

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

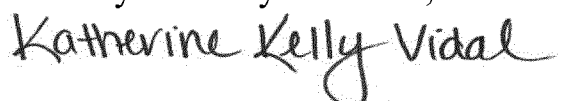
PATENT NO. : 10,958,840 B2
APPLICATION NO. : 16/713798
DATED : March 23, 2021
INVENTOR(S) : César Douady et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

In Claim 16, Column 32, Line 15, please replace “stabling” with --stabilizing--, therefor.

Signed and Sealed this
Twenty-first Day of March, 2023

Katherine Kelly Vidal
Director of the United States Patent and Trademark Office

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 10,958,840 B2
APPLICATION NO. : 16/713798
DATED : March 23, 2021
INVENTOR(S) : Douady et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

Column 14, Line 50, please delete “head” and insert --ahead--, therefor.

In the Claims

Column 31, Line 61, please replace “lookahead” with --look-ahead--, therefor.

Signed and Sealed this
Seventh Day of March, 2023

Katherine Kelly Vidal
Director of the United States Patent and Trademark Office

UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

Page _____ of _____

PATENT NO. : 10,958,840

APPLICATION NO.: 16/713,798

ISSUE DATE : March 23, 2021

INVENTOR(S) : César Douady, et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In Column 14, Line 50, please delete "head" and insert --ahead--, therefor.

In Claim 11, Column 31, Line 61, please replace "lookahead" with --look ahead-- therefor.

In Claim 16, Column 32, Line 15, please replace "stabling" with --stabilizing--, therefor.

MAILING ADDRESS OF SENDER (Please do not use Customer Number below):

6225 Buckhorn Ridge Place
San Miguel, California 93451

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Attention Certificate of Corrections Branch, 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.

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.

Electronic Acknowledgement Receipt

EFS ID:	47586425
Application Number:	16713798
International Application Number:	
Confirmation Number:	2783
Title of Invention:	SYSTEMS AND METHODS FOR STABILIZING VIDEOS
First Named Inventor/Applicant Name:	Cesar Douady
Customer Number:	177600
Filer:	D. Benjamin Esplin/Lynn Han
Filer Authorized By:	D. Benjamin Esplin
Attorney Docket Number:	46DG-026085
Receipt Date:	24-FEB-2023
Filing Date:	13-DEC-2019
Time Stamp:	12:56:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	46DG-026085_Replacement_Request_Certificate_of_Correction.pdf	209088 e9e095d05fada29543b126a5c970e8984c6a2eeb	no	2

Warnings:

Information:					
2	Request for Certificate of Correction	46DG-026085_Replacement_CoC.pdf	214536 fe23179dd7efe3a5a750a6daaa26495a48873ad6	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			423624		
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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.					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE PATENT : César Douady, *et al.*
APPLICATION OF :
SERIAL NO. : 16/713,798
FILING DATE : December 13, 2019
ART UNIT : 2697
EXAMINER : Hsu, Amy R.
FOR : SYSTEMS AND METHODS FOR STABILIZING VIDEOS

REPLACEMENT REQUEST FOR CERTIFICATE OF CORRECTION

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

This Request for Certificate of Correction is hereby filed to replace the Request previously filed on February 10, 2023. The applicant of the above-identified patent, through its attorneys, requests a Certificate of Correction, including the corrections previously requested on February 10, 2023, along with additional corrections.

Applicant requests correction of the errors set forth below.

The required fee was already paid on February 10, 2023; therefore, no additional fees are believed to be due. However, the Commissioner is hereby authorized to charge any additional fees or credit any overpayment to the undersigned's Deposit Account No. 602731 (Reference No. 46DG-026085).

Correction of text in the Patent

Upon reviewing the above-identified patent, Applicant noted errors which should be corrected. These errors are either of a clerical nature, of a typographical nature, or a mistake of minor character. Correction to these errors do not constitute new matter nor require reexamination.

It is certified that errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In Column 14, Line 50, please delete “head” and insert --ahead--, therefor.

In Claim 11, Column 31, Line 61, please replace “lookahead” with --look-ahead-- therefor.

In Claim 16, Column 32, Line 15, please replace “stabling” with --stabilizing--, therefor.

CONCLUSION

It is requested that a Certificate of Correction be issued to correct these errors. Form PTO/SB/44 is attached for this purpose.

Date: February 24, 2023

Submitted,

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

Customer No. 177600
ESPLIN & ASSOCIATES, PC
docketing@esplin.legal
(760) 249-2133

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE PATENT : César Douady, *et al.*
APPLICATION OF :
SERIAL NO. : 16/713,798
FILING DATE : December 13, 2019
ART UNIT : 2697
EXAMINER : Hsu, Amy R.
FOR : SYSTEMS AND METHODS FOR STABILIZING VIDEOS

REQUEST FOR CERTIFICATE OF CORRECTION

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

The applicant of the above-identified patent, through its attorneys, hereby requests issuance of a Certificate of Correction.

Applicant requests correction of the errors set forth below.

Applicant submits the required fee herewith. The Commissioner is hereby authorized to charge any additional fees or credit any overpayment to the undersigned's Deposit Account No. 602731 (Reference No. 46DG-026085).

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Date: February 10, 2023

Submitted,

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

Customer No. 177600
ESPLIN & ASSOCIATES, PC
docketing@esplin.legal
(760) 249-2133

**UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION**

Page _____ of _____

PATENT NO. : 10,958,840

APPLICATION NO.: 16/713,798

ISSUE DATE : March 23, 2021

INVENTOR(S) : César Douady, et al.

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Electronic Patent Application Fee Transmittal

Application Number:	16713798			
Filing Date:	13-Dec-2019			
Title of Invention:	SYSTEMS AND METHODS FOR STABILIZING VIDEOS			
First Named Inventor/Applicant Name:	Cesar Douady			
Filer:	D. Benjamin Esplin/Lynn Han			
Attorney Docket Number:	46DG-026085			
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:				
CERTIFICATE OF CORRECTION	1811	1	160	160

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

Electronic Acknowledgement Receipt

EFS ID:	47516130
Application Number:	16713798
International Application Number:	
Confirmation Number:	2783
Title of Invention:	SYSTEMS AND METHODS FOR STABILIZING VIDEOS
First Named Inventor/Applicant Name:	Cesar Douady
Customer Number:	177600
Filer:	D. Benjamin Esplin/Lynn Han
Filer Authorized By:	D. Benjamin Esplin
Attorney Docket Number:	46DG-026085
Receipt Date:	10-FEB-2023
Filing Date:	13-DEC-2019
Time Stamp:	14:56:51
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	E202320E57169889
Deposit Account	602731
Authorized User	Lynn Han

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	Request for Certificate of Correction	46DG-026085_Request_Certificate_of_Correction.pdf	207438	no	2
			81209e694a84b1e5d2dde0e902d74cbca8d080a3		

Warnings:

Information:

2	Request for Certificate of Correction	46DG-026085_CoC.pdf	202774	no	2
			993a5f71b3ea6d4220ef8fc9d1bf52be884555b		

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	38124	no	2
			525187115f1c58b9dde72de2cdbcb8db8086a20e		

Warnings:

Information:

Total Files Size (in bytes):			448336
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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



UNITED STATES 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	PATENT NUMBER	GROUP ART UNIT	REQUEST ID
16/713,798	10958840	2697	134813

PAIR Correspondence Address/Fee Address Change

The following fields have been changed to Customer Number 10802 on 03/22/2021 via Private PAIR in view of the certification copied below that authorized the change.

- Maintenance Fee Address

The address for Customer Number 10802 is:
10802

Ipan Intellectual Property Associated Network GMBH
Munchener Strasse 14
Munich, D-85540
GERMANY

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



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.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/713,798	03/23/2021	10958840	46DG-026085	2783

177600 7590 03/03/2021
GoPro Issuance
3025 Clearview Way
San Mateo, CA 94402

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):

GoPro, Inc., San Mateo, CA;
Cesar Douady, Les Molières, FRANCE;
Thomas Derbanne, Paris, FRANCE;
Maxim Karpushin, Paris, FRANCE;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

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**CHANGE OF
CORRESPONDENCE ADDRESS**
*Application*Address to:
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	16/713,798
Filing Date	12-13-2019
First Named Inventor	Cesar Douady
Art Unit	2697
Examiner Name	AMY R. HSU
Attorney Docket Number	46DG-026085

Please change the Correspondence Address for the above-identified patent application to:

The address associated with
Customer Number:

177600

OR

Firm or
Individual Name

Address

City

State

Zip

Country

Telephone

Email

This form cannot be used to change the data associated with a Customer Number. To change the data associated with an existing Customer Number use "Request for Customer Number Data Change" (PTO/SB/124).

I am the:



Applicant/Inventor

Assignee of record of the entire interest.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).Attorney or agent of record. Registration Number 58297.

Registered practitioner named in the application transmittal letter in an application without an executed oath or declaration. See 37 CFR 1.33(a)(1). Registration Number _____.

Signature

/D. Benjamin Esplin/

Typed or Printed
Name

D. Benjamin Esplin

Date

February 16, 2021

Telephone

760-249-2133

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.



*Total of _____ forms are submitted.

This collection of information is required by 37 CFR 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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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.

Electronic Patent Application Fee Transmittal

Application Number:	16713798			
Filing Date:	13-Dec-2019			
Title of Invention:	SYSTEMS AND METHODS FOR STABILIZING VIDEOS			
First Named Inventor/Applicant Name:	Cesar Douady			
Filer:	D. Benjamin Esplin/Chelsea Pearsall			
Attorney Docket Number:	46DG-026085			
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	1200	1200

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1200

Electronic Acknowledgement Receipt

EFS ID:	41938451
Application Number:	16713798
International Application Number:	
Confirmation Number:	2783
Title of Invention:	SYSTEMS AND METHODS FOR STABILIZING VIDEOS
First Named Inventor/Applicant Name:	Cesar Douady
Customer Number:	137002
Filer:	D. Benjamin Esplin/Chelsea Pearsall
Filer Authorized By:	D. Benjamin Esplin
Attorney Docket Number:	46DG-026085
Receipt Date:	16-FEB-2021
Filing Date:	13-DEC-2019
Time Stamp:	19:42:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1200
RAM confirmation Number	E20212FJ42392176
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-026085_Issue_Fee_Transmittal_FINAL.pdf	86868	no	1
			5e45c1ce7c22c5cef86950225dd4feeaaacefe88		

Warnings:

Information:

2	Change of Address	46DG-026085_COA.pdf	71119	no	2
			3e82e39c350bf8993ea6892164a8f5bfe9fabaf6		

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	30728	no	2
			6a98b812abd5b264ffec25993c94505487be8d1		

Warnings:

Information:

Total Files Size (in bytes):			188715
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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.

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)

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.

137002 7590 01/22/2021
Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008

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.
16/713,798	12/13/2019	Cesar Douady	46DG-026085	2783

TITLE OF INVENTION: SYSTEMS AND METHODS FOR STABILIZING VIDEOS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	04/22/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
HSU, AMY R	2697	348-208300

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 & Associate, 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

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

GoPro, Inc.

San Mateo, CA

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 February 16, 2021

Typed or printed name D. Benjamin Esplin

Registration No. 58297

Bibliographic Data

Application No: 16/713,798

Foreign Priority claimed: ☐ Yes ☒ No

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

Verified and Acknowledged: /AMY R HSU/

Examiner's Signature

Initials

Title: SYSTEMS AND METHODS FOR STABILIZING VIDEOS

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/13/2019	348	2697	46DG-026085
RULE			

APPLICANTS

GoPro, Inc., San Mateo, CA,

INVENTORS

Cesar Douady, Les Molières, FRANCE

Thomas Derbanne, Paris, FRANCE

Maxim Karpushin, Paris, FRANCE

CONTINUING DATA

This application is a CON of 16587811 09/30/2019

16587811 is a CON of 16548549 08/22/2019 PAT 10536643

16548549 is a CON of 16392501 04/23/2019 PAT 10432864

16392501 has PRO of 62733237 09/19/2018

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

01/07/2020

STATE OR COUNTRY

FRANCE

ADDRESS

Esplin & Associates (GoPro)

5411 Avenida Encinas

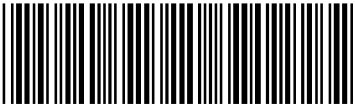
Suite 100

Carlsbad, CA 92008

UNITED STATES

FILING FEE RECEIVED

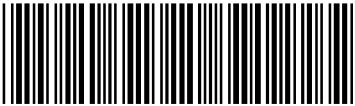
\$1,920

Issue Classification 	Application/Control No. 16/713,798	Applicant(s)/Patent Under Reexamination Douady et al.
	Examiner AMY R HSU	Art Unit 2697

CPC						
Symbol					Type	Version
H04N	/	5	/	2328	F	2013-01-01
H04N	/	5	/	2252	I	2013-01-01
H04N	/	5	/	144	I	2013-01-01
H04N	/	5	/	2253	I	2013-01-01
H04N	/	5	/	2254	I	2013-01-01
H04N	/	5	/	232933	I	2018-08-01
H04N	/	5	/	23258	I	2013-01-01
H04N	/	5	/	23267	I	2013-01-01

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version
/				

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 21	
/AMY R HSU/ Primary Examiner, Art Unit 2697 (Primary Examiner) _____ (Date) _____		16 January 2021 O.G. Print Claim(s) 1	O.G. Print Figure 1

Issue Classification 	Application/Control No. 16/713,798	Applicant(s)/Patent Under Reexamination Douady et al.
	Examiner AMY R HSU	Art Unit 2697

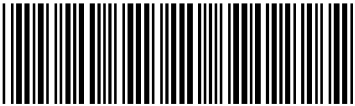
INTERNATIONAL CLASSIFICATION			
CLAIMED			
H04N5/232	/	5	/ 232
H04N5/225	/	5	/ 225
H04N5/14	/	5	/ 14

NON-CLAIMED			
	/		/

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

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

NONE (Assistant Examiner) (Date)		Total Claims Allowed: 21	
/AMY R HSU/ Primary Examiner, Art Unit 2697 (Primary Examiner) (Date)		16 January 2021 O.G. Print Claim(s)	1 O.G. Print Figure

Issue Classification 	Application/Control No. 16/713,798	Applicant(s)/Patent Under Reexamination Douady et al.
	Examiner AMY R HSU	Art Unit 2697

☐ 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	9	10	18	19										
2	2	10	11	19	20										
3	3	11	12	20	21										
4	4	12	13	21	22										
1	5	13	14												
5	6	14	15												
6	7	15	16												
7	8	16	17												
8	9	17	18												

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 21	
/AMY R HSU/ Primary Examiner, Art Unit 2697 (Primary Examiner) _____ (Date) _____		16 January 2021 (Date)	O.G. Print Claim(s) 1
			O.G. Print Figure 1

<i>Notice of References Cited</i>	Application/Control No. 16/713,798		Applicant(s)/Patent Under Reexamination Douady et al.	
	Examiner AMY R HSU		Art Unit 2697	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-20160006935-A1	01-2016	Zhou; Jianping	H04N5/23258	348/208.1
*	B	US-20150350548-A1	12-2015	Beysserie; Sebastien X.	H04N5/23254	348/208.6
*	C	US-10432864-B1	10-2019	Douady; Cesar	H04N5/2254	1/1
*	D	US-10341564-B1	07-2019	Derbanne; Thomas	H04N5/23267	1/1
*	E	US-9787902-B1	10-2017	Beysserie; Sebastien X.	H04N5/23267	1/1
*	F	US-20150022677-A1	01-2015	Guo; Kai	H04N5/23254	348/208.1
*	G	US-20130182134-A1	07-2013	Grundmann; Matthias	H04N5/23264	348/208.6
*	H	US-20120105654-A1	05-2012	Kwatra; Vivek	G06T7/246	348/208.4
*	I	US-20170085740-A1	03-2017	Lin; Shang-Hung	H04N5/23261	1/1
	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.

<i>Search Notes</i> 	Application/Control No. 16/713,798	Applicant(s)/Patent Under Reexamination Douady et al.
	Examiner AMY R HSU	Art Unit 2697

CPC - Searched*		
Symbol	Date	Examiner
H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933	11/06/2020	ah

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
subclass search and keyword search for weight balance, stabilization , smoothed trajectory; NPL search	11/06/2020	ah
update search, claim interference search, inventor name search	1/16/2021	ah

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	see claim interference search history attached	01/16/2021	ah

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NOTICE OF ALLOWANCE AND FEE(S) DUE

137002 7590 01/22/2021
Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008

EXAMINER

HSU, AMY R

ART UNIT

PAPER NUMBER

2697

DATE MAILED: 01/22/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/713,798	12/13/2019	Cesar Douady	46DG-026085	2783

TITLE OF INVENTION: SYSTEMS AND METHODS FOR STABILIZING VIDEOS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	04/22/2021

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)

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.

137002 7590 01/22/2021
Esplin & Associates (GoPro)
5411 Avenida Encinas
Suite 100
Carlsbad, CA 92008

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.
16/713,798	12/13/2019	Cesar Douady	46DG-026085	2783

TITLE OF INVENTION: SYSTEMS AND METHODS FOR STABILIZING VIDEOS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	04/22/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
HSU, AMY R	2697	348-208300

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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/713,798	12/13/2019	Cesar Douady	46DG-026085	2783
137002	7590	01/22/2021	EXAMINER	
Esplin & Associates (GoPro)			HSU, AMY R	
5411 Avenida Encinas			ART UNIT	
Suite 100			PAPER NUMBER	
Carlsbad, CA 92008			2697	

DATE MAILED: 01/22/2021

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

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

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

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

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

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

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 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. 16/713,798	Applicant(s) Douady et al.	
	Examiner AMY R HSU	Art Unit 2697	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 claims dated 1/11/2021.
☐ 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 2-22. 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 _____
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/AMY R HSU/
Primary Examiner, Art Unit 2697

DETAILED ACTION

Allowable Subject Matter

1. Claims 2-22 are allowed.
2. The following is an examiner's statement of reasons for allowance: In the prior art, U.S. Pub. No. 2015/0350548 to Beysserie et al. teaches a digital image capture device to stabilize a video stream in real-time by using an overscan region and a look-ahead technique enabled by buffering a number of video input frames before generating a first stabilized video output frame. Further, U.S. Pub. No. 2015/0022677 to Guo et al. teaches a method and system to process video images to remove jitteriness due to hand shake by comprising a series of successive image frames of a scene of interest and estimate a global camera motion from successive frames, stabilize the camera motion by establishing an upper bound and a lower bound of global camera motion and smoothing the curve of the camera motion between the upper and lower bounds. However, the prior art of record does not teach all of the limitations of the currently claimed invention.

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

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMY R HSU whose telephone number is (571)270-3012. The examiner can normally be reached on 9am-5pm.

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, Lin Ye can be reached on (571)272-7372. 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 <https://ppair-my.uspto.gov/pair/PrivatePair>. 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.

AMY R. HSU
Examiner
Art Unit 2664

/AMY R HSU/
Primary Examiner, Art Unit 2697

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	64	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and (determin\$4 near4 window) same stabiliz\$5	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:00
L2	64	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and (stabiliz\$5) same (remot\$4 near5 process\$4)	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:00
L3	14	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and circular near5 buffer same stabiliz\$5	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:00
L4	24	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and punch\$out same stabiliz\$5	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:01
L5	8	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$).did. or (US-10432864-\$ or US-10341564-\$ or US-9787902-\$).did.	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:02
L6	7	L5 and (weight\$balance weight low\$light high\$pass sticky stickiness)	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:02
L7	9	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$ or US-20170085740-\$).did. or (US-10432864-\$ or US-10341564-\$ or US-9787902-\$).did.	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:02
L8	9	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$ or US-20170085740-\$).did. or (US-10432864-\$ or US-10341564-\$ or US-9787902-\$).did.	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:07
L9	6	L8 and (velocity acceleration)	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:07

L10	14	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and circular same buffer same stabiliz\$5	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:07
L11	99	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and smooth\$4 near3 trajectory	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:08
L12	4	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and smooth\$4 near3 trajectory same horizon	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:08
L13	7	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and smooth\$4 near3 trajectory and temporal near3 horizon	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:08
L14	7	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and smooth\$4 near3 trajectory and temporal same horizon	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:08
L15	99	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and smooth\$4 near3 trajectory	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:08
L16	41	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and smooth\$4 near3 trajectory and horizon\$4	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:08
L17	5	l8 and (horizon\$4)	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:17
L18	4	l8 and (horizon\$4) and ahead\$4	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:18
L19	4	l8 and (horizon\$4) and ahead\$4 and smooth\$4	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:18

L20	4	l8 and (horizon\$4) and ahead\$4 and smooth\$4 same trajectory	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:18
L21	1	l8 and (horizon\$4) and ahead\$4 and smooth\$4 same trajectory same delay\$4	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:18
L22	1	l8 and (horizon\$4 same temporal)	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:22
L23	1	"16713798"	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:22
L24	119	(cesar and douady).in. or (thomas and derbanne).in. or (maxim and karpushin).in.	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:22
L25	2	l24 and (temporal near3 horizon).clm.	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:23
L26	0	l8 and (horizon\$4 same temporal).clm.	US-PGPUB; USPAT	OR	OFF	2021/01/16 15:23
S1	3	"16587811"	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:19
S2	4	"16548549" "16392501"	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:20
S3	4	S2 and (smoothed near3 trajectory) same punchout same viewing near3 window.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:21
S4	2	S3 and (weight\$balance stickiness low\$light).clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:22
S5	2	S3 and (weight\$balance stickiness low\$light) and look\$ahead.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:23
S6	2	S3 and (weight\$balance stickiness low\$light) and look\$ahead same placement.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:23
S7	2	S3 and ((weight\$balance stickiness low\$light) and look\$ahead same placement).clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:24
S8	5	"16548549" "16392501" "16587811"	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:27

S9	0	S8 and (field near3 view near3 larged near5 size).clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:28
S10	2	S8 and (field near3 view near3 larger near5 size).clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:28
S11	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:28
S12	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:29
S13	1	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions same look\$ahead same weight\$balance.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:29
S14	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions same look\$ahead and weight\$balance.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:30
S15	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions same look\$ahead same placement near4 viewing near3 window same visual near3 content.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:30
S16	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions same look\$ahead same placement near4 viewing near3 window same visual near3 content same punchout.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:31
S17	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions same look\$ahead same placement near4 viewing near3 window same visual near3 content same punchout same selective near3 cropping.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:31
S18	4	S8 and (system near3 stabilizes).clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:53
S19	4	S8 and (system near3 stabilizes) same physical near3 processors.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:54
S20	4	S8 and (system near3 stabilizes) same physical near3 processors same determine near3 trajectory same smoothed near3 trajectory same viewing near3 window.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:57

S21	82	("10271021" "20110102609" "20130343728" "20140063271" "20140063272" "20140160309" "20150189178" "20160048216" "20170078577" "20190215495" "20190348075" "6982746" "10015308" "10542215" "20080307329" "20100033614" "20110063236" "20120137236" "20130141600" "20160124917" "20160191800" "20160224225" "20160227105" "20160255273" "20180121057" "20190191090" "9819857" "10432864" "20130002813" "20170041545" "20170142337" "20180041705" "20180048821" "20180220073" "20190124267" "0000030" "10262691" "10284794" "10341564" "20030160862" "20030210327" "20040010804" "20040125133" "20060291841" "20090278917" "20100277617" "20100281375" "20100299630" "20110013778" "20110242352" "20120206565" "20130058535" "20130177168" "20130210563" "20130250047" "20130329132" "20140028876" "20140266773" "20140267586" "20140267590" "20150146014" "20150159846" "20150350548" "20160006935" "20160360109" "20170070689" "20170084086" "20170085964" "20170094169" "20170289454" "20170359534" "20180199025" "20180324358" "6654019" "8022948" "8237787" "9144714" "9279983" "9363569" "9374532" "9426430" "9787902").PN.	US- PGPUB; USPAT	OR	OFF	2020/11/05 14:01
S22	9	S21 and (smooth\$4 near3 trajectory)	US- PGPUB; USPAT	OR	OFF	2020/11/05 14:02
S23	5	S21 and (smooth\$4 near3 trajectory) and (look\$4 near3 ahead\$4)	US- PGPUB; USPAT	OR	OFF	2020/11/05 14:03
S24	3	S21 and (smooth\$4 near3 trajectory) and (look\$4 near3 ahead\$4) and determin\$4 near3 trajectory	US- PGPUB; USPAT	OR	OFF	2020/11/05 14:04
S25	2	S21 and (smooth\$4 near3 trajectory) and (look\$4 near3 ahead\$4) and determin\$4 near3 trajectory and window	US- PGPUB; USPAT	OR	OFF	2020/11/05 14:08

S26	1	"9787902".pn. and window	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:08
S27	1	"9787902".pn. and frame\$1	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:09
S28	19	S21 and (determin\$4 near\$5 (window (field near\$3 view)))	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:11
S29	4	S21 and punch\$out	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:12
S30	1	"16587811"	USPAT	OR	OFF	2020/11/05 14:12
S31	3	"16587811"	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:13
S32	36,283	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:13
S33	22	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and punch\$out same stabiliz\$5	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:13
S34	61	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and (determin\$4 near\$4 window) same stabiliz\$5	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:14
S35	23	S34 and gopro.as.	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:14
S36	38	S34 not S35	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:14
S37	9	S36 and (window near\$5 time)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:15
S38	29	S36 not S37	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:15
S39	8	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$).did. or (US-	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:19

		10432864-\$ or US-10341564-\$ or US-9787902-\$).did.				
S40	8	S39 and (stabiliz\$5) and (ahead\$4 subsequent\$4 later\$4 look\$ahead)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:19
S41	8	S39 and (ahead\$4 subsequent\$4 later\$4 look\$ahead)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:20
S42	7	S41 and (weight\$balance weight low\$light high\$pass sticky stickiness)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:22
S43	7	S39 and (weight\$balance weight low\$light high\$pass sticky stickiness)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:22
S44	6	S39 and (weight\$balance weight low\$light high\$pass sticky stickiness) same (smooth\$4 trajectory)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:23
S45	3	S39 and (weight\$balance weight low\$light high\$pass sticky stickiness) same (smooth\$4 trajectory) same parameter\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:24
S46	2	"20150350548"	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:41
S47	2	"20150350548" and (determin\$4 near5 trajectory)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:41
S48	2	"20150350548" and trajectory and (determin\$4 near5 trajectory)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:42
S49	2	"20150350548" and trajectory and (determin\$4 near5 trajectory) and look\$ahead	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:42
S50	2	"20150350548" and trajectory same position\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:48
S51	2	"20150350548" and trajectory	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:49
S52	2	"20150350548" and trajectory and position\$1	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:54
S53	2	"20150350548" and trajectory and position\$1 and gyroscope\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:59

S54	2	"20150350548" and trajectory and position\$1 and gyroscop\$4 and motion	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:00
S55	2	"20150350548" and sensor	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:10
S56	2	"20150350548" and lens	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:11
S57	2	"20150350548" and look\$ahead	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:14
S58	2	"20150350548" and look\$ahead same smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:15
S59	2	"20150350548" and look\$ahead	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:15
S60	2	"20150350548" and look\$ahead and future	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:16
S61	0	"20150350548" and crop\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:20
S62	0	"20130182134" and "20150022677"	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:21
S63	3	"20130182134" "20150022677"	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:21
S64	3	S63 and (subsequent\$4 look\$ahead)	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:22
S65	1	"20150022677" and "405"	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:26
S66	1	"20150022677" and window same smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:27
S67	2	"20150350548" and rotation\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:35
S68	8	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$).did. or (US-10432864-\$ or US-10341564-\$ or US-9787902-\$).did.	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:38

S69	2	S68 and remot\$4 near3 process\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:38
S70	61	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and (stabiliz\$5) same (remot\$4 near5 process\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:06
S71	9	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$ or US-20170085740-\$).did. or (US-10432864-\$ or US-10341564-\$ or US-9787902-\$).did.	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:36
S72	4	S71 and (real\$time\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:37
S73	9	S71 and jitter\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:40
S74	2	"20150350548" and smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:41
S75	0	"20150350548" and exposure	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:46
S76	4	S71 and (exposure)	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:46
S77	2	S71 and (exposure) same smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:47
S78	4	"16548549" "16392501"	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:50
S79	4	S78 and (smooth\$4 near3 trajectory) same subsequent.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:50
S80	4	S78 and (smooth\$4 near3 trajectory) same subsequent same viewing near3 window same punchout.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:50
S81	8	"10432864"	US-PGPUB; USPAT	OR	OFF	2020/11/06 11:49
S82	4	"10536643"	US-PGPUB; USPAT	OR	OFF	2020/11/06 11:49

S83	1	"16713798"	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:36
S84	0	"20150350548" and housing	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:45
S85	2	"20150350548" and device	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:45
S86	0	"20150350548" and outside\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:46
S87	0	"20150350548" and environment\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:46
S88	2	"20150350548" and (optic\$4 lens\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:47
S89	2	"20150350548" and gyroscope	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:48
S90	2	"20150350548" and rotation\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:49
S91	0	"20150350548" and weight\$4 same balanc\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:55
S92	2	"20150350548" and weight\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:55
S93	2	"20150350548" and translation\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:59
S94	2	"20150350548" and position\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:00
S95	2	"20150350548" and gyroscop\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:01
S96	2	"20150350548" and (motion mov\$5) near5 time\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:01
S97	2	"20150350548" and smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:03

S98	2	"20150350548" and smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:03
S99	0	"20150350548" and smooth\$4 near3 chang\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:03
S100	0	"20150350548" and (bootstrap guess\$4 estimat\$4 interpolat\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:05
S101	9	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$ or US-20170085740-\$).did. or (US-10432864-\$ or US-10341564-\$ or US-9787902-\$).did.	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:05
S102	6	S101 and (bootstrap guess\$4 estimat\$4 interpolat\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:05
S103	5	S101 and (bootstrap guess\$4 estimat\$4 interpolat\$4) same smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:06
S104	1	"16713798"	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:08
S105	9	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$ or US-20170085740-\$).did. or (US-10432864-\$ or US-10341564-\$ or US-9787902-\$).did.	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:10
S106	2	S105 and (bootstrap guess\$4 estimat\$4 interpolat\$4) same smooth\$4 same trajectory	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:10
S107	5	S105 and (bootstrap guess\$4 estimat\$4 interpolat\$4) same smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:15
S108	1	S105 and (fine same coarse)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:17
S109	1	S105 and temporal near3 horizon\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:18
S110	2	"20150350548" and (weight\$4 weigh\$4) same past same future	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:19
S111	1	"16713798" and re\$projected.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:24

S112	0	"20150350548" and (velocity acceleration)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:25
S113	2	"20150350548" and (velocity acceleration rotation\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:25
S114	6	S105 and (velocity acceleration)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:26
S115	4	S105 and (velocity acceleration) same rotation\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:26
S116	1	S105 and (velocity acceleration) same rotation\$4 same (weight\$4 weigh\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:26
S117	2	"20150350548" and buffer\$4 same look\$ahead	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:45
S118	0	"20150350548" and buffer\$4 same circular	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:46
S119	0	"20150350548" and buffer\$4 same circl\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:46
S120	1	S105 and circular same buffer	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:46
S121	11	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and circular near5 buffer same stabiliz\$5	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:49
S122	143	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and circular near5 buffer	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:49

1/16/2021 3:25:22 PM

C:\Users\ahsu1\Documents\EAST\Workspaces\16_713798.wsp

Electronic Acknowledgement Receipt

EFS ID:	41612093
Application Number:	16713798
International Application Number:	
Confirmation Number:	2783
Title of Invention:	SYSTEMS AND METHODS FOR STABILIZING VIDEOS
First Named Inventor/Applicant Name:	Cesar Douady
Customer Number:	137002
Filer:	D. Benjamin Esplin/Milanka Trang
Filer Authorized By:	D. Benjamin Esplin
Attorney Docket Number:	46DG-026085
Receipt Date:	11-JAN-2021
Filing Date:	13-DEC-2019
Time Stamp:	16:59:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	46DG-026085_Response_to_N FOA_mailed_2020-11-12.pdf	93781 9cbc1fe912fd4e3361161b27acd332e7e5df4302	no	14

Warnings:

Information:	
Total Files Size (in bytes):	93781
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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.	

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE PATENT
APPLICATION OF : Cesar Douady, *et al.*

SERIAL NO. : 16/713,798
FILING DATE : December 13, 2019
ART UNIT : 2697
EXAMINER : HSU, AMY R
FOR : SYSTEMS AND METHODS FOR STABILIZING VIDEOS

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 **November 12, 2020** ("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 **11** 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-026085).

REMARKS

By this paper, claims 2, 3, 5, 9-12, 14-17 are amended, no claims are added, and claim 1 is cancelled without prejudice and without disclaimer. Accordingly, claims 2-22 are all of the pending claims. Support for the amendments presented above is provided throughout the specification and claims as originally filed. 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.

Double Patenting Rejection

Claims 1 and 17 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 14-16 of U.S. Patent No. 10,536,643 (“the ‘643 patent”). However, solely in an effort to expedite prosecution and without acknowledging the propriety of the alleged rejections, Applicant has canceled claim 1, and has amended claim 17 to recite features of allowable claim 5. Accordingly, Applicant requests the above obviousness-type double patent rejection be withdrawn.

Rejections Under 35 U.S.C. § 103

Claims 1-3, 9-13, 17, 19-20 currently stand rejected under AIA 35 U.S.C. § 103 as allegedly being unpatentable over U.S. Patent Application Publication No. 2015/0350548 to Beyserrie, *et al.* (“Beyserrie”) in view of U.S. Patent Application Publication No. 2015/0022677 to Guo, *et al.* (“Guo”). Applicant expressly reserves the right to challenge the analogousness of any of the cited references. Applicant traverses the rejections under § 103 at least because the proposed combination of references fails to teach or suggest all of the claimed features. However, solely in an effort to expedite prosecution and without acknowledging the propriety of the alleged rejections, Applicant has canceled claim 1, and has amended claims so that claims 2-4, 6-16 depend from allowable claim 5. Applicant has also amended claim 17 to recite features of allowable claim 5 so that limitations of claim 17 parallel limitations of claim 5. Accordingly, Applicant respectfully requests that the above rejection of claims under §

103 be withdrawn.

Allowable Subject Matter

Applicant appreciates the Office Action's acknowledgment that claims 4, 5-8, 14-16, 18, 21-22 include allowable subject matter if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 5 depends on independent claim 1. Applicant has rewritten claim 5 in independent form to include all limitations of the base claim 1.

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: January 11, 2021

Respectfully submitted,

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

Customer No. 137002

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CLAIM AMENDMENTS

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

1. **(Canceled)**
2. **(Currently Amended)** The image capture system of claim [[1]] 5, wherein the position information further characterizes translational positions of the housing at the different moments within the capture duration, the trajectory further reflects the translational positions of the housing at the different moments within the capture duration, and the smoothed trajectory has smoother changes in the translational positions of the housing than the trajectory.
3. **(Currently Amended)** The image capture system of claim [[1]] 5, wherein the smoothed trajectory is determined further based on a trajectory retrieval algorithm, input to the trajectory retrieval algorithm including the trajectory of the housing and a bootstrap trajectory, the bootstrap trajectory including a current or an initial guess of the smoothed trajectory.
4. **(Original)** The image capture system of claim 3, wherein the smoothed trajectory is determined further based on iterations of smoothing including a fine scale approach to smooth on a small scale and a coarse approach to smooth on a large scale, the iterations of smoothing resulting in convergence of the smoothed trajectory.

5. **(Currently Amended)** ~~The image capture system of claim 1~~ An image capture system that stabilizes videos, the image capture system comprising:

a housing of an image capture device;

an optical element carried by the housing and configured to guide light within a field of view to an image sensor;

the image sensor carried by the housing and configured to generate a visual output signal conveying visual information based on light that becomes incident thereon during a capture duration, the visual information defining visual content having the field of view, the field of view being larger than a size of a viewing window for generating stabilized visual content;

a position sensor carried by the housing and configured to generate a position output signal based on positions of the housing during the capture duration, the position output signal conveying position information that characterizes rotational positions of the housing at different moments within the capture duration; and

one or more physical processors configured by machine-readable instructions to:

determine a trajectory of the housing during the capture duration based on the position information, the trajectory reflecting the rotational positions of the housing at the different moments within the capture duration, the trajectory including a first portion corresponding to a first moment within the capture duration and a second portion corresponding to a second moment subsequent to the first moment within the capture duration;

determine a smoothed trajectory of the housing based on a look-ahead of the trajectory and one or more of a weight-balance parameter, a low-light high-

pass parameter, and/or a stickiness parameter, the look-ahead of the trajectory including use of a subsequent portion of the trajectory to determine a preceding portion of the smoothed trajectory such that a portion of the smoothed trajectory corresponding to the first portion of the trajectory is determined based on the second portion of the trajectory, the smoothed trajectory having smoother changes in the rotational positions of the housing than the trajectory, wherein the determination of the smoothed trajectory based on the look-ahead of the trajectory includes use of a temporal horizon of motion experienced by the image capture device, the temporal horizon enabling approximation of intentional motion of the image capture device while causing a delay in the determination of the smoothed trajectory;

determine placement of the viewing window for the visual content with respect to the field of view of the visual content based on the smoothed trajectory of the housing, the viewing window defining one or more extents of the visual content to be included within a punchout of the visual content; and

generate the stabilized visual content of a video based on the viewing window, the stabilized visual content including the punchout of the one or more extents of the visual content within the viewing window, wherein inclusion in the stabilized visual content of the one or more extents of the visual content within the viewing window effectuates stabilization of the visual content via selective cropping.

6. **(Original)** The image capture system of claim 5, wherein a longer interval of the temporal horizon enables better approximation of the intentional motion of the image capture device while causing a longer delay in the determination of the smoothed trajectory.
7. **(Original)** The image capture system of claim 5, wherein the smoothed trajectory is determined further based on minimization of a value, a score, or a metric that expresses an amount of high frequencies while respecting a crop constraint.
8. **(Original)** The image capture system of claim 7, wherein the smoothed trajectory is determined further based on iterative minimization, the iterative minimization including iterations of steps that alter latest estimate, the steps including an update step that updates a current estimate to decrease a value of an objective function and a projection step that applies one or more constraints, the current estimate being re-projected based on the one or more constraints not being satisfied.
9. **(Currently Amended)** The image capture system of claim [[1]] 5, wherein the determination of the smoothed trajectory based on the look-ahead of the trajectory includes weighing past positions of the housing less than future positions of the housing.
10. **(Currently Amended)** The image capture system of claim [[1]] 5, wherein the determination of the smoothed trajectory based on the look-ahead of the trajectory

includes a prior portion of the trajectory having less impact on the determination of the smoothed trajectory than a future portion of the trajectory.

11. **(Currently Amended)** The image capture system of claim [[1]] 5, wherein the determination of the smoothed trajectory based on the look-ahead of the trajectory includes using a first amount of a prior portion of the trajectory and a second amount of a future portion of the trajectory, the first amount being smaller than the second amount.

12. **(Currently Amended)** The image capture system of claim [[1]] 5, wherein the visual content are stored in a buffer during smoothed trajectory generation such that the visual content corresponding to the portion of the smoothed trajectory are stored in the buffer during the determination of the portion of the smoothed trajectory using the lookahead of the trajectory, and the visual content stored in the buffer are used after the determination of the portion of the capture trajectory to generate the stabilized visual content.

13. **(Original)** The image capture system of claim 12, wherein the buffer includes a circular buffer, and the visual content are stored in the circular buffer as video frames to be stabilized.

14. **(Currently Amended)** The image capture system of claim [[1]] 5, wherein the weight-balance parameter controls types of motion that are minimized in smoothed

trajectory generation, the types of motion including rotational velocity and rotational acceleration.

15. **(Currently Amended)** The image capture system of claim [[1]] 5, wherein the low-light high-pass parameter controls amount or strength of smoothing performed in smoothed trajectory generation and an extent of motion blur compensation applied in determination of the smoothed trajectory.

16. **(Currently Amended)** The image capture system of claim [[1]] 5, wherein the stickiness parameter controls an extent by which a preceding portion of the trajectory impacts determination of the smoothed trajectory.

17. **(Currently Amended)** A method for stabilizing videos, the method performed by an image capture system including one or more processors, an optical element, an image sensor, and a position sensor, the optical element carried by an image capture device and configured to guide light within a field of view to the image sensor, the method comprising:

generating, by the image sensor, a visual output signal conveying visual information based on light that becomes incident thereon during a capture duration, the visual information defining visual content having the field of view, the field of view being larger than a size of a viewing window for generating stabilized visual content;

generating, by the position sensor, a position output signal based on positions of the image capture device during the capture duration, the position output signal

conveying position information that characterizes rotational positions of the image capture device at different moments within the capture duration;

determining, by the one or more processors, a trajectory of the image capture device during the capture duration based on the position information, the trajectory reflecting the rotational positions of the image capture device at the different moments within the capture duration, the trajectory including a first portion corresponding to a first moment within the capture duration and a second portion corresponding to a second moment subsequent to the first moment within the capture duration;

determining, by the one or more processors, a smoothed trajectory of the image capture device based on a look-ahead of the trajectory and one or more of a weight-balance parameter, a low-light high-pass parameter, and/or a stickiness parameter, the look-ahead of the trajectory including use of a subsequent portion of the trajectory to determine a preceding portion of the smoothed trajectory such that a portion of the smoothed trajectory corresponding to the first portion of the trajectory is determined based on the second portion of the trajectory, the smoothed trajectory having smoother changes in the rotational positions of the image capture device than the trajectory,
wherein the determination of the smoothed trajectory based on the look-ahead of the trajectory includes use of a temporal horizon of motion experienced by the image capture device, the temporal horizon enabling approximation of intentional motion of the image capture device while causing a delay in the determination of the smoothed trajectory;

determining, by the one or more processors, placement of the viewing window for the visual content with respect to the field of view of the visual content based on the

smoothed trajectory of the image capture device, the viewing window defining one or more extents of the visual content to be included within a punchout of the visual content; and

generating, by the one or more processors, the stabilized visual content of a video based on the viewing window, the stabilized visual content including the punchout of the one or more extents of the visual content within the viewing window, wherein inclusion in the stabilized visual content of the one or more extents of the visual content within the viewing window effectuates stabilization of the visual content via selective cropping.

18. **(Original)** The method of claim 17, wherein:

the weight-balance parameter controls types of motion that are minimized in smoothed trajectory generation, the types of motion including rotational velocity and rotational acceleration;

the low-light high-pass parameter controls amount or strength of smoothing performed in smoothed trajectory generation and an extent of motion blur compensation applied in determination of the smoothed trajectory; and

the stickiness parameter controls an extent by which a preceding portion of the trajectory impacts determination of the smoothed trajectory.

19. **(Original)** The method of claim 17, wherein the smoothed trajectory is determined further based on a trajectory retrieval algorithm, input to the trajectory retrieval algorithm including the trajectory of the image capture device and a bootstrap

trajectory, the bootstrap trajectory including a current or an initial guess of the smoothed trajectory.

20. **(Original)** The method of claim 17, wherein the determination of the smoothed trajectory based on the look-ahead of the trajectory includes:

weighing past positions of the image capture device less than future positions of the image capture device;

a prior portion of the trajectory having less impact on the determination of the smoothed trajectory than a future portion of the trajectory; or

using a first amount of the prior portion of the trajectory and a second amount of the future portion of the trajectory, the first amount being smaller than the second amount.

21. **(Original)** The method of claim 17, wherein the smoothed trajectory is determined further based on iterations of smoothing including a fine scale approach to smooth on a small scale and a coarse approach to smooth on a large scale, the iterations of smoothing resulting in convergence of the smoothed trajectory.

22. **(Original)** The method of claim 17, wherein the smoothed trajectory is determined further based on iterative minimization, the iterative minimization including iterations of steps that alter latest estimate, the steps including an update step that updates a current estimate to decrease a value of an objective function and a projection

step that applies one or more constraints, the current estimate being re-projected based on the one or more constraints not being satisfied.

Electronic Patent Application Fee Transmittal

Application Number:	16713798			
Filing Date:	13-Dec-2019			
Title of Invention:	SYSTEMS AND METHODS FOR STABILIZING VIDEOS			
First Named Inventor/Applicant Name:	Cesar Douady			
Filer:	D. Benjamin Esplin/Milanka Trang			
Attorney Docket Number:	46DG-026085			
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	170	170
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 (\$)				170

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed		PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce	
Electronic Petition Request	TERMINAL DISCLAIMER TO OBTAIN A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT		
Application Number	16713798		
Filing Date	13-Dec-2019		
First Named Inventor	Cesar Douady		
Attorney Docket Number	46DG-026085		
Title of Invention	SYSTEMS AND METHODS FOR STABILIZING VIDEOS		
☒ 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) 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) 10536643 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.	
Applicant 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 <u>58297</u> ☐ 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.

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16713798

Filing Date: 13-Dec-2019

Applicant/Patent under Reexamination: Douady

Electronic Terminal Disclaimer filed on January 11, 2021

☒ 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:	41602807
Application Number:	16713798
International Application Number:	
Confirmation Number:	2783
Title of Invention:	SYSTEMS AND METHODS FOR STABILIZING VIDEOS
First Named Inventor/Applicant Name:	Cesar Douady
Customer Number:	137002
Filer:	D. Benjamin Esplin/Milanka Trang
Filer Authorized By:	D. Benjamin Esplin
Attorney Docket Number:	46DG-026085
Receipt Date:	11-JAN-2021
Filing Date:	13-DEC-2019
Time Stamp:	16:57:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 170
RAM confirmation Number	E20211AG57181884
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	33453	no	2
			0b8770854bd30445107935e551650b1a8b6a3e90		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30621	no	2
			ae6582694ac53ef17256ed40081b3cd385883ad7		

Warnings:

Information:

Total Files Size (in bytes):	64074
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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.

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 16/713,798	Filing Date 12/13/2019	☐ To be Mailed
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ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

	(Column 1)	(Column 2)		RATE (\$)	FEE (\$)
FOR	NUMBER FILED	NUMBER EXTRA			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (l), 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)		RATE (\$)	ADDITIONAL FEE (\$)	
AMENDMENT	01/11/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA				
	Total (37 CFR 1.16(i))	* 21	Minus	** 20	= 1		x \$100 =	100	
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x \$480 =	0	
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
							TOTAL ADD'L FEE	100	
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA				
	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".							/MONICA D FRANCIS/		
*** 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.

<i>Notice of References Cited</i>	Application/Control No. 16/713,798		Applicant(s)/Patent Under Reexamination Douady et al.	
	Examiner AMY R HSU		Art Unit 2697	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-20160006935-A1	01-2016	Zhou; Jianping	H04N5/23258	348/208.1
*	B	US-20150350548-A1	12-2015	Beysserie; Sebastien X.	H04N5/23254	348/208.6
*	C	US-10432864-B1	10-2019	Douady; Cesar	H04N5/2328	1/1
*	D	US-10341564-B1	07-2019	Derbanne; Thomas	H04N5/23267	1/1
*	E	US-9787902-B1	10-2017	Beysserie; Sebastien X.	H04N5/23267	1/1
*	F	US-20150022677-A1	01-2015	Guo; Kai	H04N5/23254	348/208.1
*	G	US-20130182134-A1	07-2013	Grundmann; Matthias	H04N5/23264	348/208.6
*	H	US-20120105654-A1	05-2012	Kwatra; Vivek	G06T7/246	348/208.4
*	I	US-20170085740-A1	03-2017	Lin; Shang-Hung	H04N5/23261	1/1
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS					
*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/713,798
	Filing Date	12/13/2019
	First Named Inventor	César Douady
	Art Unit	0000
Page 1 of 1	Matter Number	46DG-026085

U.S. PATENT/PUBLICATION DOCUMENTS					
Initials	Cite No.	Document Number	Issue/Publication Date	First Named Inventor	Relevant Pages, Columns, etc.
	1	10015308	07/03/2018	CHO KYUNGMIN	
	2	10542215	01/21/2020	KUNISHIGE KEIJI	
	3	9819857	11/14/2017	MIYAJIMA TAKURO	
	4	20160255273	09/01/2016	WAKAMATSU NOBUSHIGE	
	5	20130141600	06/06/2013	PROCA ADRIAN	
	6	20190191090	06/20/2019	MURASHIMA RYUICHI	
	7	20160191800	06/30/2016	YOSHIKAWA AKIO	
	8	20160227105	08/04/2016	KOBAYASHI SEIJI	
	9	20160224225	08/04/2016	KONDO EMI	
	10	20120137236	05/31/2012	ABE MITSUO	
	11	20110063236	03/17/2011	ARAI KOJI	
	12	20100033614	02/11/2010	YOO JEOUNG-GON	
	13	20180121057	05/03/2018	LIANG ZHE	
	14	20160124917	05/05/2016	DUCAT FABIEN	
	15	20080307329	12/11/2008	ENDO TSUYOSHI	

FOREIGN PATENT DOCUMENTS						
Initials	Cite No.	Document Number	Publication Date	Country	Relevant Pages, Columns, etc.	T

OTHER DOCUMENTS			
Initials	Cite No.	Author, Title, Date, Pages, etc.	T

Examiner Signature	/AMY R HSU/	Date Considered	11/06/2020
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.			

Bibliographic Data

Application No: 16/713,798

Foreign Priority claimed: ☐ Yes ☒ No

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

Verified and Acknowledged: /AMY R HSU/

Examiner's Signature

Initials

Title: SYSTEMS AND METHODS FOR STABILIZING VIDEOS

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/13/2019	348	2697	46DG-026085
RULE			

APPLICANTS

GoPro, Inc., San Mateo, CA,

INVENTORS

Cesar Douady, Les Molières, FRANCE

Thomas Derbanne, Paris, FRANCE

Maxim Karpushin, Paris, FRANCE

CONTINUING DATA

This application is a CON of 16587811 09/30/2019

16587811 is a CON of 16548549 08/22/2019 PAT 10536643

16548549 is a CON of 16392501 04/23/2019 PAT 10432864

16392501 has PRO of 62733237 09/19/2018

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

01/07/2020

STATE OR COUNTRY

FRANCE

ADDRESS

Esplin & Associates (GoPro)

5411 Avenida Encinas

Suite 100

Carlsbad, CA 92008

UNITED STATES

FILING FEE RECEIVED

\$1,920

<i>Search Notes</i> 	Application/Control No. 16/713,798	Applicant(s)/Patent Under Reexamination Douady et al.
	Examiner AMY R HSU	Art Unit 2697

CPC - Searched*		
Symbol	Date	Examiner
H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933	11/06/2020	ah

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
subclass search and keyword search for weight balance, stabilization , smoothed trajectory; NPL search	11/06/2020	ah

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

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<i>Index of Claims</i> 	Application/Control No. 16/713,798	Applicant(s)/Patent Under Reexamination Douady et al.
	Examiner AMY R HSU	Art Unit 2697

✓	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	11/06/2020								
	1	✓								
	2	✓								
	3	✓								
	4	○								
	5	○								
	6	○								
	7	○								
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	16	○								
	17	✓								
	18	○								
	19	✓								
	20	✓								
	21	○								
	22	○								

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	1	"16713798"	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:08
L5	9	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$ or US-20170085740-\$).did. or (US-10432864-\$ or US-10341564-\$ or US-9787902-\$).did.	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:10
L6	2	L5 and (bootstrap guess\$4 estimat\$4 interpolat\$4) same smooth\$4 same trajectory	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:10
L7	5	L5 and (bootstrap guess\$4 estimat\$4 interpolat\$4) same smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:15
L8	1	L5 and (fine same coarse)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:17
L9	1	L5 and temporal near3 horizon\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:18
L10	2	"20150350548" and (weight\$4 weigh\$4) same past same future	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:19
L11	1	"16713798" and re\$projected.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:24
L15	0	"20150350548" and (velocity acceleration)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:25
L16	2	"20150350548" and (velocity acceleration rotation\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:25
L17	6	I5 and (velocity acceleration)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:26
L18	4	I5 and (velocity acceleration) same rotation\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:26
L19	1	I5 and (velocity acceleration) same rotation\$4 same (weight\$4 weigh\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:26

L20	2	"20150350548" and buffer\$4 same look\$ahead	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:45
L21	0	"20150350548" and buffer\$4 same circular	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:46
L22	0	"20150350548" and buffer\$4 same circl\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:46
L23	1	I5 and circular same buffer	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:46
L24	11	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and circular near5 buffer same stabiliz\$5	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:49
L25	143	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and circular near5 buffer	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:49
S1	3	"16587811"	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:19
S2	4	"16548549" "16392501"	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:20
S3	4	S2 and (smoothed near3 trajectory) same punchout same viewing near3 window.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:21
S4	2	S3 and (weight\$balance stickiness low\$light).clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:22
S5	2	S3 and (weight\$balance stickiness low\$light) and look\$ahead.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:23
S6	2	S3 and (weight\$balance stickiness low\$light) and look\$ahead same placement.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:23
S7	2	S3 and ((weight\$balance stickiness low\$light) and look\$ahead same placement).clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:24
S8	5	"16548549" "16392501" "16587811"	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:27

S9	0	S8 and (field near3 view near3 larged near5 size).clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:28
S10	2	S8 and (field near3 view near3 larger near5 size).clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:28
S11	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:28
S12	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:29
S13	1	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions same look\$ahead same weight\$balance.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:29
S14	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions same look\$ahead and weight\$balance.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:30
S15	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions same look\$ahead same placement near4 viewing near3 window same visual near3 content.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:30
S16	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions same look\$ahead same placement near4 viewing near3 window same visual near3 content same punchout.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:31
S17	2	S8 and (field near3 view near3 larger near5 size) same position near3 sensor same rotational near3 positions same look\$ahead same placement near4 viewing near3 window same visual near3 content same punchout same selective near3 cropping.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:31
S18	4	S8 and (system near3 stabilizes).clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:53
S19	4	S8 and (system near3 stabilizes) same physical near3 processors.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:54
S20	4	S8 and (system near3 stabilizes) same physical near3 processors same determine near3 trajectory same smoothed near3 trajectory same viewing near3 window.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/05 13:57

S21	82	("10271021" "20110102609" "20130343728" "20140063271" "20140063272" "20140160309" "20150189178" "20160048216" "20170078577" "20190215495" "20190348075" "6982746" "10015308" "10542215" "20080307329" "20100033614" "20110063236" "20120137236" "20130141600" "20160124917" "20160191800" "20160224225" "20160227105" "20160255273" "20180121057" "20190191090" "9819857" "10432864" "20130002813" "20170041545" "20170142337" "20180041705" "20180048821" "20180220073" "20190124267" "0000030" "10262691" "10284794" "10341564" "20030160862" "20030210327" "20040010804" "20040125133" "20060291841" "20090278917" "20100277617" "20100281375" "20100299630" "20110013778" "20110242352" "20120206565" "20130058535" "20130177168" "20130210563" "20130250047" "20130329132" "20140028876" "20140266773" "20140267586" "20140267590" "20150146014" "20150159846" "20150350548" "20160006935" "20160360109" "20170070689" "20170084086" "20170085964" "20170094169" "20170289454" "20170359534" "20180199025" "20180324358" "6654019" "8022948" "8237787" "9144714" "9279983" "9363569" "9374532" "9426430" "9787902").PN.	US- PGPUB; USPAT	OR	OFF	2020/11/05 14:01
S22	9	S21 and (smooth\$4 near3 trajectory)	US- PGPUB; USPAT	OR	OFF	2020/11/05 14:02
S23	5	S21 and (smooth\$4 near3 trajectory) and (look\$4 near3 ahead\$4)	US- PGPUB; USPAT	OR	OFF	2020/11/05 14:03
S24	3	S21 and (smooth\$4 near3 trajectory) and (look\$4 near3 ahead\$4) and determin\$4 near3 trajectory	US- PGPUB; USPAT	OR	OFF	2020/11/05 14:04
S25	2	S21 and (smooth\$4 near3 trajectory) and (look\$4 near3 ahead\$4) and determin\$4 near3 trajectory and window	US- PGPUB; USPAT	OR	OFF	2020/11/05 14:08

S26	1	"9787902".pn. and window	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:08
S27	1	"9787902".pn. and frame\$1	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:09
S28	19	S21 and (determin\$4 near\$5 (window (field near\$3 view)))	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:11
S29	4	S21 and punch\$out	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:12
S30	1	"16587811"	USPAT	OR	OFF	2020/11/05 14:12
S31	3	"16587811"	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:13
S32	36,283	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:13
S33	22	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and punch\$out same stabiliz\$5	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:13
S34	61	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and (determin\$4 near\$4 window) same stabiliz\$5	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:14
S35	23	S34 and gopro.as.	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:14
S36	38	S34 not S35	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:14
S37	9	S36 and (window near\$5 time)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:15
S38	29	S36 not S37	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:15
S39	8	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$).did. or (US-	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:19

		10432864-\$ or US-10341564-\$ or US-9787902-\$).did.				
S40	8	S39 and (stabiliz\$5) and (ahead\$4 subsequent\$4 later\$4 look\$ahead)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:19
S41	8	S39 and (ahead\$4 subsequent\$4 later\$4 look\$ahead)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:20
S42	7	S41 and (weight\$balance weight low\$light high\$pass sticky stickiness)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:22
S43	7	S39 and (weight\$balance weight low\$light high\$pass sticky stickiness)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:22
S44	6	S39 and (weight\$balance weight low\$light high\$pass sticky stickiness) same (smooth\$4 trajectory)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:23
S45	3	S39 and (weight\$balance weight low\$light high\$pass sticky stickiness) same (smooth\$4 trajectory) same parameter\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:24
S46	2	"20150350548"	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:41
S47	2	"20150350548" and (determin\$4 near5 trajectory)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:41
S48	2	"20150350548" and trajectory and (determin\$4 near5 trajectory)	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:42
S49	2	"20150350548" and trajectory and (determin\$4 near5 trajectory) and look\$ahead	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:42
S50	2	"20150350548" and trajectory same position\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:48
S51	2	"20150350548" and trajectory	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:49
S52	2	"20150350548" and trajectory and position\$1	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:54
S53	2	"20150350548" and trajectory and position\$1 and gyroscope\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 14:59

