CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
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Project Number
S0918

Project Title
Mayday, Mayday! The Geolocation System for First Responders

Abstract

Objectives/Goals
Many first responder fatalities or injuries are caused by becoming lost during rural search and rescue operations or getting trapped inside burning buildings. We attempted to create an accurate tracking device that works outdoors and indoors and is not affected by a loss in GPS signal. The device would be able to send position beacons outside of a building or across terrain to a incident command (IC) base system displaying the location and altitude of the device on a map.

Methods/Materials
The device created includes a GPS with a high-RF sensitivity, a Honeywell Dead Reckoning Module (calculates position utilizing inertial measurement sensors in tandem with last-known GPS position), an Arduino Mega Pro Mini (3.3v), an XBee data radio, and an amateur radio transmitter with a Byonics TinyTrak3 encoder. The amateur radios form the main communications link between the device and IC. The XBee radios form a small mesh network between each tracking device and IC and outputs raw NMEA data every two seconds for real-time tracking. A Pelican 1020 case enclosed the components. Circuitry and coding for the device was developed.
Tests were run in order to verify operation and accuracy of the device. We staged multiple simulated emergency exercises during which a "firefighter" wearing the device became "trapped" within our school. IC then deployed the rapid intervention team (RIT) with position information to locate the firefighter. The distance between the reported position and the actual position of the firefighter was recorded.

Results
In each of the trials, the RIT was able to arrive at the firefighter's location within one to ten feet. While the radio carried by the RIT did have GPS, the GPS waypoints deviated significantly from the RIT#s actual position while the firefighter unit equipped with the Dead Reckoning Module was more normalized. Furthermore, the altitude only fluctuated when the firefighter moved up or down stairs or changed floors. The device was able to run for over 4.5 hours on a pair of 9 volt batteries.

Conclusions/Discussion
We attained our goal of creating a device that could be used to accurately track firefighters or other first responders outside and inside buildings. The device was able to determine its coordinates utilizing both GPS and dead-reckoning techniques and relay this data to an incident command display which reported the device's location and altitude.

Summary Statement
We created and tested a tracking system designed for first responders which works inside and outside of buildings and isn't affected by GPS status.

Help Received
Friends assisted with testing of the devices.