodiments be combined in fewer components or distributed in additional components. Similarly, in some embodiments, the functionality of some of the illustrated components may not be provided and/or other additional functionality may be available.

[0089] Those skilled in the art will also appreciate that, while various items are illustrated as being stored in memory or on storage while being used, these items or portions of them may be transferred between memory and other storage devices for purposes of memory management and data integrity. Alternatively, in other embodiments some or all of the software components may execute in memory on another device and communicate with the illustrated computer system via inter-computer communication. Some or all of the system components or data structures may also be stored (e.g., as instructions or structured data) on a computer-accessible medium or a portable article to be read by an appropriate drive, various examples of which are described above. In some embodiments, instructions stored on a computer-accessible medium separate from computer system 700 may be transmitted to computer system 700 via transmission media or signals such as electrical, electromagnetic, or digital signals, conveyed via a communication medium such as a network and/or a wireless link. Various embodiments may further include receiving, sending or storing instructions and/or data implemented in accordance with the foregoing description upon a computer-accessible medium. Accordingly, the present invention may be practiced with other computer system configurations.

Conclusion

[0090] Various embodiments may further include receiving, sending or storing instructions and/or data implemented in accordance with the foregoing description upon a computer-accessible medium. Generally speaking, a computer-accessible medium may include storage media or memory media such as magnetic or optical media, e.g., disk or DVD/CD-ROM, volatile or non-volatile media such as RAM (e.g. SDRAM, DDR, RDRAM, SRAM, etc.), ROM, etc. As well as transmission media or signals such as electrical, electromagnetic, or digital signals, conveyed via a communication medium such as network and/or a wireless link.

[0091] The various methods as illustrated in the Figures and described herein represent exemplary embodiments of methods. The methods may be implemented in software, hardware, or a combination thereof. The order of method may be changed, and various elements may be added, reordered, combined, omitted, modified, etc.

[0092] Various modifications and changes may be made as would be obvious to a person skilled in the art having the benefit of this disclosure. It is intended that the invention embrace all such modifications and changes and, accordingly, the above description to be regarded in an illustrative rather than a restrictive sense.

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WHAT IS CLAIMED IS:

1. A computer-implemented method, comprising:

rendering an output image without radially symmetric distortion from an input image with radially symmetrical distortion, wherein said rendering an output image without radially symmetric distortion comprises:

rendering each one-dimensional element in a first planar dimension of the input image to generate pixel values in a corresponding one-dimensional element in the first planar dimension of an intermediate buffer; and

rendering each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image.

2. The computer-implemented method as recited in claim 1, wherein the radially symmetric distortion is one of barrel distortion and pincushion distortion.

3. The computer-implemented method as recited in claim 1, wherein the elements in the first planar dimension are rows, and wherein the elements in the second planar dimensions are columns.

4. The computer-implemented method as recited in claim 1, wherein the elements in the first planar dimension are columns, and wherein the elements in the second planar dimensions are rows.

5. The computer-implemented method as recited in claim 1, wherein said rendering each element in a first planar dimension of the input image to generate pixel values in a corresponding element in the first planar dimension of an intermediate buffer comprises, for each pixel in each element in the first planar dimension of the intermediate buffer:

calculating corresponding pixel coordinates in the corresponding element in the first planar dimension of the input image; and

interpolating two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the first planar dimension of the input image to generate a pixel value for the pixel in the element in the first planar dimension of the intermediate buffer.

6. The computer-implemented method as recited in claim 5, further comprising decimating the element in the first planar dimension of the input image prior to said interpolating.

7. The computer-implemented method as recited in claim 1, wherein said rendering each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image comprises, for each pixel in each element in the second planar dimension of the output image:

calculating corresponding pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer; and

interpolating two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer to generate a pixel value for the pixel in the element in the second planar dimension of the output image.

8. The computer-implemented method as recited in claim 7, further comprising decimating the element in the second planar dimension of the intermediate buffer prior to said interpolating.

9. The computer-implemented method as recited in claim 1, further comprising:

rendering a second output image with radially symmetric distortion from a second input image without radially symmetric distortion, wherein said rendering a second output image with radially symmetric distortion comprises:

rendering each one-dimensional element in a first planar dimension of the second input image to generate pixel values in a corresponding one-dimensional element in the first planar dimension of a second intermediate buffer; and

rendering each one-dimensional element in a second planar dimension of the second intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the second output image.

10. A system, comprising:

at least one processor; and

a memory comprising program instructions, wherein the program instructions are executable by the at least one processor to:

render an output image without radially symmetric distortion from an input image with radially symmetric distortion, wherein, to render an output image without radially symmetric distortion, the program instructions are executable by the at least one processor to:

render each one-dimensional element in a first planar dimension of the input image to generate pixel values in a corresponding one-dimensional element in the first planar dimension of an intermediate buffer; and

render each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image.

11. The system as recited in claim 10, wherein the elements in the first planar dimension are rows, and wherein the elements in the second planar dimensions are columns.

12. The system as recited in claim 10, wherein the elements in the first planar dimension are columns, and wherein the elements in the second planar dimensions are rows.

13. The system as recited in claim 10, wherein, to render each element in a first planar dimension of the input image to generate pixel values in a corresponding element in the first planar dimension of an intermediate

buffer, the program instructions are executable by the at least one processor to, for each pixel in each element in the first planar dimension of the intermediate buffer:

calculate corresponding pixel coordinates in the corresponding element in the first planar dimension of the input image; and

interpolate two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the first planar dimension of the input image to generate a pixel value for the pixel in the element in the first planar dimension of the intermediate buffer.

14. The system as recited in claim 13, wherein the program instructions are executable by the at least one processor to decimate the element in the first planar dimension of the input image prior to said interpolating.

15. The system as recited in claim 10, wherein, to render each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image, the program instructions are executable by the at least one processor to, for each pixel in each element in the second planar dimension of the output image:

calculate corresponding pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer; and

interpolate two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer to generate a pixel value for the pixel in the element in the second planar dimension of the output image.

16. The system as recited in claim 15, wherein the program instructions are executable by the at least one processor to decimate the element in the second planar dimension of the intermediate buffer prior to said interpolating.

17. The system as recited in claim 10, wherein the program instructions are executable by the at least one processor to:

render a second output image with radially symmetric distortion from a second input image without radially symmetric distortion, wherein said rendering a second output image with radially symmetric distortion comprises:

render each one-dimensional element in a first planar dimension of the second input image to generate pixel values in a corresponding one-dimensional element in the first planar dimension of a second intermediate buffer; and

render each one-dimensional element in a second planar dimension of the second intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the second output image.

18. A computer-readable storage medium storing program instructions, wherein the program instructions are computer-executable to implement:

rendering an output image without radially symmetric distortion from an input image with radially symmetric distortion, wherein said rendering an output image without radially symmetric distortion comprises:

rendering each one-dimensional element in a first planar dimension of the input image to generate pixel values in a corresponding one-dimensional element in the first planar dimension of an intermediate buffer; and

rendering each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image.

19. The computer-readable storage medium as recited in claim 18, wherein, in said rendering each element in a first planar dimension of the input image to generate pixel values in a corresponding element in the first planar dimension of an intermediate buffer, the program instructions are computer-executable to implement, for each pixel in each element in the first planar dimension of the intermediate buffer:

calculating corresponding pixel coordinates in the corresponding element in the first planar dimension of the input image; and

interpolating two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the first planar dimension of the input image to generate a pixel value for the pixel in the element in the first planar dimension of the intermediate buffer.

20. The computer-readable storage medium as recited in claim 19, wherein the program instructions are computer-executable to implement decimating the element in the first planar dimension of the input image prior to said interpolating.

21. The computer-readable storage medium as recited in claim 18, wherein, in said rendering each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image, the program instructions are computer-executable to implement, for each pixel in each element in the second planar dimension of the output image:

calculating corresponding pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer; and

interpolating two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer to generate a pixel value for the pixel in the element in the second planar dimension of the output image.

22. The computer-readable storage medium as recited in claim 21, wherein the program instructions are computer-executable to implement decimating the element in the second planar dimension of the intermediate buffer prior to said interpolating.

23. The computer-readable storage medium as recited in claim 18, wherein the program instructions are computer-executable to implement:

rendering a second output image with radially symmetric distortion from a second input image without radially symmetric distortion, wherein said rendering a second output image with radially symmetric distortion comprises:

rendering each one-dimensional element in a first planar dimension of the second input image to generate pixel values in a corresponding one-dimensional element in the first planar dimension of a second intermediate buffer; and

rendering each one-dimensional element in a second planar dimension of the second intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the second output image.

24. A computer-implemented method, comprising:

rendering an output image with radially symmetric distortion from an input image without radially symmetric distortion, wherein said rendering an output image with radially symmetric distortion comprises:

rendering each one-dimensional element in a first planar dimension of the input image to generate pixel values in a corresponding one-dimensional element in the first planar dimension of an intermediate buffer; and

rendering each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image.

25. The computer-implemented method as recited in claim 24, wherein the radially symmetric distortion is one of barrel distortion and pincushion distortion.

26. The computer-implemented method as recited in claim 24, wherein the elements in the first planar dimension are rows, and wherein the elements in the second planar dimensions are columns.

27. The computer-implemented method as recited in claim 24, wherein the elements in the first planar dimension are columns, and wherein the elements in the second planar dimensions are rows.

28. The computer-implemented method as recited in claim 24, wherein said rendering each element in a first planar dimension of the input image to generate pixel values in a corresponding element in the first planar dimension of an intermediate buffer comprises, for each pixel in each element in the first planar dimension of the intermediate buffer:

calculating corresponding pixel coordinates in the corresponding element in the first planar dimension of the input image; and

interpolating two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the first planar dimension of the input image to generate a pixel value for the pixel in the element in the first planar dimension of the intermediate buffer.

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29. The computer-implemented method as recited in claim 28, further comprising decimating the element in the first planar dimension of the input image prior to said interpolating.

30. The computer-implemented method as recited in claim 24, wherein said rendering each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image comprises, for each pixel in each element in the second planar dimension of the output image:

calculating corresponding pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer; and

interpolating two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer to generate a pixel value for the pixel in the element in the second planar dimension of the output image.

31. The computer-implemented method as recited in claim 30, further comprising decimating the element in the second planar dimension of the intermediate buffer prior to said interpolating.

32. A system, comprising:

at least one processor; and

a memory comprising program instructions, wherein the program instructions are executable by the at least one processor to:

render an output image with radially symmetric distortion from an input image without radially symmetric distortion, wherein, to render an output image with radially symmetric distortion, the program instructions are executable by the at least one processor to:

render each one-dimensional element in a first planar dimension of the input image to generate pixel values in a corresponding one-dimensional element in the first planar dimension of an intermediate buffer; and

render each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image.

33. The system as recited in claim 32, wherein the elements in the first planar dimension are rows, and wherein the elements in the second planar dimensions are columns.

34. The system as recited in claim 32, wherein the elements in the first planar dimension are columns, and wherein the elements in the second planar dimensions are rows.

35. The system as recited in claim 32, wherein, to render each element in a first planar dimension of the input image to generate pixel values in a corresponding element in the first planar dimension of an intermediate buffer, the program instructions are executable by the at least one processor to, for each pixel in each element in the first planar dimension of the intermediate buffer:

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calculate corresponding pixel coordinates in the corresponding element in the first planar dimension of the input image; and

interpolate two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the first planar dimension of the input image to generate a pixel value for the pixel in the element in the first planar dimension of the intermediate buffer.

36. The system as recited in claim 35, wherein the program instructions are executable by the at least one processor to decimate the element in the first planar dimension of the input image prior to said interpolating.

37. The system as recited in claim 32, wherein, to render each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image, the program instructions are executable by the at least one processor to, for each pixel in each element in the second planar dimension of the output image:

calculate corresponding pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer; and

interpolate two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer to generate a pixel value for the pixel in the element in the second planar dimension of the output image.

38. The system as recited in claim 37, wherein the program instructions are executable by the at least one processor to decimate the element in the second planar dimension of the intermediate buffer prior to said interpolating.

39. A computer-readable storage medium storing program instructions, wherein the program instructions are computer-executable to implement:

rendering an output image with radially symmetric distortion from an input image without radially symmetric distortion, wherein said rendering an output image with radially symmetric distortion comprises:

rendering each one-dimensional element in a first planar dimension of the input image to generate pixel values in a corresponding one-dimensional element in the first planar dimension of an intermediate buffer; and

rendering each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image.

40. The computer-readable storage medium as recited in claim 39, wherein, in said rendering each element in a first planar dimension of the input image to generate pixel values in a corresponding element in the first planar dimension of an intermediate buffer, the program instructions are computer-executable to implement, for each pixel in each element in the first planar dimension of the intermediate buffer:

calculating corresponding pixel coordinates in the corresponding element in the first planar dimension of the input image; and

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Exhibit 1003 Page 217

interpolating two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the first planar dimension of the input image to generate a pixel value for the pixel in the element in the first planar dimension of the intermediate buffer.

41. The computer-readable storage medium as recited in claim 40, wherein the program instructions are computer-executable to implement decimating the element in the first planar dimension of the input image prior to said interpolating.

42. The computer-readable storage medium as recited in claim 39, wherein, in said rendering each one-dimensional element in a second planar dimension of the intermediate buffer to generate pixel values in a corresponding one-dimensional element in the second planar dimension of the output image, the program instructions are computer-executable to implement, for each pixel in each element in the second planar dimension of the output image:

calculating corresponding pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer; and

interpolating two or more pixel values from pixels proximate to the calculated pixel coordinates in the corresponding element in the second planar dimension of the intermediate buffer to generate a pixel value for the pixel in the element in the second planar dimension of the output image.

43. The computer-readable storage medium as recited in claim 42, wherein the program instructions are computer-executable to implement decimating the element in the second planar dimension of the intermediate buffer prior to said interpolating.

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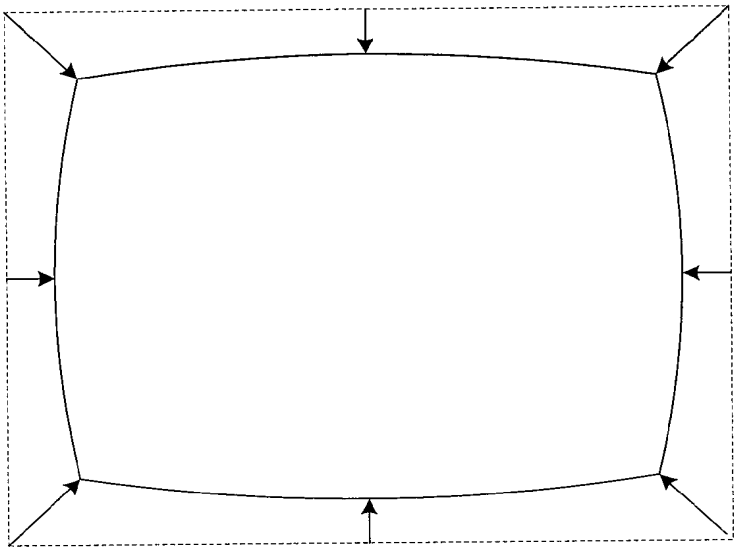


Figure 1A

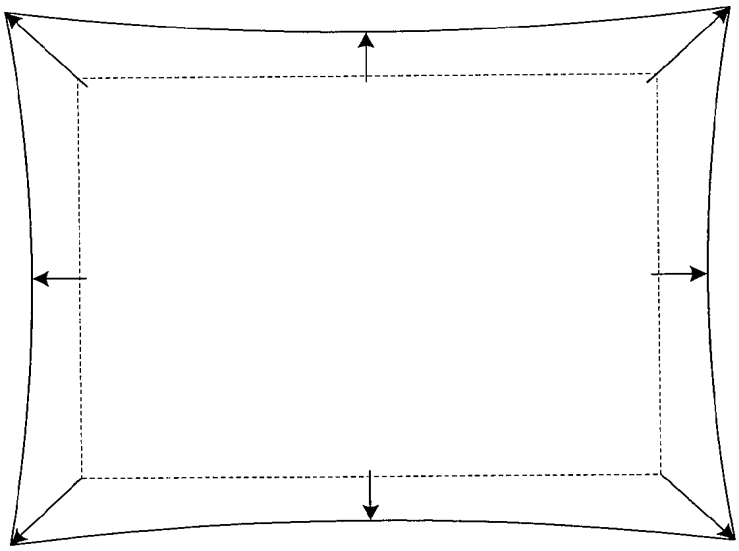


Figure 1B

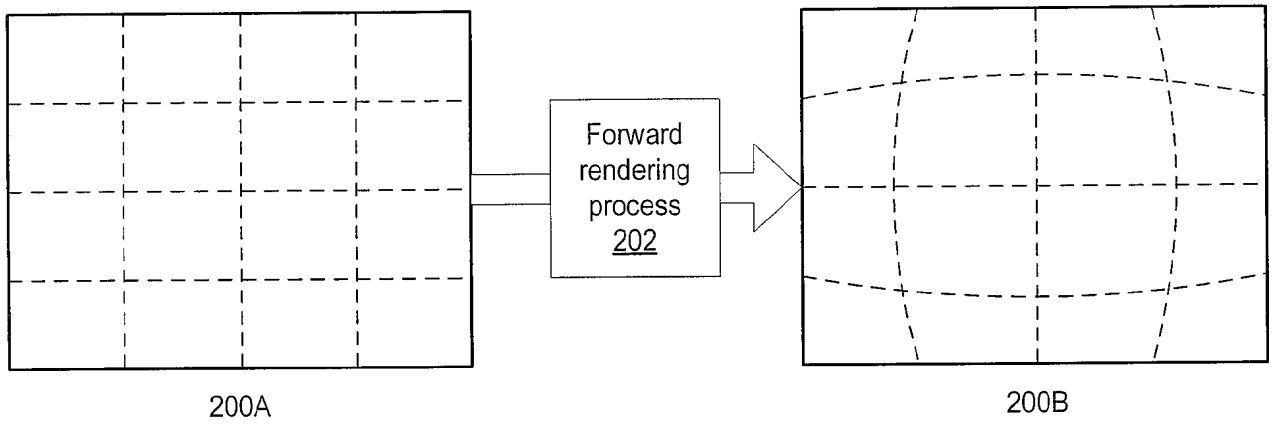


Figure 2A

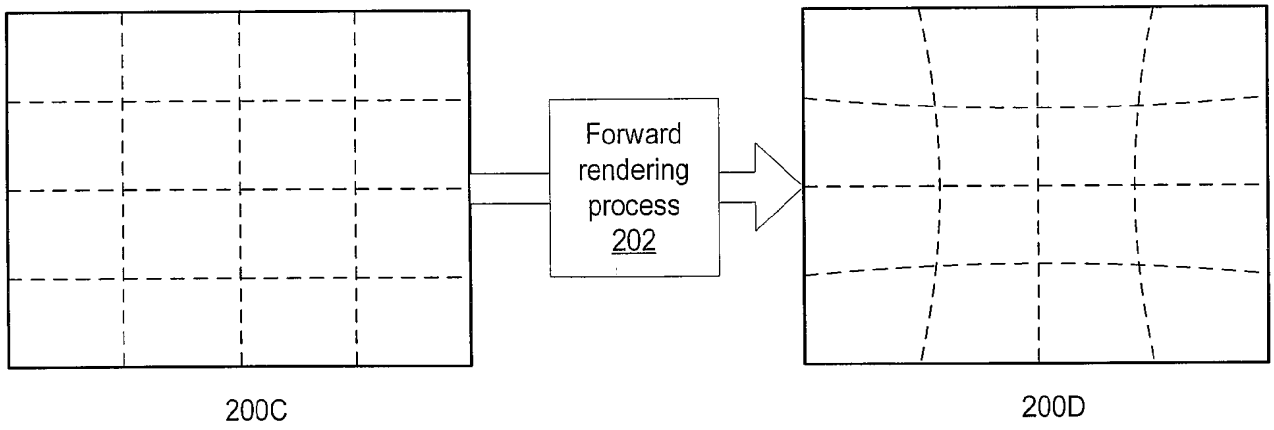


Figure 2B

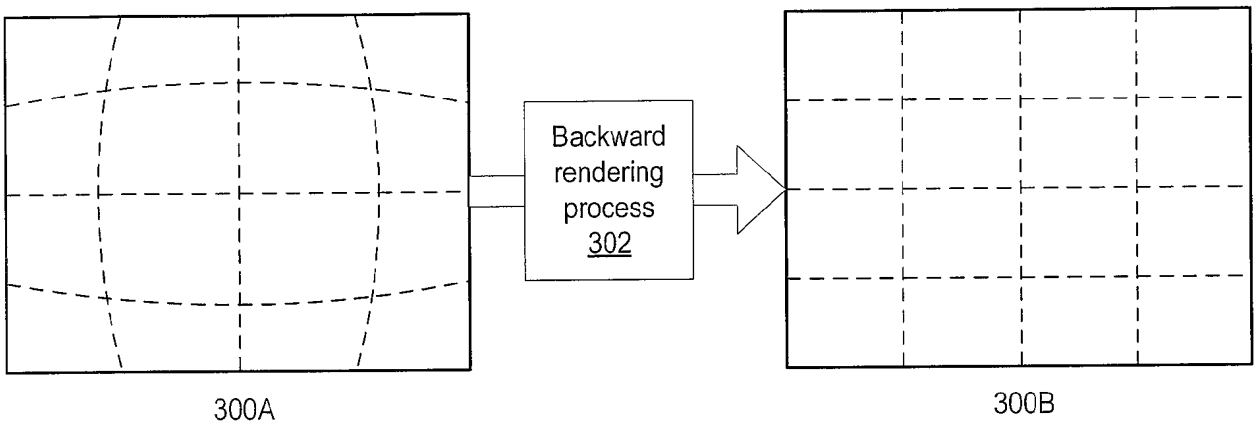


Figure 3A

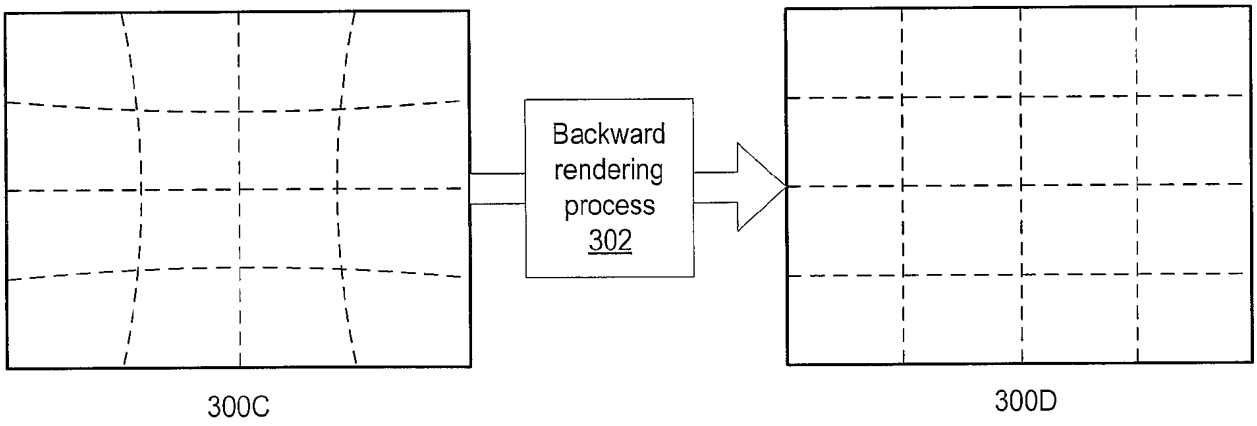


Figure 3B

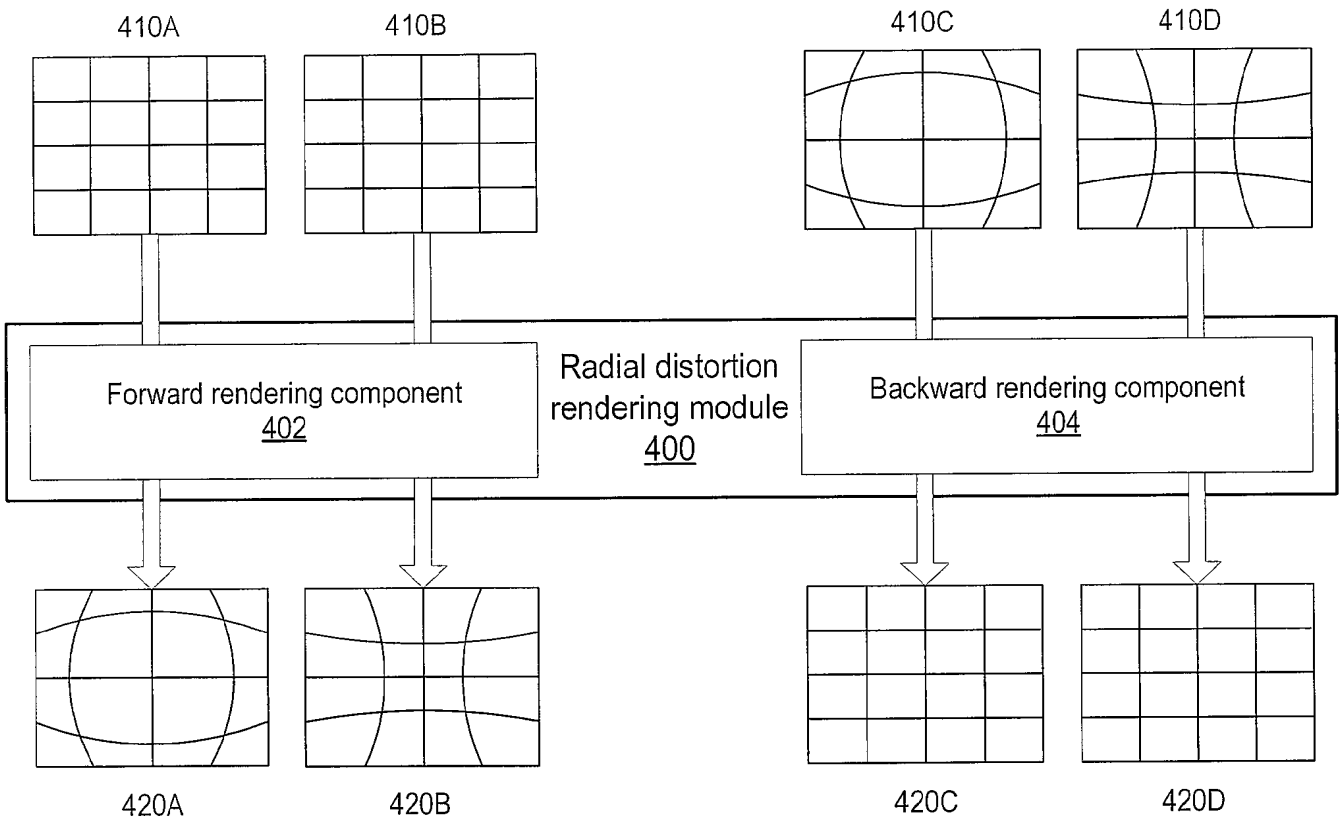

410A
410B
410C
410D
Forward rendering component
402
Radial distortion
rendering module
400
Backward rendering component
404
420A
420B
420C
420D