S54	2	"20150350548" and trajectory and position\$1 and gyroscope\$4 and motion	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:00
S55	2	"20150350548" and sensor	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:10
S56	2	"20150350548" and lens	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:11
S57	2	"20150350548" and look\$ahead	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:14
S58	2	"20150350548" and look\$ahead same smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:15
S59	2	"20150350548" and look\$ahead	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:15
S60	2	"20150350548" and look\$ahead and future	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:16
S61	0	"20150350548" and crop\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:20
S62	0	"20130182134" and "20150022677"	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:21
S63	3	"20130182134" "20150022677"	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:21
S64	3	S63 and (subsequent\$4 look\$ahead)	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:22
S65	1	"20150022677" and "405"	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:26
S66	1	"20150022677" and window same smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:27
S67	2	"20150350548" and rotation\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:35
S68	8	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$).did. or (US-10432864-\$ or US-10341564-\$ or US-9787902-\$).did.	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:38

S69	2	S68 and remot\$4 near3 process\$4	US-PGPUB; USPAT	OR	OFF	2020/11/05 15:38
S70	61	((H04N5/144 OR H04N5/2252 OR H04N5/2253 OR H04N5/2254 OR H04N5/23258 OR H04N5/23267 OR H04N5/2328 OR H04N5/232933).CPC.) and (stabiliz\$5) same (remot\$4 near5 process\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:06
S71	9	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$ or US-20170085740-\$).did. or (US-10432864-\$ or US-10341564-\$ or US-9787902-\$).did.	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:36
S72	4	S71 and (real\$time\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:37
S73	9	S71 and jitter\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:40
S74	2	"20150350548" and smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:41
S75	0	"20150350548" and exposure	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:46
S76	4	S71 and (exposure)	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:46
S77	2	S71 and (exposure) same smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:47
S78	4	"16548549" "16392501"	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:50
S79	4	S78 and (smooth\$4 near3 trajectory) same subsequent.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:50
S80	4	S78 and (smooth\$4 near3 trajectory) same subsequent same viewing near3 window same punchout.clm.	US-PGPUB; USPAT	OR	OFF	2020/11/06 10:50
S81	8	"10432864"	US-PGPUB; USPAT	OR	OFF	2020/11/06 11:49
S82	4	"10536643"	US-PGPUB; USPAT	OR	OFF	2020/11/06 11:49

S83	1	"16713798"	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:36
S84	0	"20150350548" and housing	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:45
S85	2	"20150350548" and device	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:45
S86	0	"20150350548" and outside\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:46
S87	0	"20150350548" and environment\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:46
S88	2	"20150350548" and (optic\$4 lens\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:47
S89	2	"20150350548" and gyroscope	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:48
S90	2	"20150350548" and rotation\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:49
S91	0	"20150350548" and weight\$4 same balanc\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:55
S92	2	"20150350548" and weight\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:55
S93	2	"20150350548" and translation\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 14:59
S94	2	"20150350548" and position\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:00
S95	2	"20150350548" and gyroscop\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:01
S96	2	"20150350548" and (motion mov\$5) near5 time\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:01
S97	2	"20150350548" and smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:03

S98	2	"20150350548" and smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:03
S99	0	"20150350548" and smooth\$4 near3 chang\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:03
S100	0	"20150350548" and (bootstrap guess\$4 estimat\$4 interpolat\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:05
S101	9	(US-20160006935-\$ or US-20150350548-\$ or US-20150022677-\$ or US-20130182134-\$ or US-20120105654-\$ or US-20170085740-\$). did. or (US-10432864-\$ or US-10341564-\$ or US-9787902-\$).did.	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:05
S102	6	S101 and (bootstrap guess\$4 estimat\$4 interpolat\$4)	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:05
S103	5	S101 and (bootstrap guess\$4 estimat\$4 interpolat\$4) same smooth\$4	US-PGPUB; USPAT	OR	OFF	2020/11/06 15:06

11/6/2020 3:57:14 PM

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137002	7590	11/12/2020		
Esplin & Associates (GoPro)			EXAMINER	
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Carlsbad, CA 92008			ART UNIT	PAPER NUMBER
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			11/12/2020	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

DETAILED ACTION

Notice of Pre-AIA or AIA Status

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

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 conflicting claims 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); *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 nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file

provisions of the AIA as explained in MPEP § 2159. See MPEP § 2146 *et seq.* for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) 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 www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

3. Claims 1, 17 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 14-16 of U.S. Patent No. 10,536,643. Although the claims at issue are not identical, they are not patentably distinct from each other because the two sets of claims similarly recite n image capture system that stabilizes videos, the image capture system comprising processors configured to determine a trajectory of the housing during the capture duration based on position information, determine a smoothed trajectory of the device based on a look-ahead of the trajectory and one or more of a weight-balance parameter, a low-light high-pass parameter, and/or a stickiness parameter, the look-ahead of the trajectory including use of a subsequent portion of the trajectory to determine a preceding portion of the smoothed trajectory, determine placement of a viewing window based on the smoothed trajectory of the housing, and generate stabilized visual content based on the viewing window,

including a punchout of the visual content within the viewing window, using selective cropping.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-3, 9-13, 17, 19-20 are rejected under 35 U.S.C. 103 as being unpatentable over U.S. Pub. No. 2015/0350548 to Beysserie et al. ("Beysserie"), and further in view of U.S. Pub. No. 2015/0022677 to Guo ("Guo").

6. Regarding claims 1-3, Beysserie teaches an image capture system that stabilizes videos, the image capture system comprising:

a housing of an image capture device (*image capture device, shown in Figure 7, understood to be within a housing*);

an optical element carried by the housing and configured to guide light within a field of view to an image sensor (*paragraph [0017] teaches a lens*);

the image sensor carried by the housing and configured to generate a visual output signal conveying visual information based on light that becomes incident thereon during a capture duration, the visual information defining visual content having the field of view, the field of view being larger than a size of a viewing window for generating stabilized visual content (*see Figure 3 showing the captured frame is larger than the visible frame*);

a position sensor carried by the housing and configured to generate a position output signal based on positions of the housing during the capture duration, the position output signal conveying position information that characterizes rotational positions of the housing at different moments within the capture duration (*reference number 725, device sensors including accelerometer and/or gyroscope; paragraph [0017] further teaches rotational position to be stabilized using gyroscope output, Figure 5B for example shows the positions over time—different moments*); and

one or more physical processors configured by machine-readable instructions to:
determine a trajectory of the housing during the capture duration based on the position information, the trajectory reflecting the rotational positions of the housing at the different moments within the capture duration, the trajectory including a first portion corresponding to a first moment within the capture duration and a second portion corresponding to a second moment subsequent to the first moment within the capture duration (*motion information associated with a single image at a capture time is known through the use of a motion sensor such as gyro-sensors or accelerometer; thus motion over time is known, see Figure 2A and paragraphs [0004], [0012], where Figure 2A shows at least two different moments during the capture duration and Figure 5B further shows the trajectory with respect to time; Figure 7 shows the apparatus 700 including the image sensor and lens within reference number 750*);

determine a smoothed trajectory of the housing based on a look-ahead of the trajectory and one or more of a weight-balance parameter, a low-light high-pass parameter, and /or a stickiness parameter, the look-ahead of the trajectory including use of a subsequent portion of the trajectory to determine a preceding portion of the

smoothed trajectory such that a portion of the smoothed trajectory corresponding to the first portion of the trajectory is determined based on the second portion of the trajectory, the smoothed trajectory having smoother changes in the rotational positions of the housing than the trajectory (*paragraph [0012] teaches a look-ahead technique used to stabilize video in real-time by using "future" frames of image data to adjust a current frame; paragraph [0015] further teaches that motion of each frame is monitored and a current frame is adjusted for stabilization based on at least "future" motion data: position/motion information of image data captured subsequently to the current frame; paragraph [0017] teaches the weighting factor used to moderate or balance movement during stabilization operation and provides further details of weighting values and weighting kernel function, see also paragraph [0023] and Figure 6*);

Beysserie is silent on: determine placement of the viewing window for the visual content with respect to the field of view of the visual content based on the smoothed trajectory of the housing, the viewing window defining one or more extents of the visual content to be included within a punchout of the visual content; and

generate the stabilized visual content of a video based on the viewing window, the stabilized visual content including the punchout of the one or more extents of the visual content within the viewing window, wherein inclusion in the stabilized visual content of the one or more extents of the visual content within the viewing window effectuates stabilization of the visual content via selective cropping.

Guo teaches determine a viewing window for the visual content based on the smoothed trajectory of the image capture device, the viewing window defining one or more extents of the visual content; and generate stabilized visual content of a video

based on the viewing window, the stabilized visual content including a punchout of the one or more extents of the visual content within the viewing window (*Guo teaches that in general, because video stabilization involves motion compensation that produces missing image content, then typically the video is trimmed to keep the portion that appears in all frames. For example, with respect to Figure 4, a selectively cropped window centered in the first frame may be selected and this cropped window moves along the smooth camera path and thus the upper and lower boundary of the camera path is determined from the cropped window; see paragraph [0048]; Guo teaches that the cropped window 405 is based on the smooth camera path $P(t)$, see for example paragraphs [0036], [0050]*).

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the teaching of Beysserie in view of Guo to crop the viewing window based on the smooth trajectory of the image capture device so that motion compensation may be performed on all of the frames based on the look-ahead technique while avoiding the problem of missing image data due to motion compensation (*i.e.* so that portions of the scene that are not in every frame due to motion are compensated for and the remaining cropped portion appears smoothly).

Regarding claim 2, Beysserie in view of Guo teach the image capture system of claim 1, wherein the position information further characterizes translational positions of the housing at the different moments within the capture duration, the trajectory further reflects the translational positions of the housing at the different moments within the capture duration, and the smoothed trajectory has smoother changes in the

translational positions of the housing than the trajectory (*paragraph [0004] teaches motion information which is position information from sensors such as gyro-sensors, and the position information correlates with a time of a captured image, where there are multiple moments of time; paragraph [0017] teaches translational positions. Beysserie teaches smoothing the transitions for the smooth trajectory for example in paragraph [0022]*).

Regarding claim 3, Beysserie in view of Guo teaches the image capture system of claim 1, Guo further teaches wherein the smoothed trajectory is determined further based on a trajectory retrieval algorithm, input to the trajectory retrieval algorithm including the trajectory of the housing and a bootstrap trajectory, the bootstrap trajectory including a current or an initial guess of the smoothed trajectory (*paragraph [0026] teaches that the device can synthesize a new image sequence for stabilized camera trajectory based on camera motion estimation and camera path smoothing; paragraph [0047] further teaches estimating the camera's path of motion which is used to determine the smoothed trajectory*).

Regarding claim 9, Beysserie in view of Guo teaches the image capture system of claim 1, Beysserie teaches wherein the determination of the smoothed trajectory based on the look-ahead of the trajectory includes weighing past positions of the housing less than future positions of the housing (*paragraph [0024] teaches that the immediate past frame is used to set the current frame's initial stabilization weight, however the future frames weigh in the calculation more because several of the future frames are used compared to only the immediate past frame*).

Regarding claim 10, Beysserie in view of Guo teaches the image capture system of claim 1, wherein the determination of the smoothed trajectory based on the look-ahead of the trajectory includes a prior portion of the trajectory having less impact on the determination of the smoothed trajectory than a future portion of the trajectory (*paragraph [0024] teaches that the immediate past frame is used to set the current frame's initial stabilization weight, however the future look-ahead frames weigh in the calculation more because several of the future frames are used compared to only the immediate past frame*).

Regarding claim 11, Beysserie in view of Guo teaches the image capture system of claim 1, Beysserie further teaches the determination of the smoothed trajectory based on the look-ahead of the trajectory includes using a first amount of a prior portion of the trajectory and a second amount of a future portion of the trajectory, the first amount being smaller than the second amount (*paragraph [0024] teaches that one frame of the prior portion is used and many frames of the future portion of the trajectory are used*).

Regarding claim 12, Beysserie in view of Guo teaches the image capture system of claim 1, Beysserie further teaches the visual content are stored in a buffer during smoothed trajectory generation such that the visual content corresponding to the portion of the smoothed trajectory are stored in the buffer during the determination of the portion of the smoothed trajectory using the lookahead of the trajectory, and the visual content stored in the buffer are used after the determination of the portion of the capture trajectory to generate the stabilized visual content (*see paragraph [0012]*).

Regarding claim 13, Beysserie in view of Guo teach the image capture system of claim 12, but are silent on wherein the buffer includes a circular buffer, and the visual content are stored in the circular buffer as video frames to be stabilized. One of ordinary skill in the art could substitute the buffer taught by Beysserie in Figure 2, reference number 250, with well-known simple circuitry such as a circular buffer. It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the teaching of Beysserie in view of Guo to substitute the buffer with a circular buffer to maintain a certain size of storage that is needed to store the future frames in a rolling fashion as time proceeds.

Claims 17, 19-20 are rejected similarly to claims 1, 3, 9 and 10.

Allowable Subject Matter

7. Claims 4-5-8, 14-16, 18, 21-22 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.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMY R HSU whose telephone number is (571)270-3012. The examiner can normally be reached on 9am-5pm.

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, Lin Ye can be reached on (571)272-7372. 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 <https://ppair-my.uspto.gov/pair/PrivatePair>. 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.

AMY R. HSU
Examiner
Art Unit 2664

/AMY R HSU/
Primary Examiner, Art Unit 2697

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/713,798
	Filing Date	12/13/2019
	First Named Inventor	César Douady
	Art Unit	0000
Page 1 of 3	Matter Number	46DG-026085

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Initials	Cite No.	Document Number	Issue/Publication Date	First Named Inventor	Relevant Pages, Columns, etc.
	1	6654019	11/25/2003	Gilbert	
	2	8022948	09/20/2011	Garbow	
	3	8237787	08/07/2012	HOLLINGER STEVEN J	
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	5	9279983	03/08/2016	DAVIS BENJAMIN	
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	19	20090278917	11/12/2009	Dobbins	
	20	20100277617	11/04/2010	HOLLINGER STEVEN J	
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	22	20100299630	11/25/2010	David McCutchen	
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Examiner Signature	/AMY R HSU/	Date Considered	11/06/2020
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/713,798
	Filing Date	12/13/2019
	First Named Inventor	César Douady
	Art Unit	0000
Page 2 of 3	Matter Number	46DG-026085

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Initials	Cite No.	Document Number	Issue/Publication Date	First Named Inventor	Relevant Pages, Columns, etc.
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	36	20140267590	09/18/2014	MCCLATCHIE IAIN RICHARD TYRONE	
	37	20150146014	05/28/2015	BLACK ROBERT A	
	38	20150159846	06/11/2015	HOLLINGER STEVEN J	
	39	20150350548	12/03/2015	BEYSSERIE SEBASTIEN X	
	40	20160006935	01/07/2016	ZHOU JIANPING	
	41	20160360109	12/08/2016	LAROIA RAJIV	
	42	20170041545	02/09/2017	MURGIA CARLO	
	43	20170070689	03/09/2017	SILVERSTEIN D AMNON	
	44	20170084086	03/23/2017	David Young Joon Pio	
	45	20170085964	03/23/2017	Yan Chen	
	46	20170094169	03/30/2017	YOSHIKAWA HIROMI	
	47	20170142337	05/18/2017	KOKARAM ANIL CHRISTOPHER	
	48	20170289454	10/05/2017	PETTERSSON GUSTAF	
	49	20170359534	12/14/2017	LI XIAOXING	
	50	20180041705	02/08/2018	WAKAMATSU NOBUSHIGE	
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	54	20180324358	11/08/2018	YAMADA HIDESHI	
	55	20190124267	04/25/2019	HARUNA KOHTA	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/713,798
	Filing Date	12/13/2019
	First Named Inventor	César Douady
	Art Unit	0000
Page 3 of 3	Matter Number	46DG-026085

FOREIGN PATENT DOCUMENTS						
Initials	Cite No.	Document Number	Publication Date	Country	Relevant Pages, Columns, etc.	T
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	60	International Search Report and Written Opinion for Application No. PCT/US2019/020241, date of mailing June 3, 2019, 12 pages.	
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	67	O'DONOVAN, A., et al., "Real Time Capture of Audio Images and their Use with Video," 2007 IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, October 21-24, 2007, Pages 10-13.	
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/713,798
	Filing Date	12/13/2019
	First Named Inventor	César Douady
	Art Unit	2697
Page 1 of 1	Matter Number	46DG-026085

U.S. PATENT/PUBLICATION DOCUMENTS					
Initials	Cite No.	Document Number	Issue/Publication Date	First Named Inventor	Relevant Pages, Columns, etc.
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	2	10271021	04/23/2019	SMOLYANSKIY NIKOLAI	
	3	20110102609	05/05/2011	IWATA NAOTO	
	4	20130343728	12/26/2013	KITATANI KENICHI	
	5	20140063271	03/06/2014	OGURA MOTONORI	
	6	20140063272	03/06/2014	TSUCHIDA YUKITAKA	
	7	20140160309	06/12/2014	KARPENKO ALEXANDRE	
	8	20150189178	07/02/2015	LOMBARDI MICHAEL J	
	9	20160048216	02/18/2016	FINK RYAN	
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	11	20190215495	07/11/2019	SMOLYANSKIY NIKOLAI	
	12	20190348075	11/14/2019	DERBANNE THOMAS	

FOREIGN PATENT DOCUMENTS						
Initials	Cite No.	Document Number	Publication Date	Country	Relevant Pages, Columns, etc.	T

OTHER DOCUMENTS			
Initials	Cite No.	Author, Title, Date, Pages, etc.	T

Examiner Signature	/AMY R HSU/	Date Considered	11/06/2020
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Video stabilization using robust feature **trajectories**

[PDF] ieeexplore.ieee.org

Y.Y. Lee, Y.Y. Choung, S.Y. Chen ... - 2009 IEEE 12th ..., 2009 - ieeexplore.ieee.org

... In summary, our approach directly **stabilize** a video with- out explicitly estimating camera motion ... not re- lated to camera shakes, we would like to deprecate short **trajectories** when **stabilizing** cameras. Therefore, we mea- sure the importance of a **trajectory** by its temporal persis ...

☆ 99 Cited by 192 Related articles All 3 versions

(PDF) **Stabilizing** omnidirectional videos using 3d structure and spherical image warping

[PDF] psu.edu

M.Kamali, A.Banno, J.C. Bazin, S.Kwon, K.Kaneko - IAPP MVA, 2011 - Citeseer

This paper addresses the problem of **stabilizing** spherical videos. Whereas various techniques have been proposed to **stabilize** conventional videos, this work is the first approach proposed for ... Let $X_p \in \mathbb{R}^3$ be corresponding to **trajectory** p . We project this point in a frame l where ...

☆ 99 Cited by 26 Related articles All 6 versions 9%

Stabilizing cell phone video using inertial measurement sensors

[PDF] ieeexplore.ieee.org

G.Hanning, N.Forslow, P.Ferraz ... - ... on Computer Vision ..., 2011 - ieeexplore.ieee.org

Page 1. **Stabilizing** Cell Phone Video using Inertial Measurement Sensors ... Stabilization & Rectification Resulting video Figure 2. System overview. **trajectory** smoothing step ... In order to **stabilize** this kind of video sequence, a smooth orientation estimation is needed ...

☆ 99 Cited by 79 Related articles All 12 versions

Action recognition with improved **trajectories**

[PDF] cv-foundation.org

H.Wang, C.Schmid - ... of the IEEE international conference on ..., 2013 - cv-foundation.org

HOF benefits most from **stabilizing** optical flow. Both "Combined" and "WarpFlow" are significantly better than the other two ... [14] report 62.5% by decompos- ing visual motion to **stabilize** dense **trajectories** ... [12] report 82.7% by modeling **trajectory** clusters with a tree structure ...

☆ 99 Cited by 2646 Related articles All 32 versions 9%

Stabilization of traffic videos based on both foreground and background feature **trajectories**

[PDF] ieeexplore.ieee.org

Q.Liu, M.Zhao - IEEE Transactions on Circuits and Systems ..., 2018 - ieeexplore.ieee.org

... the lack of professional **stabilizing** instruments, these amateur videos may suffer from the jitter of ... It is more urgent and more challenging to **stabilize** traffic videos than the videos captured by ... ie, the jitter, and generates a stabilized view for each feature **trajectory**, either foreground ...

☆ 99 Cited by 4 Related articles

pmid: Design and control of a thermal **stabilizing** system for a MEMS optomechanical uncooled infrared imaging camera

[HTML] sciencedirect.com

J.Choi, J.Yamaguchi, S.Morales, R.Hargwitz ... - Sensors and Actuators A ..., 2003 - Elsevier

... S. LQGR with desired **trajectory** control scheme ... This paper presented the design and control of a thermal **stabilizing** system for an optomechanical uncooled infrared imaging ... 1) A/V Sioman, P. Bugge, J. Molloy, D. Stewart A Microcontroller-based driver to **stabilize** the temperature ...

☆ 99 Cited by 36 Related articles All 14 versions

Spatially and temporally optimized video stabilization

[PDF] ieeexplore.ieee.org

Y.S.Wang, F.Liu, P.S.Hsu, Y.Y.Lee - IEEE transactions on ..., 2013 - ieeexplore.ieee.org

... In addition, we **stabilize** a subset of video frames sequentially instead of the whole video cube at a ... we solve for only 3 Å 7,958 control points in average when **stabilizing** each 260 ... While the KLT implementation used in our method is not real-time, feature **trajectory** estimation is a ...

☆ 99 Cited by 97 Related articles All 15 versions

Electronic Acknowledgement Receipt

EFS ID:	40853733
Application Number:	16713798
International Application Number:	
Confirmation Number:	2783
Title of Invention:	SYSTEMS AND METHODS FOR STABILIZING VIDEOS
First Named Inventor/Applicant Name:	Cesar Douady
Customer Number:	137002
Filer:	Vadim Polonichko/Maria Plascencia
Filer Authorized By:	Vadim Polonichko
Attorney Docket Number:	46DG-026085
Receipt Date:	15-OCT-2020
Filing Date:	13-DEC-2019
Time Stamp:	14:00:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

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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-026085_SyncIDS-Form.pdf	46362 5d65f449ea4526de7baa91493c8c9b491095225c	no	1

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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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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.					

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/713,798
	Filing Date	12/13/2019
	First Named Inventor	César Douady
	Art Unit	2697
Page 1 of 1	Matter Number	46DG-026085

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(b), this Information Disclosure Statement is being filed within three months of the filing of a national application other than a continued prosecution application under 37 CFR 1.53(d); within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 in an international application; before the mailing of a first Office Action on the merits; or before the mailing of a first Office Action after the filing of a request for continued examination under 37 CFR 1.114.

CERTIFICATION STATEMENT

No certification statement is required. This Information Disclosure Statement is being filed in accordance with 37 CFR 1.97(b).

FEE

No fee is required. This Information Disclosure Statement is being filed in accordance with 37 CFR 1.97(b).

If necessary, the Director is hereby authorized to charge or credit Deposit Account No. 601896 for any additional fees, or any underpayment or credit for overpayment in connection herewith. Please reference attorney docket number 46DG-026085 for any such charge or credit.

ADDITIONAL COMMENTS

SIGNATURE

Signature	/ Vadim Polonichko /	Date	2020-10-15
Name	Vadim Polonichko	Registration Number	62769

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/713,798
	Filing Date	12/13/2019
	First Named Inventor	César Douady
	Art Unit	2697
Page 1 of 1	Matter Number	46DG-026085

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	2	10271021	04/23/2019	SMOLYANSKIY NIKOLAI	
	3	20110102609	05/05/2011	IWATA NAOTO	
	4	20130343728	12/26/2013	KITATANI KENICHI	
	5	20140063271	03/06/2014	OGURA MOTONORI	
	6	20140063272	03/06/2014	TSUCHIDA YUKITAKA	
	7	20140160309	06/12/2014	KARPENKO ALEXANDRE	
	8	20150189178	07/02/2015	LOMBARDI MICHAEL J	
	9	20160048216	02/18/2016	FINK RYAN	
	10	20170078577	03/16/2017	WAKAMATSU NOBUSHIGE	
	11	20190215495	07/11/2019	SMOLYANSKIY NIKOLAI	
	12	20190348075	11/14/2019	DERBANNE THOMAS	

FOREIGN PATENT DOCUMENTS						
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Examiner Signature		Date Considered	
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	46DG-026085
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR STABILIZING VIDEOS		
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
	Cesar		Douady	
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service				
City	Les Molières Orsay		Country of Residence	FR
Mailing Address of Inventor:				
Address 1		3000 Clearview Way 3025 Clearview Way		
Address 2				
City	San Mateo		State/Province	CA
Postal Code	94402	Country	US	
Inventor 2				
Legal Name				
Prefix	Given Name	Middle Name	Family Name	Suffix
	Thomas		Derbanne	
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service				
City	Paris		Country of Residence	FR
Mailing Address of Inventor:				
Address 1		3000 Clearview Way 3025 Clearview Way		
Address 2				
City	San Mateo		State/Province	CA
Postal Code	94402	Country	US	
Inventor 3				
Legal Name				

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	46DG-026085
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR STABILIZING VIDEOS		

Prefix	Given Name	Middle Name	Family Name	Suffix
	Maxim		Karpushin	
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service				
City	Paris	Country of Residence ⁱ	FR	
Mailing Address of Inventor:				
Address 1	~~3000 Clearview Way~~ 3025 Clearview Way			
Address 2				
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	SYSTEMS AND METHODS FOR STABILIZING VIDEOS		
Attorney Docket Number	46DG-026085	Small Entity Status Claimed	☐
Application Type			
Subject Matter			
Total Number of Drawing Sheets (if any)	9	Suggested Figure for Publication (if any)	

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 ⁱ

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	46DG-026085
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR STABILIZING VIDEOS		

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.

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	16/587,811	2019-09-30

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	46DG-026085
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR STABILIZING VIDEOS		

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
16/587,811	Continuation of	16/548,549	2019-08-22

Prior Application Status	Patented	Remove			
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
16548549	Continuation of	16392501	2019-04-23	10432864	2019-10-01

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
16392501	Claims benefit of provisional	62733237	2018-09-19

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 ¹	Filing Date (YYYY-MM-DD)	Access Code ¹ (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

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

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	46DG-026085
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR STABILIZING VIDEOS		

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	46DG-026085
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR STABILIZING VIDEOS		

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.

☒ 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

Mailing Address Information For Applicant:

Address 1	~~3000 Clearview Way~~ 3025 Clearview Way		
Address 2			
City	San Mateo	State/Province	CA
Country ¹	US	Postal Code	94402
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button.

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	46DG-026085
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR STABILIZING VIDEOS		

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				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	46DG-026085
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR STABILIZING VIDEOS		

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)	2020-09-25
First Name	D. Benjamin	Last Name	Esplin	Registration Number	58297

Additional Signature may be generated within this form by selecting the Add button.



UNITED STATES
PATENT AND TRADEMARK OFFICE

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

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #
16/713,798

RECEIPT DATE / TIME
09/25/2020 01:43:19 PM ET

ATTORNEY DOCKET #
46DG-026085

Title of Invention

SYSTEMS AND METHODS FOR STABILIZING VIDEOS

Application Information

APPLICATION TYPE Utility - Nonprovisional Application
under 35 USC 111(a)

PATENT # -

CONFIRMATION # 2783

FILED BY Chelsea Pearsall

PATENT CENTER # 60088059

FILING DATE 12/13/2019

CUSTOMER # 137002

FIRST NAMED INVENTOR Cesar Douady

CORRESPONDENCE ADDRESS -

AUTHORIZED BY David Esplin

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
46DG-026085-Corrected_ADS.pdf	8	Application Data Sheet	480 KB

Warning: This is not a USPTO supplied ADS fillable form. Data in the form cannot be automatically loaded to other USPTO systems.

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
46DG-026085-Corrected_ADS.pdf	3CB41FA5DEF8E064CD26DE243562F0C0B51EA42B90FF35678 25D64525DF1A803D4FC05D6A388CB5B0086F766B1EF6BA774

FD FE1243D21A43CF94A9212D04E479

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 filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

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

New International Application Filed with the USPTO as a Receiving Office

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

Electronic Acknowledgement Receipt

EFS ID:	39725759
Application Number:	16713798
International Application Number:	
Confirmation Number:	2783
Title of Invention:	SYSTEMS AND METHODS FOR STABILIZING VIDEOS
First Named Inventor/Applicant Name:	Cesar Douady
Customer Number:	137002
Filer:	Vadim Polonichko/Julie Jager
Filer Authorized By:	Vadim Polonichko
Attorney Docket Number:	46DG-026085
Receipt Date:	15-JUN-2020
Filing Date:	13-DEC-2019
Time Stamp:	21:27:35
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-026085_SyncIDS-Form.pdf	46711 ec303431f74c64da5d02133767e360a953d94e83	no	1

Warnings:

Information:					
This is not an USPTO supplied IDS fillable form					
2	Transmittal Letter	GP-46DG-026085_Transmittal-Letter.pdf	505569 04a2788dbb22b4a65cfa4506984ef0933da94b57	no	1
Warnings:					
Information:					
Total Files Size (in bytes):			552280		
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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.					

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/713,798
	Filing Date	12/13/2019
	First Named Inventor	César Douady
	Art Unit	0000
Page 1 of 1	Matter Number	46DG-026085

U.S. PATENT/PUBLICATION DOCUMENTS					
Initials	Cite No.	Document Number	Issue/Publication Date	First Named Inventor	Relevant Pages, Columns, etc.
	1	10015308	07/03/2018	CHO KYUNGMIN	
	2	10542215	01/21/2020	KUNISHIGE KEIJI	
	3	9819857	11/14/2017	MIYAJIMA TAKURO	
	4	20160255273	09/01/2016	WAKAMATSU NOBUSHIGE	
	5	20130141600	06/06/2013	PROCA ADRIAN	
	6	20190191090	06/20/2019	MURASHIMA RYUICHI	
	7	20160191800	06/30/2016	YOSHIKAWA AKIO	
	8	20160227105	08/04/2016	KOBAYASHI SEIJI	
	9	20160224225	08/04/2016	KONDO EMI	
	10	20120137236	05/31/2012	ABE MITSUO	
	11	20110063236	03/17/2011	ARAI KOJI	
	12	20100033614	02/11/2010	YOO JEOUNG-GON	
	13	20180121057	05/03/2018	LIANG ZHE	
	14	20160124917	05/05/2016	DUCAT FABIEN	
	15	20080307329	12/11/2008	ENDO TSUYOSHI	

FOREIGN PATENT DOCUMENTS						
Initials	Cite No.	Document Number	Publication Date	Country	Relevant Pages, Columns, etc.	T

OTHER DOCUMENTS			
Initials	Cite No.	Author, Title, Date, Pages, etc.	T

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	16/713,798
	Filing Date	12/13/2019
	First Named Inventor	César Douady
	Art Unit	0000
Page 1 of 1	Matter Number	46DG-026085

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(b), this Information Disclosure Statement is being filed within three months of the filing of a national application other than a continued prosecution application under 37 CFR 1.53(d); within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 in an international application; before the mailing of a first Office Action on the merits; or before the mailing of a first Office Action after the filing of a request for continued examination under 37 CFR 1.114.

CERTIFICATION STATEMENT
No certification statement is required. This Information Disclosure Statement is being filed in accordance with 37 CFR 1.97(b).

FEE
No fee is required. This Information Disclosure Statement is being filed in accordance with 37 CFR 1.97(b). If necessary, the Director is hereby authorized to charge or credit Deposit Account No. 601896 for any additional fees, or any underpayment or credit for overpayment in connection herewith. Please reference attorney docket number 46DG-026085 for any such charge or credit.

ADDITIONAL COMMENTS

SIGNATURE			
Signature	/ Vadim Polonichko /	Date	2020-06-15
Name	Vadim Polonichko	Registration Number	62769



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	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/713,798	12/13/2019	Cesar Douady	46DG-026085

CONFIRMATION NO. 2783

PUBLICATION NOTICE



0000000116291094

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

Title:SYSTEMS AND METHODS FOR STABILIZING VIDEOS

Publication No.US-2020-0120252-A1

Publication Date:04/16/2020

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 Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: D. BENJAMIN ESPLIN C/O ESPLIN & ASSOCIATES, PC 5411 AVENIDA ENCINAS, STE 100 CARLSBAD, CALIFORNIA 92008 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)
Applicant's or agent's file reference 46DG-026045	Date of mailing <i>(day/month/year)</i> FOR FURTHER ACTION See paragraphs 1 and 4 below
International application No. PCT/US2019/048292	International filing date <i>(day/month/year)</i> 27 August 2019 (27.08.2019)
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 90bis.1 and 90bis.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 45bis.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/US COMMISSIONER FOR PATENTS MAIL STOP PCT, ATTN: ISA/US P.O. BOX 1450 ALEXANDRIA, VA 22313-1450, UNITED STATES OF AMERICA Facsimile No. (571)273-8300	Authorized officer HARRY C. KIM Telephone No. 571-272-4300
--	---

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 46DG-026045	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US2019/048292	International filing date (<i>day/month/year</i>) 27 August 2019 (27.08.2019)	(Earliest) Priority Date (<i>day/month/year</i>) 23 April 2019 (23.04.2019)
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.

☐ 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 43.6bis(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 18.2, 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. 9

☒ 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/US2019/048292

A. CLASSIFICATION OF SUBJECT MATTER		
IPC: H04N 5/232 CPC: H04N 5/23248, 5/23267, 5/23254, 5/23258, 5/23261		
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) CPC: CPC: H04N 5/23248, 5/23267, 5/23254, 5/23258, 5/23261/IPC: H04N 5/232		
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) US-PGPUB, USPAT: information, and, image, second, rotate, boundary, direction, sensor, track, line, course, orientation, trajectory, path, position, stabilize, smooth, ois, data, output, punch, determine, housing, window, same, extent, view, calculate, first, rotation, moment, out, punchout, karpushin, derbanne, Thomas, ctm, douady, cesar, maxim, frame, accelerometer, detect		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 10,262,691 B1 (GILMOUR ET AL.) 16 April 2019 (16.04.2019). See entire documents.	1-20
A	US 2018/0199025 A1 (HOLZER ET AL.) 12 July 2018 (12.07.2018). See entire documents.	1-20
A	10,284,794 B1 (FRANCOIS ET AL.) 07 May 2019 (07.05.2019). See entire documents.	1-20
A	US 2014/0028876 A1 (MILLS) 30 January 2014 (30.01.2014). See entire documents.	1-20
A	US 2015/0159846 A1 (HOLLINGER) 11 June 2015 (11.06.2015). See entire documents.	1-20
A	US 2014/0267590 A1 (MCCLATCHIE ET AL.) 18 September 2014 (18.09.2014). See entire documents.	1-20
☒ 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) of 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 22 September 2019 (22.09.2019)		Date of mailing of the international search report 27 SEP 2019
Name and mailing address of the ISA/US COMMISSIONER FOR PATENTS MAIL STOP PCT, ATTN: ISA/US P.O. BOX 1450 ALEXANDRIA, VA 22313-1450, UNITED STATES OF AMERICA Facsimile No. (571)273-8300		Authorized officer HARRY C. KIM Telephone No. 571-272-4300

Form PCT/ISA/210 (second sheet) (January 2013)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2019/048292

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2013/0210563 A1 (HOLLINGER) 15 August 2013 (15.08.2013) . See entire documents.	1-20

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

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

D. BENJAMIN ESPLIN
C/O ESPLIN & ASSOCIATES, PC
5411 AVENIDA ENCINAS, STE 100
CARLSBAD, CALIFORNIA 92008
UNITED STATES OF AMERICA

Date of mailing
(day/month/year)

27 SEP 2019

Applicant's or agent's file reference

46DG-026045

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2019/048292

International filing date (day/month/year)

27 August 2019 (27.08.2019)

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

IPC: H04N 5/232

CPC: H04N 5/23248, 5/23267, 5/23254, 5/23258, 5/23261

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 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 56.1bis(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/US

COMMISSIONER FOR PATENTS
MAIL STOP PCT, ATTN: ISA/US
P.O. BOX 1450 ALEXANDRIA, VA
22313-1450, UNITED STATES OF
AMERICA

Date of completion of this opinion

22 September 2019 (22.09.2019)

Authorized officer

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

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US2019/048292

Box No. 1 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 12.5(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 43bis.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 13ter.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 13ter.1(a)).
☐ on paper or in the form of an image file (Rule 13ter.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/US2019/048292

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

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	1-20	YES
	Claims	NONE	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	NONE	NO

2. Citations and explanations:

EXPLANATION

ClaimS 1-20 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the claims limitations.

The prior art provides examples of an image capture system that stabilizes videos including a housing, optical element carried by the housing, image sensor carried by the housing, and position sensor to generate a position output signal on positions of the housing during capture, and determine a trajectory of the housing during capture based on position information. For example, U.S. Pub. No. 2013/0210563 teaches a ball-shaped camera thrown or projected into an airborne trajectory and image capture system with network devices collaborating for the purpose of generating panoramic images and video sourced from network ball cameras and capable of capturing stable image and video while spinning, spiraling or processing through a trajectory. U.S. Pub. No. 2018/0199025 to Holzer provides another example of a drone based system for capturing multi-media representation of an entity by capturing a plurality of images having location information and fused to form multi-view interactive digital media representations. However, the prior art does not teach all of the limitations of the currently claimed invention including determining a smoothed trajectory of the housing based on a subsequent portion of the trajectory such that a portion of the smoothed trajectory corresponding to the first portion of the trajectory is determined based on the second portion of the trajectory, and determining a viewing window for the visual content based on the smoothed trajectory of the housing.

Claims 1-20 meets 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.

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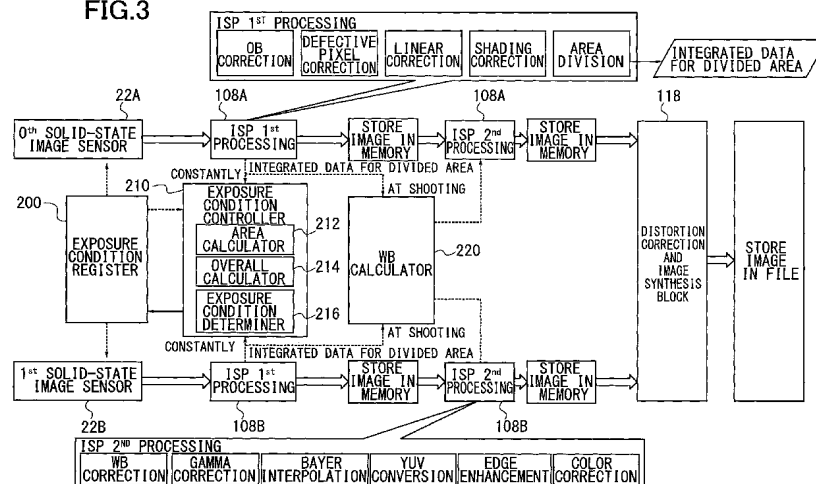
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[Continued on next page]

(54) Title: IMAGING CONTROLLER AND IMAGING CONTROL METHOD AND PROGRAM

FIG.3



(57) Abstract: An imaging controller includes an index calculator to calculate an index value for each of divided areas of images captured by a plurality of imaging units, the index value for evaluating a photographic state of each of the divided areas, an evaluation value calculator to evaluate the images and an overlapping area between the images on the basis of the index value of each divided area calculated by the index calculator and calculate an overall evaluation value, and a condition determiner to determine an imaging condition for each of the imaging units on the basis of the overall evaluation value calculated by the evaluation value calculator.



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SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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— with international search report (Art. 21(3))

DESCRIPTION
IMAGING CONTROLLER AND IMAGING CONTROL METHOD AND
PROGRAM

CROSS REFERENCE TO RELATED APPLICATION

The present application is based on and claims priority from Japanese Patent Application No. 2012-199622, filed on September 11, 2012.

Technical Field

[0001]

The present invention relates to an imaging controller which can provide appropriate imaging conditions to multiple imaging units, and an imaging control method executed by the imaging controller and a program for realizing the imaging control method.

Background Art

[0002]

There is a known omnidirectional imaging system which includes multiple wide-angle lenses such as fisheye lens or super wide-angle lens to capture an image in omnidirections at once. It is configured to project images from the lenses onto a sensor surface and combine the images through image processing to thereby generate an omnidirectional image. For example, by use of two wide-angle lenses with angle of view of over 180 degrees, omnidirectional images can be generated. In the image processing a partial image captured by each lens system is subjected to distortion correction and projection conversion on the basis of a certain projection model with a distortion from an ideal model taken into account. Then, the partial images are connected on the basis of an overlapping portion of the partial images to form a single omnidirectional image.

[0003]

In related art an exposure correction technique of a digital camera to acquire a proper exposure from a captured image is known. For instance, Japanese Patent Application Publication No. 2007-329555 discloses an imaging system including multiple imaging units arranged to have an overlapping imaging area to extract an overlapping area from each of the images captured by the imaging units. It is configured to adjust at least one of the exposure and white balance of the imaging units according to each image of the extracted overlapping areas to reduce a difference in the brightness or color of the captured images, for the purpose of abating workloads of post-processing such as synthesis.

[0004]

However, it is difficult for the omnidirectional imaging system to acquire a proper exposure by such a related-art exposure correction technique because the optical conditions or photographic circumstances of the imaging units thereof differ. The related art disclosed in the above document only concerns an overlapping area so that it cannot obtain appropriate exposure correction values under an unbalanced exposure condition if the overlapping area is small relative to the entire image. In particular, since the imaging area of the omnidirectional imaging system is omnidirectional, a high-brightness subject as the sun is often captured on a sensor, which may cause a flare and an increase in image offset value. A proper exposure can be obtained for each sensor, however, it may cause a difference in brightness between the connecting portions of the images and impair the quality of an omnidirectional image.

Disclosure of the Invention

[0005]

The present invention aims to provide an imaging controller and imaging control method and program which can provide to each of imaging units a proper imaging condition to abate a discontinuity at the connecting points of the images captured by the imaging units in synthesizing the images.

[0006]

According to one aspect of the present invention, an imaging controller comprises an index calculator to calculate an index value for each of divided areas of images captured by a plurality of imaging units, the index value for evaluating a photographic state of each of the divided areas, an evaluation value calculator to evaluate the images and an overlapping area between the images on the basis of the index value of each divided area calculated by the index calculator and calculate an overall evaluation value, and a condition determiner to determine an imaging condition for each of the imaging units on the basis of the overall evaluation value calculated by the evaluation value calculator.

Brief Description of the Drawings

[0007]

Features, embodiments, and advantages of the present invention will become apparent from the following detailed description with reference to the accompanying drawings:

FIG. 1 is a cross section view of an omnidirectional imaging system according to the present embodiment;

FIG. 2 shows the hardware configuration of the omnidirectional imaging system in FIG. 1;

FIG. 3 shows a flow of the entire image processing of the omnidirectional imaging system in FIG. 1;

FIGs. 4A, 4B show 0th and 1st images captured by two fisheye lenses, respectively and FIG. 4C shows a synthetic image of the 0th and 1st captured images by way of example;

FIG. 5A, 5B show an area division method according to the present embodiment;

FIG. 6 is a flowchart for exposure control executed by the omnidirectional imaging system according to the present embodiment; and

FIG. 7 is a flowchart for exposure calculation executed by the omnidirectional imaging system according to the present embodiment.

Description of Embodiments

[0008]

Hereinafter, an embodiment of an imaging controller and an imaging system will be described in detail with reference to the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts. By way of example, the present embodiment describes an omnidirectional imaging system which comprises a camera unit including two fisheye lenses and a function to decide an imaging condition on the basis of images captured by the two fisheye lenses. However, the present embodiment should not be limited to such an example. Alternatively, the omnidirectional imaging system can comprise a camera unit including three or more fisheye lenses to determine an imaging condition according to the images captured by the fisheye lenses. Herein, a fisheye lens can include a wide-angle lens or a super wide-angle lens.

[0009]

Referring to FIGs. 1 to 2, the overall configuration of an omnidirectional imaging system 10 is described. FIG. 1 is a cross section view of the

omnidirectional imaging system 10 (hereinafter, simply imaging system). It comprises a camera unit 12, a housing 14 accommodating the camera unit 12 and elements as controller, batteries, and a shutter button 18 provided on the housing 14.

[0010]

The camera unit 12 in FIG. 1 comprises two lens systems 20A, 20B and two solid-state image sensors 22A, 22B as CCD (charge coupled device) sensor or CMOS (complementary metal oxide semiconductor). Herein, each of the pairs of the lens systems 20 and solid-state image sensors 22 are referred to as imaging unit. The lens systems 20A, 20B are each comprised of 6 groups of 7 lenses as a fisheye lens, for instance. In the present embodiment the fisheye lens has total angle of view of 180 degrees ($360 \text{ degrees}/n$, $n = 2$) or more, preferably 185 degrees or more, more preferably 190 degrees or more.

[0011]

The optical elements as lenses, prisms, filters, aperture stops of the lens systems 20A, 20B are positioned relative to the solid-state image sensors 22A, 22B so that the optical axes of the optical elements are orthogonal to the centers of the light receiving areas of the corresponding solid-state image sensors 22 as well as the light receiving areas become the imaging planes of the corresponding fisheye lenses. The solid-state image sensors 22 are area image sensors on which photodiodes are two-dimensionally arranged, to convert light gathered by the lens systems 20 to image signals.

[0012]

In the present embodiment the lens systems 20A, 20B are the same and disposed opposite to each other so that their optical axes coincide. The solid-state image sensors 22A, 22B convert light distribution to image signals and output them to a not-shown image processor on the controller. The image

processor combines partial images from the solid-state image sensors 22A, 22B to generate a synthetic image with solid angle of 4π in radian or an omnidirectional image. The omnidirectional image is captured in all the directions which can be seen from a shooting point. Instead of the omnidirectional image, a panorama image which is captured in a 360-degree range only on a horizontal plane can be generated.

[0013]

To form an omnidirectional image with use of the fisheye lenses with total angle of view of more than 180 degrees, an overlapping portion of the captured images by the imaging units is used for connecting images as reference data representing the same image. Generated omnidirectional images are output to, for instance, a display provided in or connected to the camera unit 12, a printer or an external storage medium such as SD card®, compact flash®.

[0014]

FIG. 2 shows the structure of hardware of the imaging system 10 according to the present embodiment. The imaging system 10 comprises a digital still camera processor 100 (hereinafter, simply processor), a lens barrel unit 102, and various elements connected with the processor 100. The lens barrel unit 102 includes the two pairs of lens systems 20A, 20B and solid-state image sensors 22A, 22B. The solid-state image sensors 22A, 22B are controlled by a command from a CPU 130 of the processor 100.

[0015]

The processor 100 comprises ISPs (image signal processors) 108A, 108B, a DMAC (direct memory access controller) 110, an arbiter (ARBMEMC) 112 for memory access, a MEMC (memory controller) 114 for memory access, and a distortion correction and image synthesis block 118. The ISPs 108A, 108B

perform automatic exposure control to and set white balance and gamma balance of image data signal-processed by the solid-state image sensors 22A, 22B.

[0016]

The MEMC 114 is connected to an SDRAM 116 which temporarily stores data used in the processing of the ISP 108A, 108B and distortion correction and image synthesis block 118. The distortion correction and image synthesis block 118 performs distortion correction and vertical inclination correction on the two partial images from the two imaging units on the basis of information from a triaxial acceleration sensor 120 and synthesizes them.

[0017]

The processor 100 further comprises a DMAC 122, an image processing block 124, a CPU 130, an image data transferrer 126, an SDRAMC 128, a memory card control block 140, a USB block 146, a peripheral block 150, an audio unit 152, a serial block 158, an LCD (Liquid Crystal Display) driver 162, and a bridge 168.

[0018]

The CPU 130 controls the operations of the elements of the imaging system 10. The image processing block 124 performs various kinds of image processing on image data together with a resize block 132, a JPEG block 134, and an H. 264 block 136. The resize block 132 enlarges or shrinks the size of image data by interpolation. The JPEG block 134 is a codec block to compress and decompress image data in JPEG. The H. 264 block 136 is a codec block to compress and decompress video data in H.264. The image data transferrer 126 transfers the images processed by the image processing block 124. The SDRAMC 128 controls the SDRAM 138 connected to the processor 100 and temporarily storing image data during image processing by the processor 100.

[0019]

The memory card control block 140 controls data read and write to a memory card and a flash ROM 144 inserted to a memory card throttle 142 in which a memory card is detachably inserted. The USB block 146 controls USB communication with an external device such as personal computer connected via a USB connector 148. The peripheral block 150 is connected to a power switch 166.

[0020]

The audio unit 152 is connected to a microphone 156 for receiving an audio signal from a user and a speaker 154 for outputting the audio signal, to control audio input and output. The serial block 158 controls serial communication with the external device and is connected to a wireless NIC (network interface card) 160. The LCD driver 162 is a drive circuit for the LCD 164 and converts the image data to signals for displaying various kinds of information on an LCD 164.

[0021]

The flash ROM 144 contains a control program written in readable codes by the CPU 130 and various kinds of parameters. Upon power-on of the power switch 166, the control program is loaded onto a main memory. The CPU 130 controls the operations of the units and elements of the image processor in compliance with the control program on the main memory, and temporarily stores necessary control data in the SDRAM 138 and a not-shown local SRAM.

[0022]

FIG. 3 shows essential function blocks for controlling imaging condition and the flow of the entire image processing of the imaging system 10 according to the present embodiment. First, the solid-state image sensors 22A, 22B capture images under a certain exposure condition and output them. Then, the ISPs 108A, 108B in FIG. 2 perform optical black correction, defective pixel correction, linear

correction, shading correction and area division (collectively referred to as first processing) to the images from the solid-state image sensors 22A, 22B and store them in memory.

[0023]

The optical black correction is a processing in which an output signal from an effective pixel area is subjected to clamp correction, using the output signals of optical black areas of the solid-state image sensors as a black reference level. A solid-state image sensor such as CMOS may contain defective pixels from which pixels values are not obtainable because of impurities entering a semiconductor substrate in the manufacturing of the image sensor. The defective pixel correction is a processing in which the value of a defective pixel is corrected according to a combined signal from neighboring pixels of the defective pixel.

[0024]

The linear correction is for each of RGBs. The shading correction is to correct a distortion of shading in an effective pixel area by multiplying the output signal of the effective pixel area by a certain correction coefficient. The area division is to divide a captured image into small areas and calculate an integrated value or an integrated average value of brightness values for each divided area.

[0025]

Returning to FIG. 3, after the first processing the ISPs 108A, 108B further perform white balance, gamma correction, Bayer interpolation, YUV conversion, edge enhancement and color correction (collectively referred to as second processing) to the images, and the images are stored in the memory. The amount of light transmitting through the color filters of the image sensors changes depending on the color of the filter. The white balance correction is to correct a difference in sensitivity to the three colors R (red), G (green), and B (blue) and set a gain for appropriately representing white color in an image. A WB (white

balance) calculator 220 calculates a white balance parameter according to the RGB integrated value or integrated average value calculated in the area division process. The gamma correction is to correct a gamma value of an input signal so that the output linearity of an output device is maintained with the characteristic thereof taken into account.

[0026]

Further, in the CMOS each pixel is attached with any of RGB color filters. The Bayer interpolation is to interpolate insufficient two colors from neighboring pixels. The YUV conversion is to convert RAW data in RGB format to data in YUV format of a brightness signal Y and a color difference signal UV. The edge enhancement is to extract the edges of an image according to a brightness signal, apply a gain to the edges, and remove noise in the image in parallel to the edge extraction. The color correction includes chroma setting, hue setting, partial hue change, and color suppression.

[0027]

After the various kinds of processing to the captured images under a certain exposure parameter, the images are subjected to distortion correction and image synthesis. A generated omnidirectional image is added with a tag properly and stored in a file in the internal memory or an external storage. Inclination correction can be additionally performed on the basis of the information from the triaxial acceleration sensor 120 or a stored image file can be subjected to compression when appropriate. A thumb-nail image can be generated by cropping or cutting out the center area of an image.

[0028]

In the above-described image processing the exposure parameter for the solid-state image sensors 22A, 22B is determined and set in an exposure condition register 200 by an exposure condition controller 210. The imaging system 10

according to the present embodiment does not need to include a photometer for measuring the brightness of a subject but uses the outputs of the solid-state image sensors 22A, 22B for exposure control. To display a captured image on a LCD or an EVF (electronic view finder), image signals are constantly read from the solid-state image sensors 22A, 22B. The exposure condition controller 210 repeatedly conducts a photometry on the basis of a read image signal and determines whether a brightness level is appropriate, to correct the exposure parameter such as F-value, exposure time (shutter speed), amplifier gain (ISO sensitivity) and obtain a proper exposure.

[0029]

In omnidirectional photographing with the omnidirectional imaging system 10, the two imaging units generate two images. In a photographic scene including a high-brightness object as the sun, a flare may occur in one of the images as shown in FIGs. 4A, 4B and spread over the entire image from the high-brightness object. In such a case a synthetic image of the two images or omnidirectional image may be impaired in quality because an increased offset of the one of the images causes a difference in brightness at the connecting portions. Further, no proper object for exposure correction but an extremely white or black object will appear in an overlapping area of the two images.

[0030]

In the imaging unit using fisheye lenses with total angle of view of over 180 degrees, most of photographic areas do not overlap except for partial overlapping areas. Because of this, it is difficult to acquire a proper exposure for the above scene by exposure correction based only on the overlapping area. Further, even with the proper exposure obtained for the individual imaging units, a discontinuity of color attribute as brightness may occur at the connecting positions of a synthetic image.

[0031]

In view of avoiding insufficient exposure control, in the imaging system 10 the exposure condition controller 210 is configured to evaluate the level of exposure of all of the images with the overlapping area and non-overlapping areas of the images taken into consideration and decide exposure parameters as aperture a , exposure time t and amplifier gain g for the solid-state image sensors 22A, 22B to be set in the exposure condition register 200.

[0032]

Specifically, the exposure condition controller 210 includes an area calculator 212, an overall calculator 214 and an exposure condition determiner 216, and can be realized by the ISPs 108 and CPU 130. In the first processing the ISPs 108A, 108B calculate the integrated value or integrated average value for each divided area and outputs integrated data for each divided area, and the exposure condition controller 210 reads the integrated data.

[0033]

FIGs. 5A, 5B show how to divide an image into small areas by way of example. In the present embodiment incident light on the lens systems 20A, 20B is imaged on the light-receiving areas of the solid-state image sensors 22A, 22B in accordance with a certain projection model such as equidistant projection. Images are captured on the two-dimensional solid-state area image sensors and image data represented in a plane coordinate system. In the present embodiment a circular fisheye lens having an image circle diameter smaller than an image diagonal line is used and an obtained image is a planar image including the entire image circle in which the photographic areas in FIGs. 4A, 4B are projected.

[0034]

The entire image captured by each solid-state image sensor is divided into small areas in circular polar coordinate system with radius r and argument θ in FIG.

5A or small areas in planar orthogonal coordinate system with x and y coordinates in FIG. 5B. It is preferable to exclude the outside of the image circle from a subject of integration and averaging since it is a non-exposed outside area. In the area division of the ISPs 108, each image is divided into small areas as shown in FIGs. 5A, 5B and the integrated value or integrated average value of brightness is calculated for each divided area. The integrated value is obtained by integrating the brightness values of all the pixels in each divided area while the integrated average value is obtained by normalizing the integrated value with the size (number of pixels) of each divided area excluding the outside area.

[0035]

The area calculator 212 receives the integrated data for each divided area including the integrated average value and calculates an index value for each divided area to evaluate a photographic state thereof. In the present embodiment the index value is an area brightness level b for evaluating an absolute brightness of each divided area. The brightness level $b(x, y)$ of a certain divided area is calculated for each solid-state image sensor 22 by the following equation:

$$b(x, y) = s(x, y) \frac{a^2}{t \cdot g} \quad \dots (1)$$

where $s(x, y)$ is an integrated average value for a certain divided area, a is an aperture, t is exposure time, and g is amplifier gain. The brightness level $b(r, \theta)$ of a divided area in a circular coordinate system can be calculated in the same manner.

[0036]

The brightness level $b(x, y)$ is an index value to evaluate the brightness of a subject in each divided area and calculated from the brightness of a pixel value of an actual image according to a current exposure parameter (a, t, g).

[0037]

The overall calculator 214 evaluates the captured images including the overlapping area as a whole on the basis of the calculated brightness level $b^i(x, y)$ and calculates an overall evaluation value with weighting according to an overlapping portion between the photographic areas of the images. Herein, the solid-state image sensors 22A, 22B are referred to as 0th and 1st image sensors and their brightness levels are referred to as $b^0(x, y)$ and $b^1(x, y)$, respectively. In the present embodiment the overall evaluation value is an overall brightness level bT to evaluate the brightness of all the areas of the images or subject brightness as a whole with a certain weighting.

[0038]

The overall brightness level bT^i is calculated for an i -th solid-state image sensor by the following equation:

$$bT^i = \frac{\sum_{x,y} b^0(x, y) \times w^{0i}(x, y) + \sum_{x,y} b^1(x, y) \times w^{1i}(x, y)}{\sum_{x,y} w^{0i}(x, y) + \sum_{x,y} w^{1i}(x, y)} \quad \dots (2)$$

where $b^j(x, y)$ is a brightness level for each divided area of each solid-state image sensor j ($j \in 0, 1$) and $w^{ji}(x, y)$ is a weighted value in weighted averaging for each divided area.

[0039]

As expressed by the above equation, different sets of weighted values $w^{ji}(x, y)$ are used for each solid-state image sensor. The weighted values $w^{ji}(x, y)$ can be adjusted so that a larger value is given to a solid-state image sensor with a lower brightness level to prevent receipt of an influence from a light source. Thus, weighting can be performed properly in accordance with a result of determination about a photographic scene. Further, the small areas (x, y) can be zoned into intermediate areas as overlapping area and non-overlapping area as

indicated by hatching in FIGs. 5A, 5B. The overall brightness level bT^i can be calculated by the following equation, using the brightness level and weighted values for each intermediate area.

$$bT^i = \frac{w1i \times bE^0 + w2i \times bE^1 + w3i \times bC^0 + w4i \times bC^1}{w1i + w2i + w3i + w4i} \dots (3)$$

where bE^0 is a brightness level (average) of an edge area (overlapping area) of the 0th image, bC^0 is a brightness level (average) of a center area (non-overlapping area) of the 0th image, bE^1 is a brightness level (average) of an edge area (overlapping area) of the 1st image, bC^1 is a brightness level (average) of a center area (non-overlapping area) of the 1st image, and $w1i$ to $w4i$ are weighted values of weighted averaging set for each intermediate area of an i -th solid-state image sensor. The basic values of weighted values $w1i$ to $w4i$ can be calculated by the following equations (4):

$$\begin{aligned} W1i &= W2i = A_e / (A_0 + A_1 + 2A_e) \\ W3i &= A_0 / (A_0 + A_1 + 2A_e) \\ W4i &= A_1 / (A_0 + A_1 + 2A_e) \end{aligned}$$

where A_e is the size of the edge areas of the 0th and 1st images, and A_0 and A_1 are the sizes of the center areas of the 0th and 1st images. The calculated basis values can be corrected in accordance with a result of determination about a photographic scene such that a solid-state image sensor with a lower brightness level is given a larger weight.

[0040]

Preferably, the overall calculator 214 can include a weighting setter to set the weighted values $w^{ji}(x, y)$ according to a signal level of a captured image. The weighting setter is configured to create a brightness distribution (histogram) from the brightness levels $b^j(x, y)$ of all the divided areas and analyze a total average

value and brightness distribution for the scene determination. Then, according to a determined scene, it can change the weighted values $w^{ji}(x, y)$ for a certain divided area depending on the brightness level $b^j(x, y)$ for the divided area in question.

[0041]

For example, in a dark scene as night view, the weighting setter sets, by adding a predetermined amount to the area brightness level, the weighted value $w^{ji}(x, y)$ to a larger value for evaluating a divided area with a larger brightness level $b(x, y)$ calculated. Thereby, a bright subject in a dark scene is highly evaluated for photometry and exposure can be properly controlled according to a result of the photometry. Meanwhile, in a bright scene the weighting setter sets a larger weighted value $w^{ji}(x, y)$ for a divided area with a smaller brightness level $b(x, y)$ calculated. Thus, a dark subject in a bright scene is highly evaluated for photometry.

[0042]

Alternatively, a divided area containing an extremely black or white subject can be detected according to an upper limit threshold and a lower limit threshold to exclude the divided area for a subject of the photometry. For example, if a divided area or a white area with a brightness level equal to or over an upper limit threshold (b_{uth}) and/or a divided area or a black area with a brightness level equal to or below a lower limit threshold (b_{lth}) is/are detected, these areas can be given a smaller weight or zero. Thereby, it is possible to calculate the overall brightness level bT with the divided area unsuitable for exposure correction given a small weight or not taken into account.

[0043]

The weighting setter determines a scene of each the 0th and 1st images captured by the two solid-state image sensors 22A, 22B on the basis of a relation

of the brightness between the two images and sets weighted values appropriate for the scene for each of the solid-state image sensors 22A, 22B. For example, to prevent receipt of an influence from a light source, the weighted values $w^{ji}(x, y)$ can be adjusted so that a larger value is given to a solid-state image sensor with a lower brightness level.

[0044]

The exposure condition determiner 216 determines an exposure parameter (a, t, g) for each i-th solid-state image sensor on the basis of the overall brightness level bT^i calculated by the overall calculator 214. The overall brightness level bT is to evaluate the brightness of a subject in the images, and a condition for acquiring a proper exposure can be represented by the following conditions:

$$\frac{a^2}{t} = \frac{bT \cdot g}{K} \quad \dots (4)$$

$$Bv + Sv = Av + Tv \quad \dots (5)$$

where k is a constant, Bv is a brightness value, Sv is a sensitivity value, Av is an aperture value and Tv is a time value. The condition (5) is a transformation of the condition (4) taking 2 as a base of logarithm of each of the four parameters.

[0045]

The four parameters are calculated by the following equations:

$$Av = 2 \log_2 a \quad \dots (6)$$

$$Tv = \log_2 \frac{1}{t} \quad \dots (7)$$

$$Bv = \log_2 (k_1 bT) \quad \dots (8)$$

$$Sv = \log_2 (k_2 g) \quad \dots (9)$$

In the equations (8), (9) k_1, k_2 are constants.

[0046]

Specifically, to satisfy the above exposure conditions, the exposure condition determiner 216 adjusts the aperture a , exposure time t and amplifier gain g for each i -th solid-state image sensors 22 according to a current exposure parameter and a measured subject brightness or overall brightness level and acquires a proper exposure. The corrected exposure parameter (a' , t' , g') can be obtained from the brightness level bT^i , referring to a table called a program diagram which is prepared in advance in accordance with the characteristic of the imaging system 10. Herein, the program diagram refers to a diagram or a table containing the combinations of the amplifier gain g and exposure time t with a fixed aperture a . Exposure values can be determined from the combinations.

[0047]

In the present embodiment an optimal combination of the aperture a , exposure time t and amplifier gain g is obtainable from the overall brightness level bT by a certain program diagram. Alternatively, at least one of the aperture a , exposure time t and amplifier gain g can be manually set and the rest of them can be found from the program diagram. Such automatic exposure mode exemplifies shutter priority mode in which exposure time t is manually set, aperture priority mode in which aperture a is manually set, and sensitivity priority mode in which amplifier gain g is manually set.

[0048]

Hereinafter, the exposure control by the imaging system 10 is described, referring to FIGs. 6, 7. FIG. 6 is a flowchart for the exposure control while FIG. 7 is a flowchart for exposure calculation process of the exposure control. The operation in FIG. 6 is repeatedly executed every time images are captured by the image sensors 22A, 22B. In step S101 the imaging system 10 calculates an integrated average value for each divided area of the two image sensors 22A, 22B

by integrating the pixel values thereof. In step S102 the exposure calculation in FIG. 7 is called up.

[0049]

In FIG. 7 in step S201 the imaging system 10 takes the statistics of integrated average values for the divided areas of each solid-state image sensor 22 to calculate an average and a dispersion (or a standard deviation) of the image. In step S202 the imaging system 10 determines whether a current exposure parameter is in an allowable range from the average and dispersion of the two images to sufficiently evaluate a subject brightness. For example, if the average of the images is close to zero and the dispersion is lower than a certain threshold, it is probable that black saturation occur in the captured images. In contrast, if the average is close to saturation and a dispersion is low, it is probable that white saturation occur in the captured images. The light amount of captured images with black or white saturation cannot be properly measured so that the exposure parameter indicating black or white saturation is determined to be outside the allowable range.

[0050]

With NO in step S202, the imaging system 10 proceeds to step S206 and adjusts an exposure parameter to acquire a proper exposure, and completes the operation in step S207. For instance, with the occurrence of black saturation, the exposure parameter is adjusted so that the aperture is opened and exposure time and sensitivity are increased. In contrast, with the occurrence of white saturation, the exposure parameter is adjusted so that the aperture is closed and exposure time and sensitivity are decreased. When the gain g is fixed, the exposure parameter (a' , t') is adjusted by lowering an exposure value E_v by a predetermined number of steps in black saturation. In white saturation the exposure parameter (a' , t') is adjusted by raising an exposure value E_v by a predetermined number of steps.

When the aperture a is fixed, the exposure parameter (t' , g') is adjusted by increasing the exposure time t and amplifier gain g in black saturation and decreasing them in white saturation.

[0051]

With YES in step S202, the area calculator 212 calculates a brightness level $b^i(x, y)$ for each divided area of the 0th and 1st images on the basis of the integrated average value $s(x, y)$ and a current exposure parameter (a , t , g).

[0052]

In step S204 the overall calculator 214 determines a scene of the images and reads a weighted value $w^j(x, y)$ for the determined scene. In step S205 the overall calculator 214 calculates the weighted average of the brightness levels $b^0(x, y)$ and $b^1(x, y)$ and calculates the overall brightness level bT^i for each i -th solid-state image sensors by the equations (2) and (3). In step S206 the exposure condition determiner 216 adjusts the exposure according to the overall brightness level bT^i to satisfy the conditions (4) and (5) and determines the exposure parameter (a' , t' , g'). Then, the imaging system 10 completes the exposure calculation and returns to step S103 in FIG. 6.

[0053]

In step S103 the exposure parameter in the exposure condition register 200 is updated to the determined exposure parameter (a' , t' , g'), completing the exposure control operation. By repeating the operations in FIGs. 6, 7, the exposure condition is set to a proper exposure satisfying the above conditions (4), (5).

[0054]

In omnidirectional photographing with the omnidirectional imaging system 10, the same subject is captured in the overlapping area, therefore, the brightness levels b of the two images should be the same value. In view of the

occurrence of flares in one of the images as shown in FIGs. 4A, 4B, according to the present embodiment the overall exposure level of the captured images including the overlapping area and non-overlapping areas is evaluated to determine the exposure parameter (a, t, g) for each of the imaging units. Thereby, it is made possible to abate a discontinuity of the brightness at the connecting positions of a synthetic image and generate high-quality synthetic images.

[0055]

Thus, according to the above embodiment, it is possible to provide an imaging controller and imaging control method and program which can provide to each of imaging units a proper imaging condition to abate a discontinuity at the connecting points of the images captured by the imaging units in synthesizing the images.

[0056]

The above embodiment has described an example where two images captured with the lens systems having angle of view of over 180 degrees are overlapped for synthesis. Alternatively, three or more images captured with multiple imaging units can be overlapped for synthesis.

[0057]

Moreover, the above embodiment has described the imaging system 10 to capture an omnidirectional still image as an example of the imaging controller. The present invention should not be limited to such an example. Alternatively, the imaging controller can be configured as an omnidirectional video imaging system or unit, a portable data terminal such as a smart phone or tablet having an omnidirectional still or video shooting function, or a digital still camera processor or a controller to control a camera unit of an imaging system.

[0058]

The functions of the omnidirectional imaging system can be realized by a computer-executable program written in legacy programming language such as assembler, C, C++, C#, JAVA[®] or object-oriented programming language. Such a program can be stored in a storage medium such as ROM, EEPROM, EPROM, flash memory, flexible disc, CD-ROM, CD-RW, DVD-ROM, DVD-RAM, DVD-RW, blue ray disc, SD card, or MO and distributed through an electric communication line. Further, a part or all of the above functions can be implemented on, for example, a programmable device (PD) as field programmable gate array (FPGA) or implemented as application specific integrated circuit (ASIC). To realize the functions on the PD, circuit configuration data as bit stream data and data written in HDL (hardware description language), VHDL (very high speed integrated circuits hardware description language), and Verilog-HDL stored in a storage medium can be distributed.

[0059]

Although the present invention has been described in terms of exemplary embodiments, it is not limited thereto. It should be appreciated that variations or modifications may be made in the embodiments described by persons skilled in the art without departing from the scope of the present invention as defined by the following claims.

Claims

1. An imaging controller comprising:
 - an index calculator to calculate an index value for each of divided areas of images captured by a plurality of imaging units, the index value for evaluating a photographic state of each of the divided areas;
 - an evaluation value calculator to evaluate the images and an overlapping area between the images on the basis of the index value of each divided area calculated by the index calculator and calculate an overall evaluation value; and
 - a condition determiner to determine an imaging condition for each of the imaging units on the basis of the overall evaluation value calculated by the evaluation value calculator.
2. The imaging controller according to claim 1, wherein:
 - the imaging condition includes an exposure condition;
 - the index value of a certain divided area is a first brightness level to evaluate a brightness of the certain divided area;
 - the overall evaluation value is a second brightness level for each of the imaging units to evaluate a total brightness of the images by applying weighting to the overlapping area; and
 - the condition determiner is configured to determine an imaging condition for each of the imaging units on the basis of the second brightness level.
3. The imaging controller according to either claim 1 or 2, further comprising
 - a setter to set, for each of the imaging units, a set of weighted values for the divided areas according to a relation of brightness between the images captured by the imaging units.

4. The imaging controller according to any one of claims 1 to 3, further comprising

a weighting setter to apply weighting to a certain divided area in accordance with the index value calculated for the certain divided area.

5. The imaging controller according to claim 4, wherein

the weighting setter is configured to apply weighting to the divided areas such that in a dark scene a divided area for which a larger index value is calculated is given a larger weighting.

6. The imaging controller according to either claim 4 or 5, wherein

the weighting setter is configured to apply weighting to the divided areas such that in a bright scene a divided area for which a smaller index value is calculated is given a larger weighting.

7. The imaging controller according to any one of claims 4 to 6, wherein

the weighting setter is configured to apply weighting to the divided areas such that a divided area for which the index value as an upper limit threshold or more or a lower limit threshold or less is calculated is given a smaller weighting or zero.

8. The imaging controller according to any one of claims 1 to 7, wherein

the imaging condition includes at least one of an aperture, an exposure time and a gain.

9. An imaging control method comprising the steps of:

calculating an index value for each of divided areas of images captured by a plurality of imaging units, the index value for evaluating a photographic state of each of the divided areas;

evaluating the images and an overlapping area between the images on the basis of the index value of each divided area calculated in the calculating step and calculating an overall evaluation value; and

determining an imaging condition for each of the imaging units on the basis of the overall evaluation value calculated in the evaluating step.

10. A non-transitory computer-readable storage medium storing a program for causing a computer to execute the steps of the imaging control method according to claim 9.

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FIG.1

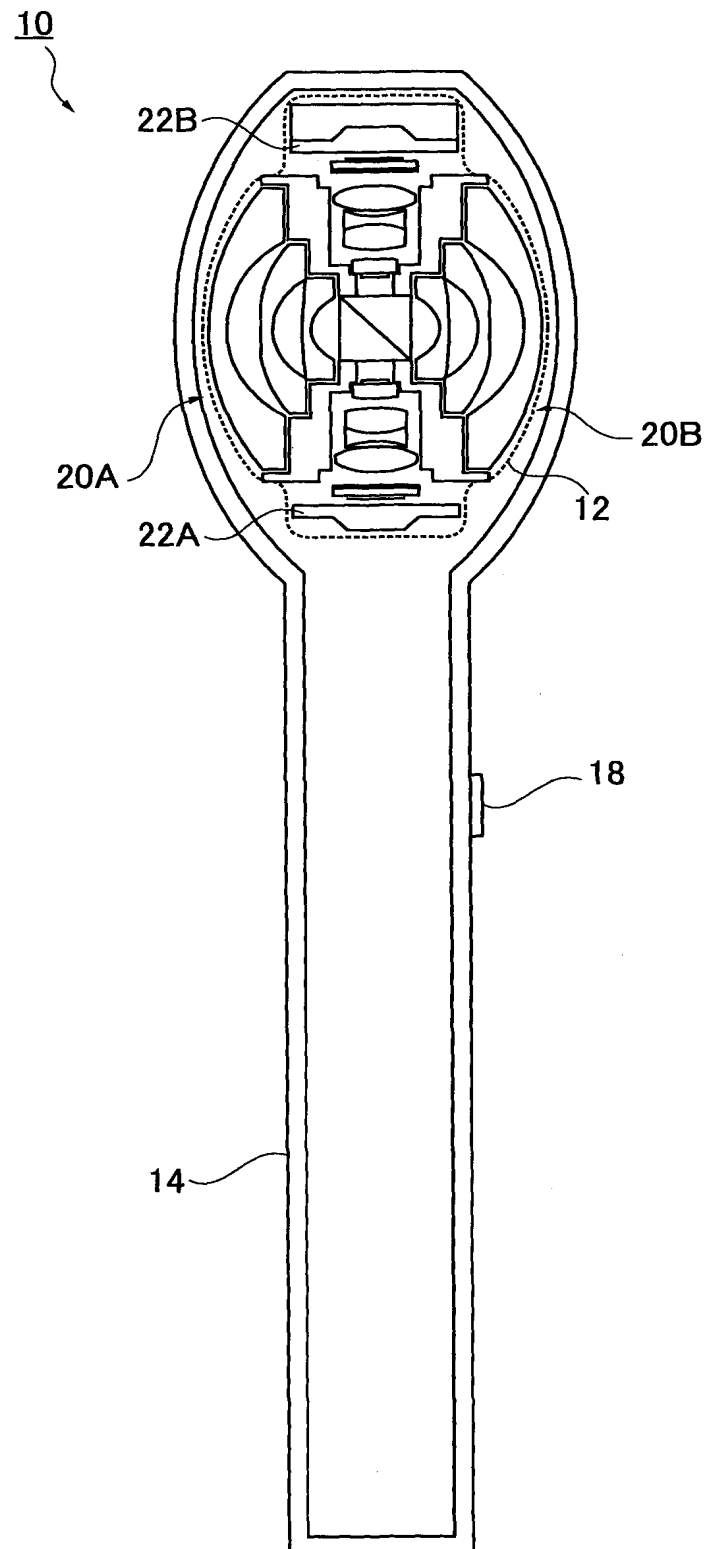
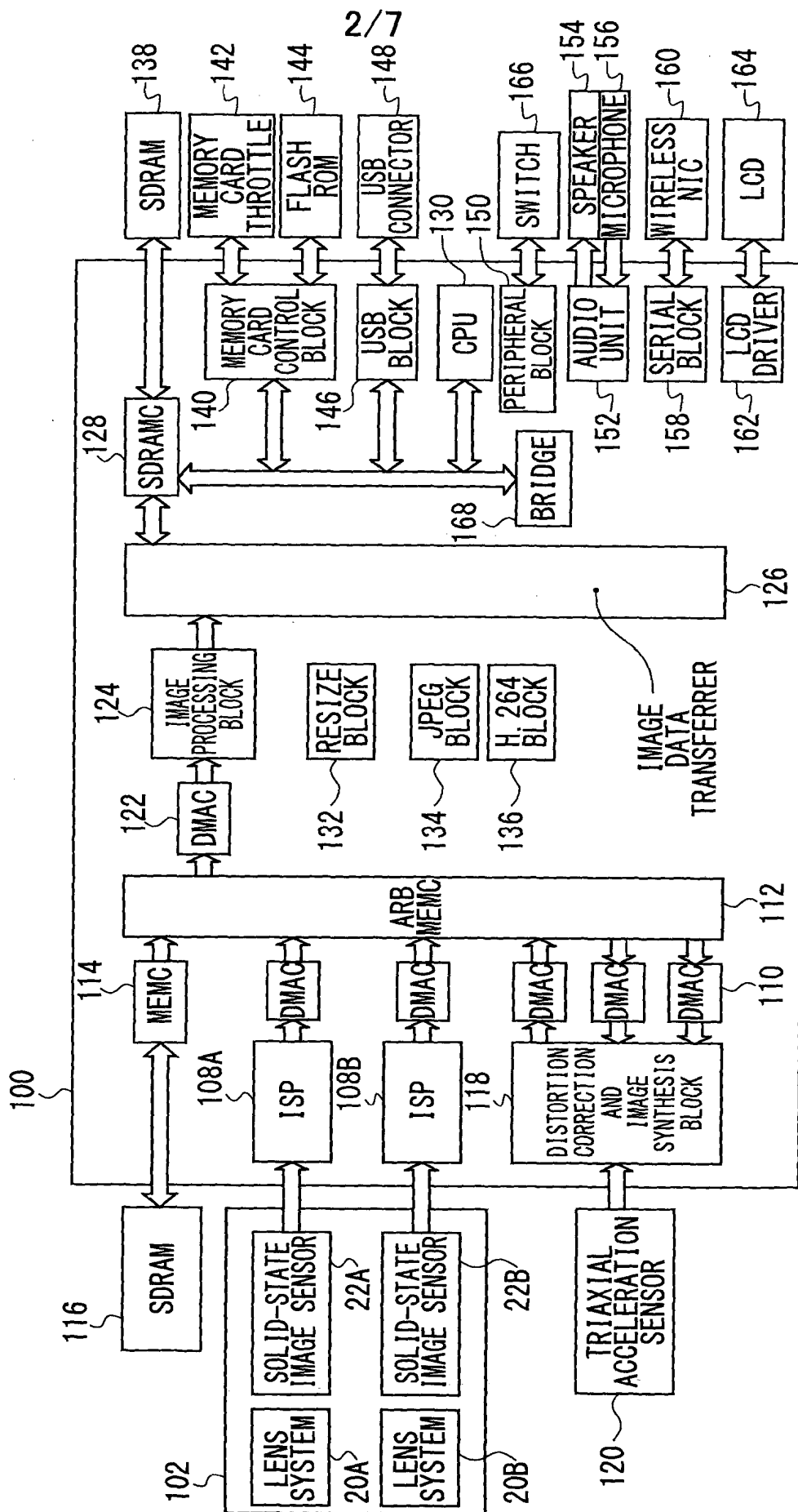


FIG.2



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FIG.3

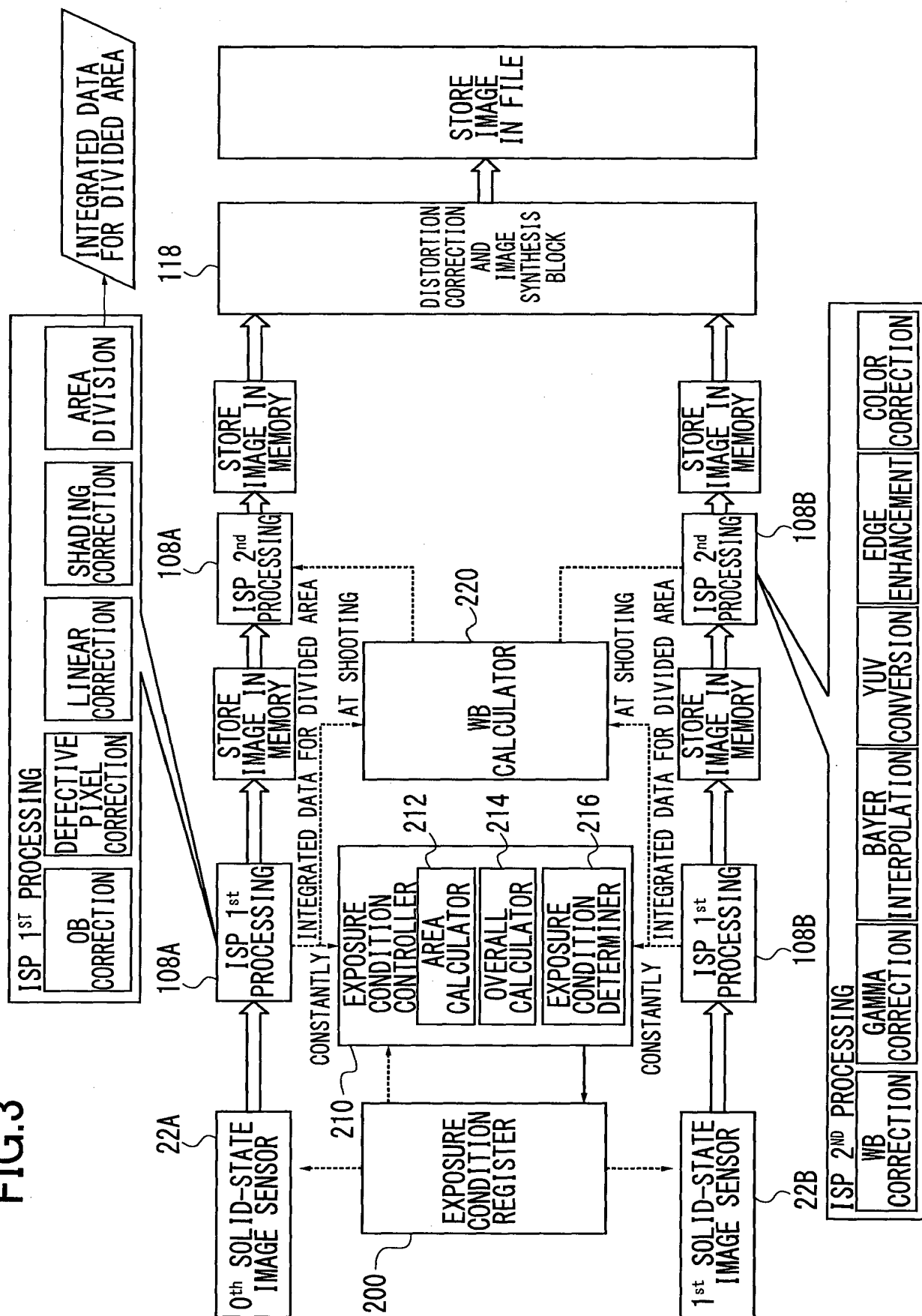


FIG.4A

0TH CAPTURED IMAGE

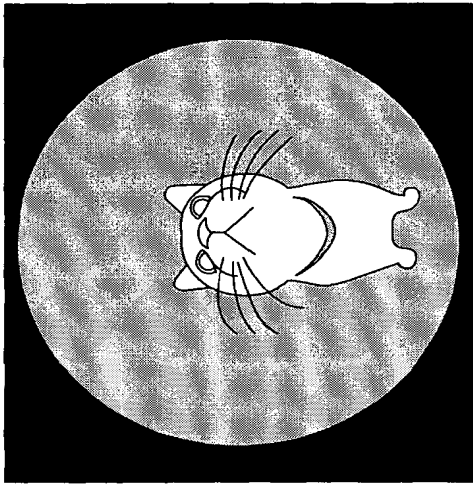
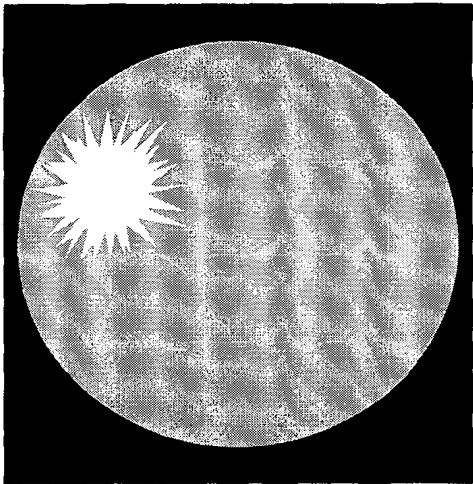


