Mar 31st, 2:00 PM - 3:20 PM

A Path to an Inertial Based Stand Alone Pedestrian Navigation System

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An estimated 285 million people around the world suffer from some form of visual impairment, and of those people, 39 million are blind [1]. This research aims to develop a personalized navigation system, which assists individuals navigating in various unknown environments. While we see a significant demand for this technology among individuals with visual impairments, there is an endless list of potential applications including for first responders and military personnel. The goal is to create a fully integrated and automated system that can localize a user in an environment while simultaneously building a map of the environment from external sensor data. This field of study is known as SLAM (simultaneous localization and mapping) and has been extensively studied for various robotic applications including autonomous driving and unmanned vehicle navigation [2-3]. Despite the large volumes of research conducted for robotic applications, relatively little work has been done in applying these SLAM techniques to pedestrian users. In this research, we developed and experimentally demonstrated a standalone navigation system that can not only track pedestrian locations indoor/outdoor but also assist navigation through obstacle detection. In our system, localization was done by using several inertial sensors to track movement on a foot-mounted IMU (Inertial Measurement Unit). Sensor data was used to identify to specific points in the human gait, which allows for accurate tracking. Inertial based navigation offers an alternative to GPS based navigation. GPS navigation suffers from low accuracy and fails in satellite-restricted environments, including many indoor settings. We developed an algorithm that uses obstacle detection data in combination with location and heading information obtained from IMU data to detect features in the user's environment and construct of map of barriers and obstacles.

References

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