Figure 4

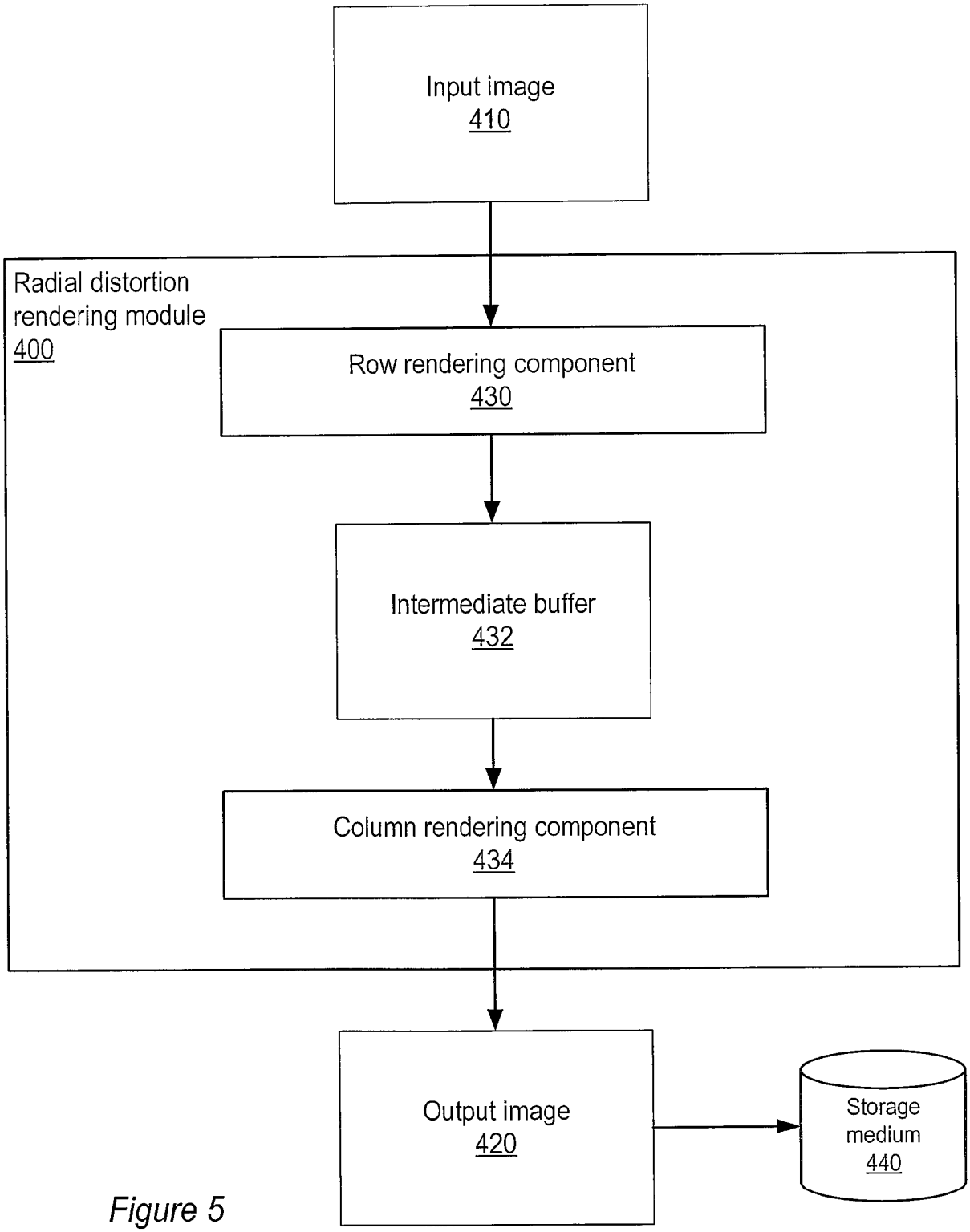

Input image
410
Radial distortion rendering module
400
Row rendering component
430
Intermediate buffer
432
Column rendering component
434
Output image
420
Storage medium
440

Figure 5

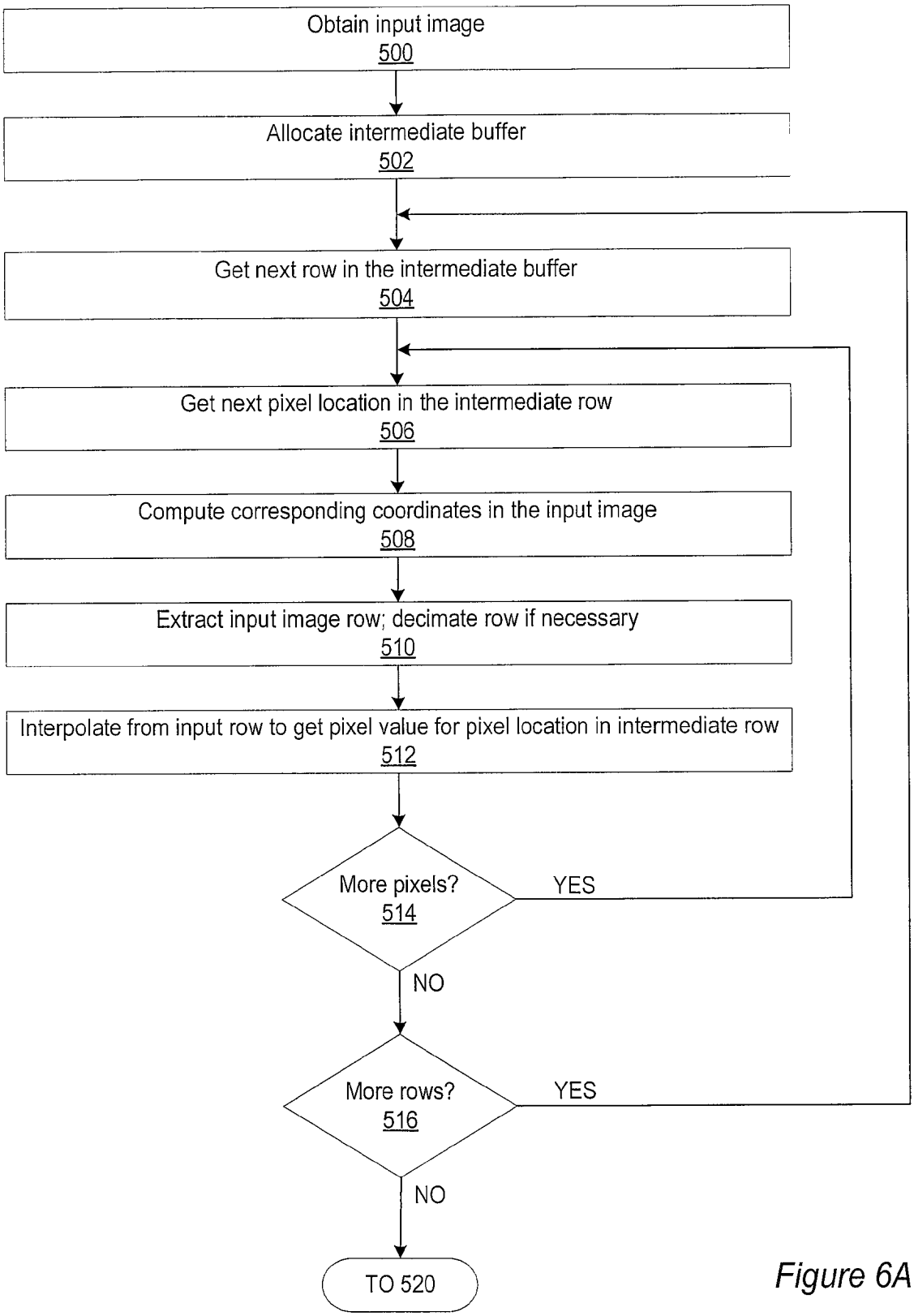

Obtain input image
500
Allocate intermediate buffer
502
Get next row in the intermediate buffer
504
Get next pixel location in the intermediate row
506
Compute corresponding coordinates in the input image
508
Extract input image row; decimate row if necessary
510
Interpolate from input row to get pixel value for pixel location in intermediate row
512
More pixels?
514
YES
NO
More rows?
516
YES
NO
TO 520

Figure 6A

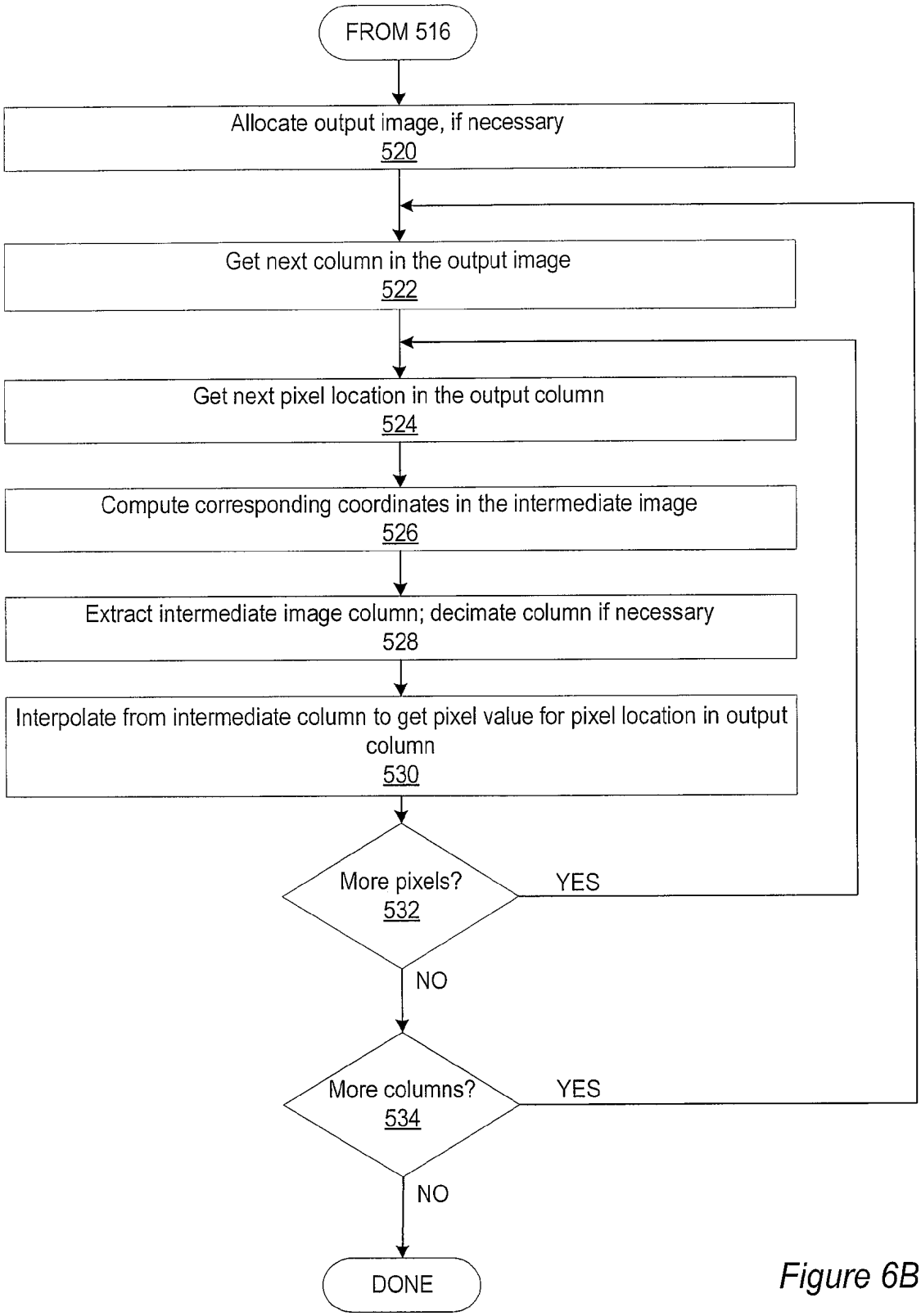

FROM 516
Allocate output image, if necessary
520
Get next column in the output image
522
Get next pixel location in the output column
524
Compute corresponding coordinates in the intermediate image
526
Extract intermediate image column; decimate column if necessary
528
Interpolate from intermediate column to get pixel value for pixel location in output column
530
More pixels?
532
YES
NO
More columns?
534
YES
NO
DONE

Figure 6B

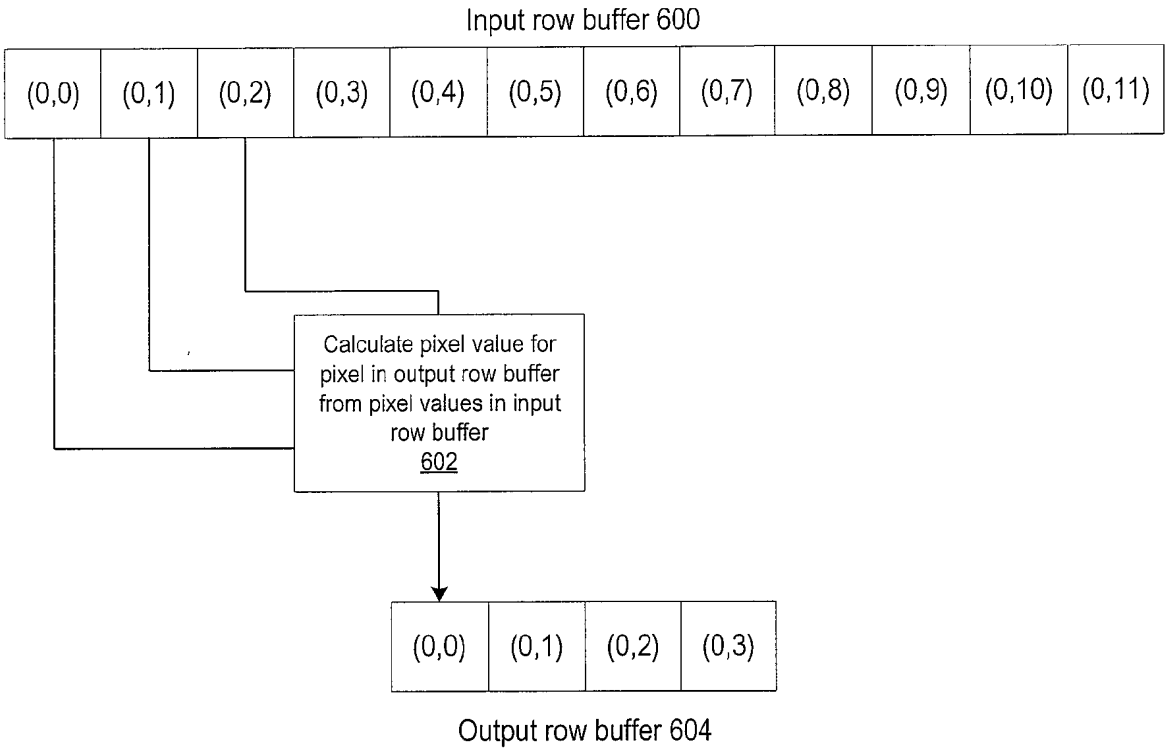

Input row buffer 600
(0,0)
(0,1)
(0,2)
(0,3)
(0,4)
(0,5)
(0,6)
(0,7)
(0,8)
(0,9)
(0,10)
(0,11)
Calculate pixel value for pixel in output row buffer from pixel values in input row buffer
602
(0,0)
(0,1)
(0,2)
(0,3)
Output row buffer 604

Figure 7

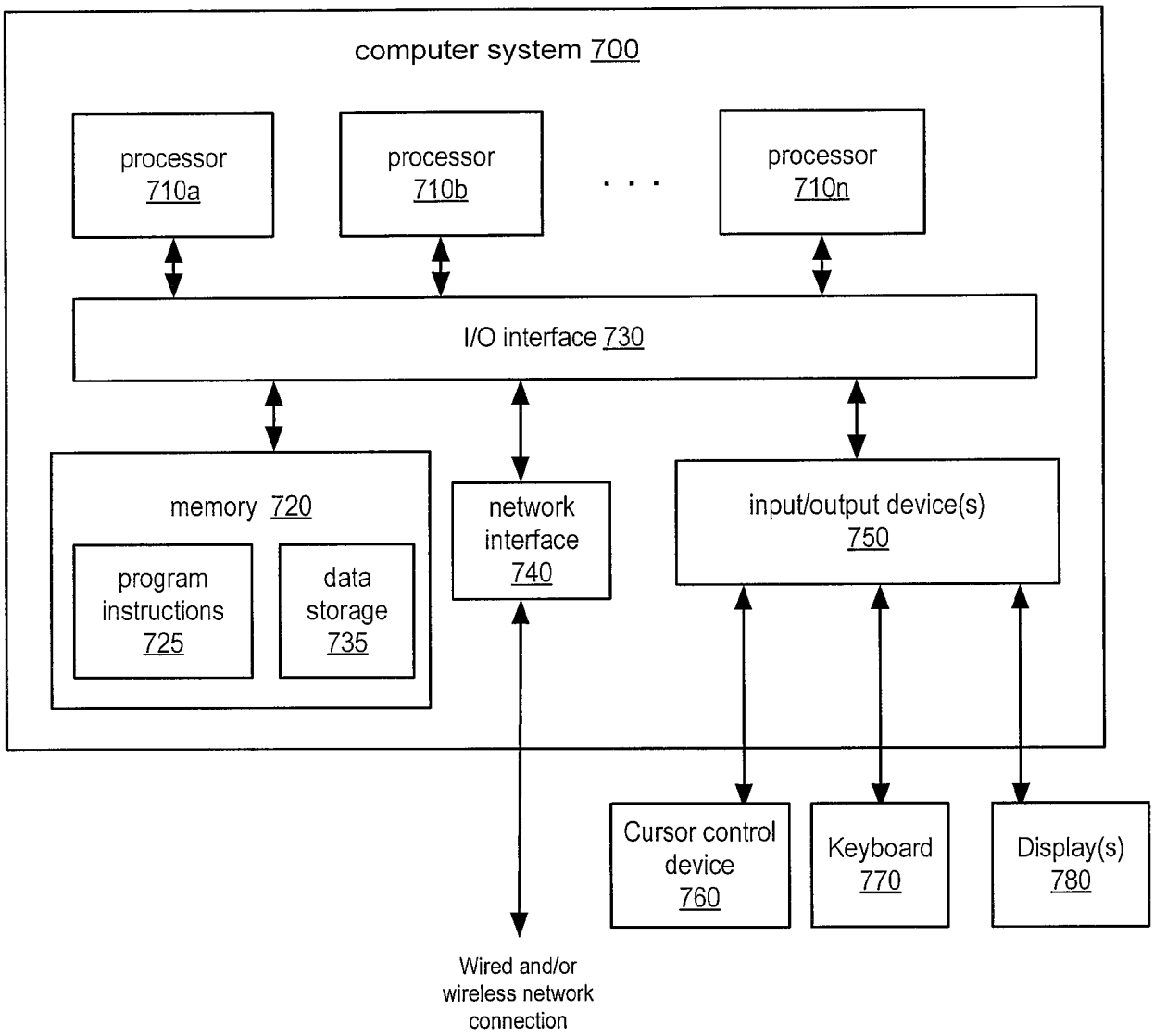

computer system 700
processor 710a
processor 710b
processor 710n
I/O interface 730
memory 720
program instructions 725
data storage 735
network interface 740
input/output device(s) 750
Cursor control device 760
Keyboard 770
Display(s) 780
Wired and/or wireless network connection

Figure 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/045277

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06T3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, INSPEC, IBM-TDB, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	sections 2, 3	8,16,22, 31,38,43

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 August 2009	25/08/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Katartzis, Antonios

Form PCT/ISA/210 (second sheet) (April 2005)

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Exhibit 1003 Page 228

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/156558 A1 (KIM SANG YEON [KR]) 12 August 2004 (2004-08-12) abstract figures 1-7	1-5,7, 9-13,15, 17-19, 21,23, 25-28, 30, 33-35, 37,40,42
Y	paragraph [0053] - paragraph [0093]	8,16,22, 31,38,43

Y	KARL M FANT: "A Nonaliasing, Real-Time Spatial Transform Technique" IEEE COMPUTER GRAPHICS AND APPLICATIONS, IEEE SERVICE CENTER, NEW YORK, NY, US, vol. 4, no. 1, 1 January 1986 (1986-01-01), pages 71-80, XP011155384 ISSN: 0272-1716 page 71 - page 73 figure 2	8,16,22, 31,38,43

A	ED CATMULL ET AL: "3-D transformations of images in scanline order" COMPUTER GRAPHICS PROCEEDINGS, PROCEEDINGS OF SIGGRAPH ANNUALINTERNATIONAL CONFERENCE ON COMPUTER GRAPHICS AND INTERACTIVETECHNIQUES, XX, XX, 1 January 1980 (1980-01-01), pages 279-285, XP002460758 page 279 - page 280	1-43

A	ROBERTSON P K: "SPATIAL TRANSFORMATIONS FOR RAPID SCAN-LINE SURFACE SHADOWING" IEEE COMPUTER GRAPHICS AND APPLICATIONS, IEEE SERVICE CENTER, NEW YORK, NY, US, vol. 9, no. 2, 1 March 1989 (1989-03-01), pages 30-38, XP000115874 ISSN: 0272-1716 the whole document	8,16,22, 31,38,43

A	FRASER D: "COMPARISON AT HIGH SPATIAL FREQUENCIES OF TWO-PASS AND ONE-PASS GEOMETRIC TRANSFORMATION ALGORITHMS" COMPUTER VISION GRAPHICS AND IMAGE PROCESSING, ACADEMIC PRESS, DULUTH, MA, US, vol. 46, no. 3, 1 June 1989 (1989-06-01), pages 267-283, XP000086835 abstract	8,16,22, 31,38,43

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

International application No
PCT/US2009/045277

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 2003020732 A1	30-01-2003	NONE	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT		
	Application Number	16/535,940
	Filing Date	08/08/2019
	First Named Inventor	David A. Newman
	Art Unit	2618
	Matter Number	46DG-026055

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Initials	**Cite No.**	**Document Number**	**Issue/Publication Date**	**First Named Inventor**	**Relevant Pages, Columns, etc.**
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	58	20100299630	11/25/2010	David McCutchen	

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	86	20130078990	03/28/2013	Mikyung Kim	
	87	20130127636	05/23/2013	Rameen Aryanpur	

Examiner Signature		**Date Considered**	

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Initials	**Cite No.**	**Document Number**	**Issue/Publication Date**	**First Named Inventor**	**Relevant Pages, Columns, etc.**
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	116	20140176542	06/26/2014	Makoto Shohara	

Examiner Signature		Date Considered	

Examiner: Please initial if citation considered, whether or not citation is in conformance with MPEP Section 609. Please draw a line through the citation if it is not in conformance and it is not considered. Please include a copy of this form with the next communication to the applicant.

U.S. PATENT/PUBLICATION DOCUMENTS					
Initials	**Cite No.**	**Document Number**	**Issue/Publication Date**	**First Named Inventor**	**Relevant Pages, Columns, etc.**
	117	20140193040	07/10/2014	Gonen Bronshtein	
	118	20140212107	07/31/2014	Felipe Saint-Jean	
	119	20140219634	08/07/2014	David McIntosh	
	120	20140226953	08/14/2014	Taylor Hou	
	121	20140232818	08/21/2014	G. Peter K. Carr	
	122	20140232819	08/21/2014	Charles Robert Armstrong	
	123	20140245336	08/28/2014	M. Lewis II Kirk	
	124	20140300644	10/09/2014	Clive Henry Gillard	
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	127	20140366052	12/11/2014	Ives	
	128	20140376876	12/25/2014	Michael Bentley	
	129	20150015680	01/15/2015	Yuan-Kang Wang	
	130	20150022355	01/22/2015	Hai D. Pham	
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	144	20150294141	10/15/2015	James Molyneux	
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Examiner Signature		Date Considered	

Examiner: Please initial if citation considered, whether or not citation is in conformance with MPEP Section 609. Please draw a line through the citation if it is not in conformance and it is not considered. Please include a copy of this form with the next communication to the applicant.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT		
	Application Number	16/535,940
	Filing Date	08/08/2019
	First Named Inventor	David A. Newman
	Art Unit	2618
	Matter Number	46DG-026055

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	146	20150339324	11/26/2015	Mark E. Westmoreland	
	147	20150375117	12/31/2015	Thompson	
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	151	20160026874	01/28/2016	Nick Hodulik	
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	169	2009146319A1	12/03/2009	WO		

Examiner Signature		Date Considered	
Examiner: Please initial if citation considered, whether or not citation is in conformance with MPEP Section 609. Please draw a line through the citation if it is not in conformance and it is not considered. Please include a copy of this form with the next communication to the applicant.			

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Initials	**Cite No.**	**Author, Title, Date, Pages, etc.**	**T**
	170	ERNOULT, Emeric, 'How to Triple Your YouTube Video Views with Facebook', SocialMediaExaminer.com, November 26, 2012, 16 pages.	
	171	FFmpeg, "AVPacket Struct Reference," Doxygen, July 20, 2014, 24 Pages, [online] [retrieved on July 13, 2015] Retrieved from the internet <URL:https://www.ffmpeg.org/doxygen/2.5/group_lavf_decoding.html>.	
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	174	HAN et al., 'Deep Compression: Compressing Deep Neural Networks with Pruning, Trained Quantization and Huffman Coding, International Conference on Learning Representations 2016, 14 pgs.	
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	177	IOFFE et al., 'Batch Normalization: Accelerating Deep Network Training by Reducing Internal Covariate Shift,' arXiv:1502.03167, 2015, 11 pgs.	
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	183	PCT International Search Report and Written Opinion for PCT/US16/31076, Aug. 8, 2016, 19 Pages.	
	184	PCT International Search Report for PCT/US15/23680 dated August 3, 2015, 4 pages.	
	185	PCT International Search Report for PCT/US15/41624 dated November 4, 2015, 5 pages.	
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	188	RICKER, 'First Click: TomTom's Bandit camera beats GoPro with software' March 9,2016 URL: http://www.theverge. com/2016/3/9/11179298/tomtom-bandit-beats-gopro (6 pages).	
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	190	TRAN et al., 'Learning Spatiotemporal Features with 3D Convolutional Networks', arXiv:1412.0767 [cs.CV] December 2, 2014 (9 pgs)	
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Examiner Signature		**Date Considered**	

Examiner: Please initial if citation considered, whether or not citation is in conformance with MPEP Section 609. Please draw a line through the citation if it is not in conformance and it is not considered. Please include a copy of this form with the next communication to the applicant.

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: ANTHONY JACOBSON
FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	17 DEC 2015
Applicant's or agent's file reference 26294/PCT	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 15/41624	22 July 2015 (22.07.2015)	23 July 2014 (23.07.2014)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H04N 9/80 (2015.01)
CPC - H04N 21/8549

Applicant GOPRO, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule *43bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1 *bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	05 November 2015 (05.11.2015)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (January 2015)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/41624

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/41624

Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has, within the applicable time limit:

   ☐ paid additional fees.

   ☐ paid additional fees under protest and, where applicable, the protest fee.

   ☐ paid additional fees under protest but the applicable protest fee was not paid.

   ☒ not paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is

   ☐ complied with.

   ☒ not complied with for the following reasons:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

Group I: Claims 1-42, directed to identifying scenes in captured video for inclusion in a video summary by using metadata associated with a video, identifying events of interest within the video, identifying a best scene in the video, and selecting one or more best scenes for inclusion in a video summary.

Group II: Claims 43-60, directed to generating a video summary using a video summary template by receiving a request for a video summary, selecting a video summary template comprising a plurality of template slots for use in generating the video summary, selecting, for each template slot, an associated candidate video clip, and generating the video summary by replacing each template slot in the video summary template with the associated selected candidate video clip.

Group III: Claims 61-78, directed to identifying scenes in captured video by capturing video, receiving, from a user during the capture of the video, input identifying an event of interest within the captured video, storing an indication of the event of interest in metadata, and identifying a video clip associated with the event of interest based on the metadata.

Group IV: Claims 79-99, directed to identifying activities in videos by accessing videos and video metadata, receiving an identification of an activity associated with a video, identifying metadata patterns associated with the identified activity, and associating a video with the identified activity.

Group V: Claims 100-120, directed to identifying scenes in captured video for inclusion in a video summary by accessing a video including a plurality of frames, identifying a motion value associated with each frame, identifying a differential motion value associated with each frame based on the motion value, determining a score for each frame based on the motion value and differential motion value, selecting one or more frames based on the scores, identifying a corresponding video scene, and selecting one or more scenes for inclusion in a video summary.

The groups of inventions listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical feature of the Group I invention is using metadata associated with a video, identifying events of interest within the video, identifying a best scene in the video, and selecting one or more best scenes for inclusion in a video summary, not required by Group II-V. (See Fig. 4 for example).

The special technical feature of the Group II invention is receiving a request for a video summary, selecting a video summary template comprising a plurality of template slots for use in generating the video summary, selecting, for each template slot, an associated candidate video clip, and generating the video summary by replacing each template slot in the video summary template with the associated selected candidate video clip, not required by Group I or III-V. (See Fig. 5 for example).

-- Continued in Supplemental Box --

4. Consequently, this opinion has been established in respect of the following parts of the international application:

   ☐ all parts.

   ☒ the parts relating to claims Nos. 1-42

Form PCT/ISA/237 (Box No. IV) (January 2015)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/41624

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	6-9, 11, 15, 20, 27-30, 32, 36, 41	YES
	Claims	1-5, 10, 12-14, 16-19, 21-26, 31, 33-35, 37-40, 42	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-42	NO
Industrial applicability (IA)	Claims	1-42	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-5, 10, 12-14, 16-19, 21-26, 31, 33-35, 37-40 and 42 lack novelty under PCT Article 33(2) as being anticipated by US 2010/0104261 A1 to Liu, et al. (hereinafter 'Liu').

As to claims 1 and 22, Liu teaches a method for identifying scenes in captured video for inclusion in a video summary (para [0018]-[0021] - "systems and methods for video summarization"), the method comprising; accessing metadata associated with a video, the accessed metadata representative of capture of the video (para [0018]-[0021], [0024] - "temporal content variation and the spatial image salience"; "shot segmentation analyze the change in content like scene changes, object motion, and camera motion between subsequent video frames"); identifying a plurality of events of interest within the video based on the accessed metadata (para [0018]-[0021] - "the most interesting subshots are determined using both human-emulated salience scores and low-level scene-based changes"; "Shots 104a-h may each depict a distinct event or version of an event. That is, shots 104a-h may each show a distinct camera action"); for each identified event of interest, identifying a best scene in the video associated with the identified event of interest, the identified best scene comprising a threshold amount of video occurring before and after a video frame or portion corresponding to the identified event of interest (para [0018]-[0021], [0038] - "shots are split into subshots. K-means clustering is then applied to all subshots to detect and consolidate similar subshots. Next, content based importance values computed for all frames and are propagated to subshots and computed clusters"; "image salience is computed for the subshots with high importance values and the most salient segments are selected for summarization"); and selecting one or more identified best scenes for inclusion in a video summary (para [0018]-[0021] - "these video segments are sorted based on their time stamps and they are stitched together as the summarized video").

As to claims 2 and 23, Liu further teaches a method further comprising: receiving a request for a video summary from the user; and generating a video summary including a plurality of selected best scenes (para [0002]-[0003], [0018]-[0019], [0040]-[0042], [0045] - "summarization may be used to present the main theme of video sequences to a user"; "human evaluator").

As to claims 3 and 24, Liu further teaches a method wherein generating the video summary comprises concatenating the plurality of selected best scenes (para [0019]).

As to claims 4 and 25, Liu further teaches a method wherein the accessed metadata is generated by a camera during the capture of the video (para [0021], [0024]).

As to claims 5 and 26, Liu further teaches a method wherein the accessed metadata comprises telemetry data describing a motion of the camera during the capture of the video (para [0021], [0024] - "shots 104a-h may each show a distinct camera action (e.g., zoom, pan, etc.)"; "camera motion between subsequent video frames").

As to claims 10 and 31, Liu further teaches a method further comprising: ranking the identified best scenes based on a likelihood that the identified best scene will be of interest to a user; wherein the selected one or more best scenes are selected based on the ranking (para [0018]-[0019], [0038], [0041]-[0042] - "salience of an image is used to identify and score regions of an image that a human would find interesting"; "video summary may be created by allocating budgets for all clusters, allocating budges for subshots within each cluster, and picking the video segment from each subshot. First, all clusters are sorted based on their importance values").

As to claims 12 and 33, Liu teaches a system for identifying scenes in captured video for inclusion in a video summary (para [0018]-[0021]), the system comprising; a non-transitory computer-readable storage medium storing instructions (para [0050]-[0051] - "computer program instructions may be stored in a storage device 804 (e.g., magnetic disk, database, etc.) and loaded into memory 806 when execution of the computer program instructions") configured to, when executed: access metadata associated with a video, the accessed metadata representative of capture of the video (para [0018]-[0021], [0024]); identify a plurality of events of interest within the video based on the accessed metadata (para [0018]-[0021]); for each identified event of interest, identify a best scene in the video associated with the identified event of interest, the identified best scene comprising a threshold amount of video occurring before and after a video frame or portion corresponding to the identified event of interest (para [0018]-[0021], [0038]); and select one or more identified best scenes for inclusion in a video summary (para [0018]-[0021]); and a processor configured to execute the instructions (para [0050]-[0051] - "a processor 802 that controls the overall operation of the computer 800 by executing computer program instructions, which define such operation").

(See Continuation Box)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/41624

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box V.2. Citations and explanations:

As to claims 17 and 38, Liu teaches a non-transitory computer-readable storage medium storing instructions for identifying scenes in captured video for inclusion in a video summary (para [0018]-[0021], [0050]-[0051]), the instructions configured to, when executed: access metadata associated with a video, the accessed metadata representative of capture of the video (para [0018]-[0021], [0024]); identify a plurality of events of interest within the video based on the accessed metadata (para [0018]-[0021]); for each identified event of interest, identify a best scene in the video associated with the identified event of interest, the identified best scene comprising a threshold amount of video occurring before and after a video frame or portion corresponding to the identified event of interest (para [0018]-[0021], [0038]); and select one or more identified best scenes for inclusion in a video summary (para [0018]-[0021]).

As to claims 13, 18, 34 and 39, Liu further teaches a system (and corresponding computer-readable storage medium) wherein the instructions are further configured to: receive a request for a video summary from the user; and generate a video summary including a plurality of selected best scenes (para [0002]-[0003], [0018]-[0019], [0040]-[0042], [0045]).

As to claims 14, 19, 35 and 40, Liu further teaches a system (and corresponding computer-readable storage medium) wherein the accessed metadata is generated by a camera during the capture of the video and comprises one or more of: telemetry data describing a motion of the camera during the capture of the video, location data describing a location of the camera during the capture of the video, and biometric data describing characteristics of a user of the camera during the capture of the video (para [0021], [0024] - "shots 104a-h may each show a distinct camera action (e.g., zoom, pan, etc.)"; "camera motion between subsequent video frames").

As to claims 16, 21, 37 and 42, Liu further teaches a system (and corresponding computer-readable storage medium) wherein the instructions are further configured to: rank the identified best scenes based on a likelihood that the identified best scene will be of interest to a user; wherein the selected one or more best scenes are selected based on the ranking (para [0018]-[0019], [0038], [0041]-[0042]).

Claims 6, 8-9, 15, 20, 27, 29-30, 36 and 41 lack an inventive step under PCT Article 33(3) as being obvious over Liu in view of US 2012/0057852 A1 to Devleeschouwer, et al. (hereinafter 'Devleeschouwer').

As to claims 6 and 27, Liu teaches the methods of claim 4 and 25, respectively, but does not explicitly teach a method wherein the accessed metadata comprises location data describing a location of the camera during the capture of the video. However, Devleeschouwer does teach wherein the accessed metadata comprises location data describing a location of the camera during the capture of the video (para [0091] - "information about the location of object-of-interests has to be provided in real-time, e.g. based on the real time analysis of the signal captured by some audio-visual sensors"; "the space of candidate fields of view is defined by the position and control parameters of the PTZ camera"). Devleeschouwer further teaches detecting objects/persons of interest in video segments (para [0044]), assigning a level of interest to an object detected in a scene (para [0057]-[0058]), and producing a video report/summarization of an event based on concatenation of video segments captured by at set of cameras (para [0091], [0152], [0154]). It would have been obvious to one of ordinary skill in the art to utilize wherein the accessed metadata comprises location data describing a location of the camera during the capture of the video as taught by Devleeschouwer in order to provide systems and methods for video summarization as taught by Liu capable of improved access to location data for scene determination and analysis. Both Liu and Devleeschouwer are directed to systems and methods for video summarization.

As to claims 8 and 29, Liu teaches the methods of claim 1 and 22, respectively, but does not explicitly teach a method wherein the accessed metadata is accessed from an external entity after the capture of the video. However, Devleeschouwer does teach wherein the accessed metadata is accessed from an external entity after the capture of the video (para [0208] - "results of the method may be transmitted to a further near or remote location"). It would have been obvious to one of ordinary skill in the art to utilize wherein the accessed metadata is accessed from an external entity after the capture of the video as taught by Devleeschouwer in order to provide systems and methods for video summarization as taught by Liu capable of improved video processing and summary generation by remotely located entities.

As to claims 9 and 30, Devleeschouwer further teaches a method wherein the accessed metadata comprises environment data describing characteristics of an environment in which the video was captured (para [0091], [0187]-[0193], [0201]-[0204], Fig. 4, Fig. 6 - "ability to (i) control field of view selection by individual camera, and (ii) select a best camera within a set of camera"; "personalize the viewpoint selection process according to individual user preferences. For example, in the context of a sport event, coaches (who prefer large viewpoints showing the entire game) have different expectations regarding viewpoint selection than common spectator (who prefer closer and emotionally richer images). Thus these preferences are directly related to technical parameters of how the cameras are controlled" - controlling camera viewpoint selection by using user preferences based on environmental characteristic data; foreground / background modelling for views).

As to claims 15, 20, 36 and 41, Liu teaches the systems and corresponding computer-readable storage media of claims 12, 17, 33 and 38, respectively, but does not explicitly teach a system (and corresponding computer-readable storage medium) wherein the accessed metadata is accessed from an external entity after the capture of the video and comprises environment data describing characteristics of an environment in which the video was captured. However, Devleeschouwer does teach wherein the accessed metadata is accessed from an external entity after the capture of the video (para [0208]) and comprises environment data describing characteristics of an environment in which the video was captured (para [0091], [0187]-[0193], [0201]-[0204], Fig. 4, Fig. 6). It would have been obvious to one of ordinary skill in the art to utilize wherein the accessed metadata is accessed from an external entity after the capture of the video and comprises environment data describing characteristics of an environment in which the video was captured as taught by Devleeschouwer in order to provide systems and methods for video summarization as taught by Liu capable of improved access to data associated with video capture location, as well as improved video processing and summary generation by remotely located entities.

(See Next Continuation Box)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/41624

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box V.2. Citations and explanations:

Claims 7 and 28 lack an inventive step under PCT Article 33(3) as being obvious over Liu in view of US 2010/0245626 A1 (Woycechowsky).

As to claims 7 and 28, Liu teaches the methods of claim 4 and 25, respectively, but does not explicitly teach a method wherein the accessed metadata comprises biometric data describing characteristics of a user of the camera during the capture of the video. However, Woycechowsky does teach wherein the accessed metadata comprises biometric data describing characteristics of a user of the camera during the capture of the video (para [0036] - "biometric data of the camera user (for example, voice detection for a voice activated camera)"). It would have been obvious to one of ordinary skill in the art to utilize wherein the accessed metadata comprises biometric data describing characteristics of a user of the camera during the capture of the video as taught by Woycechowsky in order to provide systems and methods for video summarization as taught by Liu capable of improved user identity verification and/or authentication. Both Liu and Woycechowsky are directed to systems and methods for using cameras to record and process video data.

Claims 11 and 32 lack an inventive step under PCT Article 33(3) as being obvious over Liu in view of US 2013/0318443 A1 to Bachman, et al. (hereinafter 'Bachman').

As to claims 11 and 32, Liu further teaches a method wherein selecting one or more identified best scenes comprises: presenting the identified best scenes to the user (para [0002]-[0003], [0018]-[0019], [0038], [0041]-[0042], [0045]); but does not explicitly teach receiving, from the user, a selection of one or more identified best scenes. However, Bachman does teach receiving, from the user, a selection of one or more identified best scenes (para [0003], [0020], [0023] - "receiving information from the user including a movie template selection and a selection of one or more video clips corresponding to desirable characteristics"). It would have been obvious to one of ordinary skill in the art to utilize receiving, from the user, a selection of one or more identified best scenes as taught by Bachman in order to provide systems and methods for video summarization as taught by Liu capable of improved user identity verification and/or authentication. Both Liu and Bachman are directed to systems and methods for video summarization.

Claims 1-42 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 15/41624

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box No. IV - Lack of unity of invention:

The special technical feature of the Group III invention is receiving, from a user during the capture of the video, input identifying an event of interest within the captured video, storing an indication of the event of interest in metadata, and identifying a video clip associated with the event of interest based on the metadata, not required by Group I-II or IV-V. (See Fig. 6 for example).

The special technical feature of the Group IV invention is accessing videos and video metadata, receiving an identification of an activity associated with a video, identifying metadata patterns associated with the identified activity, and associating a video with the identified activity, not required by Group I-III or V. (See Fig. 7 for example).

The special technical feature of the Group V invention is accessing a video including a plurality of frames, identifying a motion value associated with each frame, identifying a differential motion value associated with each frame based on the motion value, determining a score for each frame based on the motion value and differential motion value, selecting one or more frames based on the scores, identifying a corresponding video scene, and selecting one or more scenes for inclusion in a video summary, not required by Group I-IV.

Groups I, II and V share the technical features of, in various combination, utilizing a plurality of video segments / clips / frames, and generating a video summary.

However, these shared technical features fail to represent a contribution over the prior art of US 2014/0161351 A1 (Yagnik), which discloses utilizing a plurality of video segments / clips / frames (para [0025]-[0028] - "receiving a video 102, which is comprised of a number of frames"), and generating a video summary (para [0009], claim 1 - "combining selected scenes to produce the summary for the video").

Groups I, III and IV share the technical features of, in various combination, utilizing metadata associated with video, and identifying activities / scenes in captured video associated with events of interest / activities within captured video.

However, these shared technical features fail to represent a contribution over the prior art of US 2014/0093164 A1 to Noorkami et al. (hereinafter 'Noorkami'), which discloses utilizing metadata associated with video (para [0062]-[0064] - "the method 700 may then insert metadata into the video content"), and identifying activities / scenes in captured video associated with events of interest / activities (para [0062]-[0064], claim 1 - "the method 700 may examine all of the shots in the video content 34 and efficiently determine one or more scene boundaries at one or more target shots, where a new scene begins at each scene boundary"; "detecting a scene in video content") within captured video (para [0019] - "each of the frames (i-1), (i), (i+1), (i+2), etc. may represent an image captured by an image capture device, such as a video camera").

Groups I, III and V share the technical features of, in various combination, identifying activities / scenes in captured video, and an amount of video occurring before and after a video frame or portion corresponding to and identified event of interest.

However, these shared technical features fail to represent a contribution over the prior art of US 2013/0300939 A1 to Chou et al. (hereinafter 'Chou'), which discloses identifying activities / scenes (para [0013], [0050] - "scene recognition in a video/audio processing environment") in captured video (para [0033] - "embodiments of system 10 can operate on videos and audios captured from any capture system"), and an amount of video occurring before and after a video frame or portion corresponding to and identified event of interest (para [0019], [0022]-[0028], [0035], [0057] - "User 32 may search the example video for various scenes (e.g., Welcome Scene, Farewell Scene, etc.)"; "order scenes into a scene sequence"; "user 32 may be provided with options to click through to particular scenes of interest, or speakers of interest, as the case may be. Because each scene sequence 52 and speaker sequence 54 may include scenes tagged with scene identifiers, and speakers tagged with speaker identifiers, respectively, searching for particular scenes and/or speakers in report 24 may be effected easily").

Groups I, III, IV and V share the technical features of, in various combination, identifying activities / scenes in captured video.

However, these shared technical features fail to represent a contribution over the prior art of US 2014/0105573 A1 to Hanckmann et al. (hereinafter 'Hanckmann'), which discloses identifying activities / scenes (para [0019], [0021], [0072] - "Action type detector 14 is a device that detects which of a predetermined set of action types is seen to occur in a time range in a video stream"; "identify the subset of likely actions, and to subsequently describe them with a rule-based method that relates the actions to entities in the scene") in captured video (para [0018] - "Camera 10 is configured to generate a stream of data that represents a temporal sequence of video images, which is stored by video data storage device").

Thus, the inventions listed as Groups I-V lack unity of invention because they do not share a same or corresponding special technical feature providing a contribution over the prior art.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference 46DG-241781	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/US2015/023680	International filing date *(day/month/year)* 31 March 2015 (31.03.2015)	Priority date *(day/month/year)* 31 March 2014 (31.03.2014)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant GOPRO, INC.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 10 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☒	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 04 October 2016 (04.10.2016)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Athina Nickitas-Etienne e-mail: pt04.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: RAJIV P. PATEL
FENWICK & WEST LLP
SILICON VALLEY CENTER
801 CALIFORNIA STREET
MOUNTAIN VIEW, CA 94041

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	06 OCT 2015
Applicant's or agent's file reference 28742/PCT	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2015/023680	31 March 2015	31 March 2014

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - G11B 27/00 (2015.01)
CPC - G11B 27/00 (2015.04)

Applicant GOPRO, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1 *bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to th IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Fom PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	03 August 2015	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2011)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2015/023680

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)

   ☐ on paper

   ☐ in electronic form

   b. (time)

   ☐ in the international application as filed

   ☐ together with the international application in electronic form

   ☐ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.

Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has, within the applicable time limit:

   ☐ paid additional fees.

   ☐ paid additional fees under protest and, where applicable, the protest fee.

   ☐ paid additional fees under protest but the applicable protest fee was not paid.

   ☒ not paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is

   ☐ complied with.

   ☒ not complied with for the following reasons:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-20, drawn to uploading a high-resolution video.
Group II, claims 21-40, drawn to processing a high-resolution video.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: receiving, from a client device, a low-resolution video transcoded from a high-resolution video, the low-resolution video comprising frames having a lower resolution than frames of the high-resolution video; selecting a portion of interest within the low-resolution video, the selected portion of interest used to obtain a corresponding portion of the high-resolution video from which the selected portion of interest within the low-resolution video was transcoded as claimed therein is not present in the invention of Group II. The special technical feature of the Group II invention: receiving, from a client device, registration of a high-resolution video accessed by the client device from a camera communicatively coupled to the client device; transmitting commands to prompt the client device to perform the at least one task on the specified portion of the high-resolution video according to the task list as claimed therein is not present in the invention of Group I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of processing a high-resolution video; receiving the specified portion of the high-resolution video; storing the high-resolution video, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 2010/0086216 A1 (LEE et al) 08 April 2010 (08.04.2010) teaches processing a high-resolution video (the video processing apparatus 100 may divide video, e.g., ultra-high resolution, via the video division unit 110, Para. 40); receiving the specified portion of the high-resolution video (the video division unit 110 may receive video data and divide the input video data into at least two areas, Para. 20); storing the high-resolution video (the video processing apparatus 100 may divide video, e.g., ultra-high resolution, via the video division unit 110, and refer to pixels belonging to other divided areas which are stored in the respective frame buffers 120-1 through 120-n, included in the data storage unit 120, for the respective divided area being processed, Para. 40).

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.

4. Consequently, this opinion has been established in respect of the following parts of the international application:

   ☐ all parts.

   ☒ the parts relating to claims Nos. 1-20

Form PCT/ISA/237 (Box No. IV) (July 2011)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2015/023680

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	None	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1, 6, 11-12, 17 lack an inventive step under PCT Article 33(3) as being obvious over Givoly in view of Coombs et al., hereinafter referred to as Coombs.

