Using Inertial Navigation Systems (INS) and the Kalman Filter in order to Create a Reliable Navigation Aid for the Blind

Chong, Isabelle

The current navigation aid of choice for the blind is the white cane, which, although lightweight and easy to acquire, has a limited range and requires extensive training to use. While Electronic Navigational Aids (ENAs) have been developed to improve upon the white cane, the need for certain environmental conditions and preconfigured infrastructure in some approaches (e.g., radio frequency identification and structured light) remains an issue. My objectives were to (1) design the conceptual and mathematical methodology of an ENA for device location and obstacle detection without the use of preconfigured infrastructure, (2) build an ENA by combining a Laser Range Finder (LRF) and an Inertial Navigation System (INS), (3) code a real-time algorithm for obstacle detection and Kalman filtering in C++, and (4) test my ENA's functionality from both an engineering and human subjects standpoint to obtain quantitative and qualitative feedback. The completed ENA can detect obstacles within a six meter range without preconfigured infrastructure, raising an alarm to the user through sound and haptic feedback if an obstacle has been detected. This device has the potential to provide a robust alternative method of blind navigation in the future.

Awards Won: