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[Continued on next page]

(54) Title: INTERACTIVE ILLUMINATION FOR GESTURE AND/OR OBJECT RECOGNITION

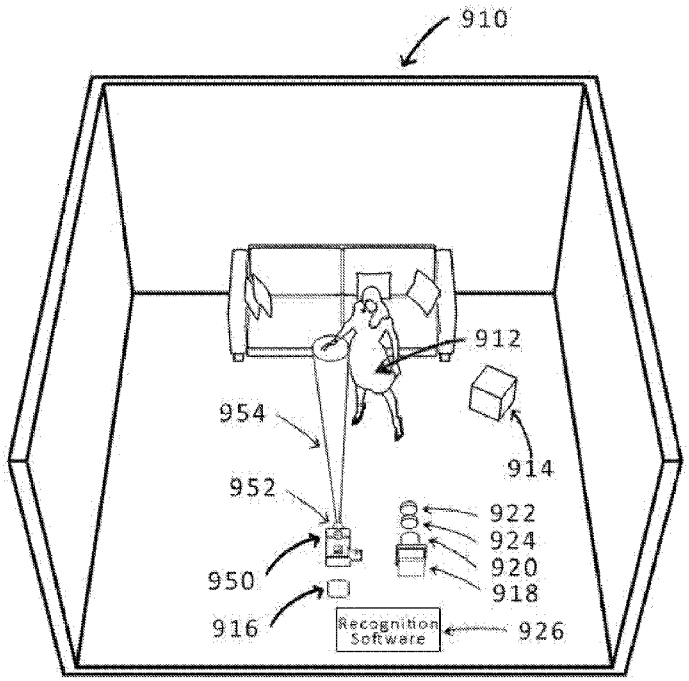

Figure 9

(57) Abstract: Methods and systems described here may be used for target illumination and mapping. Certain embodiments include a light source and an image sensor, where the light source configured to, communicate with a processor, scan a target area within a field of view, receive direction from the processor regarding projecting light within the field of view on at least one target, the image sensor configured to, communicate with the processor, receive reflected illumination from the target area within the field of view, generate data regarding the received reflected illumination; and send the data regarding the received reflected illumination to the processor.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/050551

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G01B 11/25 (2014.01)
USPC - 348/135
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) - G01B 11/00, 11/03, 11/25 (2014.01)
USPC - 348/135; 372/109; 463/36; 715/863

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - G01B 11/024, 11/2518 (2013.01)

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 2011/0212778 A1 (WELLS) 01 September 2011 (01.09.2011) entire document	1-5,16,20,23,27,28,30-34,45,49,52,56,57,59-62,64-68,110,113,115,118 ----- 6-15,17-19,21,22,24-26,29,35-44,46-48,50,51,53-55,58,63,69,111,112,114,116,117,119
Y	US 2009/0278684 A1 (PETRICOIN, JR.) 12 November 2009 (12.11.2009) entire document	6,10-13,17-19,24,25,35,39-42,46-48,53,54,63,69
Y	US 2012/0051588 A1 (MCELDOWNEY) 01 March 2012 (01.03.2012) entire document	7-9,14,15,21,22,26,29,36-38,43,44,50,51,55,58,111,112,114,116,117,119
Y	US 2010/0296535 A1 (WALSH et al) 25 November 2010 (25.11.2010) entire document	8,9,26,37,38,55
A	US 2003/0052169 A1 (TSIKOS et al) 20 March 2003 (20.03.2003) entire document	1-69,110-119
A	US 6,877,662 B2 (TSIKOS et al) 12 April 2005 (12.04.2005) entire document	1-69,110-119
A	US 2011/0013024 A1 (PRYOR) 20 January 2011 (20.01.2011) entire document	1-69,110-119
A	US 2012/0157200 A1 (SCAVEZZE et al) 21 June 2012 (21.06.2012) entire document	1-69,110-119

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

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

Date of the actual completion of the international search	Date of mailing of the international search report
21 February 2014	06 MAR 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/050551

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See extra sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-69,110-119

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Continuation of Box III.

