Exhibit 3

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(12) United States Patent

Foxlin et al.

(54) TRACKING OBJECTS WITH MARKERS

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- Assignee: InterSense, LLC, Billerica, MA (US) (73)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1546 days.
- Appl. No.: 11/543,008 (21)
- (22)Filed: Oct. 4, 2006

Prior Publication Data (65)

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Related U.S. Application Data

- (60)Provisional application No. 60/723,648, filed on Oct. 4, 2005.
- (51) Int. Cl. G06K 9/00 (2006.01)
- (52)U.S. Cl. 382/103; 348/135; 348/137; 348/139; 348/142; 348/146; 348/169; 348/208.8
- Field of Classification Search 382/103; (58)348/135, 137, 139, 142, 146, 169, 208.2 See application file for complete search history.

(56)**References** Cited

U.S. PATENT DOCUMENTS

5,615,132	А	3/1997	Horton et al.	
6,373,047	B1	4/2002	Adan et al.	
6,474,159	B1	11/2002	Foxlin et al.	
6,603,865	B1 *	8/2003	Yagi et al.	382/103
6,611,141	B1 *	8/2003	Schulz et al.	324/226
6,681,629	B2	1/2004	Foxlin et al.	
6,937,255	B2 *	8/2005	Fukuda et al.	345/633
7,324,663	B2 *	1/2008	Kiraly	382/103

US 8,224,024 B2 (10) **Patent No.:** (45) Date of Patent:

Jul. 17, 2012

7,415,212	B2 *	8/2008	Matsushita et al.	398/140
2001/0043737	A1	11/2001	Rogina et al.	
2002/0049530	A1	4/2002	Poropat	
2004/0032970	A1	2/2004	Kiraly	
2004/0073360	A1*	4/2004	Foxlin	701/207
2004/0201857	A1*	10/2004	Foxlin	356/620
2005/0256391	A1*	11/2005	Satoh et al.	600/407

OTHER PUBLICATIONS

Gunnam et al., "A Vision-Based DSP Embedded Navigation Sensor", IEEE Sensors Journal, 2(5):428-442 (2002).

Kim et al., "An Optical Tracker for Augmented Reality and Wearable Combuter", IEEE Virtual Reality Annual International Symposium pp. 146-150 (1997).

Search Report for International Application No. PCT/US06/38460 dated Oct. 16, 2007.

(Continued)

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(57)ABSTRACT

The spatial location and azimuth of an object are computed from the locations, in a single camera image, of exactly two points on the object and information about an orientation of the object.

One or more groups of four or more collinear markers are located in an image, and for each group, first and second outer markers are determined, the distances from each outer marker to the nearest marker in the same group are compared, and the outer marker with a closer nearest marker is identified as the first outer marker. Based on known distances between the outer markers and the marker nearest the first outer marker, an amount of perspective distortion of the group of markers in the image is estimated. Based on the perspective distortion, relative distances from each other point in the group to one of the outer markers are determined. Based on the relative distances, the group is identified.

1 Claim, 6 Drawing Sheets



OTHER PUBLICATIONS

William Frey, Michael Zyda, Robert McGhee, Bill Cockayne, Offthe-Shelf, Real-Time, Human Body Motion Capture for Synthetic Environments, 1995, Computer Science Department, Navel Postgraduate School, Monterey, CA 93943-5118.

Robert M. Haralick & Linda G. Shapiro, Computer and Robot Vision v.2, Addison-Wesley Publishing Company, pp. 66-68, 1993.

Robert van Liere & Jurriaan D. Mulder, "Optical Tracking Using Projective Invariant Marker Pattern Properties," IEEE Virtual Reality 2003 Conference, Mar. 22-26, Los Angeles, 2003. Kiyohide Satoh, Shinji Uchiyama, and Hiroyuki Yamamoto, "A Head Tracking Method Using Bird's-Eye View Camera and Gyroscope," Proceedings of the Third IEEE and ACM International Symposium on Mixed and Augmented Reality (ISMAR 2004), pp. 202-211 Washington, D.C., Nov. 2004.

Daisuke Kotake, Kiyohide Satoh, Shinji Uchiyama, and Hiroyuki Yamamoto, "A Hybrid and Linear Registration Method Utilizing Inclination Constraint," Proceedings of the Fourth IEEE and ACM International Symposium on Mixed and Augmented Reality (ISMAR 2005), pp. 140-149 Washington, D.C., Oct. 2005.

* cited by examiner





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Figure 2



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