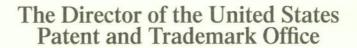
# The United States of America



Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

## **United States Patent**

*Grants to the person(s) having title to this* patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, or importing into the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

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### US009930314B2

# (12) United States Patent

Pimenov et al.

# (54) STEREO-APPROACH DISTANCE AND SPEED METER

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- (\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 324 days.
- (21) Appl. No.: 14/584,276
- (22) Filed: Dec. 29, 2014
- (65) **Prior Publication Data**US 2015/0109421 A1 Apr. 23, 2015

### Related U.S. Application Data

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- (30) Foreign Application Priority Data

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- (51) Int. Cl. H04N 13/02 (2006.01) G01C 3/14 (2006.01) (Continued)

(Continued)

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(58) Field of Classification Search CPC . G01C 11/12; G01C 3/14; G06T 2207/30252; G06T 7/0075;

(Continued)

(56) References Cited

### U.S. PATENT DOCUMENTS

7,106,365	B1*	9/2006	Sogawa	B60R 1/00
8,164,629	B1 *	4/2012	Zhang	348/148 G06T 7/20 348/142

(Continued)

### FOREIGN PATENT DOCUMENTS

RU	2092869	CI	10/1997
RU	96951	UI	8/2010
	(	Cont	inued)

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### (57) ABSTRACT

Disclosed a stereo-approach distance and speed meter system comprising: video camera module consisting of at least two video cameras focused on the analyzed object primary interface module for video camera module interface conversion into data for processing; primary image normalization and rectification module; updating data container module; attribute extraction module; attribute ranking module; primary attribute reorganization module; primary frame matching module; primary hypothesis generation module; primary hypothesis filter module; attribute post-organization module; secondary attribute matching module; secondary hypothesis generation module; secondary filter module; buffer improvement module, stereo refinement module; sequence refinement module; triangulation module; secondary rectification module; previous frame data and attribute container module; secondary interface module.

### 19 Claims, 1 Drawing Sheet