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for more than one species to be examined, the appropriate additional examination fees must be paid. The species are as follows:

Species I) wherein the illumination source and the image sensor share an aperture and which a throw angle of the directed illumination and a field of view angle of the reflected captured illumination are matched, Figure 50A

Species II) receiving information regarding illuminating the at least one select target with at least one calibrated pattern of light, the information allowing the processor to determine distance to the at least one select target via triangulation of the illumination and received reflected illumination; and information regarding structured light of the at least one received reflected illumination patterns, Figures 36, 50B, 50C

Species III) an image sensor having a dual band pass filter, Figure 9, element 924

Species IV) projecting square wave illumination to at least one select target, wherein the square wave includes at least a leading edge and a trailing edge; send information to the processor regarding the time the leading edge of the square wave illumination was projected and the time the trailing edge ofthe square wave was projected, generate a signal based on the received reflected square wave illumination, wherein the signal includes at least information regarding the received time of the leading edge and received time ofthe trailing edge of the square wave; and send the signal regarding the received reflected square wave illumination to the processor, Figure 49A

Species V) an illumination device configured to project low level full scan illumination to a target area, set a value of the number of image pulses for one scan, calculate the energy intensity of each pulse, calculate the total intensity per frame, and compare the total intensity per frame to an eye safety limit; the computing system further configured to, direct the illumination device to scan if the total intensity per frame is less than the eye safety limit, and direct the illumination device to stop scan if the total intensity per frame is greater than or equal to the eye safety limit, Figure 22

Species VI) a directed light source receiving direction to track a selected target within the target area from the processor; receiving direction to project an image on the tracked selected target from the processor; projecting an image on the tracked selected target according to the received direction, Figure 20

Species VII) determining a biometric analysis of at least one target, Figure 43

Species VIII) conducting an incremental scan, wherein each increment has a unique outbound angle from the light source aperture, and a unique inbound angle to the image sensor aperture; send data regarding the incremental outbound angles to the processor, wherein the data regarding the outbound angles and the data regarding the inbound angles include information used to calculate a distance from the system to the target via triangulation; and wherein the distance between light source aperture and the image capture aperture is relatively fixed, Figure 44A

The claims are deemed to correspond to the species listed above in the following manner:

Species I) Figure 50A; claims 60-69
Species II) Figures 36, 50B, 50C; claims 70-89, 150-159
Species III) Figure 9, element 924; claims 90-99
Species IV) Figure 49A; claims 100-109
Species V) Figure 22; claims 120-129
Species VI) Figure 20; claims 130-149
Species VII) Figure 43; claims 160-169
Species VIII) Figure 44A; claims 170-179

The following claims are generic: claims 1-59, 110-119

The species listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons:

Species I) Figure 50A; have the special technical feature of wherein the illumination source and the image sensor share an aperture and which a throw angle of the directed illumination and a field of view angle of the reflected captured illumination are matched. This special technical feature is not present in species II, III, IV, V, VI, VII or VIII.

Species II) Figures 36, 50B, 50C; have the special technical feature of receiving information regarding illuminating the at least one select target with at least one calibrated pattern of light, the information allowing the processor to determine distance to the at least one select target via triangulation of the illumination and received reflected illumination; and information regarding structured light of the at least one received reflected illumination patterns. This special technical feature is not present in species I, III, IV, V, VI, VII or VIII.

Species III) Figure 9, element 924; have the special technical feature of an image sensor having a dual band pass filter. This special technical feature is not present in species I, II, IV, V, VI, VII or VIII.

Species IV) Figure 49A; have the special technical feature of projecting square wave illumination to at least one select target, wherein the square wave includes at least a leading edge and a trailing edge; send information to the processor regarding the time the leading edge of the square wave illumination was projected and the time the trailing edge ofthe square wave was projected, generate a signal based on the received reflected square wave illumination, wherein the signal includes at least information regarding the received time of the leading edge and received time ofthe trailing edge of the square wave; and send the signal regarding the received reflected square wave illumination to the processor. This special technical feature is not present in species I, II, III, V, VI, VII or VIII.

Species V) Figure 22; have the special technical feature of an illumination device configured to project low level full scan illumination to a target area, set a value of the number of image pulses for one scan, calculate the energy intensity of each pulse, calculate the total intensity per frame, and compare the total intensity per frame to an eye safety limit; the computing system further configured to, direct the illumination device to scan if the total intensity per frame is less than the eye safety limit, and direct the illumination device to stop scan if the total intensity per frame is greater than or equal to the eye safety limit. This special technical feature is not present in species I, II, III, IV, VI, VII or VIII.

Species VI) Figure 20; have the special technical feature of a directed light source receiving direction to track a selected target within the target area from the processor; receiving direction to project an image on the tracked selected target from the processor; projecting an image on the tracked selected target according to the received direction. This special technical feature is not present in species I, II, III, IV, V, VII or VIII.

Species VII) Figure 43; have the special technical feature of determining a biometric analysis of at least one target. This special technical feature is not present in species I, II, III, IV, V, VI or VIII.

Species VIII) Figure 44A; have the special technical feature of conducting an incremental scan, wherein each increment has a unique outbound angle from the light source aperture, and a unique inbound angle to the image sensor aperture; send data regarding the incremental outbound angles to the processor, wherein the data regarding the outbound angles and the data regarding the inbound angles include information used to calculate a distance from the system to the target via triangulation; and wherein the distance between light source aperture and the image capture aperture is relatively fixed. This special technical feature is not present in species I, II, III, IV, V, VI or VII.

Species I, II, III, IV, V, VI , VII and VIII lack unity of invention because even though the inventions of these species require the technical feature of a method or apparatus or system for target illumination and mapping, comprising, a light source, which is a directed, laser, or light source, and an image sensor; the light source configured to, communicate with a processor; scan a target area within a field of view; receive direction from the processor regarding projecting light within the field of view on at least one target; the image sensor configured to, communicate with the processor; receive reflected illumination from the target area within the field of view; generate data regarding the received reflected illumination; and send the data regarding the received reflected illumination to the processor, wherein the signal includes at least information that would allow the processor to map the target area and generate an image of the target area, the light scanning system using triangulation to map data, this technical feature is not a special technical feature as it does not make a contribution over the prior art in view of US 2003/0052169 A1 (TSIKOS et al) 20 March 2003 (20.03.2003). Tsikos et al. teaches a method or apparatus (para. 3) or system (para. 17) for target illumination and mapping (para. 17), comprising, a light source, which is a directed, laser, or light source (diode lasers, para. 19) and an image sensor (para. 153); the light source configured to, communicate with a processor; scan a target area within a field of view; receive direction from the processor regarding projecting light within the field of view on at least one target; the image sensor configured to, communicate with the processor (para. 1408-1409); receive reflected illumination from the target area within the field of view; generate data regarding the received reflected illumination; and send the data regarding the received reflected illumination to the processor (para. 1426), wherein the signal includes at least information that would allow the processor to map the target area and generate an image of the target area, the light scanning system using triangulation to map data (para. 1389).

Species I, II, III, IV, V, VI , VII and VIII lack unity of invention because even though the inventions of these species require the technical feature of using an infrared light in a target illumination and mapping system, this technical feature is not a special technical feature as it does not make a contribution over the prior art in view of US 6,877,662 B2 (TSIKOS et al) 12 April 2005 (12.04.2005) col. 339, lines 44-67.

Since none of the special technical features of the Species I, II, III, IV, V, VI, VII and VIII inventions is found in more than one of the inventions, unity of invention is lacking.