FIG.4B

1ST CAPTURED IMAGE



SYNTHETIC IMAGE

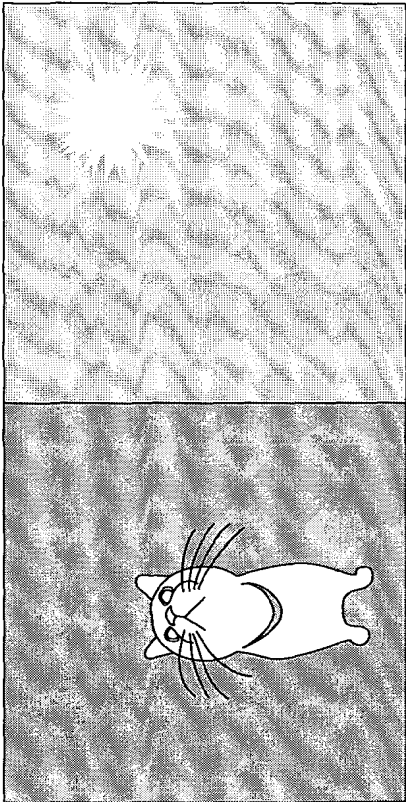


FIG.4C

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FIG.5A

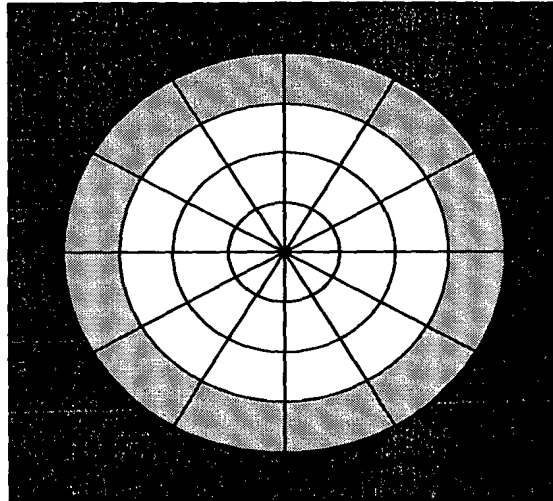
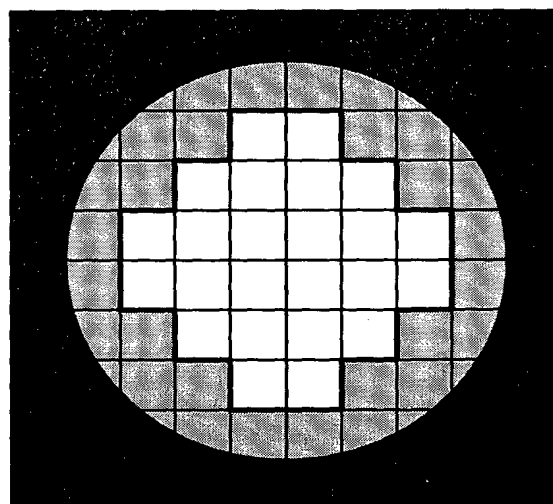
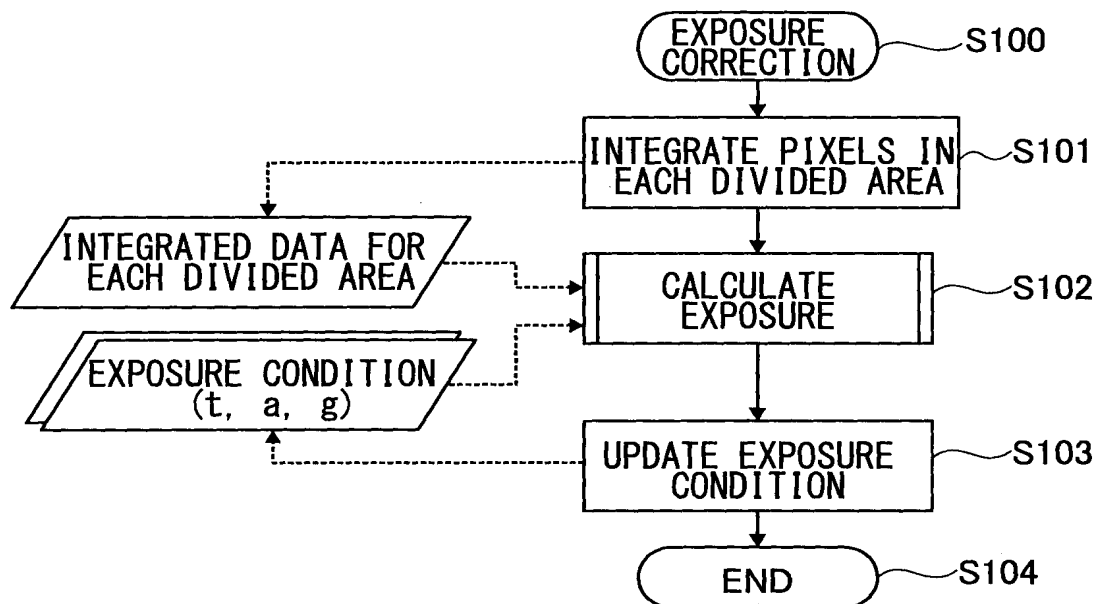


FIG.5B



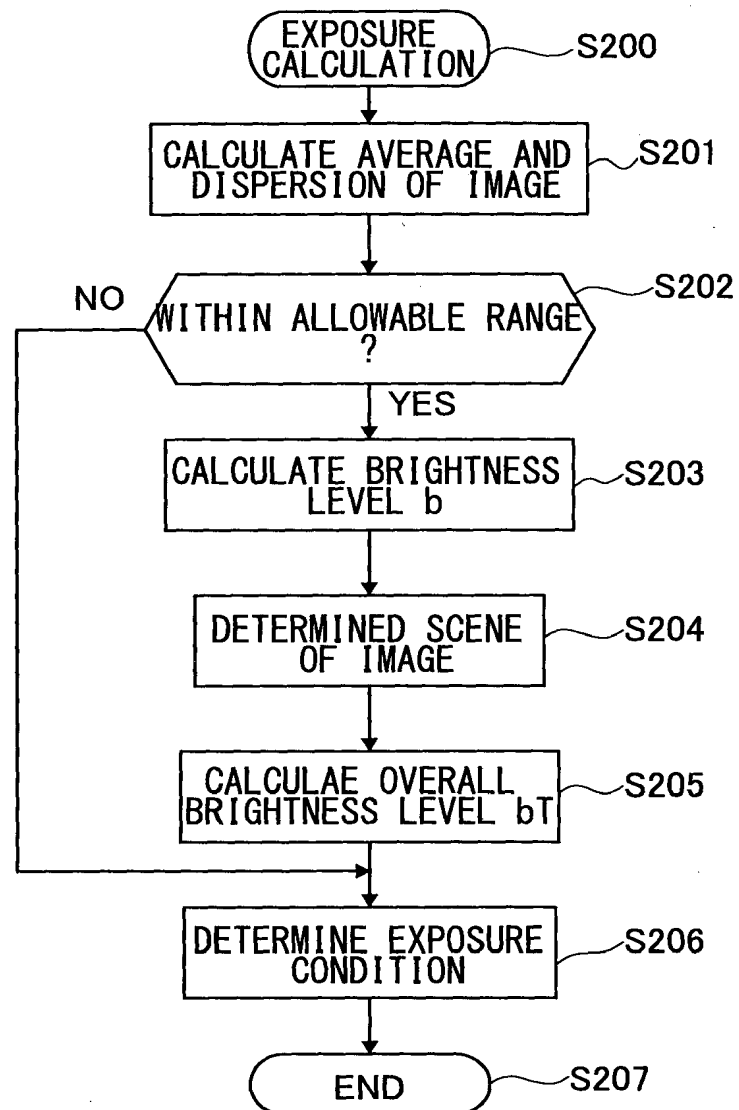
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FIG.6



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FIG.7



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER				
Int.Cl. H04N5/232(2006.01)i, G03B7/28(2006.01)i, G03B15/00(2006.01)i, G03B19/07(2006.01)i, G03B37/04(2006.01)i, H04N5/238(2006.01)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) Int.Cl. H04N5/232, G03B7/28, G03B15/00, G03B19/07, G03B37/04, H04N5/238				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Published examined utility model applications of Japan 1922-1996 Published unexamined utility model applications of Japan 1971-2013 Registered utility model specifications of Japan 1996-2013 Published registered utility model applications of Japan 1994-2013				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
Y A	JP 2003-244511 A (FUJI PHOTO FILM CO., LTD.) 2003.08.29, Paragraphs [0010],[0011] (No Family)	1,3-10 2		
Y A	JP 2007-053617 A (FUJIFILM HOLDINGS CORP.) 2007.03.01, Paragraphs [0081]-[0090], Figs.4,28-31 (No Family)	1,3-10 2		
Y A	JP 2002-281379 A (RICOH COMPANY, LTD.) 2002.09.27, Paragraphs [0107]-[0112], Figs.10,11 (No Family)	1,3-10 2		
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Name and mailing address of the ISA/JP Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan		Authorized officer Takatoshi FUJIWARA Telephone No. +81-3-3581-1101 Ext. 3581 <table border="1"> <tr> <td>5P</td> <td>3354</td> </tr> </table>	5P	3354
5P	3354			

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- (72) Inventor; and
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- (74) Agent: PAPASTERGIOU, Vassilios; 120 Harilaou Trikoupi Str., GR-114 72 Athens (GR).

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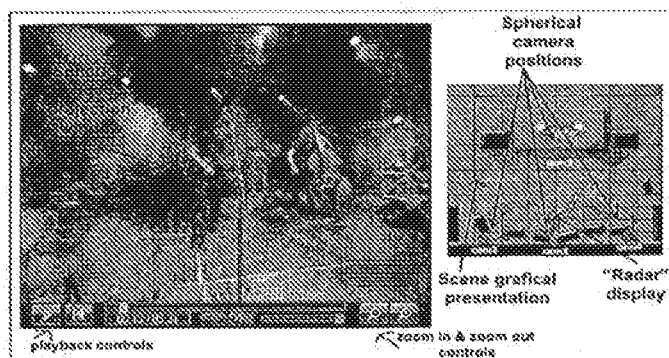


Figure 8:

Drawing presenting the Application of the Method for the synchronized interactive play-back of multiple spherical videos.

(57) Abstract: The Integrated system, method and application for the synchronized interactive play-back of multiple spherical videos, captures in spherical video format of $360^\circ \times 360^\circ$ angle of view events from different positions in space and allows their interactive play-back on a computer or through the internet. The autonomous product allows the interactive play-back of prerecorded events from a DVD. The viewer, during play-back, without interrupting or disrupting it, interactively, can alter the position from which the event is viewed by choosing which one he/she wishes to watch, among several available spherical videos, corresponding to different places in the area where the event took place, alter direction and angle of viewing from the full $360^\circ \times 360^\circ$ angle of view, rotate (turn around) his/her viewing window, approach (zoom-in) and retreat (zoom-out) while the corresponding sound remains synchronized with the projected images.

DESCRIPTION

Integrated system, method and application for the synchronized interactive play-back of multiple spherical video content and autonomous product for the interactive play-back of prerecorded events.

The Integrated system, method and application for the synchronized interactive play-back of multiple spherical video content on a computer or through the internet, involves the synchronous recording of events in multiple spherical videos from different positions in the area where the event takes place, the interactive play-back on the recorded event on a computer or through the internet by means of an interactive application for the synchronized play-back of multiple spherical videos, which offers to the viewer, during the play-back and without interrupting or disrupting it, the capability to interactively choose whichever spherical video they wish to watch from the available alternatives. This choice of a different spherical video corresponds to a virtual shift of the viewer to a different physical viewing position as each spherical video corresponds to a different spherical camera which had been positioned on a predetermined position in the area in which the event took place. In addition to choosing the position from which the event is viewed, the viewer, during the play-back of the event and without interrupting or disrupting it, can interactively alter the angle and direction of viewing as if they were turning their head to whichever direction they wished, as well as approach and move away from the point of interest (zoom-in and zoom-out).

The autonomous product for the interactive play-back of prerecorded events refers to a product in the form of a DVD which operates autonomously in a computer and allows the interactive play-back of an event that has been recorded and produced with the above integrated system. It utilizes an interactive application for the synchronized play-back of multiple spherical videos, in association with a graphical interface. The viewer, during the play-back and without interrupting or disrupting it, is offered the capability to interactively choose whichever spherical video they wish to watch from the available alternatives. This choice of a different spherical video corresponds to a virtual shift of the viewer to a different physical viewing position as each spherical video corresponds to a different spherical camera which had been positioned on a predetermined position in the area in which the event took place. In addition to choosing the position from which the event is viewed, the viewer, during the play-back of the event and without interrupting or disrupting it, can interactively alter the angle and direction of viewing as if they were turning their head to whichever direction they wished, as well as approach and move away from the point of interest (zoom-in and zoom-out).

For the complete recording of an event using conventional video technologies, usually a number of video cameras are required. Those cameras are either stationary, positioned in preselected positions of perceived increased interest or movable. They can be moved and rotated around the vertical and lateral

horizontal axis either by trained personnel (cameramen) or by mechanical means, in order to focus and approach selected points of interest. In all circumstances, the width of view that the video cameras can record is limited despite the availability of a wide range of different lenses, from extreme
5 zooms to extreme wide angles.

Although usually a great number of conventional video cameras is used to record an event it is practically not feasible to record everything that takes place. After the recording of the event, specific sections (scenes) considered
10 to be the most interesting or characteristic from each one of the individual videos from each camera are selected and edited to produce a linear video sequence which finally represents the recorded event. The finished content can be replicated on a variety of media in order to be distributed and reproduced on specific players, transmitted or streamed through the internet
15 and viewed on a suitable screen e.g. a TV.

When an event is transmitted live, the responsible event-director, while the event takes place watches all the available images corresponding to all the available cameras on the event and chooses on the spot which image is
20 transmitted at any time, usually the view from one camera at any given time. This is the view that the viewer watches in a passive way on their TV screen or on their computer screen streamed through the internet.

In both above scenarios, due to both the limitation in the angle of view that
25 conventional video cameras transmit or record, as well as the manner in which the subject to be transmitted or edited at any time is chosen, many aspects of the event are lost, even though viewers might wish to view them. As an example, if it is assumed that the event recorded or transmitted is a concert, the director has to select what to show at any time, from all the different
30 activities taking place at the same time, excluding the rest. As a result, for as long as the director chooses to focus on the singer of the group, a viewer that might have liked wish to watch the guitarist or drummer has no option to do so.

Further still, as it often happens especially in sports, when something of special interest happens, if none of the available cameras is focused on the specific location, the incident is not recorded at all. In car racing, where
35 instances of interest are unpredictable, often such incidents are missed. In conclusion, in the viewing of conventional video content either live or prerecorded, the viewer is presented with a predetermined sequence of images which they can only view passively without any capability to influence the play-back. The view point is predetermined by the positioning of the
40 cameras and the content and subject presented at any time is preselected by the director or the editor.

45 With the Integrated system, the method and application for the synchronized interactive play-back of multiple spherical videos on a computer or through the internet and the autonomous product for the interactive play-back of

prerecorded events in the form of a DVD, every activity and individual happening which take place during an event are recorded in very high resolution digital video format by means of two or more digital spherical video recording devices covering a angle of view of $360^{\circ} \times 360^{\circ}$ (spherical cameras).
5 These devices record digitally on a single image a full sphere surrounding their position. Each such device produces a different spherical representation of the event. Spherical video consists of a sequence of single spherical images (frames) each capturing an angle of view of $360^{\circ} \times 360^{\circ}$ (Figure 1).
10 Therefore, each frame of the spherical video constitutes a panoramic image which represents 360° on the horizontal and 360° on the vertical axis. Depending on the physical dimensions of the area where an event takes place, it is possible that two or more spherical cameras are used, positioned on pre-determined and preselected positions aiming to cover every aspect of the event area and as a result, capture totally every happening, activity and
15 instance that takes place during the event. With two or more spherical cameras (typically four), placed in strategically chosen positions of the event area, 100% of the activities happening on any point of the event area at any time during the event are recorded. At the same time, the sound from the event is recorded in digital format. The spherical videos from every spherical
20 camera and the corresponding sound are played-back synchronized with full interactive user control on a computer or through the internet and are projected in a normalized projection with a rate of 25 or 30 frames per second (depending on the local video system standard, PAL or NTSC) on a computer screen.

25 The viewer has the capability and freedom, at any point in time during the play-back, with out interrupting or disrupting the play-back, with full control using his/her mouse or any other pointing/navigation device, to alter interactively the position from which the event is viewed, by choosing which
30 spherical video he/she wishes to watch at any given time, selecting among the several spherical videos available, each one corresponding to any of the several different spherical cameras, which had been placed on preselected positions in the area where the event took place. In this way, the viewer selects to virtually move between the places where the cameras were
35 positioned and watch the event from these points. At the same time, the viewer has total freedom to choose the direction and width (angle) of viewing from the available full angle of view of $360^{\circ} \times 360^{\circ}$ and also total freedom to rotate (turn around) his/her viewing window, approach (zoom-in) and retreat (zoom-out), while maintaining full interactive control of the spherical video
40 play-back. Irrespective of the interactive alterations in viewing position, angle, direction or virtual distance, the corresponding sound remains synchronized with the projected images.

45 Comparing the Integrated system, the method and application for the synchronized interactive play-back of multiple spherical videos of $360^{\circ} \times 360^{\circ}$ angle of view on a computer or through the internet and the autonomous product for the interactive play-back of prerecorded events in the form of a DVD to conventional event recording, transmission and play-back

technologies, in the former the viewer has at his/her disposal locally or through the internet, multiple alternative full spherical video sequences from an event, each one of which represents a full surrounding sphere and as a result every action, instance or happening in all the area where the event takes place is captured or transmitted during the full duration of the event, each sequence corresponding to one of the several spherical cameras that had been used to capture the event. In contrast, in a conventional event recording, transmission of the same event, the viewer would have at his disposal only the linear sequence of individual and by necessity partial scenes-instances which the event director would have chosen to include in the final presentation of the event.

During the synchronized play-back of an event and without interrupting or disrupting this play-back, the viewer has the ability, whenever he/she chooses, to interactively select any one among the available spherical videos, each one of which has captured the full event duration and watch the event from the position corresponding to the particular place where the particular spherical camera had been positioned. He/she may watch the event from the selected point for as long as he/she wishes, having the capability to focus his/her attention to any particular point or subject in space, by interactively altering his/her direction of view (look around), by turning left or right, up or down, in a range of 360° in all directions (both y- and z- axes) using the interactive rotation controls, approach or retreat using the interactive zoom-in and zoom out controls (moving along the x-axis). In this way, he/she alters interactively the direction and angle of view of the viewing window. In contrast, in a conventional play-back of video material, the viewer would have had no choice with regards to the image presented to him, apart from moving forward or backward in time by means of controls such as rewind, fast forward, previous and next. Even in the restricted cases that the viewer is offered control of alternative angles (e.g. multi-angle DVDs) he/she still has no choice on the actual camera movements which dictate the viewing direction and angle of view as all these would have been fixed during the recording of the event.

With the method and the application for the synchronized interactive play-back of multiple spherical video content of $360^\circ \times 360^\circ$ angle of view on a computer or through the internet and the autonomous product for the interactive play-back of prerecorded events in the form of a DVD, the viewer has full freedom to repeat the play-back of an event while choosing to watch it from a completely different view point (choosing a spherical video from a different spherical camera) but also from a different viewing angle as he/she has the freedom to control interactively the direction and angle of view presented to him/her. In this way, the viewer in every repetition of the play-back of the event has the option to focus on a different point of interest of the same event. In contrast, in a conventional video play-back, the viewer, no matter how many times watched the video, he/she would have watched the same material as the content is fixed and offers no capability of interactive viewpoint control. All camera movements, no matter how elaborate, would have been fixed and the

image content and focus would also have been predetermined with no option to alter. If a particular action or happening was not within the viewing range of one of the available conventional cameras, then it would have not been recorded and there would have been no way to recreate it.

5

During the synchronized play-back of an event and without interrupting or disrupting this play-back, the viewer has the ability, whenever he/she chooses, to interactively select a different spherical video to be projected to him/her. In this way he/she is moving his/her position in space and is transferred virtually to the place where the chosen spherical camera was positioned during the event, while the time-continuity of the play-back is not disrupted. In contrast in a conventional video play-back, the viewer would have no ability to alter his/her position as this would have been fixed by the event director who decides which image from which camera is included in the final linear sequence that is presented to the viewer.

15

Therefore, with the integrated system, the method and the application for the synchronized interactive play-back of multiple spherical videos of $360^{\circ} \times 360^{\circ}$ angle of view on a computer or through the internet and the autonomous product for the interactive play-back of prerecorded events in the form of a DVD, the viewer has total freedom to choose what he/she will watch, from which point in space and towards which direction to focus his/her attention as he/she has total freedom to choose, interactively, at any time, to move to a different position in space (by selecting a different spherical video), to turn his/her viewpoint around at any direction, to approach or retreat, while maintaining control of the temporal play-back. The experience offered to the viewer by watching an event using an application based on the method and for the synchronized interactive play-back of multiple spherical video content of $360^{\circ} \times 360^{\circ}$ angle of view on a computer or through the internet or by using the autonomous product for the interactive play-back of prerecorded events in the form of a DVD, approximates the experience of him/her being actually in the area where the event took place and being free to move around at the same time turning his/her view to focus on points of interest at will. The viewer is not anymore a passive viewer of an event but interacts with and controls the reenaction of the event through the use of an interactive application. The viewer is no more dependent on the choices made by somebody else (the director) regarding what to watch and what not to watch, as in conventional video play-back but instead, he/she assumes actively the role of the director.

The integrated system for the synchronized interactive play-back of multiple spherical videos on a computer or through the internet is based on the method that utilizes multiple digital video sensors arranged in a predefined pattern for the capture of individual conventional videos that are then combined (stitched) together to produce a spherical video. Such a device is the LadyBug 2 spherical camera from Point Grey Research Inc. (Figure 2). Each spherical camera integrates six digital video sensors (the LadyBug 2 integrates six Sony ICX204AQ $1/3''$ 1024x768 progressive scan CCDs). Each individual sensor captures images with a resolution of 1024 x 768 pixels at a rate of up to 30

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frames per second (fps), with sensitivity (gain) between 0dB and 25dB and with shutter speeds between 0.06ms and 34ms. Five sensors are arranged around a horizontal circular pattern in a portrait orientation. In this configuration each sensor covers an angle of view wider than 72° in the horizontal axis and produces images of 1024 pixels vertical by 768 pixels horizontal resolution. The five sensors together produce a composite image with a horizontal resolution of 3840 pixels (768 pixels x 5 images). Due to the arrangement of the five sensors, parts of the neighbouring images, along the vertical edges are common and therefore some overlap is allowed which results in better stitched video images. Stitching together the five individual video images from the five radial sensors, allowing for the necessary overlap, results in composite video images with an angle of view of 360° on the horizontal axis and horizontal resolution of 3500 pixels. The sixth sensor is positioned to aim vertically and produces the top portion (dome) of the spherical image. The bottom part of the image does not present imagery of any interest as it would record the support of the camera and therefore is not captured. The stitched video images at a rate up to 30 fps are sent from the spherical video camera via optical fiber with a transmission speed of 1.2Gbps to a compressor unit where they are compressed in real time in the JPEG standard with variable compression rate and the compressed spherical images are transmitted via a FireWire 1394b connection with a transmission speed of 800Mbps, to a computer where they are either stored in a native RAW format or converted to digital video format, stored and transmitted. When spherical video is captured for PAL countries, 35fps are captured while for NTSC the rate is set to 30fps. The individual spherical RAW images are combined into 5-second long AVI video sequences with an image aspect of 2:1 and 3500 x 1750 pixels horizontal to vertical resolution. These images represent the full surrounding sphere on an orthogonal projection. In parallel to the capture of the spherical video images, the sound of the event is recorded using digital recording technologies in either two or more discrete channels and stored in WAV format. The sound is synchronized with the images and is combined with the images to produce spherical videos with embedded audio which is stored in Quicktime format encoded with the Sorenson 3 algorithm. The audio is also stored separately in MP3 format at 128 kbps, 44.1 Hz stereo.

In order to use the spherical video sequences in the method for synchronized interactive play-back of multiple spherical videos they are converted into FLV format and their resolution is reduced to 1024x512 Pixels with quality setting at 1000 kbps with a key frame every 30 (or 25) frames. The resulting spherical videos (one from each spherical camera) in order to be played back have to be stored on a computer or a removable medium (DVD) or be made available for streaming through the internet. These spherical videos are played-back in a normalized projection, in a similar way as conventional videos projecting part of the sphere in a viewing window and offering the viewer interactive of which part of the sphere to view at any point in time. The application for the synchronized interactive play-back of multiple spherical videos offers the viewer the capability to select interactively which spherical video he/she

wishes to be projected, to select alternative spherical videos while play-back is taking place while all the time during play-back the sound remains synchronized to the projected spherical video images.

- 5 The application for synchronized interactive play-back of multiple spherical videos, presents to the viewer a navigational/control interface (Figure 8), with a window in which the selected spherical video is played-back in a normalized projection, in a similar fashion as a conventional video at a frame rate of 30 or 25 frames per second, depending on territorial video standard (PAL or NTSC).
- 10 By positioning his/her pointing device (e.g. computer mouse) within this projection window, the viewer may control interactively what is projected. He/she may turn around, altering the direction of viewing towards any point in any direction in a 360 degree range. He/she may alter the angle of viewing using zoom-in and zoom-out controls. This is similar to having the capability to move a virtual camera around its position within a 3D real space. Adjacent to the actual spherical video projection window the application interface presents the viewer with a graphical representation of the actual area where the event took place. This graphical representation of the actual scene of the event may be from very simple to very elaborate, without affecting the operation and performance of the application. On this scene graphical representation the positions of the spherical cameras which were used to record the event are shown. By clicking on any of these cameras, the viewer selects it and play-back in the main projection window continues synchronized to the sound but now displaying the spherical video corresponding to the selected camera.
- 15 Video play-back always remains synchronized to the sound and play-back following change of cameras continues from the correct point in time. When a camera is selected, this is indicated also on the scene graphical representation by means of a colour change and by displaying an additional radar-like graphic that depicts the direction and angle of viewing of the selected camera. This graphic is interactively changing with every change effected by the viewer. When the direction is changed, the radar cone moves to show the new direction. When the angle of viewing changes, the radar cone becomes wider or narrower, depending on the alteration effected. Moreover, the viewer, using his/her pointing device on this representation may interactively and directly alter the direction of viewing by dragging this graphic towards the desired point on the scene graphical representation. The image projected in the main projection window follows every change in real time without any disruption or interruption in the play-back. In this way, the graphical representation offers an additional and very useful and viewer friendly navigational and control tool. The application has the capability to highlight the positions of the spherical cameras also on the projection window, superimposing graphical elements on the actual projected spherical video that is played back. Therefore, as the viewer rotates his/her view, when the position of another spherical camera comes within his/her viewport, a graphic element will make this apparent to the viewer by highlighting its relative position. This graphic element will also offer a control link to the viewer who may, by clicking on this graphic, move his/her position to the point where the
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corresponding selected camera was placed, altering the projected spherical video accordingly.

5 As a result, the viewer, from within the application for synchronized interactive play-back of multiple spherical videos, may continuously alter his/her viewing position, direction and angle of view, in a direct and interactive fashion not offered by any other technology currently in use for the play-back of recorded events.

10 The application for synchronized interactive play-back of multiple spherical videos, undertakes and controls the play-back of spherical video on a computer by feeding the projection system with the corresponding spherical video images. As spherical videos have a much higher resolution compared to
15 conventional video content, the play-back system poses increased load to the computer compared to conventional video play-back applications. Yet, spherical videos of reduced resolution (e.g. (1024x512 pixels) can be played back on medium-powered computers of current technology. As computer technology will undoubtedly continue advancing, the method and application for synchronized interactive play-back of multiple spherical videos is not
20 dependent on nor restricted by the resolution of the spherical videos involved.

The application based on the method for synchronized interactive play-back of multiple spherical videos utilizes the Adobe FLASH libraries to implement the play-back of spherical videos locally on a computer or through the internet
25 using Adobe Flash Media Server or similar. The application for synchronized interactive play-back of multiple spherical videos receives as input all the available spherical videos in FLV format as produced by the available spherical cameras on an event and digital audio in MP3 format. The spherical videos may be stored locally on the computer, in a removable magnetic or
30 optical medium (Hard Disk or DVD) or in a Web Server which makes them available for viewing through Adobe Flash Media Server. The application for synchronized interactive play-back of multiple spherical videos implements the necessary graphics engine using the Sandy3D "open source" 3D graphics library for Flash objects in association to the Flash video play-back libraries of
35 Adobe Flash. The encoding of the complete application for synchronized interactive play-back of multiple spherical videos is based on the ActionScript 3.0 programming language through Adobe Flash. These technologies enable the application for synchronized interactive play-back of multiple spherical videos to be executed locally or by means of a removable medium (HD or
40 DVD) or, embedded in the web pages of a web site, on any computer that connects to this site.

The graphics engine generates a sphere and projects, in real time, at 30 or 25
45 fps, on its internal surface, as texture the spherical image that is supplies by the video play-back system. This is implemented with the "*sphere = new Sphere('sphere', radius, segmentsW, segmentsH)*" command of the "primitive" library of the Sandy 3D graphics engine. This command generates a sphere with a given radius and polygonal count (Figure 3) which constitute the sphere

geometry (segments). The sphere radius is estimated based on the width of the available spherical video image. The polygonal count of the sphere geometry is usually set to 30. The bigger this number, the better the quality of the projected image but at the same time the generation of the sphere will become slower and this will inevitably lead to delays in the projection, therefore, the value chosen constitutes an acceptable compromise for the given parameters of computer power, and spherical image resolution. Using the *"material = new VideoMaterial(video, UpdateMS)"* command of the "materials" library of the Sandy 3D graphics engine, the spherical video to be projected is assigned as material (VideoMaterial) for the sphere and with the *"app = new Appearance(material)"* and the *"sphere.appearance = app"* commands of the "materials" library of the Sandy 3D graphics engine, the spherical image is assigned as texture for the sphere.

Next, the Sandy 3D graphics engine creates a virtual camera using the command *"camera = new Camera3D(width, height, fov)"*, where *"width"* and *"height"* are the relative dimensions of the projection window and *"fov"* is the field of view (angle of view) of the virtual camera in degrees. The virtual camera is positioned in the centre of the sphere (Figure 3), using the command *"camera.x = camera.y = camera.z = 0"* of the Sandy 3D graphics engine (values of zero are assigned to all the virtual camera co-ordinates (x,y,z)).

The image projected on the projection window becomes thereafter the image as viewed by the camera based on the above settings, all of which may be altered interactively by the viewer during play-back of the spherical video. The viewer as a result is given the view of the selected virtual camera and is therefore virtually placed on the same position as the position from which the virtual camera looks towards the spherical image. The viewer may rotate the virtual camera interactively to point to any direction inside the sphere, using his/her pointing device and in so doing his/her field of view is altered to reflect the movement of the virtual camera.