Regarding claim 1, Givoly teaches a method (a method for editing a video asset, para. 0011) for uploading a video (the compressed video asset is transmitted to a remote video editor, para. 0028), the method comprising:

receiving, from a client device, a low-resolution video transcoded from a high-resolution video, the low-resolution video comprising frames having a lower resolution than frames of the high-resolution video (software running on a personal computer [functions as the client device] compresses the video asset of a high definition resolution into a low resolution so as to provide a compressed video asset, lower and higher resolutions can be associated with different compression algorithms [compression would include a transcoding operation], this would facilitate a transmitting of the compressed video asset to a remote video editor, resolution refers to the number of pixels in a frame, para. 0022, 0026, 0028);

selecting data within the low-resolution video (after the transmitting a remote video editor edits the compressed video asset, the result of this video editing is stored as editing instructions which is metadata describing the video editing functions performed [the editing process would include selection of edits], para. 0029, 0031); and

storing the high-resolution video (the video asset is processed based on the editing instructions and stored, para. 0093-0094); but lacks the teaching uploading high-resolution video; selecting a portion of interest within the low-resolution video, the selected portion of interest used to obtain a corresponding portion of the high-resolution video from which the selected portion of interest within the low-resolution video was transcoded; transmitting commands to the client device to prompt the client device to upload the corresponding portion of the high-resolution video; and receiving the corresponding portion of the high-resolution video from the client device.

Coombs is in the field of remote picture editing (title, para. 0016) and teaches uploading high-resolution video (software running on the hub selects the identified images and applies any specified edits to the selected images, software running on hub 303 then forwards the edited high-resolution image to server 304 using an Internet connection, the recording is in a video form, para. 0016, 0033-0034);

selecting a portion of interest within the low-resolution video, the selected portion of interest used to obtain a corresponding portion of the high-resolution video from which the selected portion of interest within the low-resolution video was transcoded (the hub software can make lower-resolution copies of the original high-resolution images, the lower-resolution images can be received and stored at the server, an editor can review the lower-resolution images to select the images to be forwarded to news and media outlets for distribution to the public and determine a manner in which the selected images are to be used or edited [a portion of the uploaded media is selected], hub software selects the identified high-resolution images and applied the instructions received from the editor [the selected images are used to obtain the corresponding portion of high-resolution media], para. 0022);

transmitting commands to the client device to prompt the client device to upload the corresponding portion of the high-resolution video (editor software records the identification of the selected images and the appropriate instructions to be applied to the images and forwards the identification and instructions to the hub, hub software selects the identified high-resolution images and applied the instructions received from the editor, software running on hub 303 then forwards the edited high-resolution image to server 304 using an Internet connection [the transmission from the editor software to the hub functions as a command to prompt the hub software to upload the referenced high-resolution media portions], 0022, 0034); and

receiving the corresponding portion of the high-resolution video from the client device (software running on server 304 receives the edited high-resolution image and forwards it to an appropriate processor 306, para. 0034). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Coombs to incorporate the high-resolution uploading features in the invention of Givoly. The motivation would have been to permit the transmission of the high-resolution edited files upstream over the Internet (Coombs, para. 0033).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2015/023680

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Regarding claim 12, Givoly teaches a non-transitory computer-readable medium storing instructions that when executed cause a processor to (automated video editing is performed at the remote video editor [would be implemented using a processor executing stored instructions], para. 0031):

receive, from a client device, a low-resolution video transcoded from a high-resolution video, the low-resolution video comprising frames having a lower resolution than frames of the high-resolution video (software running on a personal computer [functions as the client device] compresses the video asset of a high definition resolution into a low resolution so as to provide a compressed video asset, lower and higher resolutions can be associated with different compression algorithms [compression would include a transcoding operation], this would facilitate a transmitting of the compressed video asset to a remote video editor, resolution refers to the number of pixels in a frame, para. 0022, 0026, 0028);

select data within the video (after the transmitting a remote video editor edits the compressed video asset, the result of this video editing is stored as editing instructions which is metadata describing the video editing functions performed [the editing process would include selection of edits], para. 0029, 0031); and

store the high-resolution video (the video asset is processed based on the editing instructions and stored, para. 0093-0094); but lacks the teaching select a portion of the high-resolution video according to a portion of interest depicted in the selected portion of the low-resolution video; instruct the client device to upload a corresponding portion of the high-resolution video from which the selected portion of the low-resolution video was transcoded; and receive the corresponding portion of the high-resolution video.

Coombs is in the field of remote picture editing (title, para. 0016) and teaches teaching select a portion of the high-resolution video according to a portion of interest depicted in the selected portion of the low-resolution video (the hub software can make lower-resolution copies of the original high-resolution images, the lower-resolution images can be received and stored at the server, an editor can review the lower-resolution images to select the images to be forwarded to news and media outlets for distribution to the public and determine a manner in which the selected images are to be used or edited [a portion of the uploaded media is selected], hub software selects the identified high-resolution images and applied the instructions received from the editor [the selected images are used to obtain the corresponding portion of high-resolution media], the recording is in a video form, para. 0016, 0022);

instruct the client device to upload a corresponding portion of the high-resolution video from which the selected portion of the low-resolution video was transcoded (editor software records the identification of the selected images and the appropriate instructions to be applied to the images and forwards the identification and instructions to the hub, hub software selects the identified high-resolution images and applied the instructions received from the editor, software running on hub 303 then forwards the edited high-resolution image to server 304 using an Internet connection [the transmission from the editor software to the hub functions as an instruction to upload the referenced high-resolution media portions], 0022, 0034); and

receive the corresponding portion of the high-resolution video (software running on server 304 receives the edited high-resolution image and forwards it to an appropriate processor 306, para. 0034). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Coombs to incorporate the high-resolution uploading features in the invention of Givoly. The motivation would have been to permit the transmission of the high-resolution edited files upstream over the Internet (Coombs, para. 0033).

Regarding claims 6 & 17, Givoly teaches wherein receiving the low-resolution video from the client device comprises: transcode the high-resolution video into the low-resolution video comprising frames at the lower resolution than frames of the high-resolution video; and receiving, from the client device, the low-resolution video transcoded from the high-resolution video (software running on a personal computer [functions as the client device] compresses the video asset of a high definition resolution into a low resolution so as to provide a compressed video asset, lower and higher resolutions can be associated with different compression algorithms [compression would include a transcoding operation], this would facilitate a transmitting of the compressed video asset to a remote video editor, resolution refers to the number of pixels in a frame, para. 0022, 0026, 0028); but lacks the teaching receiving, from the client device, registration of the high-resolution video accessible by the client device from a camera communicatively coupled to the client device; transmitting commands to the client device to prompt the client device. Coombs is in the field of remote picture editing (title, para. 0016) and teaches receiving, from the client device, registration of the high-resolution video accessible by the client device from a camera communicatively coupled to the client device (the high resolution image files are uploaded from the digital media on camera 301 to a photographer's computer 302, software residing on photographer's computer 302 then transfers a copy of the high-resolution image files including their associated metadata to a hub 303 [uploading the images from the camera to the computer functions as a registration of the images prior to transfer to the hub], para. 0025-0026); and transmitting commands to the client device to prompt the client device (editor software records the identification of the selected images and the appropriate instructions to be applied to the images and forwards the identification and instructions to the hub, hub software selects the identified high-resolution images and applied the instructions received from the editor, software running on hub 303 then forwards the edited high-resolution image to server 304 using an Internet connection [the transmission from the editor software to the hub functions as a command to prompt the hub software to upload the referenced high-resolution media portions], 0022, 0034). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Coombs to incorporate the registration features in the invention of Givoly. The motivation would have been to permit the transmission of the high-resolution edited files upstream over the Internet (Coombs, para. 0033).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2015/023680

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Regarding claim 11, Givoly lacks the teaching wherein storing the corresponding portion of the high-resolution video comprises: replacing the selected portion of interest within a stored copy of the low-resolution video with the corresponding portion of the high-resolution video. Coombs is in the field of remote picture editing (title, para. 0016) and teaches wherein storing the corresponding portion of the high-resolution video comprises: replacing the selected portion of interest within a stored copy of the low-resolution video with the corresponding portion of the high-resolution video (an editor access the lower-resolution images stored on the server using a standard web connection, reviews the images and selects and identifies desired images, software running on the hub edits the identified high-resolution images based on instructions specified by the editor and forwards the edited high-resolution images to the processor for final image editing [functions to replace selected low resolution media with high resolution media, the processor and editor function as an integrated image editing system], para. 0023). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Coombs to incorporate the replacement features in the invention of Givoly. The motivation would have been to permit the transmission of the high-resolution edited files upstream over the Internet (Coombs, para. 0033).

Claims 2-3, 13-14 lack an inventive step under PCT Article 33(3) as being obvious over Givoly in view of Coombs, and further in view of Nakamura et al., hereinafter referred to as Nakamura.

Regarding claims 2 & 13, Givoly lacks the teaching wherein selecting the portion of interest within the low-resolution video comprises: providing for display, through a video editing interface, the low-resolution video; obtaining an edit decision list describing an edit made by a user to the low-resolution video through the video editing interface; and identifying the corresponding portion of the high-resolution video from a portion comprising a video time of the edit to the low-resolution video, the edit time indicated by the edit decision list. Coombs is in the field of remote picture editing (title, para. 0016) and teaches identifying the corresponding portion of the high-resolution video from a portion (the hub software can make lower-resolution copies of the original high-resolution images, the lower-resolution images can be received and stored at the server, an editor can review the lower-resolution images to select the images to be forwarded to news and media outlets for distribution to the public and determine a manner in which the selected images are to be used or edited [a portion of the uploaded media is selected], hub software selects the identified high-resolution images and applied the instructions received from the editor [the selected images are used to obtain the corresponding portion of high-resolution media], para. 0022). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Coombs to incorporate the portion identifying features in the invention of Givoly. The motivation would have been to permit the transmission of the high-resolution edited files upstream over the Internet (Coombs, para. 0033). Nakamura is in the field of editing systems (title) and teaches wherein selecting the portion of interest within the low-resolution video comprises: providing for display, through a video editing interface, the low-resolution video (clip video display part 48 of clip viewer window 42 displays the video of a clip moved from clip explorer window 41 and playbacks the video, para. 0062); obtaining an edit decision list describing an edit made by a user to the low-resolution video through the video editing interface (each proxy editing terminal device 8 is designed to be capable of creating an EDL by performing cut editing in which desired video/audio parts of desired clips being recorded in proxy server 6 are specified and a sending order of the cut video is set by arranging these parts on a time line, para. 0055); and a portion comprising a video time of the edit to the low-resolution video, the edit time indicated by the edit decision list (the operator can specify an IN-point and an OUT-point of a clip, when a desired part of a clip is specified as a cut on clip viewer window 42 this clip is pasted on time line window 43, each editing terminal device 9 creates a final edit list by specifying desired video/audio parts of desired clips and setting a sending order of cut video by arranging the parts on a time line, the EDL information includes the time codes of IN-point and OUT-point of each cut, para. 0063-0064, 0083-0084). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Nakamura to incorporate the edit decision list features in the invention of Givoly. The motivation would have been to improve working efficiency (Nakamura, para. 0159).

Regarding claims 3 & 14, Givoly teaches wherein the corresponding portion of the high-resolution video received from the client device has been modified according to the edit decision list (the editing instructions will be sent back to the computer on which the original high definition video asset resides, a video processor will process the original high definition video asset based on the editing instructions received from the remote video editor as to provide an edited video asset of the original resolution, para. 0031).

Claims 4-5, 15-16 lack an inventive step under PCT Article 33(3) as being obvious over Givoly in view of Coombs, and further in view of Kataoka et al., hereinafter referred to as Kataoka.

Regarding claims 4 & 15, Givoly lacks the teaching wherein selecting the portion of interest within the low-resolution video comprises: obtaining a highlight tag indicating a video time of the event of interest, the highlight tag included in metadata of the high-resolution video; and selecting the portion of interest within the low-resolution video comprising video times within a threshold time interval from a video time indicated by the highlight tag. Coombs is in the field of remote picture editing (title, para. 0016) and teaches data included in metadata of the high-resolution video (lower-resolution copies contain the same image and metadata as the original high-resolution image, para. 0021). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Coombs to incorporate the metadata features in the invention of Givoly. The motivation would have been to describe the photograph (Coombs, para. 0020). Kataoka is in the field of indicating time points (abstract) and teaches wherein selecting the portion of interest within the low-resolution video comprises: obtaining a highlight tag indicating a video time of the event of interest (tag list 1 is transmitted to recording/reading apparatus 1000, to generate tag information a tag identification name is designated and a tag generation time interval is designated, tag list managing unit 225 collects thus-generated tags and generates tag list information [the tag functions as a highlight tag for a period and includes time data], para. 0024, 0055); and selecting the portion of interest within the low-resolution video comprising video times within a threshold time interval from a video time indicated by the highlight tag (the start and end times in the tag list are generated based on user operations, the user can set the interval between the tag start tie and the tag end time [functions as a threshold], para. 0052-0053). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Katoaka to incorporate the tagging features in the invention of Givoly. The motivation would have been to provide for use of the tag list (Katoaka, para. 0054).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2015/023680

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Regarding claims 5 & 16, Givoly teaches wherein receiving the low-resolution video from the client device comprises: low-resolution video (a) for transcoding from the high-resolution video and (b) for uploading (software running on a personal computer [functions as the client device] compresses the video asset of a high definition resolution into a low resolution so as to provide a compressed video asset, lower and higher resolutions can be associated with different compression algorithms [compression would include a transcoding operation], this would facilitate a transmitting of the compressed video asset to a remote video editor, resolution refers to the number of pixels in a frame, para. 0022, 0026, 0028); but lacks the teaching obtaining a highlight tag indicating that the high-resolution video comprises an event of interest, the highlight tag included in metadata of the high-resolution video; and selecting, from a plurality of videos in response to the highlight tag. Coombs is in the field of remote picture editing (title, para. 0016) and teaches data included in metadata of the high-resolution video (lower-resolution copies contain the same image and metadata as the original high-resolution image, para. 0021). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Coombs to incorporate the metadata features in the invention of Givoly. The motivation would have been to describe the photograph (Coombs, para. 0020). Kataoka is in the field of indicating time points (abstract) and teaches obtaining a highlight tag indicating that the high-resolution video comprises an event of interest (tag list 1 is transmitted to recording/reading apparatus 1000, to generate tag information a tag identification name is designated and a tag generation time interval is designated, tag list managing unit 225 collects thus-generated tags and generates tag list information [the tag functions as a highlight tag for a period], para. 0024, 0055); and selecting, from a plurality of videos in response to the highlight tag (tag list 1 is transmitted to recording/reading apparatus 1000, if the tag list read mode is designated to thereby send a read request signal to recording/reading apparatus 1000 which starts reading based on tag list 1 [a plurality of portions of media would be selected based on the tags within the tag list], para. 0055). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Katoaka to incorporate the tagging features in the invention of Givoly. The motivation would have been to provide for use of the tag list (Katoaka, para. 0054).

Claims 7-10, 18-20 lack an inventive step under PCT Article 33(3) as being obvious over Givoly in view of Coombs, and further in view of Balasubramanian et al., hereinafter referred to as Balasubramanian.

Regarding claims 7 & 18, Givoly lacks the teaching wherein transmitting the commands to the client device to prompt the client device to upload the corresponding portion of the high-resolution video comprises: obtaining a device status report from the client device indicating connectivity resources of the client device; and transmitting commands to prompt the client device to upload the corresponding portion of the high-resolution video in response to available bandwidth of the client device indicated by the device status report. Coombs is in the field of remote picture editing (title, para. 0016) and teaches transmitting commands to prompt the client device to upload the corresponding portion of the high-resolution video (editor software records the identification of the selected images and the appropriate instructions to be applied to the images and forwards the identification and instructions to the hub, hub software selects the identified high-resolution images and applied the instructions received from the editor, software running on hub 303 then forwards the edited high-resolution image to server 304 using an Internet connection [the transmission from the editor software to the hub functions as a command to prompt the hub software to upload the referenced high-resolution media portions], 0022, 0034). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Coombs to incorporate the high-resolution uploading features in the invention of Givoly. The motivation would have been to permit the transmission of the high-resolution edited files upstream over the Internet (Coombs, para. 0033). Balasubramanian is in the field of resource management (title) and teaches wherein transmitting the commands to the client device to prompt the client device to upload the corresponding portion of the high-resolution video comprises: obtaining a device status report from the client device indicating connectivity resources of the client device (resource manager 210 may receive reports of resource usage from various resource monitors, resources 210 may detect for congested resources based on the received reports, para. 0053); and performing an operation in response to available bandwidth of the client device indicated by the device status report (if resource usage is less than the target level then a DRC pattern with the next larger ON fraction may be selected to increase bandwidth, para. 0078). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Balasubramanian to incorporate the status report features in the invention of Givoly. The motivation would have been to maintain resource usage close to the target level (Balasubramanian, para. 0078).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2015/023680

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Regarding claims 8 & 19, Givoly lacks the teaching wherein the client device is one of a plurality of client devices uploading respective high-resolution videos, and wherein transmitting the commands to the client device to prompt the client device to upload the corresponding portion of the high-resolution video comprises: obtaining a device status report from each of the plurality of client devices, each device status report indicating memory resources of a corresponding client device of the plurality of client devices; determining an upload order for uploading high-resolution videos from the plurality of client devices, the upload order prioritizing uploads from client devices with lower memory resources than other client devices of the plurality; transmitting commands to the plurality of client devices to prompt the plurality of client devices to upload their respective high-resolution videos according to the determined upload order. Coombs is in the field of remote picture editing (title, para. 0016) and teaches wherein the client device is one of a plurality of client devices uploading respective high-resolution videos, and wherein transmitting the commands to the client device to prompt the client device to upload the corresponding portion of the high-resolution video comprises: transmitting commands to the plurality of client devices to prompt the plurality of client devices to upload their respective high-resolution videos (editor software records the identification of the selected images and the appropriate instructions to be applied to the images and forwards the identification and instructions to the hub, hub software selects the identified high-resolution images and applied the instructions received from the editor, software running on hub 303 then forwards the edited high-resolution image to server 304 using an Internet connection [the transmission from the editor software to the hub functions as a command to prompt the hub software to upload the referenced high-resolution media portions], hub 303 can be external to any one photographer's computer and receive files from multiple photographers covering the event, the editor application provides information about the currently available events [there would be a different hub at each event therefore there would be a plurality of hubs], 0022, 0026, 0029, 0034). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Coombs to incorporate the high-resolution uploading features in the invention of Givoly. The motivation would have been to permit the transmission of the high-resolution edited files upstream over the Internet (Coombs, para. 0033). Balasubramanian is in the field of resource management (title) and teaches obtaining a device status report from the client device, each device status report indicating memory resources of a corresponding client device (resource monitors 220 may monitor memory resources of processors 130, resource manager 210 may send a request to a resource monitor for certain resources whenever resource manager 210 desires to know the status of the resources, the resource monitor may then return a report indicative of usage of the resources, para. 0035, 0040); determining a transmission order, the transmission order prioritizing uploads from the client device with lower memory resources (resource manager 210 may receive reports of resource usage from various resource monitors, resource manager 210 may detect for congested resources based on the received reports, if congestion is detected for any resources then resource manager 210 may take actions to mitigate the congestion, a scheduler on the network side may maintain the priority of QoS flows relative to BE flows even when wireless device 110 reduces the forward link bandwidth due to congestion [the priority of the transmissions is maintained when the device has lower memory resources], para. 0053, 0058). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Balasubramanian to incorporate the status report features in the invention of Givoly. The motivation would have been to maintain resource usage close to the target level (Balasubramanian, para. 0078).

Regarding claims 9 & 20, Givoly lacks the teaching wherein the client device is one of a plurality of client devices each uploading a respective high-resolution video, and wherein transmitting the commands to the client device to prompt the client device to upload the corresponding portion of the high-resolution video comprises: determining an upload schedule for the plurality of client devices according to connectivity resources, memory resources, and processing resources of a media server receiving and storing uploaded high-resolution videos; and transmitting commands to the plurality of client devices to prompt the plurality of client devices to upload their respective high-resolution videos according to the determined upload schedule. Coombs is in the field of remote picture editing (title, para. 0016) and teaches wherein the client device is one of a plurality of client devices each uploading a respective high-resolution video, and wherein transmitting the commands to the client device to prompt the client device to upload the corresponding portion of the high-resolution video (editor software records the identification of the selected images and the appropriate instructions to be applied to the images and forwards the identification and instructions to the hub, hub software selects the identified high-resolution images and applied the instructions received from the editor, software running on hub 303 then forwards the edited high-resolution image to server 304 using an Internet connection [the transmission from the editor software to the hub functions as a command to prompt the hub software to upload the referenced high-resolution media portions], hub 303 can be external to any one photographer's computer and receive files from multiple photographers covering the event, the editor application provides information about the currently available events [there would be a different hub at each event therefore there would be a plurality of hubs], 0022, 0026, 0029, 0034) comprises: a media server receiving and storing uploaded high-resolution videos (software running on server 304 receives edited high-resolution image and forwards it to an appropriate processor 306 for additional editing before the image is disseminated for use by news or media outlets [the media would be stored for future transmission]; para. 0034); and transmitting commands to the plurality of client devices to prompt the plurality of client devices to upload their respective high-resolution videos (editor software records the identification of the selected images and the appropriate instructions to be applied to the images and forwards the identification and instructions to the hub, hub software selects the identified high-resolution images and applied the instructions received from the editor, software running on hub 303 then forwards the edited high-resolution image to server 304 using an Internet connection [the transmission from the editor software to the hub functions as a command to prompt the hub software to upload the referenced high-resolution media portions], hub 303 can be external to any one photographer's computer and receive files from multiple photographers covering the event, the editor application provides information about the currently available events [there would be a different hub at each event therefore there would be a plurality of hubs], 0022, 0026, 0029, 0034). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Coombs to incorporate the high-resolution uploading features in the invention of Givoly. The motivation would have been to permit the transmission of the high-resolution edited files upstream over the Internet (Coombs, para. 0033). Balasubramanian is in the field of resource management (title) and teaches determining a transmission schedule for the plurality of client devices according to connectivity resources, memory resources, and processing resources of a device (resource monitors 220 may monitor CPU and memory resources of processors 130, bus monitor 220m may determine usage of bus 142 [connectivity resources], resource manager 210 may receive reports from the resource monitor and may attempt to maintain resource usage close to the target level, if resource usage is greater than the target level then a DRC pattern with the next smaller ON fraction may be selected to decrease bandwidth [functions as a transmission schedule], para. 0035, 0078). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Balasubramanian to incorporate the device resource features in the invention of Givoly. The motivation would have been to maintain resource usage close to the target level (Balasubramanian, para. 0078).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2015/023680

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Regarding claim 10, Givoly lacks the teaching wherein the client device is one of a plurality of client devices each uploading a respective high-resolution video, and wherein transmitting the commands to the client device to prompt the client device to upload the corresponding portion of the high-resolution video comprises: determining upload bandwidth allocations for each of the plurality of client devices according to connectivity resources and processing resources available to store high-resolution videos once uploaded; and transmitting commands to the plurality of client devices to prompt the plurality of client devices to upload their respective high-resolution videos according to the determined upload bandwidth allocations. Coombs is in the field of remote picture editing (title, para. 0016) and teaches wherein the client device is one of a plurality of client devices each uploading a respective high-resolution video, and wherein transmitting the commands to the client device to prompt the client device to upload the corresponding portion of the high-resolution video (editor software records the identification of the selected images and the appropriate instructions to be applied to the images and forwards the identification and instructions to the hub, hub software selects the identified high-resolution images and applied the instructions received from the editor, software running on hub 303 then forwards the edited high-resolution image to server 304 using an Internet connection [the transmission from the editor software to the hub functions as a command to prompt the hub software to upload the referenced high-resolution media portions], hub 303 can be external to any one photographer's computer and receive files from multiple photographers covering the event, the editor application provides information about the currently available events [there would be a different hub at each event therefore there would be a plurality of hubs], 0022, 0026, 0029, 0034) comprises: store high-resolution videos once uploaded (software running on server 304 receives edited high-resolution image and forwards it to an appropriate processor 306 for additional editing before the image is disseminated for use by news or media outlets [the media would be stored for future transmission], para. 0034); transmitting commands to the plurality of client devices to prompt the plurality of client devices to upload their respective high-resolution videos (editor software records the identification of the selected images and the appropriate instructions to be applied to the images and forwards the identification and instructions to the hub, hub software selects the identified high-resolution images and applied the instructions received from the editor, software running on hub 303 then forwards the edited high-resolution image to server 304 using an Internet connection [the transmission from the editor software to the hub functions as a command to prompt the hub software to upload the referenced high-resolution media portions], hub 303 can be external to any one photographer's computer and receive files from multiple photographers covering the event, the editor application provides information about the currently available events [there would be a different hub at each event therefore there would be a plurality of hubs], 0022, 0026, 0029, 0034). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Coombs to incorporate the high-resolution uploading features in the invention of Givoly. The motivation would have been to permit the transmission of the high-resolution edited files upstream over the Internet (Coombs, para. 0033). Balasubramanian is in the field of resource management (title) and teaches determining transmission bandwidth allocations for each of the plurality of client devices according to connectivity resources and processing resources available (resource monitors 220 may monitor CPU and memory resources of processors 130, bus monitor 220m may determine usage of bus 142 [connectivity resources], resource manager 210 may receive reports from the resource monitor and may attempt to maintain resource usage close to the target level, if resource usage is less than the target level then a DRC pattern with the next larger ON fraction may be selected to increase bandwidth, if resource usage is greater than the target level then a DRC pattern with the next smaller ON fraction may be selected to decrease bandwidth [transmission bandwidth is allocated according to a target metric], para. 0035, 0078). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teaching of Balasubramanian to incorporate the device resource features in the invention of Givoly. The motivation would have been to maintain resource usage close to the target level (Balasubramanian, para. 0078).

