Tracking First Responders in GPS-Denied Environments Using Low-Cost IMUs

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The Mobile Response Command System (MRCS)

Rex Systems, Inc Chippewa Falls, WI partnered with the U.S. Army’s Communications, Electronics, Research, Development and Engineering Center (CERDEC) S&TCD

ENSCO is providing the Software for the Tracking Module

Overall System Objectives

- Provide an effective tracking/positioning system that meets the needs of both military and civilian urban First Responders;
- Develop a wearable Integrated Thermal Imager/Display with correct human factors for First Responders;
- Provide ad-hoc, mobile, wireless, digital networking technology and software based incident management.
An Integrated System

Tracking - Communications - Incident Command
Dalmatian Approach

A simple, low-cost, self-contained approach to fire-fighter tracking

Heel-mounted inexpensive IMU with integrated magnetic compass

Ruggedized, waterproof, thermal shielded

Tracking success via advanced, unconventional signal processing:
- Fully automated, real-time geolocation
- Automated detection, characterization, and processing of ZUPTS, ZAPTS, and other features in the data
- Automatic processing of magnetic compass data that accommodates boot steel and environmental steel
- Full 3D data processing including altitude
- Accommodates walking, running, crawling, side-stepping, duck-walking, etc.

Real-time position data is available to both the fire-fighter and the incident command
Testing Results

Testing to-date has been conducted in a variety of buildings:

– Single-story
– Multi-story
– High-rise

All testing has been conducted in steel-framed buildings
2-Story Building with Basement

~10 minute continuous walking test

Angled view of basement, first floor, and second floor paths

Side view of basement, first floor, and second floor paths
9-Story Building Stairwell

Starting in 3rd-floor office, walked to stairwell, down to ground floor, up to top floor, then back to 3rd floor.
Methods of Movement

Tracking results for multiple methods of movement. Multiple operators shown.
Current Status

Continuing to fine-tune data processing methods

Extensive testing in multiple environments

Finalizing logistics, packaging, etc.

Anticipated for beta release early 2009
On-Going Related Work

Development of RF TOA system to aid IMU, constrain error, and provide unlimited duration tracking

Thermal Imaging Camera and Binocular Heads up Display

Expansion of ENSCO in-house simulation (SimDog) capability for pedestrian localization

Demonstration at the Pentagon in August

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