The co-ordinate system used by the Sandy 3D graphics engine assigns x to the axis going through the camera lens, y to the axis vertical with respect to the camera and z to the lateral axis, sideways from the camera. This distinction is necessary because there is a discrepancy between the projection window and the camera/sphere co-ordinate system (Figure 4). As a result, the x-axis of the projection window corresponds to the z-axis of the camera/sphere co-ordinate system, while the y-axis in both systems refers to the vertical axis. As the projection window is two dimensional, there is no need to reference the third axis which is the x-axis on the camera/sphere co-ordinate system and refers to forward/backward movement of the camera. Such movements are not allowed in the current application.

The viewer watches always the spherical video in a normalized projection, which in effect is the projection of the part of the spherical surface that corresponds to the virtual camera field of view, on a rectangle with the

dimensions given above. The viewer may interactively stop or fast forward the play-back of the spherical video, rewind or even start play-back from the beginning using the controls available on the navigational interface. These controls execute the corresponding Flash commands. The PLAY control executes the Flash "play()" command, and commences play-back of
5 whichever spherical video is currently selected. The PAUSE control executes the Flash "pause()" command, which pauses play-back of whichever spherical video is currently selected at the point in time where the control was pressed. The STOP control executes the Flash "stop()" command, which stops play-
10 back of whichever spherical video is currently selected. There is also a SEEK BAR control which executes the Flash "seek()" command, which moves whichever spherical video is currently selected forward and or backward in time, in relation to where the pointing device is placed. The control/navigation interface of the application for synchronized interactive play-back of multiple
15 spherical videos is shown in Figure 7.

At the same time, the graphics engine allows the viewer to move his/her view towards any direction, up, down, left or right and to widen or narrow his/her angle of view. These movements are implemented by the co-ordination of two
20 distinct and independent movements/rotations, one of the virtual camera, the other of the sphere itself. Which rotation is activated depends on the movements of the pointing device by the viewer. Left clicking the pointing device inside the projection window area stores the initial values of the x- and y- axes co-ordinates of the pointing device, using the "mousePosition.x =
25 stage.mouseX" and "mousePosition.y = stage.mouseY" commands of the Flash library. As the pointing device moves on a 2 dimensional plane (the viewing window on the computer screen, there is no movement on the Z axis. Every subsequent movement of the pointing device by the viewer, while the left click is maintained (click and drag), results in continuous calculation of the differences from the initial co-ordinate values, with the "((mousePosition.y -
30 stage.mouseY)" and "((mousePosition.x - stage.mouseX)" commands where mousePosition.x and mousePosition.y are the initial co-ordinate values while stage.mouseX and stage.mouseY are the final (current) co-ordinate values. The resulting differences lead to the corresponding rotation of either the virtual
35 camera or the sphere. The sphere and/or the virtual camera are rotated by means of the "rotate" command of the Flash library, depending on the kind of movement of the pointing device by the viewer. If the pointing device is moved upwards or downwards, along the y-axis of the projection window co-ordinates, then the projection system rotates the virtual camera accordingly
40 around the X-axis of the sphere 3D space co-ordinates, with the "camera.rotateZ" command (Figure 5). If the pointing device is moved to the left or right, along the x-axis of the projection window co-ordinates, then the projection system rotates the sphere accordingly around the Y-axis of the sphere 3D space co-ordinates, with the "sphere.rotateY" command (Figure 6).

45 When the viewer activates the ZOOM-IN or ZOOM-OUT controls, aiming to widen or narrow his/her angle of view, the projection system alters the field of view of the virtual camera with the "camera.fov" command of the "scenegraph"

library of the Sandy 3D graphics engine. Activating the "camera.fov++" command, the angle of view becomes wider and the viewer appears to move away from the point of interest while activating the "camera.fov--" command, the angle of view becomes narrower and the viewer appears to move closer to the point of interest.

The graphical representation of the area where the event took place, (scene graphical representation), incorporating the positions of the available spherical cameras with the associated links to the corresponding spherical videos, and the radar-like graphical representation of the angle of view and direction of the selected camera, is initially designed using a graphics package such as Adobe Photoshop. The interactive controls are generated in Flash and are connected to the corresponding spherical video files. Therefore, whenever the viewer selects a different camera by clicking on its image on the scene graphical representation, the corresponding spherical video is assigned as texture for the inside surface of the sphere and the portion of it that corresponds to the selected direction and angle of view of the virtual camera is projected on the projection window. At the same time, the selected camera image on the scene graphical representation is highlighted and the radar-like display depicts the direction and angle of viewing. Every pixel on the scene graphical representation diagram constitutes an interactive point and therefore the relative position of the pointing device whenever this is positioned within the scene graphical representation diagram screen area is recorded with the "MouseEvent.MOUSE_UP" command of the Flash "event" library, its colour is altered to indicate that it is an active point. If the viewer clicks over the position of a camera other than the currently selected, this action is recognized in real time with the "MouseEvent.MOUSE_DOWN" command of the Flash "event" library, and the projection system, ceases the projection of the spherical video that was being played back until this moment and starts projecting on the projection window, the spherical video corresponding to the selected camera, from the current position in time, thereby maintaining temporal continuity and synchronization with the sound. These actions are implemented using the "ns.stop()" and "ns.play(video2)" commands and at the same time invokes the command "(radar.visible = true)" to make the radar graphic visible and active for the newly selected camera on the scene graphical representation window. This radar graphic follows and recognizes any movement of the pointing device within the spherical video projection window and is rotated around the corresponding camera image to reflect any changes in the direction and viewing angle. In addition to moving the pointing device within the projection window area, the viewer can alter the viewing direction by click and dragging the pointing device inside the scene graphical representation window to indicate the direction towards which he/she wishes the camera to be turned to. Such movements interactively result in rotations of either the sphere or the virtual camera or both at the same time, in real time and are based on the calculation in real time of the x,y co-ordinates of the position of the pointing device and the differences between initial and final values, in a way similar to the approach described above. When the viewer moves the pointing device within the spherical video projection window, not only the view is altered

accordingly to his/her movements but the radar graphic in the scene graphical representation window rotates accordingly to reflect these changes. When the viewer moves the pointing device within the scene graphical representation window, the radar graphic follows his/her movements while at the same time, the projected view in the spherical video projection window is altered by directing the sphere or the virtual camera or both at the same time, to rotate in real time, according to these movements.

With this capability, the viewer, during play-back and without interrupting or disrupting it, can interactively choose among different cameras, alter viewing direction and angle of viewing. The viewer using the application based on the method for synchronized interactive play-back of multiple spherical videos or the autonomous product for the interactive play-back of one or more prerecorded events in a computer, acts more like a director and not as a passive viewer, having the freedom to control every aspect of his/her viewing experience.

Using Flash commands, the application based on the method for synchronized interactive play-back of multiple spherical videos controls play-back of several spherical videos and synchronized audio at the same time. Initially the application commences play-back of the first assigned spherical video with the command "*play(video1)*" synchronized with the corresponding sound which is played back using the command "*(sound.play())*". When the viewer chooses to move to another camera position, the point in running time based on the sound play-back is recorded in fractions of a second using the "*time = channel.position*" Flash command, where *channel* is the corresponding audio channel. Play-back of the spherical video corresponding to the newly selected camera commences from this point in time using the "*ns.seek(time/1000)*" command where *ns* is the NetStream to which the video is connected. The key to the method for establishing and maintaining synchronization in the play-back of multiple spherical videos and the corresponding sound is to commence play-back of the new spherical video not from the point in time where the previous spherical video was paused but from the point in time which the sound has reached when play-back of the newly selected spherical video is ready to commence. The performance of the application based on the method for synchronized interactive play-back of multiple spherical videos depends on the capabilities of the computer which runs the application, the characteristics and performance of the graphics card, the amount of available memory and several other factors which influence the play-back of the spherical videos and sound and to varying levels introduce delays in the play-back process which would inevitably lead to synchronization loss. For this reason, the application in predetermined time intervals re-synchronizes the spherical video projected at these particular times with the sound by jumping to the spherical video frame corresponding to the sound.

The autonomous product for the interactive play-back of prerecorded events offers to the viewer the ability to repeatedly play-back an event produced

5 using the method for synchronized interactive play-back of multiple spherical videos, on any suitable computer without the need to be connected to the internet. Each product is produced for one or more specific events and include all the spherical videos and the digital audio corresponding to the particular event(s), the application for synchronized interactive play-back of multiple spherical videos and a graphical interface for navigation and control of the application, designed especially for the particular event(s).

10 The viewer through this interface interactively controls the play-back of the event which is projected on his/her computer screen. The viewer watches the play-back while at the same time he/she is given a graphical overview of the event area, by means of the scene graphical representations described above. During the play-back and without interrupting or disrupting it, the viewer has the capability to interactively choose whichever spherical video
15 they wish to watch from the available alternatives. This choice of a different spherical video corresponds to a virtual shift of the viewer to a different physical viewing position as each spherical video corresponds to a different spherical camera which had been positioned on a predetermined position in the area in which the event took place. In addition to choosing the position
20 from which the event is viewed, the viewer, during the play-back of the event and without interrupting or disrupting it, can interactively alter the angle and direction of viewing as if they were turning their head to whichever direction they wished, as well as approach and move away from the point of interest (zoom-in and zoom-out). The viewer using the autonomous product for the
25 interactive play-back of one or more prerecorded events in a computer, acts more like a director and not as a passive viewer, having the freedom to control every aspect of his/her viewing experience.

30 An example of the use of the integrated system, method and application for the synchronized interactive play-back of multiple spherical video content of $360^{\circ} \times 360^{\circ}$ angle of view and the autonomous product for the interactive play-back of prerecorded events, is the recording and reproduction of a concert.

35 For the complete capture of such an event, several spherical cameras, typically four, are placed in carefully chosen positions on and around the concert stage. These cameras record full spheres around them, thereby capturing 100% of the event. In parallel, a digital audio recording system is used to record the sound of the event in uncompressed high quality WAV
40 format. The spherical video sequences are stored in large capacity and high reliability hard disks in the native RAW spherical video format. After the event is over, the spherical videos are converted to AVI format, while the audio is converted to MP3 format. The AVI files are converted to FLV format and their resolution reduced to 1024 x 512 pixels. The FLV files are uploaded to a WEB
45 server where Flash Media Server is installed. The viewer connects to the web site where the event is uploaded and is presented with the application for the synchronized interactive play-back of multiple spherical video content, using

which he/she may watch the event play-back with full interactive control as described earlier, from within his/her web browser application.

5 During the event play-back, the viewer has total freedom to decide on which aspect of the concert he/she wishes to focus on. He/she may move his/her view point continuously in order to follow one particular performer, or even choose to assess the reactions of the crowd. He/she may focus on one musician in order to study and analyze his/her technique for as long as he/she wishes. Moreover, the viewer may choose to watch the event from different
10 positions by virtually moving to different places in the area. While he/she applies such control, play-back remains continuous and synchronized to the sound and the flow of activity is not disrupted nor interrupted in any sense. The viewer is no longer passive but interacts with the play-back through an interactive application that gives the impression that the viewer's experience
15 of the event is not restricted by the decisions of others. If the viewer decides to repeat the play-back of any part or even the full event, he/she may choose to watch it in a completely different way every time.

20 If the event is to be published as an autonomous product for interactive play-back of the concert in DVD format, the corresponding control and navigational interface is designed to suit the particular event. The scene graphical representation is also designed to reflect the scent of the event and the full application is encoded in HTML to create a fully integrated interactive application. The application for the synchronized interactive play-back of
25 multiple spherical video content and all the corresponding spherical video and digital audio files are also included and a Master of the DVD is produced which then may be reproduced (replicated) in whatever quantity is desired by standard industrial processes. The resulting product could be distributed on its own or in combination with other products (e.g combined with a CD or
30 conventional DVD of the event). The owner of the product may play it on any computer with full interactive control and freedom as described above.

CLAIMS

1. Integrated system for the recording and interactive play-back of events by means of spherical video in which events are recorded with digital spherical video recording devices capable of capturing an angle of view of $360^{\circ} \times 360^{\circ}$, the corresponding sound of the event is recorded and synchronized with the spherical videos and the unified sequences of digital spherical videos and sound are played-back under interactive user control on a computer or through the internet and are projected in a normalized projection at a rate of 25 or 30 frames per second on a computer screen, characterized by the synchronized and interactive play-back of multiple spherical videos and the corresponding sound, and the ability to offer to the viewer the capability, at any point in time during the play-back, without interrupting or disrupting the play-back, with full control using his/her mouse or any other pointing/navigation device, to alter interactively the position from which the event is viewed by choosing which spherical video he/she wishes to watch at any given time, selecting among the several available spherical videos, each one corresponding to any of the several different spherical cameras which had been placed on preselected positions in the area where the event took place, choosing in this way to virtually move to the view-points where the spherical cameras had been placed and watch the event from these points, while at the same time he/she maintains total freedom to choose the direction and angle of viewing from the available full $360^{\circ} \times 360^{\circ}$ angle of view and total freedom to rotate (turn around) his/her viewing window, approach (zoom-in) and retreat (zoom-out), while also maintaining full interactive control of the spherical video play-back. Irrespective of the interactive alterations in viewing position, angle, direction or virtual distance, the corresponding sound remains synchronized with the projected images.
2. Method for synchronized interactive play-back on a computer or through the internet of multiple spherical videos and the corresponding sound which are projected in a normalized projection at a rate of 25 or 30 frames per second on a computer screen characterized by the synchronized and interactive play-back of multiple spherical videos and the corresponding sound, offers to the viewer the capability, at any point in time during the play-back, without interrupting or disrupting the play-back, with full control using his/her mouse or any other pointing/navigation device, to alter interactively the position from which the event is viewed by choosing which spherical video he/she wishes to watch at any given time, selecting among the several available spherical videos, each one corresponding to any of the several different spherical cameras which had been placed on preselected positions in the area where the event took place, choosing in this way to virtually move to the view-points where the spherical cameras had been placed and watch the event from these points, while at the same time he/she maintains total freedom to choose the direction and angle of viewing from the available full $360^{\circ} \times 360^{\circ}$ angle of view and total freedom to rotate (turn around) his/her viewing window, approach (zoom-in) and retreat (zoom-out), while also maintaining full interactive control of the spherical video play-back. Irrespective of the interactive alterations in

viewing position, angle, direction or virtual distance, the corresponding sound remains synchronized with the projected images.

5 3. Application for synchronized interactive play-back on a computer or through the internet of multiple spherical videos and the corresponding sound which are stored locally on the play-back computer or are made available for streaming through the internet or are stored in an autonomous optical medium (DVD), are projected in a normalized projection at a rate of 25 or 30 frames per second on a computer screen, characterized by the synchronized and
10 interactive play-back of multiple spherical videos and the corresponding sound, offers to the viewer the capability, at any point in time during the play-back, without interrupting or disrupting the play-back, with full control using his/her mouse or any other pointing/navigation device, to alter interactively the position from which the event is viewed by choosing which spherical video
15 he/she wishes to watch at any given time, selecting among the several available spherical videos, each one corresponding to any of the several different spherical cameras which had been placed on preselected positions in the area where the event took place, choosing in this way to virtually move to the view-points where the spherical cameras had been placed and watch the event from these points, while at the same time he/she maintains total
20 freedom to choose the direction and angle of viewing from the available full 360°x360° angle of view and total freedom to rotate (turn around) his/her viewing window, approach (zoom-in) and retreat (zoom-out), while also maintaining full interactive control of the spherical video play-back.
25 Irrespective of the interactive alterations in viewing position, angle, direction or virtual distance, the corresponding sound remains synchronized with the projected images.

30 4. Autonomous product for the interactive play-back of one or more prerecorded events in a computer, which is available in the form of one or more optical media (DVD), operates locally in the computer of the viewer, offers control and navigational interfaces which enable the viewer to choose freely which part of the event or events wishes to watch in a normalized projection at a rate of 25 or 30 frames per second on the screen of the
35 computer of the viewer, characterized by the synchronized and interactive play-back of multiple spherical videos and the corresponding sound, which are stored in the same optical media (DVD) that constitutes the product, are projected in a normalized projection at a rate of 25 or 30 frames per second on the screen of the computer of the viewer, offers to the viewer the capability,
40 at any point in time during the play-back, without interrupting or disrupting the play-back, with full control using his/her mouse or any other pointing/navigation device, to alter interactively the position from which the event is viewed by choosing which spherical video he/she wishes to watch at any given time, selecting among the several available spherical videos, each
45 one corresponding to any of the several different spherical cameras which had been placed on preselected positions in the area where the event took place, choosing in this way to virtually move to the view-points where the spherical cameras had been placed and watch the event from these points, while at the

- 5 same time he/she maintains total freedom to choose the direction and angle of viewing from the available full 360°x360° angle of view and total freedom to rotate (turn around) his/her viewing window, approach (zoom-in) and retreat (zoom-out), while also maintaining full interactive control of the spherical video play-back. Irrespective of the interactive alterations in viewing position, angle, direction or virtual distance, the corresponding sound remains synchronized with the projected images.

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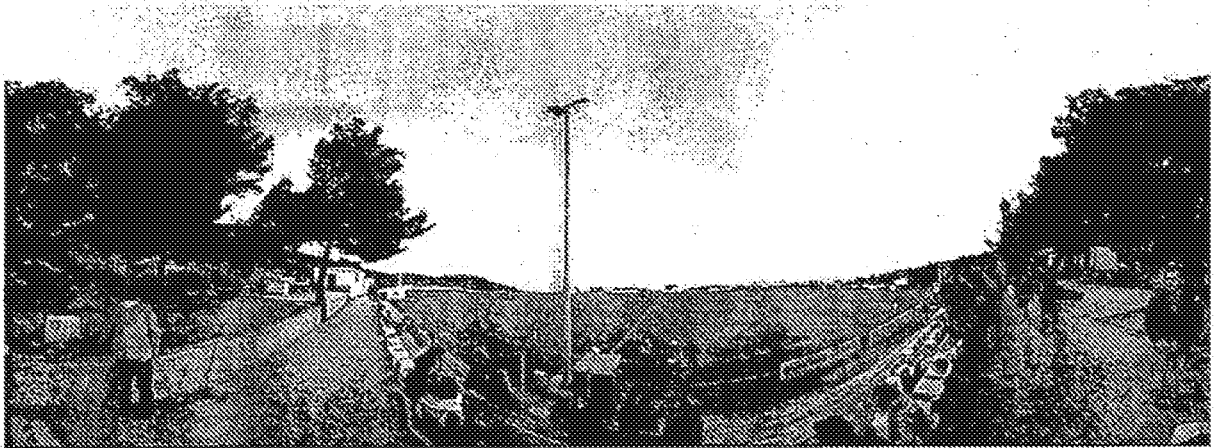


*Figure 1:
Spherical Image (Corresponds to one frame of a spherical video sequence).*

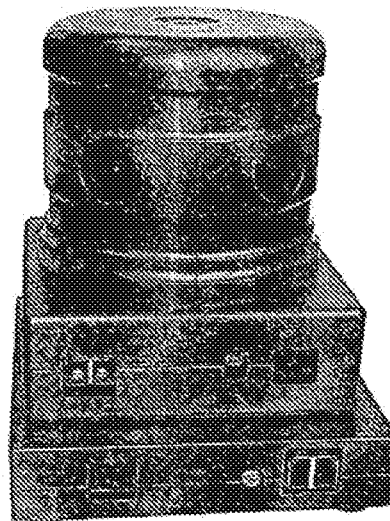


*Figure 2:
Spherical Video Capture Device (Spherical Camera) and Compression Unit (Lower
box)*

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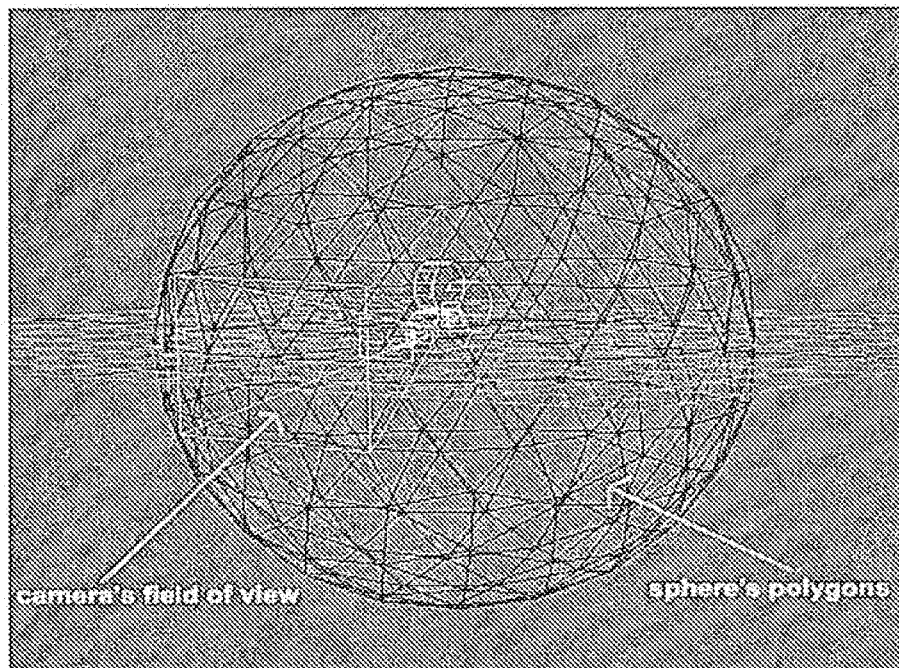


Figure 3:
The Sphere and virtual camera generated by the Graphics Engine.

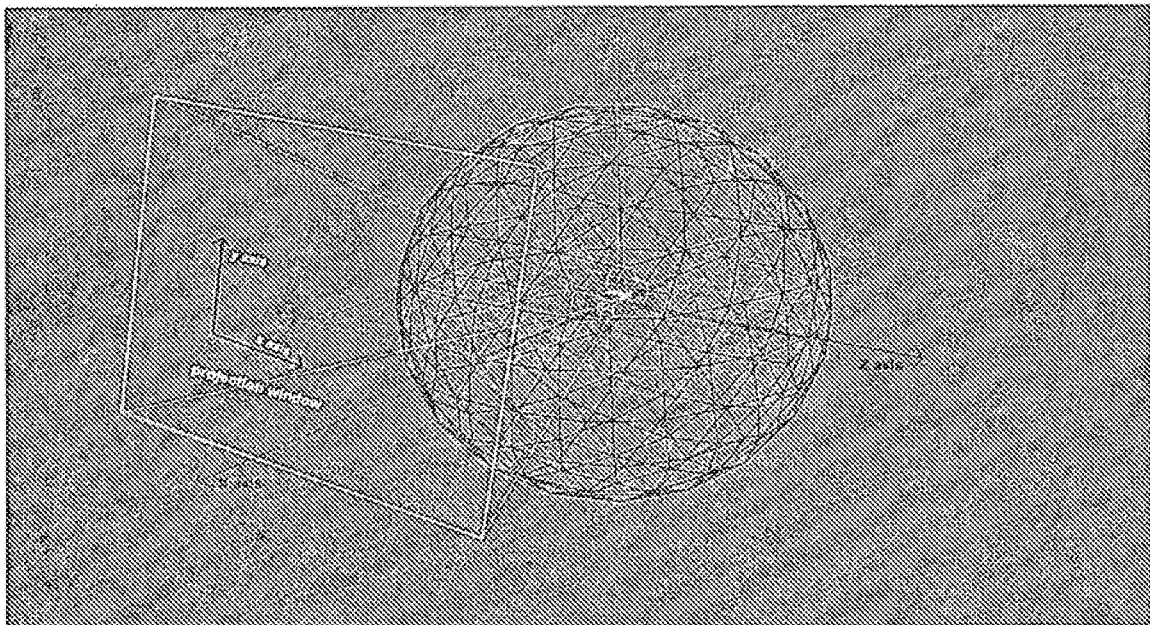


Figure 4:
Correspondence of the Projection Window and the Camera/Sphere Co-ordinate systems.

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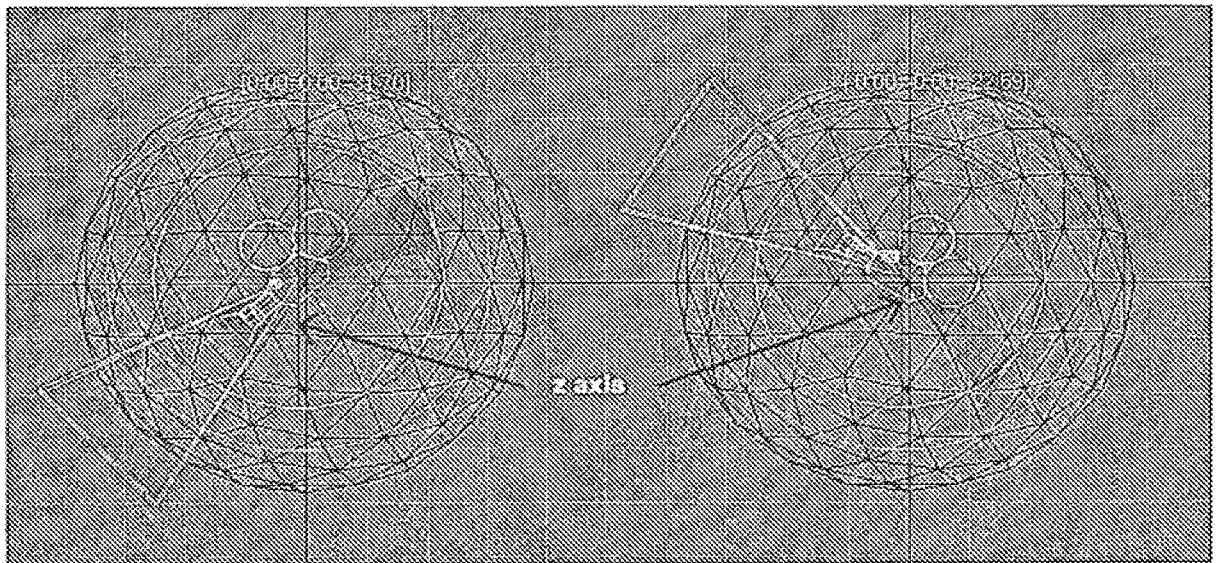


Figure 5:
Camera movement around the z-axis (up and down).

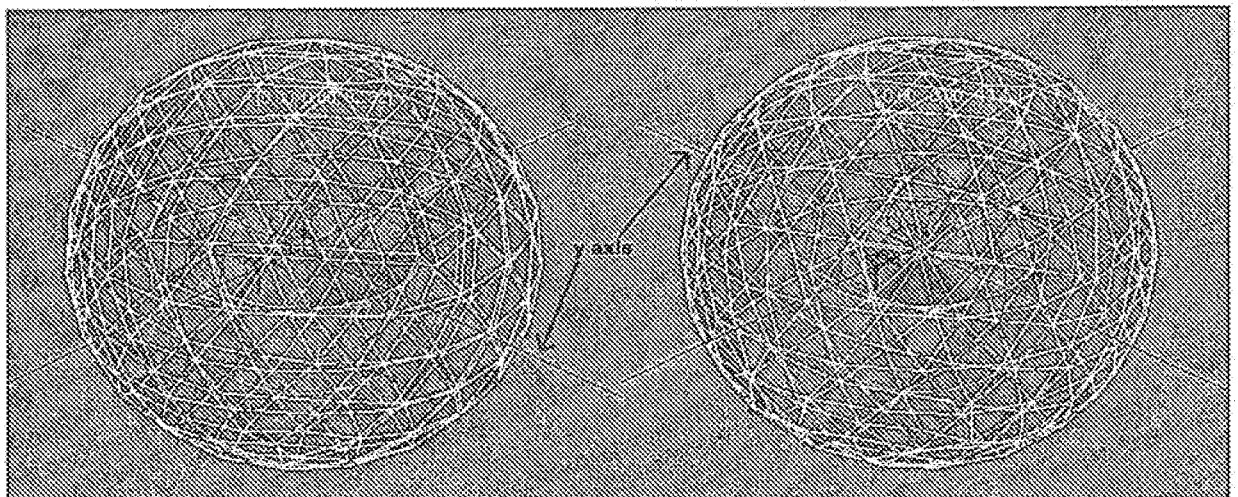


Figure 6:
Camera movement around the y-axis (left or right).

