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**APPLICATION NUMBER: 10/639,242**  
**FILING DATE: August 11, 2003**  
**PATENT NUMBER: 6922632**  
**ISSUE DATE: July 26, 2005**



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08/11/03  
16638 U.S. PTO

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1855-1930

W.K. Richardson  
1859-1951

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August 11, 2003

Attorney Docket No.: 09970-011001

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- WASHINGTON, DC

Applicant: ERIC FOXLIN

Title: TRACKING, AUTO-CALIBRATION, AND MAP-BUILDING SYSTEM

Enclosed are the following papers, including those required to receive a filing date under 37 CFR §1.53(b):

	<u>Pages</u>
Specification	77
Claims	14
Abstract	1
Declaration	[To be Filed at a Later Date]
Drawing(s)	12

Enclosures:  
— Postcard.

This application claims the benefit of U.S. Provisional Application No. 60/402,178, filed August 9, 2002, titled "Localization, Auto-Calibration, and Map-Building," the contents of which are incorporated herein by reference.

Basic filing fee	\$375
Total claims in excess of 20 times \$9	\$495
Independent claims in excess of 3 times \$42	\$378
Fee for multiple dependent claims	\$0
<b>Total filing fee:</b>	<b>\$1248</b>

Under 37 CFR §1.53(f), no filing fee is being paid at this time.

CERTIFICATE OF MAILING BY EXPRESS MAIL  
 Express Mail Label No. EV 331653751 US  
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Commissioner for Patents  
August 11, 2003  
Page 2

If this application is found to be incomplete, or if a telephone conference would otherwise be helpful, please call the undersigned at (617) 542-5070.

Kindly acknowledge receipt of this application by returning the enclosed postcard.

Please direct all correspondence to the following:

26161

PTO Customer Number

Respectfully submitted,



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Enclosures

JRR/lxf

20707517.doc

APPLICATION  
FOR  
UNITED STATES LETTERS PATENT

TITLE: TRACKING, AUTO-CALIBRATION, AND MAP-BUILDING SYSTEM

APPLICANT: ERIC FOXLIN

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TRACKING, AUTO-CALIBRATION, AND MAP-BUILDING SYSTEM

Cross-Reference to Related Applications

[01] This application claims the benefit of U.S. Provisional Application No. 60/402,178, filed August 9, 2002, titled “Localization, Auto-Calibration, and Map-Building,” the contents of which are incorporated herein by reference.

Background

[02] This invention relates to tracking, navigation, pose estimation, localization, auto-calibration, scene modeling, structure-from-motion and/or map-building based on sensor inputs.

[03] Tracking or navigation systems often make use of measurements from sensors to aid in determining a location (“localization”) or an orientation (attitude and heading) or a pose (position and orientation) of an object such as a person, a vehicle or a robot as it navigates in an environment, such as within the bounds of a building. A variety of types of sensors are available for such systems, including sensors that measure a relative location between a sensor and a target. An example of such a sensor/target combination is an acoustic emitter (target) and a microphone array (sensor) that can determine a direction of arrival of an acoustic signal broadcast from the emitter. Different types of sensors measure different aspects of the relative pose of a sensor and a target, such as a range, direction, or relative orientation. Different sensors may have different measurement characteristics that affect the mapping between the relative pose of a sensor and a target and the measurement values provided by the sensor. These characteristics can include uncertainty or noise characteristics of the measurement values.

[04] Systems have been developed that use Kalman Filtering techniques to incorporate information in sensor measurements to track the position or orientation of an object, typically also using information about the dynamic characteristics of the object. The implementation of such Kalman Filtering techniques is often complex, and typically

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