Claims 1-20 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 28742/PCT	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US2015/023680	International filing date *(day/month/year)* 31 March 2015	(Earliest) Priority Date *(day/month/year)* 31 March 2014
Applicant GOPRO, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

☒ the international application in the language in which it was filed.

☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☒ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

a. the figure of the **drawings** to be published with the abstract is Figure No. 5

☒ as suggested by the applicant.

☐ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/023680

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
See Extra Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No. required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-20

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/023680

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G11B 27/00 (2015.01)
CPC - G11B 27/00 (2015.04)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - G11B 27/00; H04N 3/93 (2015.01)
USPC - 386/278, 281; 709/223, 224, 226, 227, 229; 715/723

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - G11B 27/00; H04N 3/93 (2015.04) (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatBase, Orbit, Google Patents, Google Scholar.
Search terms used: video, editing, upload, transcode, high, low, definition, resolution

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2011/0206351 A1 (GIVOLY) 25 August 2011 (25.08.2011) entire document	1-20
Y	US 2008/0123976 A1 (COOMBS et al.) 29 May 2008 (29.05.2008) entire document	1-20
Y	US 2005/0025454 A1 (NAKAMURA et al.) 03 February 2005 (03.02.2005) entire document	2-3, 13-14
Y	US 2012/0027381 A1 (KATAOKA et al.) 02 February 2012 (02.02.2012) entire document	4-5, 15-16
Y	US 2010/0318660 A1 (BALASUBRAMANIAN et al.) 16 December 2010 (16.12.2010) entire document	7-10, 18-20
A	US 2010/0086216 A1 (LEE et al.) 08 April 2010 (08.04.2010) entire document	1-20

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 August 2015	06 OCT 2015
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/023680

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-20, drawn to uploading a high-resolution video.
Group II, claims 21-40, drawn to processing a high-resolution video.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: receiving, from a client device, a low-resolution video transcoded from a high-resolution video, the low-resolution video comprising frames having a lower resolution than frames of the high-resolution video; selecting a portion of interest within the low-resolution video, the selected portion of interest used to obtain a corresponding portion of the high-resolution video from which the selected portion of interest within the low-resolution video was transcoded as claimed therein is not present in the invention of Group II. The special technical feature of the Group II invention: receiving, from a client device, registration of a high-resolution video accessed by the client device from a camera communicatively coupled to the client device; transmitting commands to prompt the client device to perform the at least one task on the specified portion of the high-resolution video according to the task list as claimed therein is not present in the invention of Group I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of processing a high-resolution video; receiving the specified portion of the high-resolution video; storing the high-resolution video, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 2010/0086216 A1 (LEE et al) 08 April 2010 (08.04.2010) teaches processing a high-resolution video (the video processing apparatus 100 may divide video, e.g., ultra-high resolution, via the video division unit 110, Para. 40); receiving the specified portion of the high-resolution video (the video division unit 110 may receive video data and divide the input video data into at least two areas, Para. 20); storing the high-resolution video (the video processing apparatus 100 may divide video, e.g., ultra-high resolution, via the video division unit 110, and refer to pixels belonging to other divided areas which are stored in the respective frame buffers 120-1 through 120-n, included in the data storage unit 120, for the respective divided area being processed, Para. 40).

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 46DG-251177	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US17/16367	International filing date *(day/month/year)* 03 February 2017 (03.02.2017)	(Earliest) Priority Date *(day/month/year)* 04 February 2016 (04.02.2016)
Applicant GOPRO, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

   a. the figure of the **drawings** to be published with the abstract is Figure No. 1

   ☒ as suggested by the applicant.

   ☐ as selected by this Authority, because the applicant failed to suggest a figure.

   ☐ as selected by this Authority, because this figure better characterizes the invention.

   b. ☐ none of the figures is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US17/16367

A. CLASSIFICATION OF SUBJECT MATTER
IPC - H04N21/81; H04N21/84; G06F3/0488 (2017.01)
CPC - H04N21/8146; H04N21/47205; G06F3/0488

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/327856 (MOUILLESEAUX, J et al.) 13 December 2009, fig. 1, paragraphs [0009], [0041], [0043]-[0045], [0055], [0058]-[0059], [0064]-[0065], [0094], [0125]	1-3, 5-6, 8-12, 14-15, 17-20
Y		4, 7, 13, 16
Y	WO 01/20466 A1 (HOTV INC.) 22 March 2001, abstract	4, 13
Y	US 2015/0220504 A1 (ADOBE SYSTEM INCORPORATED) 06 August 2015, paragraphs [0044]-[0046]	7, 16

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 March 2017 (29.03.2017)	14 APR 2017
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: Andrew Hilger
Fenwick & West LLP
Silicon Valley Center
801 California Street
Mountain View, CA 94041
United States of America

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

	Date of mailing *(day/month/year)* 17 MAR 2016
Applicant's or agent's file reference 28303/PCT	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US15/12086	International filing date *(day/month/year)* 04 January 2016 (04.01.2016)
Applicant GOPRO, INC.	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   How? Directly to the International Bureau of WIPO preferably through ePCT or on paper to, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

   Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

   Within **19 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas Telephone No. PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/220 (July 2014)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference V695541080WO	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. **PCT/US2015/012086**	International filing date *(day/month/year)* **20 January 2015 (20.01.2015)**	(Earliest) Priority Date *(day/month/year)* 21 January 2014 (21.01.2014)

Applicant

VORMETRIC, INC.

This International search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of **3** sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language**, the international search was carried out on the basis of :
      ☒ the international application in the language in which it was filed
      ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.
2. ☐ **Certain claims were found unsearchable** (See Box No. II)
3. ☐ **Unity of invention is lacking** (See Box No. III)
4. With regard to the **title,**
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established by this Authority to read as follows:
5. With regard to the **abstract,**
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. With regard to the drawings,
   a. the figure of the **drawings** to be published with the abstract is Figure No. **4**
      ☐ as suggested by the applicant.
      ☒ as selected by this Authority, because the applicant failed to suggest a figure.
      ☐ as selected by this Authority, because this figure better characterizes the invention.
   b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/012086

A. CLASSIFICATION OF SUBJECT MATTER

G06F 21/62(2013.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06F 21/62; H04L 9/28; G06F 17/30; G06F 11/14; G06F 12/00; G06F 21/02; G06F 11/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: thread, I/O process, re-key, meta data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7685462 B1 (JAMES LEONG et al.) 23 March 2010 See column 3, line 64 - column 4, line 2; column 7, line 10; column 8, lines 29-37; claims 1, 10, 18; and figure 1.	1-21
A	US 2012-0210045 A1 (CHING-WEN CHANG) 16 August 2012 See paragraphs [0077]-[0084]; and figure 8.	1-21
A	US 2009-0196414 A1 (HEMANT MITTAL et al.) 06 August 2009 See paragraphs [0039]-[0046]; and figure 4.	1-21
A	WO 2012-094367 A1 (APPLE INC.) 12 July 2012 See paragraphs [0028]-[0033]; and figure 4.	1-21
A	US 8560578 B2 (KARAN MEHRA et al.) 15 October 2013 See column 6, line 19 - column 8, line 16; and figure 2.	1-21

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 March 2015 (31.03.2015)	**01 April 2015 (01.04.2015)**

Name and mailing address of the ISA/KR
International Application Division
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea
Facsimile No. ++82 42 472 7140

Authorized officer
AIIN, Jeong IIwan
Telephone No. +82-42-481-8440

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2015/012086

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7685462 B1	23/03/2010	US 7328364 B1	05/02/2008
US 2012-0210045 A1	16/08/2012	TW 2012-34177 A	16/08/2012
		US 8914587 B2	16/12/2014
US 2009-0196414 A1	06/08/2009	US 8712035 B2	29/04/2014
WO 2012-094367 A1	12/07/2012	CN 103299315 A	11/09/2013
		EP 2661714 A1	13/11/2013
		JP 2014-509418 A	17/04/2014
		KR 10-2013-0101147 A	12/09/2013
		US 2012-0173882 A1	05/07/2012
		US 8924739 B2	30/12/2014
US 8560578 B2	15/10/2013	US 2009-327367 A1	31/12/2009

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
GENCARELLA, MICHAEL

WOMBLE CARLYLE SANDRIDGE & RICE LLP PO BOX 7037 ATLANTA GA 30357 USA

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing *(day/month/year)*	**01 April 2015 (01.04.2015)**
Applicant's or agent's file reference V695541080WO	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2015/012086	**20 January 2015 (20.01.2015)**	21 January 2014 (21.01.2014)

International Patent Classification (IPC) or both national classification and IPC

G06F 21/62(2013.01)i

Applicant

VORMETRIC, INC.

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.
For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR	Date of completion of this opinion	Authorized officer
International Application Division Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea Facsimile No. ++82 42 472 7140	31 March 2015 (31.03.2015)	AHN, Jeong Hwan Telephone No. +82-42-481-8440

Form PCT/ISA/237 (cover sheet) (January 2015)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2015/012086

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:
      ☐ in the form of an Annex C/ST.25 text file.
      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2015/012086

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-21	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	1-21	YES
	Claims	NONE	NO
Industrial applicability (IA)	Claims	1-21	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: US 7685462 B1 (JAMES LEONG et al.) 23 March 2010
D2: US 2012-0210045 A1 (CHING-WEN CHANG) 16 August 2012
D3: US 2009-0196414 A1 (HEMANT MITTAL et al.) 06 August 2009
D4: WO 2012-094367 A1 (APPLE INC.) 12 July 2012
D5: US 8560578 B2 (KARAN MEHRA et al.) 15 October 2013

2.1 Novelty (PCT Article 33(2)) and Inventive Step (PCT Article 33(3))

2.1.1 Claims 1-21

Claims 1, 8, 14-15, and 21 are commonly characterized in that each re-key threads and file-access thread are operated concurrently for data transformation. And the common technical features are not obvious to a person skilled in the art by the documents, taken alone or in combination. Therefore, independent claims 1, 8, 14-15, and 21 meet the requirements of PCT Article 33(2) and (3) with respect to novelty and inventive step.

Since claims 2-7, 9-13 and 16-20 are directly or indirectly dependent on claims 1, 8 and 15 respectively, claims 2-7, 9-13, and 16-20 are also considered to be novel and to involve an inventive step under PCT Article 33(2) and (3).

2.2 Industrial Applicability (PCT Article 33(4))

Claims 1-21 are industrially applicable under PCT Article 33(4).

Insta360
Exhibit 1003 Page 268

Notice of References Cited	Application/Control No. 16/535,940	Applicant(s)/Patent Under Reexamination Newman et al.	
	Examiner JWALANT B AMIN	Art Unit 2618	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20070229665-A1	10-2007	Tobiason; Joseph Daniel	H04N5/3572	348/187
*	B	US-20110249153-A1	10-2011	Hirooka; Shinichiro	B60R1/00	348/241
*	C	US-20020044153-A1	04-2002	Hoch, Michael	H04N5/222	345/647
*	D	US-9105080-B2	08-2015	McAndrew; Fintan	G06T7/80	1/1
*	E	US-6323934-B1	11-2001	Enomoto; Jun	G06T5/006	355/32
*	F	US-9262807-B2	02-2016	Stec; Piotr	G06T5/006	1/1
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*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.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/535,940	Newman et al.
	Examiner	Art Unit
	JWALANT B AMIN	2618

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor name searched	09/05/2019	JA

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Insta360
Exhibit 1003 Page 270

UNITED STATES PATENT AND TRADEMARK OFFICE

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.
16/535,940	08/08/2019	David A. Newman	46DG-026055	9986

137002 7590 09/20/2019

Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008

EXAMINER	
AMIN, JWALANT B	

ART UNIT	PAPER NUMBER
2618	

NOTIFICATION DATE	DELIVERY MODE
09/20/2019	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):

docketing@esplin.legal

Office Action Summary	Application No. 16/535,940	Applicant(s) Newman et al.	
	Examiner JWALANT B AMIN	Art Unit 2618	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 8/82019.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-20 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-5,9,11-15 and 19 is/are rejected.

8) ☑ Claim(s) 6-8,10,16-18 and 20 is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 8/82019 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of

activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit http://www.uspto.gov/forms/. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

3. Claims 1, 3, 11 and 13 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 4 and 17 of U.S. Patent No. 10,186,012. Although the conflicting claims are not identical, they are not patentably distinct from each other because claims 1, 3, 11 and 13in the current application are broader than claims 1, 4 and 17 in Patent No 10,186,012.

4. Specifically, it is well established that "Omission of element and its function in combination is obvious expedient if remaining elements perform same functions as before" In re KARLSON (CCPA) 136 USPQ 184 (1963). Claims 1, 3, 11 and 13 in the current application, is **broader** in all respects than the reference claims 1, 4 and 17.

5. Below is a table indicating the corresponding relationship between claims 1, 3, 11 and 13 of the current application and claims 1, 4 and 17 of U.S. Patent No. 10,186,012.

Current Application	U.S. Patent No. 10,186,012
1	17
3	4

11	1
13	4

6. To perform analysis required, claim 11 of the current application is compared to claim 1 of U.S. Patent No. 10,186,012.

Claim 11: Current Application	Claim 1: U.S. Patent No. 10,186,012
A method for simulating image distortion of a virtual lens in a video, the method comprising: accessing input images, the input images including fields of view of a scene captured through a lens of a camera, the input images depicting the scene with an input lens distortion centered in the fields of view; selecting sub-frames representing portions of the input images, the sub-frames including reduced fields of view of the scene smaller than the fields of view of the input images, the sub- frames including different lens distortion effects as a function of the input lens distortion present in the input images, different positions of areas of the input images included within the reduced fields of view, and a size of the areas of the input images included within the reduced fields of view; and generating output images based on a desired lens distortion and the different lens distortion effects in the sub-frames, the desired lens distortion and the input lens distortion exhibiting consistent lens characteristics, wherein the output images include the sub- frames remapped from the input lens distortion centered in the fields of view of the input	A method for simulating a virtual lens when applying a crop or zoom effect to an input image, the method comprising: receiving, by a processor, the input image, the input image having a first field of view of a scene, the input image depicting the scene with an input lens distortion centered in the first field of view, identifying, by the processor, the input lens distortion within the input image; obtaining, by the processor, a selection of a sub-frame representing a portion of the input image, the sub-frame having a second field of view of the scene smaller than the first field of view; determining, by the processor, an input lens distortion effect present in the sub-frame based on the input lens distortion centered in the first field of view, a location of the sub-frame within the first field of view, and a size of the second field of view; and the input lens distortion caused by lens characteristics of a lens used to capture the input image, the lens centered at the first field of view during capture of the input image; generating, by the processor, an output image based on the input lens distortion and the input lens distortion effect present in the sub-frame, the output image including the sub-frame

images to the desired lens distortion centered in the reduced fields of view to transform the different lens distortion effects present in the sub-frames to the desired lens distortion such that portions of the scene depicted in the sub-frames appear to have been captured using the reduced fields of view.	remapped from the input lens distortion centered in the first field of view to the input lens distortion centered in the second field of view such that a portion of the scene depicted in the sub-frame appears to have been captured using the lens centered at the second field of view.

As seen in the analysis above, claim 11 of the current application is clearly broader than claim 1 of US Patent No. 10,186,012. Therefore, this claim is properly subject to ODP rejection.

7. Similarly, ODP rejection can be shown for claim 1, 3 and 13 of the current application, as limitations in claim 1, 3 and 13 are similarly recited as the limitations in the conflicting claims 1, 4 and 17.

8. Claims 1, 3, 11 and 13 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 4 and 17 of U.S. Patent No. 10,395,338. Although the conflicting claims are not identical, they are not patentably distinct from each other because claims 1, 3, 11 and 13 in the current application are broader than claims 1, 4 and 17 in Patent No 10,395,338.

9. Specifically, it is well established that “Omission of element and its function in combination is obvious expedient if remaining elements perform same functions as before” In re KARLSON (CCPA) 136 USPQ 184 (1963). Claims 1, 3, 11 and 13 in the current application, is **broader** in all respects than the reference claims 1, 4 and 17.

10. Below is a table indicating the corresponding relationship between claims 1, 3, 11 and 13 of the current application and claims 1, 4 and 17 of U.S. Patent No. 10,395,338.

Current Application	U.S. Patent No. 10,395,338
1	17
3	4
11	1
13	4

11. To perform analysis required, claim 11 of the current application is compared to claim 1 of U.S. Patent No. 10,395,338.

Claim 11: Current Application	Claim 1: U.S. Patent No. 10,395,338
A method for simulating image distortion of a virtual lens in a video, the method comprising: accessing input images, the input images including fields of view of a scene captured through a lens of a camera, the input images depicting the scene with an input lens distortion centered in the fields of view; selecting sub-frames representing portions of the input images, the sub-frames including reduced fields of view of the scene smaller than the fields of view of the input images, the sub- frames including different lens distortion effects as a function of the input lens distortion present in the input images, different positions of areas of the input images included within the reduced fields of view, and a size of the areas of the input images included within the reduced fields of view; and	A method for simulating a virtual lens when applying a crop or zoom effect to an input image, the method comprising: receiving, by a processor, the input image, the input image including a first field of view of a scene, the input image depicting the scene with an input lens distortion within the first field of view; obtaining, by the processor, a selection of a sub-frame representing a portion of the input image, the sub-frame having a second field of view of the scene smaller than the first field of view; determining, by the processor, an input lens distortion effect present in the sub-frame based on the input lens distortion within the first field of view, a location of the sub-frame within the first field of view, and a size of the second field of view; and

generating output images based on a desired lens distortion and the different lens distortion effects in the sub-frames, the desired lens distortion and the input lens distortion exhibiting consistent lens characteristics, wherein the output images include the sub- frames remapped from the input lens distortion centered in the fields of view of the input images to the desired lens distortion centered in the reduced fields of view to transform the different lens distortion effects present in the sub-frames to the desired lens distortion such that portions of the scene depicted in the sub-frames appear to have been captured using the reduced fields of view.	generating, by the processor, an output image based on the input lens distortion and the input lens distortion effect present in the sub-frame, the output image including the sub-frame remapped from the input lens distortion within the first field of view to the input lens distortion within the second field of view such that a portion of the scene depicted in the sub-frame appears to have been captured using the second field of view

As seen in the analysis above, claim 11 of the current application is clearly broader than claim 1 of US Patent No. 10,395,338. Therefore, this claim is properly subject to ODP rejection.

Similarly, ODP rejection can be shown for claim 1, 3 and 13 of the current application, as limitations in claims 1, 3 and 13 are similarly recited as the limitations in the conflicting claims 1, 4 and 17.

12. Claims 1-5, 9, 11-15 and 19 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1, 6-7, 9-11 and 16-17, and 19-20 of copending Application No. 16/535,911 (reference application). Although the claims at issue are not identical, they are not patentably distinct from each

other because claims 1-5, 9, 11-15 and 19 in the current application are broader than claims 1, 6-7, 9-11 and 16-17, and 19-20 in copending Application No. 16/535,911.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

13. Below is a table indicating the corresponding relationship between claims 1-5, 9, 11-15 and 19 of the current application and claims 1, 6-7, 9-11 and 16-17, and 19-20 in copending Application No. 16/535,911.

Current Application	Application No. 16/535,911
1	1
2	6
3	7
4	9
5	10
9	1
11	11
12	16
13	17
14	19
15	20
19	11

14. To perform analysis required, claim 11 of the current application is compared to claim 11 of Application No. 16/535,911.

Claim 11: Current Application	Claim 11: Application No. 16/535,911
A method for simulating image distortion of a virtual lens in a video, the method comprising:	A method for simulating image distortion of a virtual lens in an image, the method performed by a camera comprising a lens, an image sensor, and one or more processors,
accessing input images, the input images including fields of view of a scene captured through a lens of a camera, the input images depicting the scene with an input lens distortion centered in the fields of view;	the lens configured to cause an input lens distortion within an input image, the image sensor configured to capture the input image including a first field of view of a scene, the input image depicting the scene with the input lens distortion centered in the first field of view, the method comprising:
selecting sub-frames representing portions of the input images, the sub-frames including reduced fields of view of the scene smaller than the fields of view of the input images, the sub- frames including different lens distortion effects as a function of the input lens distortion present in the input images, different positions of areas of the input images included within the reduced fields of view, and a size of the areas of the input images included within the reduced fields of view; and	selecting a sub-frame representing a portion of the input image, the sub-frame including a second field of view of the scene smaller than the first field of view, the sub-frame including a lens distortion effect as a function of the input lens distortion present in the input image, a position of an area of the input image included within the second field of view, and a size of the area of the input image included within the second field of view; and
generating output images based on a desired lens distortion and the different lens distortion effects in the sub-frames, the desired lens distortion and the input lens distortion exhibiting consistent lens characteristics, wherein the output images include the sub- frames remapped from the input lens distortion centered in the fields of view of the input images to the desired lens distortion centered in the reduced fields of view to transform the different lens distortion effects present in the sub-frames to the desired lens distortion such that portions of the scene depicted in the sub-frames	generating an output image based on a desired lens distortion and the lens distortion effect in the sub-frame, the desired lens distortion and the input lens distortion exhibiting consistent lens characteristics, wherein the output image includes the sub-frame remapped from the input lens distortion centered in the first field of view to the desired lens distortion centered in the second field of view to transform the lens distortion effect present in the sub-frame to the desired lens distortion such that a portion of the scene depicted in the sub-frame appears

appear to have been captured using the reduced fields of view.	to have been captured using the second field of view.

As seen in the analysis above, claim 11 of the current application is clearly broader than claim 11 of Application No. 16/535,911. Therefore, this claim is properly subject to ODP rejection.

Similarly, ODP rejection can be shown for claim 1-5, 9, 12-15 and 19 of the current application, as limitations in claims 1-5, 9, 12-15 and 19 are similarly recited as the limitations in the conflicting claims 1, 6-7, 9-11 and 16-17, and 19-20.

15. Claims 1-5 and 11-15 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-5 and 11-15 of copending Application No. 16/535,886 (reference application). Although the claims at issue are not identical, they are not patentably distinct from each other because claims 1-5 and 11-15 in the current application are broader than claims 1-5 and 11-15 in copending Application No. 16/535,886.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

16. Below is a table indicating the corresponding relationship between claims 1-5 and 11-15 of the current application and claims 1-5 and 11-15 in copending Application No. 16/535,886.

Current Application	Application No. 16/535,886
1	1

2	2
3	3
4	4
5	5
11	11
12	12
13	13
14	14
15	15

17. To perform analysis required, claim 11 of the current application is compared to claim 11 of Application No. 16/535,886.

Claim 11: Current Application	Claim 11: Application No. 16/535,886
A method for simulating image distortion of a virtual lens in a video, the method comprising: accessing input images, the input images including fields of view of a scene captured through a lens of a camera, the input images depicting the scene with an input lens distortion centered in the fields of view; selecting sub-frames representing portions of the input images, the sub-frames including reduced fields of view of the scene smaller than the fields of view of the input images, the sub- frames including different lens distortion effects as a function of the input lens distortion present in the input images, different positions of areas of the input images	A method for simulating image distortion of a virtual lens in an image, the method comprising: accessing an input image, the input image including a first field of view of a scene, the input image depicting the scene with an input lens distortion centered in the first field of view; selecting a sub-frame representing a portion of the input image, the sub-frame including a second field of view of the scene smaller than the first field of view, the sub-frame including a lens distortion effect as a function of the input lens distortion present in the input image, a position of an area of the input image included within the second field of view,

included within the reduced fields of view, and a size of the areas of the input images included within the reduced fields of view; and generating output images based on a desired lens distortion and the different lens distortion effects in the sub-frames, the desired lens distortion and the input lens distortion exhibiting consistent lens characteristics, wherein the output images include the sub- frames remapped from the input lens distortion centered in the fields of view of the input images to the desired lens distortion centered in the reduced fields of view to transform the different lens distortion effects present in the sub-frames to the desired lens distortion such that portions of the scene depicted in the sub-frames appear to have been captured using the reduced fields of view.	and a size of the area of the input image included within the second field of view; and generating an output image based on a desired lens distortion and the lens distortion effect in the sub-frame, the desired lens distortion and the input lens distortion exhibiting consistent lens characteristics, wherein the output image includes the sub-frame remapped from the input lens distortion centered in the first field of view to the desired lens distortion centered in the second field of view to transform the lens distortion effect present in the sub-frame to the desired lens distortion such that a portion of the scene depicted in the sub-frame appears to have been captured using the second field of view.

As seen in the analysis above, claim 11 of the current application is clearly broader than claim 11 of Application No. 16/535,886. Therefore, this claim is properly subject to ODP rejection.

Similarly, ODP rejection can be shown for claim 1-5 and 12-15 of the current application, as limitations in claims 1-5 and 12-15 are similarly recited as the limitations in the conflicting claims 1-5 and 11-15.

Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Tobiason et al. (US 2007/0229665) describes a method to analyze images and determine distortion parameters that can correct the distortions in the images such that features included in the calibration target pattern achieve a sufficient or optimum degree of congruence between the various images. Distortion parameters may be determined for each optical configuration (.e.g., lens combination, magnification, etc.) that is used by a machine vision inspection system.
- Hirooka et al. (US 2011/0249153) describes to correct lens distortion of an image photographed, and superimposing recognition result upon the image corrected on lens distortion to display the correct image.
- Hoch et al. (US 2002/0044153) describes that the process of using the optimized distortion correction technique in rendering add-on graphics by comparing the new distortion parameters obtained from the camera sensor to the values of distortion parameters of the current frame. Each real camera has unique distortion parameters, and the values of distortion parameters change based on changes in the focus and field of view of the lens. A region of interest (ROI) for the add-on graphics to be rendered is determined, and the ROI determination is based on the size of the graphics to be added and its insertion position within the video frame.
- McAndrew et al. (US 9105080) describes the captured image frames are initially corrected for at least one selected from a group consisting of perspective distortion and fisheye distortion, wherein the target image is selected from an area of predefined size forming a target image area in the reference image,

wherein the location at which the image area corresponding to the target image area should appear in each of the subsequently location image frames is predicted, and the actual image of the area corresponding to the target image area at the predicted location in each of the subsequently captured image frames is compared with the target image area for determining the difference between the actual location of the image of the target object with the predicted location.

- Stec et al. (US 9262807) describes the distortion correction modules is configured to determine an image acquisition focal length of a lens system with which the input image was captured, and based, at least in part, on the image acquisition focal length, determining a global transformation to be applied to the plurality of input tile coordiantes to compensate for one or more non-uniformities present in the lens system.
- Enomoto (US 6323934) describes at least one aberration characteristic selected from lateral chromatic aberration and distortion characteristics of said taking lens is detected based on said input image data; and wherein the at least one aberration selected from said lateral chromatic aberration and distortion is corrected based on the detected aberration characteristic and on position information of said image.

Allowable Subject Matter

1. Claims 6-8, 10, 16-18 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

2. The following subject matter is considered to indicate allowable subject matter over the cited prior art of references: "the sub-frames including reduced fields of view of the scene smaller than the fields of view of the input images, the sub-frames including different lens distortion effects as a function of the input lens distortion present in the input images, different positions of areas of the input images included within the reduced fields of view, and a size of the areas of the input images included within the reduced fields of view."

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to JWALANT B AMIN whose telephone number is (571)272-2455. The examiner can normally be reached on Monday-Friday 10am - 630pm CST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Barry Drennan can be reached on 571-270-7262. 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.

/JWALANT AMIN/
Primary Examiner, Art Unit 2618

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	2	"16229512"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:12
L2	4	input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") same ((field near2 view) FOV) near5 size same (location position) near5 (frame (sub adj frame) "sub-frame")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L3	2881	(david and newman).inv.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L4	17	L3 and (lens near5 distortion)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L5	26	lens near5 distortion same (frame "sub-frame" "sub frame") same location same size same (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L6	19	L5 and @ad<="20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L7	72	distortion same (frame "sub-frame" "sub frame") same location same size same (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L8	49	L7 and @ad<="20150520"	US-PGPUB;	OR	ON	2019/09/16

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			13:14
L9	30	L8 not L6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L10	26	lens near5 distortion near10 (frame "sub-frame" "sub frame") same size near10 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L11	6	L10 and @ad<="20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L12	5	lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 size near10 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L13	4	lens near5 distortion near10 (frame "sub-frame" "sub frame") same location near10 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L14	4	lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 location near10 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L15	4	lens near5 distortion near10 (frame "sub-frame" "sub frame") near10 distort$3 near5 center$2 near5 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L16	95	(identif$4 determin$3 detect$3) near10 lens near5 distortion near10 (frame "sub-frame" "sub frame")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2019/09/16 13:14

			IBM_TDB			
L17	63	L16 and @ad<="20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:14
L18	13	(distort$3 near10 center$2 near5 (FOV (field near2 view)) same location near5 (FOV (field near2 view)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:15
L19	6	L18 and @ad<="20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:15
L20	1	(input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 ((field near2 view) FOV)) and (input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 size) and (input near2 lens near5 distortion near10 (frame (sub adj frame) "sub-frame") near10 (location position) near5 (frame (sub adj frame) "sub-frame"))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:15
L21	40	map$4 near10 (lens camera) near5 distort$3 near10 (FOV (field near2 view))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2019/09/16 13:15
L22	28	L21 and @ad<="20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:15
L23	48	(identif$4 determin$3 detect$3) near10 input near5 lens near5 distortion near10 image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:15
L24	42	L23 and @ad<="20150520"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:15
L25	79044	(G06T3/0018, G06T3/00, G06T3/40,	US-PGPUB;	OR	ON	2019/09/16

		G06T5/006, G06T2207/10004, G06T2207/10016, G06T2207/20021, G06T2210/22).CPC.	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			13:15
L26	555	distort$3 near2 lens same (another different) near5 distort$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:15
L27	32	L26 and (lens near10 (center$2 centre$2) near10 view$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:15
L28	11	L27 and L25	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/09/16 13:15

9/16/2019 2:37:00 PM
C:\Users\jamin\Documents\EAST\Workspaces\16229512.wsp

Bibliographic Data

Application No: 16/535,940

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /JWALANT AMIN/ Examiner's Signature | Initials

Title: VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
08/08/2019	345	2618	46DG-026055
RULE			

APPLICANTS

GoPro, Inc., San Mateo, CA,

INVENTORS

David A. Newman San Diego, CA, UNITED STATES

Joshua Edward Bodinet San Diego, CA, UNITED STATES

Otto Kenneth Sievert Oceanside, CA, UNITED STATES

Timothy MacMillan La Honda, CA, UNITED STATES

CONTINUING DATA

This application is a CON of 16229512 12/21/2018 PAT 10395338

16229512 is a CON of 15157207 05/17/2016 PAT 10186012

15157207 has PRO of 62164409 05/20/2015

FOREIGN APPLICATIONS

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08/20/2019

STATE OR COUNTRY

UNITED STATES

ADDRESS

Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008
UNITED STATES

FILING FEE RECEIVED

$1,720

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/535,940	Newman et al.
	Examiner	Art Unit
	JWALANT B AMIN	2618

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/16/2019								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	O								
	7	O								
	8	O								
	9	✓								
	10	O								
	11	✓								
	12	✓								
	13	✓								
	14	✓								
	15	✓								
	16	O								
	17	O								
	18	O								
	19	✓								
	20	O								

Insta360
Exhibit 1003 Page 293

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/535,940

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 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. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
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			TOTAL	1720

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL 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".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

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 NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/535,940	08/08/2019	2852	1720	46DG-026055	20	2

CONFIRMATION NO. 9986

FILING RECEIPT

137002
Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008

OC000000110541703

Date Mailed: 08/21/2019

Receipt is acknowledged of this non-provisional utility 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 FIRST INVENTOR, 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 corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction 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 provided that the request is grantable.

Inventor(s)

David A. Newman, San Diego, CA;
Joshua Edward Bodinet, San Diego, CA;
Otto Kenneth Sievert, Oceanside, CA;
Timothy MacMillan, La Honda, CA;

Applicant(s)

GoPro, Inc., San Mateo, CA;

Power of Attorney: The patent practitioners associated with Customer Number 137002

Domestic Priority data as claimed by applicant

This application is a CON of 16/229,512 12/21/2018 PAT 10395338
which is a CON of 15/157,207 05/17/2016 PAT 10186012
which claims benefit of 62/164,409 05/20/2015

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 Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/20/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/535,940**

Projected Publication Date: 11/28/2019

Non-Publication Request: No

Early Publication Request: No

Title

VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING

Preliminary Class

396

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.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

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technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

ABSTRACT

In a video capture system, a virtual lens is simulated when applying a crop or zoom effect to an input video. An input video frame is received from the input video that has a first field of view and an input lens distortion caused by a lens used to capture the input video frame. A selection of a sub-frame representing a portion of the input video frame is obtained that has a second field of view smaller than the first field of view. The sub-frame is processed to remap the input lens distortion to a desired lens distortion in the sub-frame. The processed sub-frame is the outputted.

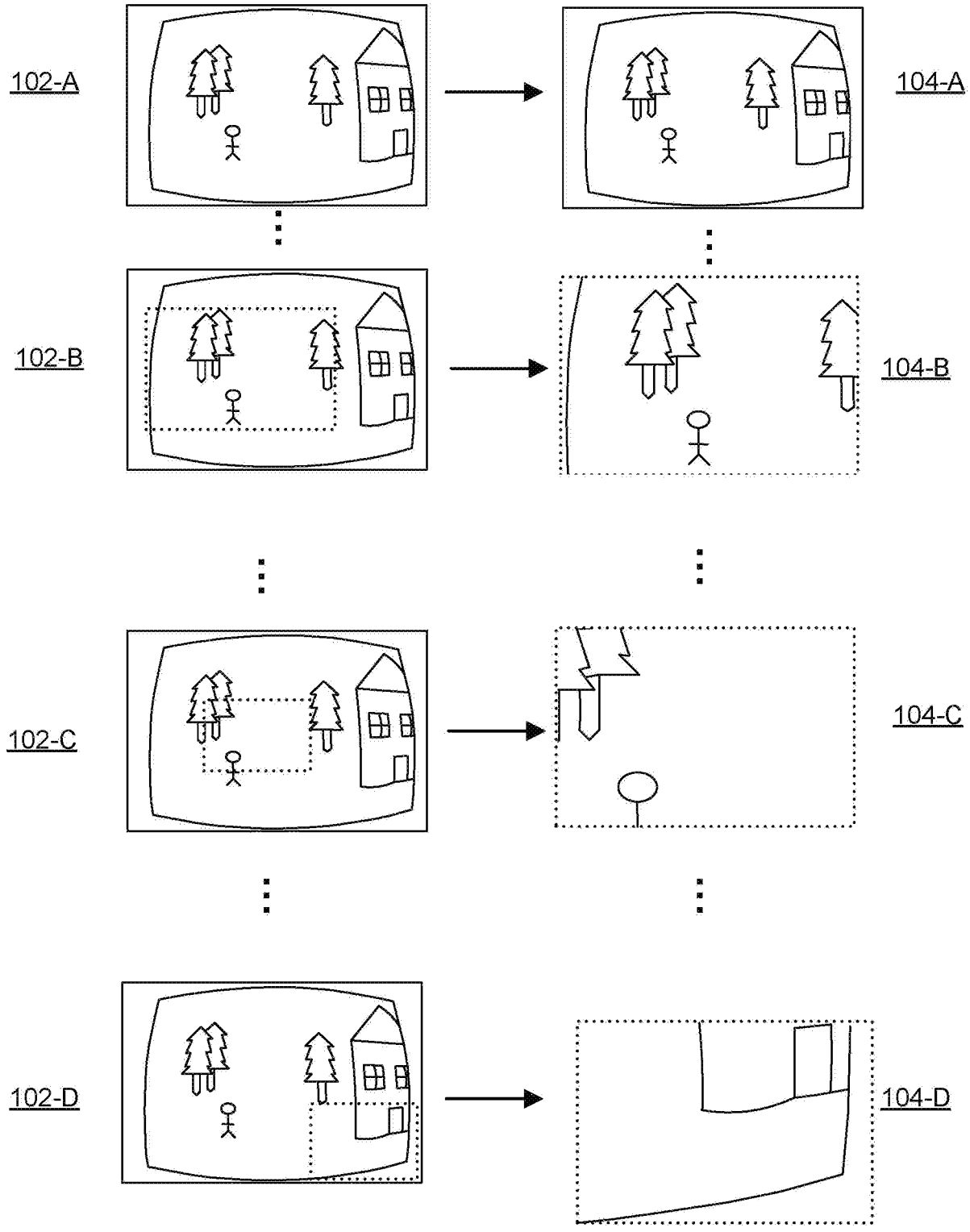
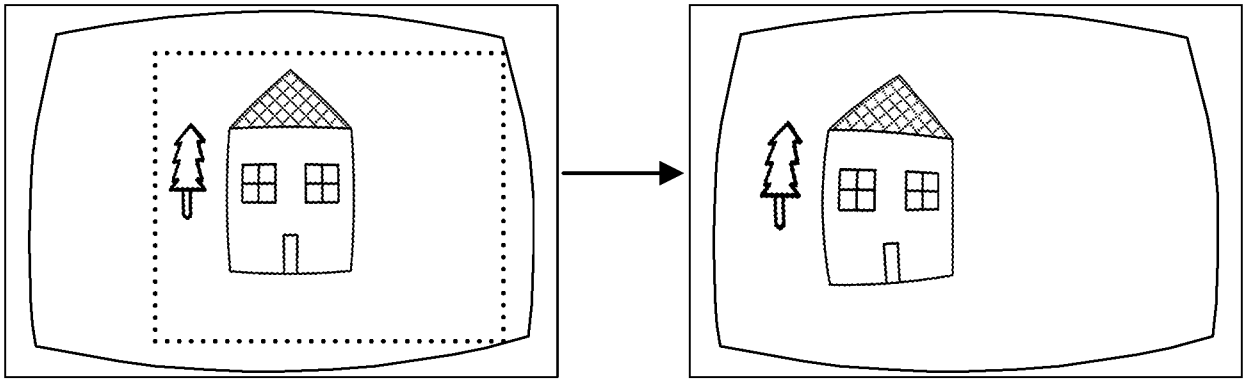
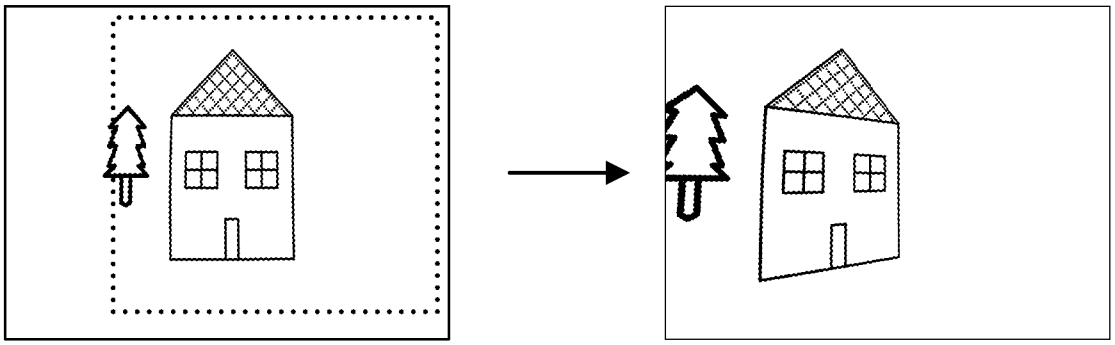


FIG. 1



222 224

FIG. 2A



232 234

FIG. 2B

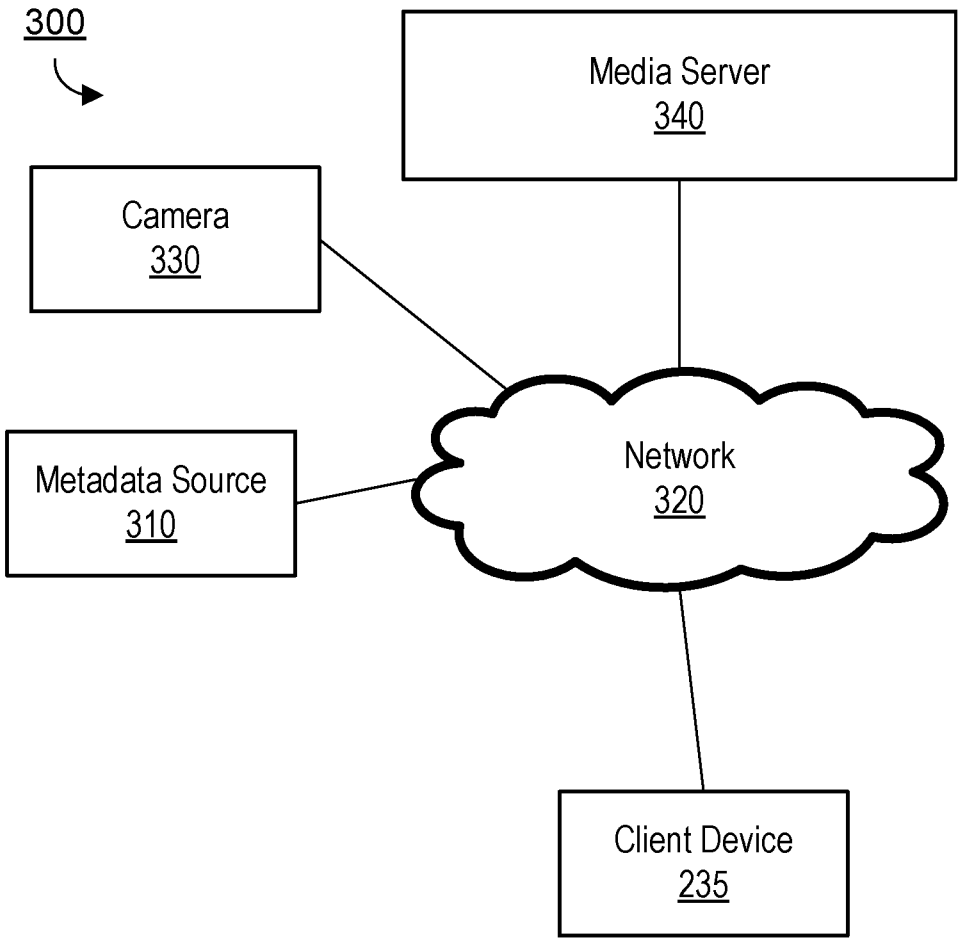

300
Media Server
340
Camera
330
Network
320
Metadata Source
310
Client Device
235

FIG. 3

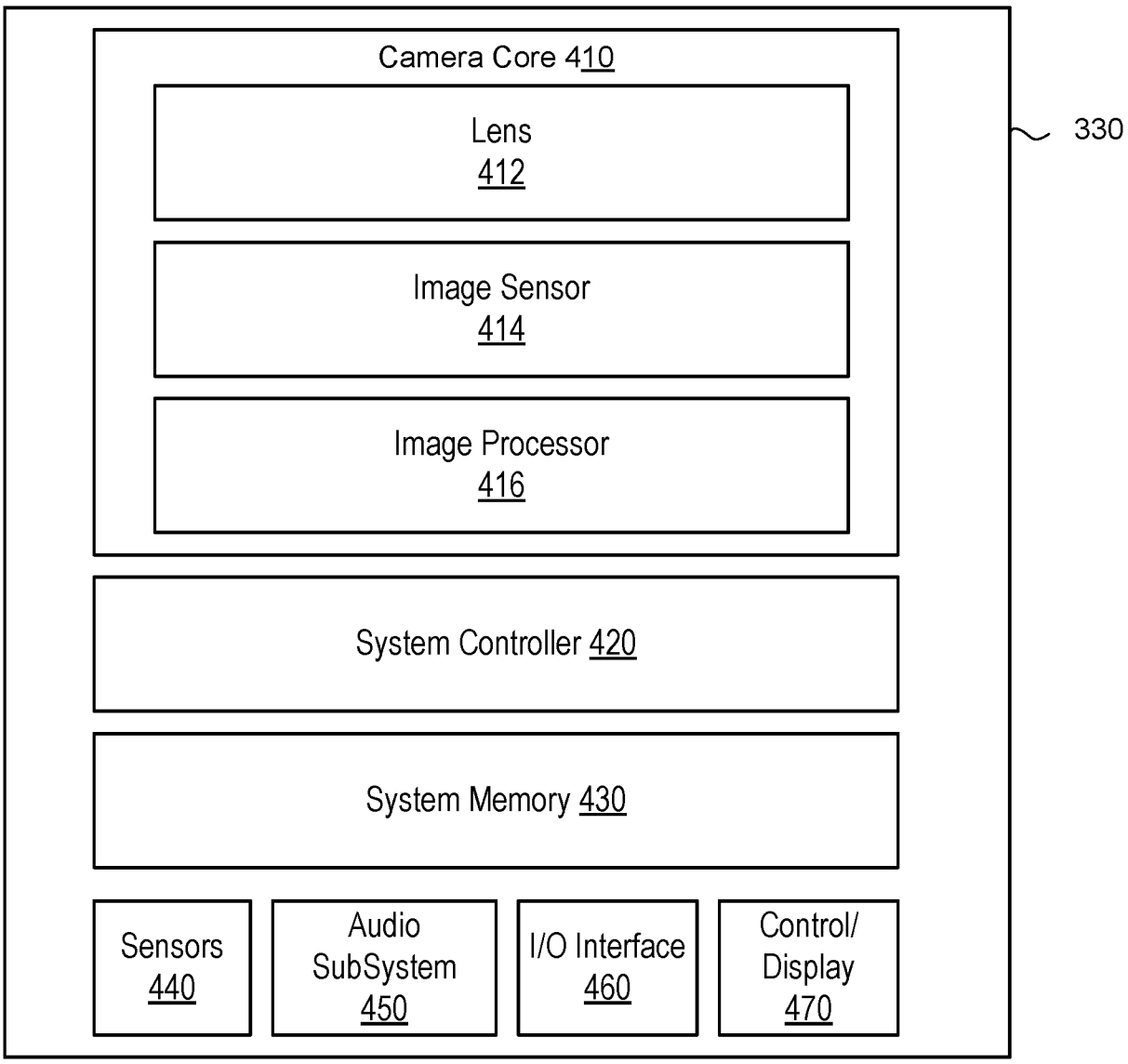

Camera Core 410
Lens
412
Image Sensor
414
Image Processor
416
330
System Controller 420
System Memory 430
Sensors
440
Audio
SubSystem
450
I/O Interface
460
Control/
Display
470

FIG. 4

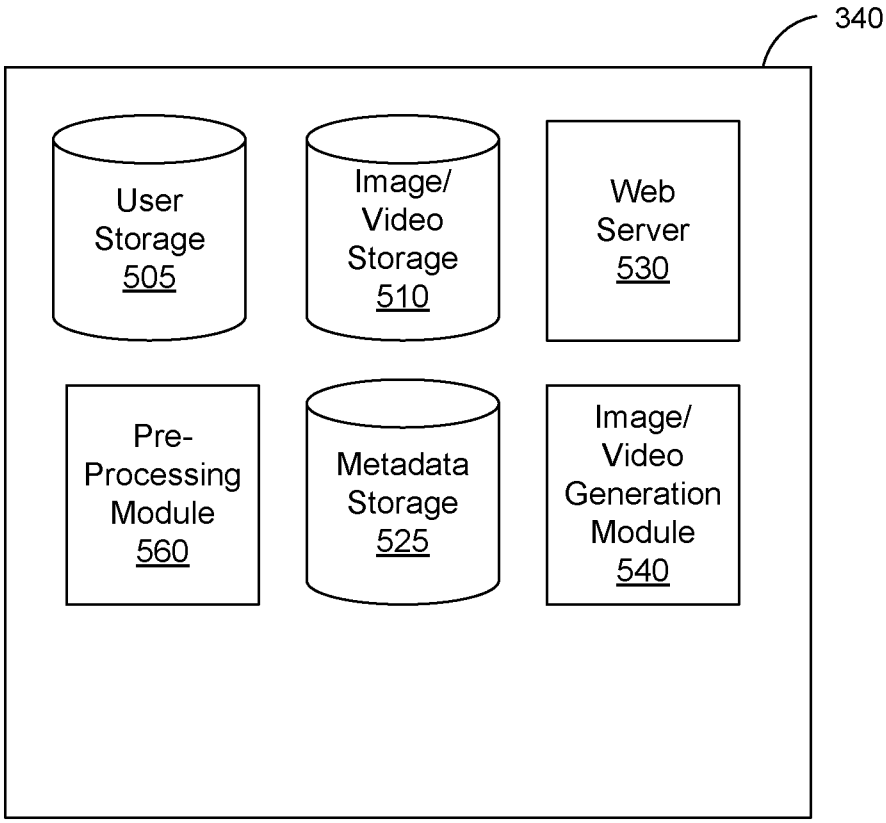

340
User Storage 505
Image/ Video Storage 510
Web Server 530
Pre-Processing Module 560
Metadata Storage 525
Image/ Video Generation Module 540

FIG. 5

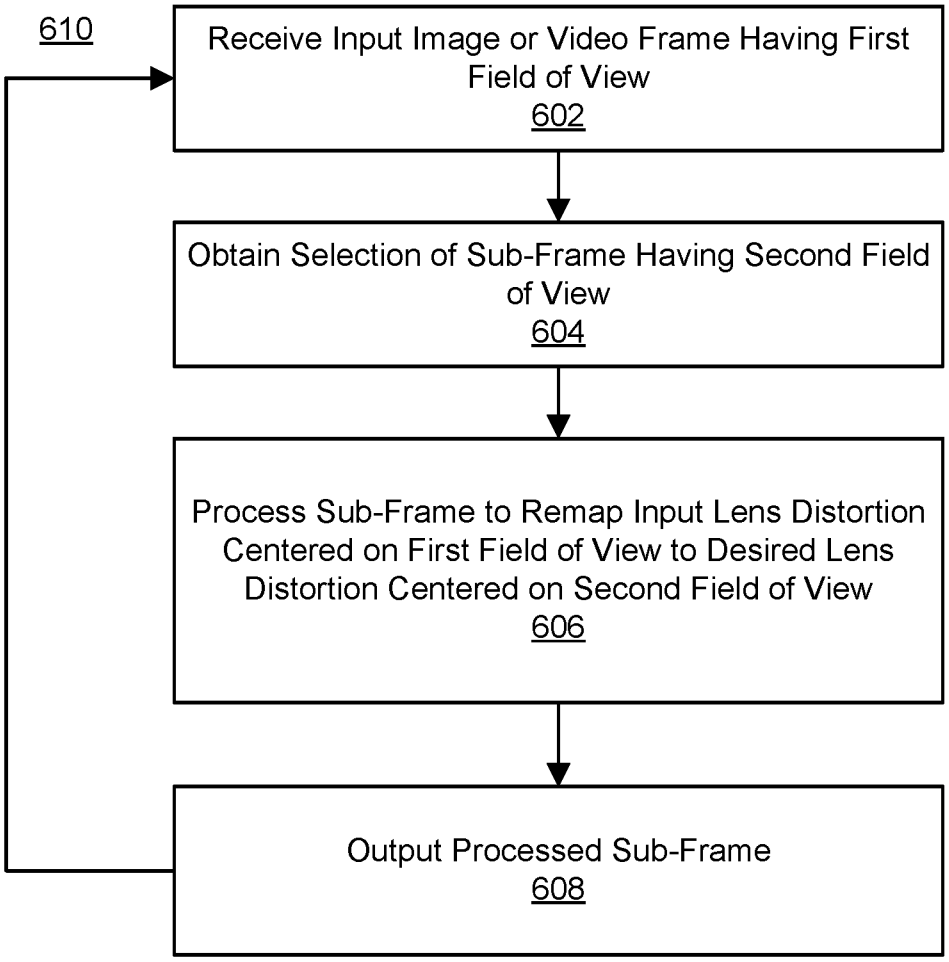

610
Receive Input Image or Video Frame Having First Field of View
602
Obtain Selection of Sub-Frame Having Second Field of View
604
Process Sub-Frame to Remap Input Lens Distortion Centered on First Field of View to Desired Lens Distortion Centered on Second Field of View
606
Output Processed Sub-Frame
608

FIG. 6

Doc Code: ECOMM.AUTH/ECOMM.WTDW
Doc Description: Internet Communications Authorized/Internet Communications Authorization Withdrawn

PTO/SB/439 (11-15)

AUTHORIZATION FOR INTERNET COMMUNICATIONS IN A PATENT APPLICATION OR REQUEST TO WITHDRAW AUTHORIZATION FOR INTERNET COMMUNICATIONS		
	Application No.	
	Filing Date	
	First Named Inventor	David A. Newman
	Art Unit	
	Examiner Name	
	Practitioner Docket No.	46DG-026055

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

I. To authorize permission for Internet Communications.

☑ Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. I understand that a copy of these communications will be made of record in the application file. (MPEP 502.03)

II. To withdraw authorization for Internet Communications.

☐ The authorization given on _____, to the USPTO to communicate with the undersigned and any practitioner in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via Internet communications such as video conferencing, instant messaging, or electronic mail is hereby withdrawn. I understand that the withdrawal is effective when approved rather than when received.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 58297.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/D. Benjamin Esplin/ — Signature

August 8, 2019 — Date

D. Benjamin Esplin — Typed or printed name

760-814-5268 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Juristic entities must be represented by a patent practitioner (see 37 CFR 1.31, which is applicable to any paper filed on or after September 16, 2012, that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below*.