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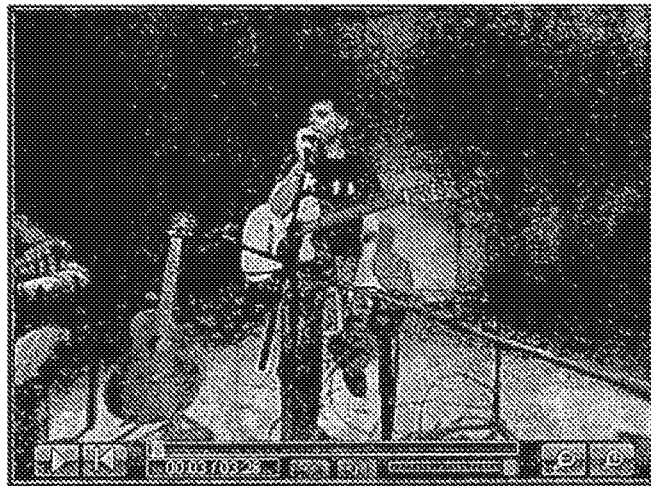


Figure 7:

The viewing window for the normalized projection of spherical video in the application for the synchronized interactive play-back of multiple spherical videos.

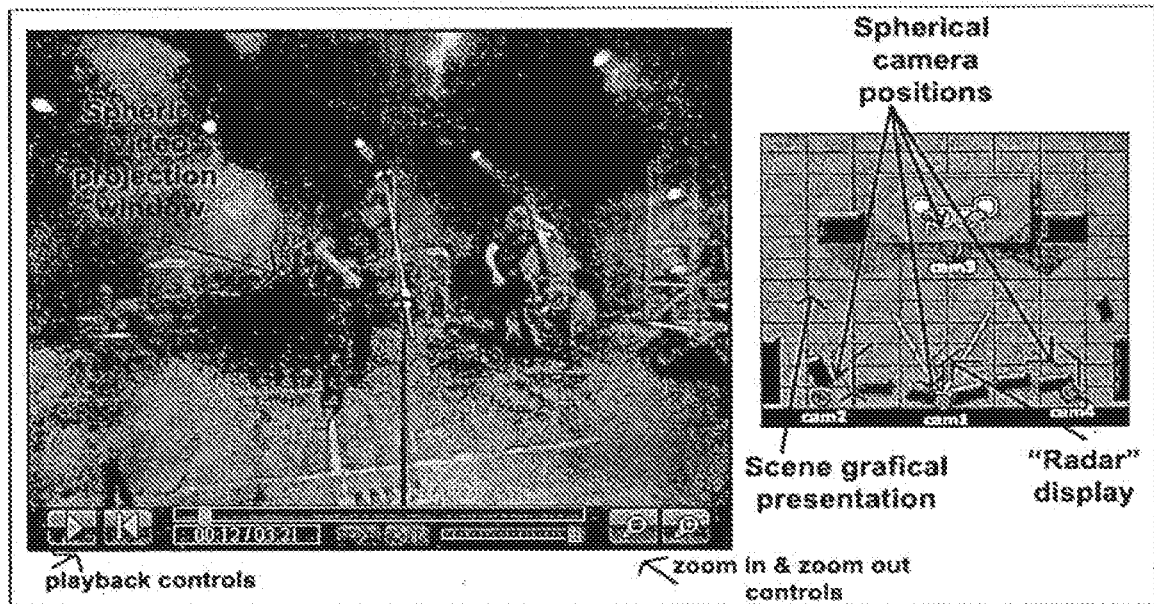


Figure 8:

Drawing presenting the Application of the Method for the synchronized interactive play-back of multiple spherical videos.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/GR2008/000060

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04N5/262 H04N5/232

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 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.
Y	US 2004/075738 A1 (BURKE SEAN [US] ET AL) 22 April 2004 (2004-04-22) abstract paragraphs [0004], [0158] - [0168]; figures 12-14	1-4
Y	MORITA S ET AL: "Networked video surveillance using multiple omnidirectional cameras" COMPUTATIONAL INTELLIGENCE IN ROBOTICS AND AUTOMATION, 2003, PROCEEDINGS, 2003 IEEE INTERNATIONAL SYMPOSIUM ON JULY 16 - 20, 2003, PISCATAWAY, NJ, USA, IEEE, vol. 3, 16 July 2003 (2003-07-16), pages 1245-1250, XP010650320 ISBN: 978-0-7803-7866-7 Section 3.3	1-4

☒ 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 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.

Z document member of the same patent family

Date of the actual completion of the international search

30 January 2009

Date of mailing of the international search report

06/02/2009

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
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Authorized officer

Tillier, Christophe

INTERNATIONAL SEARCH REPORT

International application No
PCT/GR2008/000060

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2005 244410 A (NIPPON TELEGRAPH & TELEPHONE) 8 September 2005 (2005-09-08) the whole document	1-4
A	HEID J: "VR: QUICKTIME'S NEW EDGE" MACWORLD, PC WORLD COMMUNICATIONS, SAN FRANCISCO, CA, US, 1 July 1995 (1995-07-01), pages 1-74, XP002924983 ISSN: 0741-8647 the whole document	1-4

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GR2008/000060

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2004075738	A1	22-04-2004	NONE	
JP 2005244410	A	08-09-2005	NONE	

Form PCT/ISA/210 (patent family annex) (April 2005)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/713,798
	Filing Date	12/13/2019
	First Named Inventor	César Douady
	Art Unit	0000
Page 1 of 1	Matter Number	46DG-026085

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(b), this Information Disclosure Statement is being filed within three months of the filing of a national application other than a continued prosecution application under 37 CFR 1.53(d); within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 in an international application; before the mailing of a first Office Action on the merits; or before the mailing of a first Office Action after the filing of a request for continued examination under 37 CFR 1.114.

CERTIFICATION STATEMENT
No certification statement is required. This Information Disclosure Statement is being filed in accordance with 37 CFR 1.97(b).

FEE
No fee is required. This Information Disclosure Statement is being filed in accordance with 37 CFR 1.97(b). If necessary, the Director is hereby authorized to charge or credit Deposit Account No. 601896 for any additional fees, or any underpayment or credit for overpayment in connection herewith. Please reference attorney docket number 46DG-026085 for any such charge or credit.

ADDITIONAL COMMENTS

SIGNATURE			
Signature	/ Vadim Polonichko /	Date	2020-01-10
Name	Vadim Polonichko	Registration Number	62769

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
United States of America

RECEIVED
PATENT DOCKING

SEP 29 2015

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) **29 SEP 2015**

Applicant's or agent's file reference
29679/PCT

FOR FURTHER ACTION See paragraphs 1 and 4 below

International application No.
PCT/US15/38913

International filing date
(day/month/year) **01 July 2015 (01.07.2015)**

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 90bis.1 and 90bis.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 45bis.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. 571-273-8390

Authorized officer

Shane Thomas

Telephone No. PCT Helpdesk: 571-272-4360
PCT USP: 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 29679/PCT	FOR FURTHER ACTION	
	see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US15/39913	International filing date (day/month/year) 01 July 2015 (01.07.2015)	(Earliest) Priority Date (day/month/year) 03 July 2014 (03.07.2014)
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.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/US15/38913

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G10L 19/008 (2015.01)

CPC - G10L 19/008

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) Classification(s): G10L 19/008; G10L 25/03; H04N 21/2368 (2015.01)

CPC Classification(s): G10L 19/008; G10L 2021/02166; H04R 1/02

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)

PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); Google/ GooglePatents; IEEE; EBSCO; Espacenet.
Keywords: camera; spherical video; audio; channel; tetrahedron; cube; perpendicular; direction.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/0299630 A1 (MCCUTCHEN, D et al.) 25 November 2010; Abstract; paragraphs [0050], [0069], [0092].	1, 7 and 13
Y		2-6, 8-12 and 14-18
Y	WO 2014/090277 A1 (NOKIA CORPORATION) 19 June 2014; Abstract; page 2, lines 9-10; page 13, lines 5-7; page 28, lines 5-8.	2, 8 and 14
Y	US 2013/0177168 A1 (NOKIA CORPORATION) 11 July 2013; Abstract; paragraph [0059].	3, 9, and 15
Y	US 2011/0013778 A1 (TAKUMAI, S) 20 January 2011; Abstract; Figure 12; paragraphs [0068], [0096].	4, 10 and 16
Y	US 2013/0258532 A1 (SPORTVISION, INC.) 7 March 2013; Abstract; paragraphs [0029], [0072].	5, 6, 11, 12, 17 and 18
A	US 2004/0010804 A1 (HENDRICKS, J et al.) 15 January 2004; whole document.	1-18
A	US 2014/0039894 A1 (MICROSOFT CORPORATION) 6 February 2014; whole document.	1-18

☐ 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

"F" 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

"Z" document member of the same patent family

Date of the actual completion of the international search

8 September 2015 (08/09/2015)

Date of mailing of the international search report

29 SEP 2015

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: 571-272-4305
PCT OBP: 571-272-7774

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

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To: Jason E. Amsei
Fenwick & West LLP
Silicon Valley Center
801 California Street
Mountain View, CA 94041
United States of America

Date of mailing
(day/month/year)

29 SEP 2015

Applicant's or agent's file reference
29679/PCT

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US15/38913

International filing date (day/month/year)

01 July 2015 (01.07.2015)

Priority date (day/month/year)

03 July 2014 (03.07.2014)

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

IPC(8) - G10L 19/008 (2015.01)

CPC - G10L 19/008

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 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/
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-8300

Date of completion of this opinion

8 September 2015 (08.09.2015)

Authorized officer

Shane Thomas

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

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Box No. 1 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 43bis.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 13ter.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 13ter.1(a)).
 - ☐ on paper or in the form of an image file (Rule 13ter.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:

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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

1. Statement

Novelty (N)	Claims	2-6, 8-12 and 14-18	YES
	Claims	1, 7 and 13	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-15	NO
Industrial applicability (IA)	Claims	1-18	YES
	Claims	NONE	NO

2. Citations and explanations:

Claims 1, 7 and 13 lack novelty under PCT Article 33(2) as being anticipated by US 2010/0299630 A1 to MCCUTCHEN, D et al. (hereinafter "MCCUTCHEN").

As per claim 1, MCCUTCHEN discloses a method for generating a video with corresponding audio (a plug in service may involve generating an appropriate formatted output image to the HMD device in which the streamed AAC stereo audio channels are synchronized to the video, paragraphs [0068], [0092]), comprising: receiving a spherical video (a spherical immersive image may be displayed, paragraph [0050]); receiving a plurality of audio channels representing audio captured concurrently with the spherical video (an immersive camera may capture a spherical video image in a server-client system for live immersive streaming and the streamed AAC stereo audio channels may be synchronized to the video by the application of a delay to compensate for the latency of the video encoding, paragraphs [0089], [0092]), each of the plurality of audio channels comprising directional audio corresponding to a different direction (the streamed AAC stereo audio channels are synchronized to the video in which a synchronized audio input is provided by external balanced audio stereo line level inputs or the embedded microphones in the camera head and audio 238 may be from four directional (different direction) microphones, paragraphs [0091], [0092]); mapping different spatial regions of the spherical video to different audio channels (mapping system may include immersive video display in which the streamed AAC stereo audio channels may be synchronized to the video and immersive imaging may include spherical imaging in which the Augmentation plug in service may involve augmentation objects arranged using a scene graph, spatial partitioning using a quad tree, Figure 20; paragraphs [0029], [0039], [0074], [0092]); for each of a plurality of frames of the spherical video, extracting a sub-frame having a reduced field of view relative to a field of view of the spherical video (a reduced worldview image of all or most of the spherical image may be displayed in which the Frame Capture plug in service may provide functionality to extract videos and images 116 from immersive motion pictures based on the viewing angles chosen over time, paragraphs [0009], [0050], [0071], [0074]); for each of the sub-frames, determining, by a processor, one or more of the spatial regions overlapping the sub-frame (spatial partitioning may be performed and continuous streaming of immersive video may be done such as encoding image at 30 frames/sec in which the processing steps in the server may include Automatic Sensor Luminance Balance detection based on camera image overlap zones with auto correction, paragraphs [0074], [0092]) and generating a portion of an audio stream from one or more different audio channels corresponding to the one or more spatial regions overlapping the sub-frame (the streamed AAC stereo audio channels may be synchronized to the video and several simultaneous encodings of the continuously streaming immersive video may be done, for example a Flash H.264 audio/video may encode a high quality equirectangular image at 30 frames/sec at a 4 mbps-5 mbps compressed target bit rate, paragraph [0092]); and outputting the generated video and the audio stream (the digital sensor readings from the camera may be processed in a server to make the final streaming video result in which synchronized audio input may be provided, paragraph [0092]).

Continued Within the Next Supplemental Box

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Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claims 8-11 are objected to under PCT Rule 66.2(a)(iii) as containing the following defects in the form or contents thereof: due to their placement and the variance in their preamble language with that of Claim 1, Claims 8-11 have been best understood to depend on Claim 7, not Claim 1.

WRITTEN OPINION OF THE
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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:

Claim 6 is objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because Claim 6 is indefinite for the following reason: "content relevant to the target path" lacks antecedent basis; Claim 6 has been best understood to depend on Claim 5.

Claim 12 is objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because Claim 12 is indefinite for the following reason: "content relevant to the target path" lacks antecedent basis; Claim 12 has been best understood to depend on Claim 11.

Claim 18 is objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because Claim 18 is indefinite for the following reason: "content relevant to the target path" lacks antecedent basis. Claim 18 has been best understood to depend on Claim 17.

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

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Supplemental Box

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

Continued from Box V: Citations and Explanations-

As per claim 7, MCCUTCHEN discloses a non-transitory computer-readable storage medium storing instructions for generating a video with corresponding audio (a data management service for receiving data from the servers may include identification information, and to store the received data in the memory of the computer host in which a plug in service may involve generating an appropriate formatted output image to the HMD device in which the streamed AAC stereo audio channels are synchronized to the video, paragraphs [0044], [0068], [0092]), the instructions when executed by one or more processors causing the one or more processors to perform steps including: receiving a spherical video (a spherical immersive image may be displayed, paragraph [0050]); receiving a plurality of audio channels representing audio captured concurrently with the spherical video (an immersive camera may capture a spherical video image in a server-client system for live immersive streaming and the streamed AAC stereo audio channels may be synchronized to the video by the application of a delay to compensate for the latency of the video encoding, paragraphs [0089], [0092]), each of the plurality of audio channels comprising directional audio corresponding to a different direction (the streamed AAC stereo audio channels are synchronized to the video in which a synchronized audio input is provided by external balanced audio stereo line level inputs or the embedded microphones in the camera head and audio 238 may be from four directional (different direction) microphones, paragraphs [0091], [0092]); mapping different spatial regions of the spherical video to different audio channels (mapping system may include immersive video display in which the streamed AAC stereo audio channels may be synchronized to the video and immersive imaging may include spherical imaging in which the Augmentation plug in service may involve augmentation objects arranged using a scene graph, spatial partitioning using a quad tree, Figure 20; paragraphs [0029], [0039], [0074], [0092]); for each of a plurality of frames of the spherical video, extracting a sub-frame having a reduced field of view relative to a field of view of the spherical video (a reduced worldview image of all or most of the spherical image may be displayed in which the Frame Capture plug in service may provide functionality to extract videos and images 116 from immersive motion pictures based on the viewing angles chosen over time, paragraphs [0009], [0071]); for each of the sub-frames, determining one or more of the spatial regions overlapping the sub-frame (spatial partitioning may be performed and continuous streaming of immersive video may be done such as encoding image at 30 frames/sec in which the processing steps in the server may include Automatic Sensor Luminance Balance detection based on camera image overlap zones with auto correction, paragraphs [0074], [0092]) and generating a portion of an audio stream from one or more different audio channels corresponding to the one or more spatial regions overlapping the sub-frame (the streamed AAC stereo audio channels may be synchronized to the video and several simultaneous encodings of the continuously streaming immersive video may be done, for example a Flash H.264 audio/video may encode a high quality video and the audio stream (the digital sensor readings from the camera may be processed in a server to make the final streaming video result in which synchronized audio input may be provided, paragraph [0092]).

As per claim 13, MCCUTCHEN discloses a media server system for generating a video with corresponding audio (a plug in service may involve generating an appropriate formatted output image to the HMD device in which the streamed AAC stereo audio channels are synchronized to the video, paragraphs [0068], [0092]), the video server system comprising: one or more processors (a server-client system may include the streaming Media Processor, paragraph [0089]); and a non-transitory computer-readable storage medium storing instructions that when executed by the one or more processors causes the one or more processors (a server-client system may include the streaming Media Processor and a data management service for receiving data from the servers that may include identification information for storing the received data in the memory of the computer host, paragraphs [0044], [0089]) to perform steps including: receiving a spherical video (a spherical immersive image may be displayed, paragraph [0050]); receiving a plurality of audio channels representing audio captured concurrently with the spherical video (an immersive camera may capture a spherical video image in a server-client system for live immersive streaming and the streamed AAC stereo audio channels may be synchronized to the video by the application of a delay to compensate for the latency of the video encoding, paragraphs [0089], [0092]), each of the plurality of audio channels comprising directional audio corresponding to a different direction (the streamed AAC stereo audio channels are synchronized to the video in which a synchronized audio input is provided by external balanced audio stereo line level inputs or the embedded microphones in the camera head and audio 238 may be from four directional (different direction) microphones, paragraphs [0091], [0092]); mapping different spatial regions of the spherical video to different audio channels (mapping system may include immersive video display in which the streamed AAC stereo audio channels may be synchronized to the video and immersive imaging may include spherical imaging in which the Augmentation plug in service may involve augmentation objects arranged using a scene graph, spatial partitioning using a quad tree, Figure 20; paragraphs [0029], [0039], [0074], [0092]); for each of a plurality of frames of the spherical video, extracting a sub-frame having a reduced field of view relative to a field of view of the spherical video (a reduced worldview image of all or most of the spherical image may be displayed in which the Frame Capture plug in service may provide functionality to extract videos and images 116 from immersive motion pictures based on the viewing angles chosen over time, paragraphs [0009], [0071]); for each of the sub-frames, determining one or more of the spatial regions overlapping the sub-frame (spatial partitioning may be performed and continuous streaming of immersive video may be done such as encoding image at 30 frames/sec in which the processing steps in the server may include Automatic Sensor Luminance Balance detection based on camera image overlap zones with auto correction, paragraphs [0074], [0092]) and generating a portion of an audio stream from one or more different audio channels corresponding to the one or more spatial regions overlapping the sub-frame (the streamed AAC stereo audio channels may be synchronized to the video and several simultaneous encodings of the continuously streaming immersive video may be done, for example a Flash H.264 audio/video may encode a high quality equirectangular image at 30 frames/sec at a 4 mbps-5 mbps compressed target bit rate, paragraph [0092]); and outputting the generated video and the audio stream (the digital sensor readings from the camera may be processed in a server to make the final streaming video result in which synchronized audio input may be provided, paragraph [0092]).

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WRITTEN OPINION OF THE
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Supplemental Box

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

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Claims 2, 8 and 14 lack an inventive step under PCT Article 33(3) as being obvious over MCCUTCHEN in view of WO 2014/090277 A1 to NOKIA CORPORATION (hereinafter NOKIA'277).

As per claims 2, 8 and 14, MCCUTCHEN discloses the method of claim 1, the non-transitory computer-readable storage medium of claim 7 and the media server system of claim 13. However, MCCUTCHEN fails to disclose wherein generating the portion of the audio stream comprises: weighting each of the plurality of audio channels based on an amount of overlap between the spatial regions and the extracted sub-frame; and combining the weighted plurality of audio channels to generate the portion of the audio stream. NOKIA'277 discloses wherein generating the portion of the audio stream (a surround sound processor instance may be configured to output a multichannel output audio signal track, page 2, lines 8-10); comprises: weighting each of the plurality of audio channels based on an amount of overlap between the spatial regions and the extracted sub-frame (the number of channels output that may be of audio signal may at least one of the two processor instances be selected determining a spatial region within which at least one of the two processor instances may apply spatial processing and in which each audio frame may be 20 milliseconds long and may have an overlap of 10 milliseconds (amount of overlap) between frames, page 2, lines 9-10; page 13, lines 5-7; page 26, lines 5-6); and combining the weighted plurality of audio channels to generate the portion of the audio stream (a surround sound processor instance may be configured to output a multichannel output audio signal track in which the mixer may be configured to generate a difference between the tracks or instances or a weighted additive combination, page 2, lines 8-10; page 37, lines 13-15). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of MCCUTCHEN to include wherein generating the portion of the audio stream comprises: weighting each of the plurality of audio channels based on an amount of overlap between the spatial regions and the extracted sub-frame; and combining the weighted plurality of audio channels to generate the portion of the audio stream, as taught in NOKIA'277, for the benefit of using an advanced signal processing for recording and or amplifying real multi-channel audio from the desired direction.

Claims 3, 9 and 15 lack an inventive step under PCT Article 33(3) as being obvious over MCCUTCHEN in view of US 2013/0177168 A1 to NOKIA CORPORATION (hereinafter NOKIA'168).

As per claims 3, 9 and 15, MCCUTCHEN discloses the method of claim 1, the non-transitory computer-readable storage medium of claim 7 and the media server system of claim 13. MCCUTCHEN further discloses wherein each of the plurality of audio channels corresponds to a direction (the streamed AAC stereo audio channels are synchronized to the video in which a synchronized audio input is provided by external balanced audio stereo line level inputs or the embedded microphones in the camera head and audio 238 may be from four directional microphones, paragraphs [0091], [0092]). However, MCCUTCHEN fails to disclose wherein each of the plurality of audio channels corresponds to a direction perpendicular to a face of a tetrahedron. NOKIA'168 discloses wherein each of the plurality of audio channels corresponds to a direction perpendicular to a face of a tetrahedron (each microphone may be considered to be directed perpendicular to a face of a tetrahedron, paragraph [0059]). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of MCCUTCHEN to include wherein each of the plurality of audio channels corresponds to a direction perpendicular to a face of a tetrahedron, as taught in NOKIA'168, for the benefit of providing a method and apparatus for enhancing audio capture and recording flexibility with respect to microphones orientation and positioning.

Claims 4, 10 and 16 lack an inventive step under PCT Article 33(3) as being obvious over MCCUTCHEN in view of US 2011/0013778 A1 to TAKUMAI, S (hereinafter TAKUMAI').

As per claims 4, 10 and 16, MCCUTCHEN discloses the method of claim 1, the non-transitory computer-readable storage medium of claim 7 and the media server system of claim 13. MCCUTCHEN further discloses wherein each of the plurality of audio channels corresponds to a direction (the streamed AAC stereo audio channels are synchronized to the video in which a synchronized audio input is provided by external balanced audio stereo line level inputs or the embedded microphones in the camera head and audio 238 may be from four directional microphones, paragraphs [0091], [0092]). However, MCCUTCHEN fails to disclose wherein each of the plurality of audio channels corresponds to a direction perpendicular to a face of a cube. TAKUMAI' discloses wherein each of the plurality of audio channels corresponds to a direction perpendicular to a face of a cube (the speaker array apparatus may be installed in a shape such as a cube and the gain of the audio beams of respective channels that may be of the test sound output from speaker array 10 while sweeping may be the highest in a recommended listening position of the user such as perpendicular to the front surface (face of a cube) of the speaker array 10, Figure 12; paragraphs [0007], [0068], [0076], [0096]). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of MCCUTCHEN, to include wherein each of the plurality of audio channels corresponds to a direction perpendicular to a face of a cube, as taught in TAKUMAI', for the benefit of providing speaker array apparatus to adjust audio beams for high quality sound output.

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US15/38913

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
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Claims 5, 6, 11, 12, 17 and 18 lack an inventive step under PCT Article 33(3) as being obvious over MCCUTCHEN in view of US 2013/0058532 A1 to SPORTVISION, INC. (hereinafter "SPORTVISION").

As per claim 5, MCCUTCHEN discloses the method of claim 1. MCCUTCHEN further discloses wherein a camera capturing the spherical video (an immersive camera may capture a spherical video image in a server-client system for live immersive streaming, paragraph [0089]). However, MCCUTCHEN fails to disclose wherein comprising: receiving video metadata including location data pertaining to a location of a camera capturing the spherical video and timing data pertaining to a time of capture of the spherical video; receiving user metadata representing a target path, the target path comprising a sequence of time-stamped locations corresponding to a target; determining the sub-frame as having content relevant to the target path. SPORTVISION discloses comprising: receiving video metadata including location data pertaining to a location of a camera capturing the spherical video (two or more cameras may be positioned to capture images of the event that may be at the locations in the event facility, paragraphs [0025], [0028]) and timing data pertaining to a time of capture of the spherical video (images may be received that can be from video of a sporting event such that of the moving object from multiple cameras at different time points during a time interval, paragraph [0004]); receiving user metadata representing a target path (the position and/or path of an object may be determined and the user interface display may provide information to a human operator based on the data received from the cameras, paragraphs [0003], [0072]), the target path comprising a sequence of time-stamped locations corresponding to a target (the processing facility 140 may include equipment which receives and stores the captured images, time stamps the captured images using a common clock, and processes the captured images to determine the position and/or path of the object, paragraph [0029]); determining the sub-frame as having content relevant to the target path (the path of the object may be determined and the technique may include measuring the position of the ball in multiple video frames from multiple cameras, paragraphs [0043], [0045]). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of MCCUTCHEN to include wherein comprising: receiving video metadata including location data pertaining to a location of a camera capturing the spherical video and timing data pertaining to a time of capture of the spherical video; receiving user metadata representing a target path, the target path comprising a sequence of time-stamped locations corresponding to a target; determining the sub-frame as having content relevant to the target path, as taught in SPORTVISION, for the benefit of providing a method to determine position and path of an object using asynchronous camera by capturing images at various time points.

As per claims 6, 12 and 18, a combination of MCCUTCHEN and SPORTVISION discloses the method of claim 5, the non-transitory computer-readable storage medium of claim 11 and the media server system of claim 17. However, MCCUTCHEN discloses wherein determining the sub-frame as having content relevant to the target path comprises: determining a direction of the target relative to the camera based on the video metadata and the user metadata; and selecting the sub-frame based on the direction. SPORTVISION discloses wherein determining the sub-frame as having content relevant to the target path comprises: determining a direction of the target relative to the camera based on the video metadata and the user metadata (series of images can be combined to depict different locations of the object along the path; and the statistical information regarding the object can be also be obtained, including speed, direction, distance traveled, height, time in the air and so forth and measuring the position of the ball in multiple video frames may be from multiple cameras, paragraphs [0030], [0046]); and selecting the sub-frame based on the direction (Cameras may be used to track an object [0025] and the rate of image capture may be needed (selecting) such as for example thirty frames or sixty fields per second that may be to determine the position and/or path (direction) of the object which is a function of the speed of the object, paragraphs [0025], [0026]). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of MCCUTCHEN to include wherein determining the sub-frame as having content relevant to the target path comprises: determining a direction of the target relative to the camera based on the video metadata and the user metadata; and selecting the sub-frame based on the direction, as taught in SPORTVISION, for the benefit of providing a method to track object accurately at desired locations using cameras and capturing images at different times and determine its path.

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

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Supplemental Box

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

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As per claims 11 and 17, MCCUTCHEN discloses the non-transitory computer-readable storage medium of claim 7 and the media server system of claim 13. MCCUTCHEN further discloses wherein the instructions when executed further causing the one or more processors (a server-client system may include the streaming Media Processor and a data management service for receiving data from the servers that may include identification information for storing the received data in the memory of the computer host, paragraphs [0044], [0089]) to perform steps including: a camera capturing the spherical video (an immersive camera may capture a spherical video image in a server-client system for live immersive streaming, paragraph [0089]). However, MCCUTCHEN fails to disclose wherein steps including: receiving video metadata including location data pertaining to a location of a camera capturing the spherical video and timing data pertaining to a time of capture of the spherical video; receiving user metadata representing a target path, the target path comprising a sequence of time-stamped locations corresponding to a target; determining the sub-frame as having content relevant to the target path. SPORTVISION discloses wherein steps including: receiving video metadata including location data pertaining to a location of a camera capturing the spherical video (two or more cameras may be positioned to capture images of the event that may be at the locations in the event facility, paragraphs [0025], [0028]) and timing data pertaining to a time of capture of the spherical video (images may be received that can be from video of sporting event such that of the moving object from multiple cameras at different time points during a time interval, paragraph [0004]); receiving user metadata representing a target path (the position and/or path of an object may be determined and the user interface display may provide information to a human operator based on the data received from the cameras, paragraphs [0003], [0072]), the target path comprising a sequence of time-stamped locations corresponding to a target (the processing facility 140 may include equipment which receives and stores the captured images, time stamps the captured images using a common clock, and processes the captured images to determine the position and/or path of the object, paragraph [0029]); determining the sub-frame as having content relevant to the target path (the path of the object may be determined and the technique may include measuring the position of the ball in multiple video frames from multiple cameras, paragraphs [0043], [0045]). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of MCCUTCHEN to include wherein steps including: receiving video metadata including location data pertaining to a location of a camera capturing the spherical video and timing data pertaining to a time of capture of the spherical video; receiving user metadata representing a target path, the target path comprising a sequence of time-stamped locations corresponding to a target; determining the sub-frame as having content relevant to the target path, as taught in SPORTVISION, for the benefit of providing a method to determine position and path of an object using asynchronous camera by capturing images at various time points.

Claims 1-18 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.