☐ * Total of _____ forms are submitted.

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.
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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.
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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 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 Data Sheet 37 CFR 1.76	Attorney Docket Number	46DG-026055
	Application Number	
Title of Invention	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	David	A.	Newman	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	San Diego	State/Province	CA	Country of Residence [i]	US

Mailing Address of Inventor:

Address 1	GoPro, Inc.		
Address 2	3000 Clearview Way, Bldg. E		
City	San Mateo	State/Province	CA
Postal Code	94402	Country [i]	US

Inventor 2

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Joshua	Edward	Bodinet	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	San Diego	State/Province	CA	Country of Residence [i]	US

Mailing Address of Inventor:

Address 1	GoPro, Inc.		
Address 2	3000 Clearview Way, Bldg. E		
City	San Mateo	State/Province	CA
Postal Code	94402	Country [i]	US

Inventor 3

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Otto	Kenneth	Sievert	

PTO/AIA/14 (08-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	46DG-026055
	Application Number	
Title of Invention	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING	

Residence Information (Select One)	◉ US Residency	○ Non US Residency	○ Active US Military Service		
City	Oceanside	**State/Province**	CA	**Country of Residence** i	US

Mailing Address of Inventor:

Address 1	GoPro, Inc.		
Address 2	3000 Clearview Way, Bldg. E		
City	San Mateo	**State/Province**	CA
Postal Code	94402	**Country** i	US

Inventor 4

Legal Name

Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Timothy		MacMillan	

Residence Information (Select One)	◉ US Residency	○ Non US Residency	○ Active US Military Service		
City	La Honda	**State/Province**	CA	**Country of Residence** i	US

Mailing Address of Inventor:

Address 1	GoPro, Inc.		
Address 2	3000 Clearview Way, Bldg. E		
City	San Mateo	**State/Province**	CA
Postal Code	94402	**Country** i	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	137002		
Email Address	docketing@esplin.legal	Add Email	Remove Email

Application Information:

Title of the Invention	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING		
Attorney Docket Number	46DG-026055	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	6	**Suggested Figure for Publication (if any)**	

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	46DG-026055
	Application Number	
Title of Invention	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING	

Filing By Reference:

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 Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

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	137002		

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix	Remove
Registration Number					
Prefix	**Given Name**	Middle Name	**Family Name**	Suffix	Remove
Registration Number					

Additional Representative Information blocks may be generated within this form by selecting the **Add** button.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	46DG-026055
	Application Number	
Title of Invention	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim 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" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	16229512	2018-12-21

Prior Application Status	Patented		Remove		
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
16229512	Continuation of	15157207	2016-05-17	10186012	2019-01-22

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15157207	Claims benefit of provisional	62164409	2015-05-20

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. 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(i)(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).

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

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

WEB ADS 1.0

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	46DG-026055
	Application Number	
Title of Invention	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING	

☐ 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.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	46DG-026055
	Application Number	
Title of Invention	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is 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 State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	46DG-026055
	Application Number	
Title of Invention	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING	

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.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◉ Assignee	○ Legal Representative under 35 U.S.C. 117	○ Joint Inventor
○ Person to whom the inventor is obligated to assign.	○ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:	
If the Applicant is an Organization check here.	☒
Organization Name	GoPro, Inc.

Mailing Address Information For Applicant:

Address 1	3000 Clearview Way		
Address 2			
City	San Mateo	**State/Province**	CA
Country[i]	US	Postal Code	94402
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	46DG-026055
	Application Number	
Title of Invention	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING	

Assignee Information including Non-Applicant Assignee 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.

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.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	46DG-026055
	Application Number	
Title of Invention	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING	

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/D. Benjamin Esplin/			Date (YYYY-MM-DD)	
First Name	D. Benjamin	Last Name	Esplin	Registration Number	58297

Additional Signature may be generated within this form by selecting the Add button.

COMBINED DECLARATION/ASSIGNMENT (37 CFR 1.63)

For good and valuable consideration, the receipt of which is hereby acknowledged, the person(s) named below (referred to as "INVENTOR" whether singular or plural) has sold, assigned, and transferred and does hereby sell, assign, and transfer to **GoPro, Inc.**, a **Delaware** corporation, having a place of business at **3000 Clearview Way, Bldg. E, San Mateo, CA 94402** ("ASSIGNEE"), for itself and its successors, transferees, and assignees, the following:

1. The entire worldwide right, title, and interest in all inventions and improvements ("SUBJECT MATTER") that are disclosed in the following provisional or non-provisional application filed under 35 U.S.C. § 111, design application filed under 35 U.S.C. § 171, Registered Community Designs, international application filed according to the Patent Cooperation Treaty (PCT), or U.S. national phase application filed under 35 U.S.C. § 371 ("APPLICATION") and any patents issuing thereon ("PATENT RIGHTS"):

- Application No. _____, entitled "**Virtual Lens Simulation for Video and Photo Cropping**" filed on _____, which claims priority from a provisional application, filed on May 20, 2015, now bearing U.S. Application No. 62/164,409.

2. The entire worldwide right, title, and interest in and to: (a) the APPLICATION; (b) all applications claiming priority from the APPLICATION; (c) all provisional, utility, divisional, continuation, substitute, renewal, reissue, and other applications related thereto which have been or may be filed in the United States or elsewhere in the world; (d) all patents (including reissues and re-examinations) which may be granted on the applications set forth in (a), (b), and (c) above; and (e) all right of priority in the APPLICATION and in any underlying provisional or foreign application, together with all rights to recover damages for infringement of provisional rights.

INVENTOR agrees that ASSIGNEE may apply for and receive patents for SUBJECT MATTER in ASSIGNEE's own name.

INVENTOR agrees to do the following, when requested, and without further consideration, in order to carry out the intent of this Assignment: (1) execute all oaths, assignments, powers of attorney, applications, and other papers necessary or desirable to fully secure to ASSIGNEE the rights, titles and interests herein conveyed; (2) communicate to ASSIGNEE all known facts relating to the SUBJECT MATTER; and (3) generally do all lawful acts that ASSIGNEE shall consider desirable for securing, maintaining, and enforcing worldwide patent protection relating to the SUBJECT MATTER and for vesting in ASSIGNEE the rights, titles, and interests herein conveyed. INVENTOR further agrees to provide any successor, assign, or legal representative of ASSIGNEE with the benefits and assistance provided to ASSIGNEE hereunder.

INVENTOR represents that INVENTOR has the rights, titles, and interests to convey as set forth herein, and covenants with ASSIGNEE that the INVENTOR has not made and will not hereafter make any assignment, grant, mortgage, license, or other agreement affecting the rights, titles, and interests herein conveyed.

Title:	Virtual Lens Simulation for Video and Photo Cropping		
Filed:		Atty Docket #	23769-33280
Application #:			

INVENTOR grants the attorney of record the power to insert on this Assignment any further identification that may be necessary or desirable in order to comply with the rules of the United States Patent and Trademark Office for recordation of this document.

This Assignment may be executed in one or more counterparts, each of which shall be deemed an original and all of which may be taken together as one and the same Assignment.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

By signing below, INVENTOR further attests to the following:

- The APPLICATION was made or authorized to be made by INVENTOR.
- INVENTOR believes that INVENTOR is the original inventor or an original joint inventor of a claimed invention in the APPLICATION.
- INVENTOR acknowledges the duty to disclose to the United States Patent and Trademark Office all information known to INVENTOR to be material to patentability as defined in 37 CFR § 1.56, which for a continuation-in-part includes information known to INVENTOR to be material to patentability as defined in 37 CFR § 1.56 that became available between the filing date of the prior patent application and the National or PCT filing date of the continuation-in-part application.

INVENTOR hereby acknowledges 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.

Name and Signature _____ Date of Signature _____

May 3, 2016

David A. Newman

Name and Signature _____ Date of Signature _____

May 3, 2016

Joshua Edward Bodinet

Title:	Virtual Lens Simulation for Video and Photo Cropping		
Filed:		Atty Docket #	23769-33280
Application #:			

Name and Signature

Otto Sievert

Otto Kenneth Sievert

Date of Signature

May 17, 2016

Name and Signature

Tim Macmillan

Timothy Macmillan

Date of Signature

May 4, 2016

Electronic Acknowledgement Receipt

EFS ID:	36823834
Application Number:	16535940
International Application Number:	
Confirmation Number:	9986
Title of Invention:	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING
First Named Inventor/Applicant Name:	David A. Newman
Customer Number:	137002
Filer:	D. Benjamin Esplin/Chelsea Pearsall
Filer Authorized By:	D. Benjamin Esplin
Attorney Docket Number:	46DG-026055
Receipt Date:	08-AUG-2019
Filing Date:	
Time Stamp:	17:02:05
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1720
RAM confirmation Number	E201988H02245600
Deposit Account	602731
Authorized User	Chelsea Pearsall

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 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	Application Data Sheet	WebADS.pdf	156992 66cf5825ba4f641f50f86aba68198b6c02d4d5d3	no	9
Warnings:					
Information:					
2		46DG-026055_Specification-1.pdf	141079 db420ea14761e75cd24e81135540236f30ef5869	yes	27

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	21
Claims	22	26
Abstract	27	27

Warnings:					
Information:					
3	Drawings-only black and white line drawings	46DG-026055_Drawings.pdf	287380 826c4a11ad453c07692fddbcfbe957154d32c763	no	6
Warnings:					
Information:					
4	Oath or Declaration filed	46DG-026055_Dec-Assign.pdf	152255 9199d2e694f796516e3537c84741c6f80ad72af9	no	3
Warnings:					
Information:					
5	Power of Attorney	46DG-026055_POA.pdf	322505 e8a0c67ede52ada3b943ab64cb55140fbc4f4e6d	no	2

Warnings:					
Information:					
6	Internet Communications Authorized	46DG-026055_Email_Authorization.pdf	88292 eab233235864abf3c49d70f4fb7c97d0677fd374	no	2
Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	35062 18f045d6a9a51cbfeca9c0b05e6fe686bfa6a32e	no	2
Warnings:					
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		Total Files Size (in bytes):	1183565		

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.

CLAIMS

1. A system that simulates image distortion of a virtual lens in a video, the system comprising:

one or more processors; and

a non-transitory computer-readable storage medium storing instructions that when executed cause the one or more processors to perform steps including:

accessing input images, the input images including fields of view of a scene captured through a lens of a camera, the input images depicting the scene with an input lens distortion centered in the fields of view;

selecting sub-frames representing portions of the input images, the sub-frames including reduced fields of view of the scene smaller than the fields of view of the input images, the sub-frames including different lens distortion effects as a function of the input lens distortion present in the input images, different positions of areas of the input images included within the reduced fields of view, and a size of the areas of the input images included within the reduced fields of view; and

generating output images based on a desired lens distortion and the different lens distortion effects in the sub-frames, the desired lens distortion and the input lens distortion exhibiting consistent lens characteristics, wherein the output images include the sub-frames remapped from the input lens distortion centered in the fields of view of the input images to the desired lens distortion centered in the reduced fields of view to transform the different lens distortion effects present in the sub-frames to the desired lens distortion such that portions of the scene depicted in the sub-frames appear to have been captured using the reduced fields of view.

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2. The system of claim 1, wherein image stabilization is applied to the input images.

3. The system of claim 1, wherein the sub-frames are selected based on metadata associated with the input images.

4. The system of claim 3, wherein the metadata indicates motion of the camera that captured the input images.

5. The system of claim 3, wherein the metadata indicates orientation of the camera that captured the input images.

6. The system of claim 1, wherein the output images are combined as video frames of an output video.

7. The system of claim 6, wherein remapping of the sub-frames from the input lens distortion centered in the fields of view of the input images to the desired lens distortion centered in the reduced fields of view results in the output video having consistent frame-to-frame lens characteristics.

8. The system of claim 7, wherein the different positions of the areas of the input images included within the reduced fields of view simulate virtual re-pointing of the camera using the reduced fields of view.

9. The system of claim 8, wherein the one or more processors and the non-transitory computer-readable storage medium are included in the camera.

10. The system of claim 9, wherein the lens includes a wide angle lens, and lens characteristics of the wide angle lens causes straight lines in the scene to appear as curved lines near edges of the input images.

11. A method for simulating image distortion of a virtual lens in a video, the method comprising:

accessing input images, the input images including fields of view of a scene captured through a lens of a camera, the input images depicting the scene with an input lens distortion centered in the fields of view;

selecting sub-frames representing portions of the input images, the sub-frames including reduced fields of view of the scene smaller than the fields of view of the input images, the sub-frames including different lens distortion effects as a function of the input lens distortion present in the input images, different positions of areas of the input images included within the reduced fields of view, and a size of the areas of the input images included within the reduced fields of view; and

generating output images based on a desired lens distortion and the different lens distortion effects in the sub-frames, the desired lens distortion and the input lens distortion exhibiting consistent lens characteristics, wherein the output images include the sub-frames remapped from the input lens distortion centered in the fields of view of the input images to the desired lens distortion centered in the reduced fields of view to transform the different lens distortion effects present in the sub-frames to the desired lens distortion

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such that portions of the scene depicted in the sub-frames appear to have been captured using the reduced fields of view.

12. The method of claim 11, wherein image stabilization is applied to the input images.

13. The method of claim 11, wherein the sub-frames are selected based on metadata associated with the input images.

14. The method of claim 13, wherein the metadata indicates motion of the camera that captured the input images.

15. The method of claim 13, wherein the metadata indicates orientation of the camera that captured the input images.

16. The method of claim 11, wherein the output images are combined as video frames of an output video.

17. The method of claim 16, wherein remapping of the sub-frames from the input lens distortion centered in the fields of view of the input images to the desired lens distortion centered in the reduced fields of view results in the output video having consistent frame-to-frame lens characteristics.

18. The method of claim 17, wherein the different positions of the areas of the input images included within the reduced fields of view simulate virtual re-pointing of the camera using the reduced fields of view.

19. The method of claim 18, wherein the method is performed by one or more processors included in the camera.

20. The method of claim 19, wherein the lens includes a wide angle lens, and lens characteristics of the wide angle lens causes straight lines in the scene to appear as curved lines near edges of the input images.

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VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING

BACKGROUND

TECHNICAL FIELD

[0001] This disclosure relates to video editing, and more specifically, to simulating a virtual lens in a cropped image or video.

DESCRIPTION OF THE RELATED ART

[0002] It is often desirable to perform crop or zoom operations on high resolution images or video frames to extract a reduced field of view sub-frame. Particularly, for wide angle or spherical images or video, subjects in the originally captured content may appear very small. Furthermore, much of the captured field of view may be of little interest to a given viewer. Thus, cropping or zooming the content can beneficially obtain an image or video with the subject more suitably framed. Wide angle lens used to capture wide angle or spherical content may introduce the perception of distortion that tends to increase near the edges and corners of the captured frames due to the fact that the cameras are projecting content from a spherical world onto a rectangular display. Thus, cropping an image to extract a sub-frame near an edge or corner of a wide angle image capture may result in an image having significantly different distortion than a sub-frame extracted from a center of the image. Furthermore, the cropped image will have a different overall distortion effect than the original image. These distortion variations may be undesirable particularly when combining cropped sub-frames corresponding to different regions of a video (e.g., to track movement of a subject of interest), or combining cropped sub-frames with uncropped frames (e.g., to produce in zoom effect).

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BRIEF DESCRIPTIONS OF THE DRAWINGS

[0003] The disclosed embodiments have other advantages and features which will be more readily apparent from the following detailed description of the invention and the appended claims, when taken in conjunction with the accompanying drawings, in which:

[0004] Figure (or "FIG.") 1 illustrates example representations of input images and edited output images generated from the respective input images.

[0005] FIG. 2A illustrates an example embodiment of a re-pointing effect introduced into an image captured by a fisheye camera lens.

[0006] FIG. 2B illustrates an example embodiment of a re-pointing effect introduced into an image captured by a rectilinear camera lens.

[0007] FIG. 3 illustrates an example network environment for capturing and editing images or video.

[0008] FIG. 4 illustrates an example architecture of a camera.

[0009] FIG. 5 illustrates an example embodiment of a video server.

[0010] FIG. 6 illustrates an example embodiment of a process for simulating a virtual lens when applying a crop or zoom effect to an input video to generate an edited output video.

DETAILED DESCRIPTION

[0011] The figures and the following description relate to preferred embodiments by way of illustration only. It should be noted that from the following discussion, alternative embodiments of the structures and methods disclosed herein will be readily recognized as viable alternatives that may be employed without departing from the principles of what is claimed.

[0012] Reference will now be made in detail to several embodiments, examples of which are illustrated in the accompanying figures. It is noted that wherever practicable similar or like reference numbers

may be used in the figures and may indicate similar or like functionality. The figures depict embodiments of the disclosed system (or method) for purposes of illustration only. One skilled in the art will readily recognize from the following description that alternative embodiments of the structures and methods illustrated herein may be employed without departing from the principles described herein.

CONFIGURATION OVERVIEW

[0013] In an image or video capture system, a virtual lens is simulated when applying a crop or zoom effect to an input image or video. An input image or video frame is received that has a first field of view of a scene. The input image or video frame depicts the scene with an input lens distortion caused by lens characteristics of a lens used to capture the input image or video frame. A selection of a sub-frame representing a portion of the input image or video frame is obtained that has a second field of view of the scene smaller than the first field of view. The sub-frame is processed to remap the input lens distortion centered in the first field of view to a desired lens distortion in the sub-frame centered in the second field of view. The processed sub-frame is the outputted.

EFFECTS OF CAMERA LENS CURVATURE

[0014] FIG. 1 illustrates example representations of images (e.g., images 102-A, 102-B, 102-C, 102-D) and output images (e.g., images 104-A, 104-B, 104-C, 104-D) generated from editing the original images 102. In an embodiment, the images 102 or 104 may comprise frames of video. For images or video captured using a wide angle lens, the projection of the captured images 102 onto a rectangular display may result in the appearance of increased distortion (e.g., curvature) in the edge and corner regions of the images 102 relative to the center region. For example, some wide angles lenses may produce a fisheye effect in which straight lines in the scene that are near the edge and corner regions of the image appear increasingly curved in the captured image. The output images may include zooming and/or panning effects in which a reduced field of view image may be extracted which may be of

varying size and location in different images. For example, a zooming effect is introduced between images 104-A and 104-B to go from the original field of view in output image 104-A to a reduced field of view image in output image 104-B. The particular reduced field of view (e.g., a sub-frame) may be selected manually by a video editor in post-processing, or may be selected automatically to generate images or video likely to be of interest to a viewer based on various metadata. The metadata may also specify lens characteristics of the lens used to capture images or video frames. In another example, the image may be zoomed further in image 104-C and panned between image 104-C and 104-D (e.g., to track the movement of the person in a video). As a result of the wide angle lens introduced in the original images 102, different sub-frames may have completely different distortion characteristics from each other and from the original images 102. For example, sub-frames 104 taken from near the center of the captured image (e.g., sub-frame 104-C) may appear relatively undistorted and will not exhibit significant curvature around the edges (e.g., straight lines in the portion of the scene depicted by sub-frame 104-C may appear fairly straight in sub-frame 104-C), while sub-frames taken from the corner or edge regions of the image (e.g., sub-frame 104-D) may appear to have high curvature distortion (e.g., straight lines in the portion of the scene depicted by sub-frame 104-D may appear highly curved in sub-frame 104-D). Additionally, absent other processing, the distortion present in a given sub-frame 104 may appear differently depending on the size of the sub-frame and will not have the same lens characteristic (e.g., fisheye effect) as the originally captured image 102 from which it was derived.

[0015] When producing an output video or images from original content that includes cropping, zooming, re-pointing, and/or panning, it may be desirable for the output video or images to exhibit consistent lens characteristics. Thus, for example, it may be desirable for cropped sub-frames extracted from different portions of an original video to exhibit similar lens characteristics. Furthermore, it may be desirable for cropped sub-frames of different size to exhibit similar lens characteristics to each other and to the original uncropped video. Thus, to achieve this effect, a virtual lens model is applied to each

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of the extracted sub-frames 104 to produce consistent lens characteristics across each output image. As a result, the output images may simulate the same effect that would have been achieved by a camera operator manually re-orienting and/or physically moving the camera to produce the panning, re-pointing, cropping, and/or zooming effects. In one embodiment, the output images 104 may be processed so that the lens characteristics in the output images 104 match the characteristics naturally appearing in the original images 102. For example, each of the sub-frames 104-B, 104-C, 104-D may be processed to have a similar fisheye effect as the sub-frame 104-A as if the scenes depicted in sub-frames 104-B, 104-C, 104-D were natively captured in the same way as the original images 102. Alternatively, any desired lens characteristic may be applied that does not necessarily match the lens characteristic of the original image 102. In this way, a cohesive output video or set of images may be generated with consistent lens characteristics from frame-to-frame so that it is not apparent to the viewer that the panning, re-pointing, or zooming effects were created in post-processing instead of during capture. This process may be applied to any type of lens distortion including, for example, lens distortion characteristic of conventional lenses, wide angle lenses, fisheye lenses, zoom lenses, hemispherical lenses, flat lenses or other types of camera lenses.

[0016] FIG. 2A illustrates an example of a virtual camera re-pointing in a camera that produces a fisheye wide angle projection. In the captured image 222, the camera is pointed at the center of the house. Thus, the straight lines of the house appear fairly straight in the image 222 although some curvature may appear with greater distance from the center of image 222. The camera may be virtually re-pointed (e.g., in post-processing) to center the shot to the right of the house, either by panning or re-pointing the view window or cropping the view as shown by the dotted lines to produce the image 224. In image 224, the same scene is shown but with the view now centered to the right of the house. As can be seen, the lens distortion may be centered in image 224 so that straight lines of the house (which is no longer centered) may appear to have greater curvature. The image 224 may be generated from the

image 222 and may simulate an image that would have been captured by the camera if the scene had been captured with the camera pointed to the location to the right of the house. As will be apparent, the virtual repointing of the camera creates a very different curvature effect than if original image 222 was simply cropped to re-center at the new location.

[0017] FIG. 2B illustrates another example in a camera that produces a rectilinear projection instead of a fisheye projection. In image 232, the camera is pointed at the center of the house. Image 234 is generated by virtually re-pointing the camera to re-center the scene at a point to the right of the house, thus introducing some perceived distortion in the depiction of the house. The image 234 may be generated from the image 232 and simulates an image that would have been captured by the camera if the scene had been captured with the camera pointed to the location to the right of the house.

EXAMPLE MEDIA PROCESSING SYSTEM

[0018] FIG. 3 is a block diagram of a media processing system 300, according to one embodiment. The media content system 300 may include one or more metadata sources 310, a network 320, a camera 330, a client device 335 and a media server 340. In alternative configurations, different and/or additional components may be included in the media content system 300. Examples of metadata sources 310 may include sensors (such as accelerometers, speedometers, rotation sensors, GPS sensors, altimeters, and the like), camera inputs (such as an image sensor, microphones, buttons, and the like), and data sources (such as clocks, external servers, web pages, local memory, and the like). In some embodiments, one or more of the metadata sources 310 can be included within the camera 330. Alternatively, one or more of the metadata sources 310 may be integrated with a client device or another computing device such as, for example, a mobile phone.

[0019] The camera 330 can include a camera body, one or more a camera lenses, various indicators on the camera body (such as LEDs, displays, and the like), various input mechanisms (such as buttons,

switches, and touch-screen mechanisms), and electronics (e.g., imaging electronics, power electronics, metadata sensors, etc.) internal to the camera body for capturing images via the one or more lenses and/or performing other functions. In one embodiment, the camera 330 may be capable of capturing spherical or substantially spherical content. As used herein, spherical content may include still images or video having spherical or substantially spherical field of view. For example, in one embodiment, the camera 330 may capture an image or video having a 360 degree field of view in the horizontal plane and a 180 degree field of view in the vertical plane. Alternatively, the camera 330 may capture substantially spherical images or video having less than 360 degrees in the horizontal direction and less than 180 degrees in the vertical direction (e.g., within 10% of the field of view associated with fully spherical content). In other embodiments, the camera 330 may capture images or video having a non-spherical wide angle field of view.

[0020] As described in greater detail in conjunction with FIG. 4 below, the camera 330 can include sensors to capture metadata associated with video data, such as timing data, motion data, speed data, acceleration data, altitude data, GPS data, and the like. In a particular embodiment, location and/or time centric metadata (geographic location, time, speed, etc.) can be incorporated into a media file together with the captured content in order to track the location of the camera 330 over time. This metadata may be captured by the camera 330 itself or by another device (e.g., a mobile phone) proximate to the camera 330. In one embodiment, the metadata may be incorporated with the content stream by the camera 330 as the content is being captured. In another embodiment, a metadata file separate from the images or video file may be captured (by the same capture device or a different capture device) and the two separate files can be combined or otherwise processed together in post-processing. Furthermore, in one embodiment, metadata identifying the lens characteristics may be stored together with the image or video so that in post-processing, a post-processing editor may determine what type of lens distortion may be present in the captured image or video.

[0021] The media server 340 may receive and store images or video captured by the camera 330 and may allow users to access images or videos at a later time. In one embodiment, the media server 340 may provide the user with an interface, such as a web page or native application installed on the client device 335, to interact with and/or edit the stored images or videos and to generate output images or videos relevant to a particular user from one or more stored images or videos. At least some of output images or video frames may have a reduced field of view relative to the original images or video frames so as to produce zooming, re-pointing, and/or panning effect. To generate the output images or video, the media server 340 may extract a sequence of relevant sub-frames having the reduced field of view from the original images or video frames. For example, sub-frames may be selected from one or more input images or video frames to generate output images or video that tracks a path of a particular individual or object. In one embodiment, the media server 340 can automatically identify sub-frames by identifying spherical images or video captured near a particular location and time where a user was present (or other time and location of interest). In another embodiment, a time-varying path (e.g., a sequence of time-stamped locations) of a target (e.g., a person, object, or other scene of interest) can be used to automatically find spherical video having time and location metadata closely matching the path. Furthermore, by correlating the relative location of the camera 330 with a location at each time point in the path of interest, the media server 340 may automatically determine a direction between the camera 330 and the target and thereby automatically select the appropriate sub-frames depicting the target. In other embodiments, the media server 340 can automatically identify sub-frames of interest based on the image or video content itself or an associated audio track. For example, facial recognition, object recognition, motion tracking, or other content recognition or identification techniques may be applied to the video to identify sub-frames of interest. Alternatively, or in addition, a microphone array may be used to determine directionality associated with a received audio signal, and the sub-frames of interest may be chosen based on the direction between the camera and the audio source. These embodiments

beneficially can be performed without any location tracking of the target of interest. Furthermore, in one embodiment, after the media server 340 identifies sub-frames of interest, the media server 340 automatically obtains a sub-frame center location, a sub-frame size, and a scaling factor for transforming the input image based on the metadata associated with the input image or based on image characteristics of the input image (e.g., time and location of interest, target of interest, the image or video content itself or an associated audio track). The scaling factor is defined as a ratio of a size of the input image to the sub-frame size. The media server 340 applies the crop or zoom effect applied to the input image based on the sub-frame center location, sub-frame size, and the scaling factor to generate the sub-frame. Further still, any of the above techniques may be used in combination to automatically determine which sub-frames to select for generating output images or video. In other embodiments, the selection of sub-frames may be performed manually using post-processing tools, e.g., image or video editing tools. In some embodiments, the media server 340 obtains metadata associated with the input image. The metadata at least specifies the lens characteristics of the lens to capture the input image. The media server 340 processes the sub-frame using the lens characteristics specified in the metadata. For example, the media server 340 processes the sub-frame to remap the input lens distortion centered in a first field of view of the input image to a desired lens distortion in the sub-frame centered in a second field of view of the sub-frame. The second field of view of the sub-frame is smaller than the first field of view. The desired lens distortion exhibits consistent lens characteristics with those in the input image. The media server 340 outputs the processed sub-frame with the same size as the input image.

[0022] A user can interact with interfaces provided by the media server 340 via the client device 335. The client device 335 may be any computing device capable of receiving user inputs as well as transmitting and/or receiving data via the network 320. In one embodiment, the client device 335 may comprise a conventional computer system, such as a desktop or a laptop computer. Alternatively, the

client device 335 may comprise a device having computer functionality, such as a personal digital assistant (PDA), a mobile telephone, a smartphone or another suitable device. The user can use the client device 335 to view and interact with or edit videos or images stored on the media server 340. For example, the user can view web pages including summaries for a set of videos or images captured by the camera 330 via a web browser on the client device 335.

[0023] One or more input devices associated with the client device 335 may receive input from the user. For example, the client device 335 can include a touch-sensitive display, a keyboard, a trackpad, a mouse, a voice recognition system, and the like. In some embodiments, the client device 335 can access videos, images, and/or metadata from the camera 330 or one or more metadata sources 310, and can transfer the accessed metadata to the media server 340. For example, the client device may retrieve videos or images and metadata associated with the videos or images from the camera via a universal serial bus (USB) cable coupling the camera 330 and the client device 335. The client device 335 can then upload the retrieved videos and metadata to the media server 340. In one embodiment, the client device 335 may interact with the video server 340 through an application programming interface (API) running on a native operating system of the client device 335, such as IOS® or ANDROID™. While FIG. 3 shows a single client device 335, in various embodiments, any number of client devices 335 may communicate with the media server 340.

[0024] The media server 340 may communicate with the client device 335, the metadata sources 310, and the camera 330 via the network 320, which may include any combination of local area and/or wide area networks, using both wired and/or wireless communication systems. In one embodiment, the network 320 may use standard communications technologies and/or protocols. In some embodiments, the processes attributed to the client 335 or media server 340 herein may instead by performed within the camera 330.

[0025] Various components of the environment 300 of FIG. 3 such as the camera 330, metadata source

310, media server 340, and client device 325 can include one or more processors and a non-transitory computer-readable storage medium storing instructions therein that when executed cause the processor to carry out the functions attributed to the respective devices described herein.

EXAMPLE CAMERA CONFIGURATION

[0026] FIG. 4 is a block diagram illustrating a camera 330, according to one embodiment. In the illustrated embodiment, the camera 330 may comprise a camera core 410 comprising a lens 412, an image sensor 414, and an image processor 416. The camera 330 may additionally include a system controller 420 (e.g., a microcontroller or microprocessor) that may control the operation and functionality of the camera 330 and system memory 430 that may be configured to store executable computer instructions that, when executed by the system controller 420 and/or the image processors 416, may perform the camera functionalities described herein. In some embodiments, a camera 330 may include multiple camera cores 410 to capture fields of view in different directions which may then be stitched together to form a cohesive image. For example, in an embodiment of a spherical camera system, the camera 330 may include two camera cores 410 each having a hemispherical or hyperhemispherical lens that each captures a hemispherical or hyperhemispherical field of view which are stitched together in post-processing to form a spherical image.

[0027] The lens 412 can be, for example, a wide angle lens, hemispherical, or hyperhemispherical lens that focuses light entering the lens to the image sensor 414 which captures images and/or video frames. As described above, different lens may produce different lens distortion effects in different portions of the image or video frame due to different lens characteristics. For example, the lens characteristics may cause straight lines in the image of a scene to appear as curved lines in at least a portion of the image or video frame. In another example, the lens characteristics may change orientations of straight lines in an image of the scene. In such an example, the vertical or horizontal straight lines may appear to be oblique lines in the image of the scene. In another example, the lens characteristics may cause lines of

the same length in the scene to appear to be different lengths in different portions of the image or video frame. The lens characteristics may be based on an optical design of the lens. Examples of lens characteristics that may affect the lens distortion may include, for example, a focal length, an f-number, a field of view, a magnification, a numerical aperture, a resolution, a working distance, an aperture size, lens materials, lens coatings, or other lens characteristics. Different types of lens may have different lens characteristics causing different distortions. For example, a conventional lens may have a fixed focal length (e.g., greater than 50mm) and produces a "natural" field of view that may look natural to observers from a normal view distance. A wide angle lens may have a shorter focal length (e.g., less than 40mm) than the one of conventional lens and may produce a wide field of view (also referred to as an expanded field of view). The types of the wide angle lens may include rectilinear wide-angle lens and a fisheye lens. The rectilinear wide-angle lens may produce a wide field of view that yields images of a scene in which straight lines in the scene appear as straight lines in the image. The fisheye lens produces a wider field of view than the rectilinear wide-angle lens and may cause straight lines in the scene to appear as curved lines in the image in at least a portion of the image. A hemispherical lens (which may be a type of fisheye lens) may produce a hemispherical field of view. A zoom lens may magnify a scene so that objects in the scene appear larger than in the image. A flat may have a flat shape that introduces other types of distortion into the image.

[0028] The image sensor 414 may capture high-definition images or video having a resolution of, for example, 720p, 1080p, 4k, or higher. In one embodiment, spherical video or images may be captured as a 5760 pixels by 2880 pixels with a 360 degree horizontal field of view and a 180 degree vertical field of view. For video, the image sensor 414 may capture video at frame rates of, for example, 30 frames per second, 60 frames per second, or higher. The image processor 416 may perform one or more image processing functions of the captured images or video. For example, the image processor 416 may perform a Bayer transformation, demosaicing, noise reduction, image sharpening, image stabilization,

rolling shutter artifact reduction, color space conversion, compression, or other in-camera processing functions. Processed images and video may be temporarily or persistently stored to system memory 430 and/or to a non-volatile storage, which may be in the form of internal storage or an external memory card.

[0029] An input/output (I/O) interface 460 may transmit and receive data from various external devices. For example, the I/O interface 460 may facilitate the receiving or transmitting video or audio information through an I/O port. Examples of I/O ports or interfaces may include USB ports, HDMI ports, Ethernet ports, audioports, and the like. Furthermore, embodiments of the I/O interface 460 may include wireless ports that can accommodate wireless connections. Examples of wireless ports include Bluetooth, Wireless USB, Near Field Communication (NFC), and the like. The I/O interface 460 may also include an interface to synchronize the camera 330 with other cameras or with other external devices, such as a remote control, a second camera, a smartphone, a client device 235, or a media server 340.

[0030] A control/display subsystem 470 may include various control and display components associated with operation of the camera 330 including, for example, LED lights, a display, buttons, microphones, speakers, and the like. The audio subsystem 450 may include, for example, one or more microphones and one or more audio processors to capture and process audio data correlated with video capture. In one embodiment, the audio subsystem 450 may include a microphone array having two or microphones arranged to obtain directional audio signals.

[0031] Sensors 440 may capture various metadata concurrently with, or separately from, video or image capture. For example, the sensors 440 may capture time-stamped location information based on a global positioning system (GPS) sensor, and/or an altimeter. Other sensors 440 may be used to detect and capture orientation of the camera 330 including, for example, an orientation sensor, an accelerometer, a gyroscope, or a magnetometer. Sensor data captured from the various sensors 440 may

be processed to generate other types of metadata. For example, sensor data from the accelerometer may be used to generate motion metadata, comprising velocity and/or acceleration vectors representative of motion of the camera 330. Furthermore, sensor data from the may be used to generate orientation metadata describing the orientation of the camera 330. Sensor data from the GPS sensor provides GPS coordinates identifying the location of the camera 330, and the altimeter measures the altitude of the camera 330. In one embodiment, the sensors 440 may be rigidly coupled to the camera 330 such that any motion, orientation or change in location experienced by the camera 330 may also be experienced by the sensors 440. The sensors 440 furthermore may associates a time stamp representing when the data was captured by each sensor. In one embodiment, the sensors 440 may automatically begin collecting sensor metadata when the camera 330 begins recording a video or captures an image.

EXAMPLE MEDIA SERVER ARCHITECTURE

[0032] FIG. 5 is a block diagram of an architecture of the media server 340. In the illustrated embodiment, the media server 340 may comprise a user storage 505, an image/video storage 510, a metadata storage 525, a web server 530, a image/video generation module 540, and a pre-processing module 560. In other embodiments, the media server 340 may include additional, fewer, or different components for performing the functionalities described herein. Conventional components such as network interfaces, security functions, load balancers, failover servers, management and network operations consoles, and the like are not shown so as to not obscure the details of the system architecture.

[0033] In an embodiment, the media server 340 may enable users to create and manage individual user accounts. User account information is stored in the user storage 505. A user account may include information provided by the user (such as biographic information, geographic information, and the like) and may also include additional information inferred by the media server 340 (such as information associated with a user's historical use of a camera and interactions with the media server 340).

Examples of user information may include a username, contact information, a user's hometown or geographic region, other location information associated with the user, other users linked to the user as "friends," and the like. The user storage 505 may include data describing interactions between a user and videos captured by the user. For example, a user account can include a unique identifier associating videos uploaded by the user with the user's user account.

[0034] The image/video storage 510 may store videos or images captured and uploaded by users of the media server 340. The media server 340 may access videos or images captured using the camera 330 and store the videos or images in the image/video storage 510. In one example, the media server 340 may provide the user with an interface executing on the client device 335 that the user may use to upload videos or images to the image/video storage 510. In one embodiment, the media server 340 may index images and videos retrieved from the camera 330 or the client device 335, and may store information associated with the indexed images and videos in the image/video storage 510. For example, the media server 340 may provide the user with an interface to select one or more index filters used to index images or videos. Examples of index filters may include but are not limited to: the time and location that the image or video was captured, the type of equipment used by the user (e.g., ski equipment, mountain bike equipment, etc.), the type of activity being performed by the user while the image or video was captured (e.g., snowboarding, mountain biking, etc.), or the type of camera 330 used to capture the content.

[0035] In some embodiments, the media server 340 generates a unique identifier for each image or video stored in the image/video storage 510 which may be stored as metadata associated with the image or video in the metadata storage 525. In some embodiments, the generated identifier for a particular image or video may be unique to a particular user. For example, each user can be associated with a first unique identifier (such as a 10-digit alphanumeric string), and each image or video captured by a user may be associated with a second unique identifier made up of the first unique identifier associated with

the user concatenated with an image or video identifier (such as an 8-digit alphanumeric string unique to the user). Thus, each image or video identifier may be unique among all images and videos stored at the image/video storage 510, and can be used to identify the user that captured the image or video.

[0036] The metadata storage 525 may store metadata associated with images or videos stored by the image/video storage 510 and with users stored in the user storage 505. Particularly, for each image or video, the metadata storage 525 may store metadata including time-stamped location information associated with each image or frame of the video to indicate the location of the camera 330 at any particular moment during capture of the content. Additionally, the metadata storage 525 may store other types of sensor data captured by the camera 330 in association with an image or video frame including, for example, gyroscope data indicating motion and/or orientation of the device. In some embodiments, metadata corresponding to an image or video may be stored within an image or video file itself, and not in a separate storage module. The metadata storage 525 may also store time-stamped location information associated with a particular user so as to represent a user's physical path during a particular time interval. This data may be obtained from a camera held by the user, a mobile phone application that tracks the user's path, or another metadata source. Furthermore, in one embodiment, the metadata storage 525 stores metadata specifying the lens characteristics with the image or video and metadata associated with the input image or image characteristics of the input image (e.g., time and location of interest, target of interest, the image or video content itself or an associated audio track).

[0037] The web server 530 may provide a communicative interface between the media server 340 and other entities of the environment of FIG. 3. For example, the web server 530 may access videos and associated metadata from the camera 330 or the client device 335 to store in the image/video storage 510 and the metadata storage 525, respectively. The web server 530 can also receive user input provided to the client device 335, can request automatically generated output images or videos relevant to the user generated from the stored video content. The web server 530 may furthermore include

editing tools to enables users to edit images or videos stored in the video storage 510.

[0038] A pre-processing module 560 may pre-process and indexes uploaded images or videos. For example, in one embodiment, uploaded images or videos may be automatically processed by the pre-processing module 560 to conform the images or videos to a particular file format, resolution, etc. Furthermore, in one embodiment, the pre-processing module 560 may automatically parse the metadata associated with images or videos upon being uploaded.

[0039] The image/video generation module 540 may automatically generate output images or videos relevant to a user or to a particular set of inputs. For example, the image/video generation module 540 may generate an output video or sequence of images including content that tracks a sequence of locations representing a physical path over a particular time interval. Alternatively, the image/video generation module 440 may generate an output video or sequence of images including content that tracks a particular face or object identified in the images or video, tracks an area of motion having particular motion characteristics, tracks an identified audio source, etc. The output images or videos may have a reduced field of view (e.g., a standard non-spherical field of view) and represent relevant sub-frames to provide an image or video of interest. For example, the image or video may track a particular path of an individual, object, or other target so that each sub-frame depicts the target as the target moves through a given scene.

[0040] In some embodiments, image/video generation module 540 obtains metadata associated with the input image from metadata storage 525 and identifies sub-frames of interest. The image/video generation module 540 automatically obtains a sub-frame center location, a sub-frame size, and a scaling factor for transforming the input image based on the metadata associated with the input image or image characteristics of the input image (e.g., time and location of interest, target of interest, the image or video content itself or an associated audio track). The image/video generation module 540 processes the sub-frame using the lens characteristics specified in the metadata and outputs the processed sub-

frame with the same size as the input image.

[0041] In an embodiment, the media server 340 may enable the user to select from predefined image or video generation templates. For example, the user can request that the media server 340 generate a video or set of images based on location tracking, based on facial recognition, gesture recognition, audio tracking, motion detection, voice recognition, or other techniques. Various parameters used by the media server 340 to select relevant frames such as thresholds governing proximity distance and clip duration can be adjusted or pre-set.

[0042] In an embodiment, the user interface may also provide an interactive viewer that enables the user to pan around within the content being viewed. This may allow the user to search for significant moments to incorporate into the output video or image and manually edit the automatically generated video or image. In one embodiment, the user interface enables various editing effects to be added to a generated output image or video. For example, the editing interface may enable effects such as, cut-away effects, panning, tilting, rotations, reverse angles, image stabilization, zooming, object tracking,

PROCESS FOR VIRTUAL LENS SIMULATION

[0043] FIG. 6 illustrates an example embodiment of a process for generating an output image or video using a virtual lens model. The media server 340 may receive 602 an input image or video frame depicting a scene, which may have a first field of view, such as, for example, a wide angle or spherical field of view. Furthermore, the input image may depict the scene with a lens distortion centered on the field of view of the input image. Thus, for example, if a fisheye lens is used, straight lines of the scene in the center of the input image may appear straight while straight lines of the scene near the edges of the input image may appear curved. The media server 340 may obtain 604 a selection of a sub-frame (e.g., either manually or automatically) comprising a second field of view which may be a reduced field relative to the input image or video frame. For example, the sub-frame may be selected as a re-pointing

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of the original input image or video frame, a crop of the original input image or video frame, or a zoomed in portion of the original input image or video frame. The sub-frame may be processed 606 to remap the input lens distortion centered on the first field of view of the original input image or video frame to a desired lens distortion centered on a second field of view of the sub-frame. This remapping may comprise a transformation that may have the same general effect as removing the existing lens distortion effect present in the sub-frame and then applying a desired lens distortion effect, but may do so by applying a direct mapping instead of two separate operations. For example, the remapping be achieved by applying a direct transformation function that describes a relationship between the input lens distortion of the input sub-frame (which may be centered on the original input image or video frame) and the desired lens distortion of the output sub-frame (which may be centered on the sub-frame). For example, in an embodiment, the single function transformation may be determined based on a combination (e.g., a product) of a first function to remove the lens distortion and convert the original input image or video frame to a rectilinear image, and a second function to apply the desired lens distortion. However, the transformation may be achieved without an intermediate step of converting to rectilinear. The direct mapping may enable the transformation to be achieved with higher quality and less loss than a comparable two-step process of separately removing the input distortion and then introducing the desired lens distortion. The transformed sub-frame may simulate the distortion that would be seen if the field of view of the sub-frame was originally captured by a camera having the desired lens distortion. In one embodiment, the desired lens distortion effect may match the lens distortion present in the initial input image or video frame prior to extracting the sub-frame, but may be re-centered on the sub-frame. In one embodiment, the function(s) may be determined based on metadata stored with the input image or video that specifies the type or characteristics of the lens used the capture the input image or video. The processed sub-frame is then outputted 508. The process may repeat 510 for each frame of an input video to generate an output video having the desired lens

distortion effect or may be applied to each of a set of input images.

[0044] In an alternative embodiment, a two-step transformation may be used instead of a direct mapping. For example, based on known characteristics of the lens and the location and size of the selected sub-frame, an appropriate inverse function may be performed to remove the lens distortion present in the sub-frame. For example, if the original input image or video frame is captured with a fisheye lens, curvature in the areas of the sub-frame corresponding to the edges and corners of the original input image or video frame may be removed. The inverse function of the input lens distortion may be applied centered on the field of view of the original input image or video frame. As a result of applying the inverse function, the sub-frame may be transformed to a rectilinear image in which straight lines in the portion of the scene depicted in the sub-frame appear straight. Then, a desired lens distortion function centered at the center of the sub-frame may be applied to the rectilinear image to re-introduce a lens distortion effect.

ADDITIONAL CONFIGURATION CONSIDERATIONS

[0045] Throughout this specification, some embodiments have used the expression "coupled" along with its derivatives. The term "coupled" as used herein is not necessarily limited to two or more elements being in direct physical or electrical contact. Rather, the term "coupled" may also encompass two or more elements are not in direct contact with each other, but yet still co-operate or interact with each other, or are structured to provide a thermal conduction path between the elements.

[0046] Likewise, as used herein, the terms "comprises," "comprising," "includes," "including," "has," "having" or any other variation thereof, are intended to cover a non-exclusive inclusion. For example, a process, method, article, or apparatus that comprises a list of elements is not necessarily limited to only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus.

[0047] In addition, use of the "a" or "an" are employed to describe elements and components of the embodiments herein. This is done merely for convenience and to give a general sense of the invention. This description should be read to include one or at least one and the singular also includes the plural unless it is obvious that it is meant otherwise.

[0048] Finally, as used herein any reference to "one embodiment" or "an embodiment" means that a particular element, feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment.

[0049] Upon reading this disclosure, those of skill in the art will appreciate still additional alternative structural and functional designs for the described embodiments as disclosed from the principles herein. Thus, while particular embodiments and applications have been illustrated and described, it is to be understood that the disclosed embodiments are not limited to the precise construction and components disclosed herein. Various modifications, changes and variations, which will be apparent to those skilled in the art, may be made in the arrangement, operation and details of the method and apparatus disclosed herein without departing from the scope defined in the appended claims.

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Exhibit 1003 Page 348

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING
First Named Inventor/Applicant Name:	David A. Newman
Filer:	D. Benjamin Esplin/Chelsea Pearsall
Attorney Docket Number:	46DG-026055

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1720**

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
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Application Number	
Filing Date	Herewith
First Named Inventor	David A. Newman
Title	VIRTUAL LENS SIMULATION FOR VIDEO AND PHOTO CROPPING
Art Unit	
Examiner Name	
Attorney Docket Number	46DG-026055

SIGNATURE of Applicant or Patent Practitioner

Signature	/D. Benjamin Esplin/	Date (Optional)	
Name	D. Benjamin Esplin	Registration Number	58297
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

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I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

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☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 137002

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☐ The address associated with the above-mentioned Customer Number

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☐ The address associated with **Customer Number:**

OR

Firm or Individual Name					
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Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	
Name	Sharon Zezima		
Title	General Counsel of GoPro, Inc.		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

This collection of information is required by 37 CFR 1.131, 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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