Team Members

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CPE 656 Project Description

Train Location

The computer engineering department owns a model train system that is intended to mirror a typical train environment. The purpose of the train track is to be a teaching tool for instructing students on creating safety critical software. In a real-word train environment, trains often carry very valuable assets: people, oil, merchandise, etc. It is important for a railway system to be able to track the location of each train in order to prevent collisions and to monitor the state of trains in the event of attack. It is desired for the department model train system to be able to track the location of each train for this reason. Like subway trains, the department model train system is completely indoors, so a Global Position System (GPS) solution is not possible.

There is already a system in-place that measures inertial changes to the train to determine its location using an accelerometer and gyroscope together in what is called an inertial motion unit (IMU). This system, however, quickly loses accuracy on the location of the train after a few seconds of operation.

The purpose of this project is to develop an updated inertial navigation system for the train. The train navigation system is to visually display the position of a train with a segment of track at any time. A rail car will be attached to the train that is equipped with an IMU. Data collected by the IMU will be sent to a base station that will calculate, from the measurements, the position of the train. The location of RFID tags on the track will be used to compensate for the error accumulated from the inertial calculations. The team is responsible developing the entire navigation system including selecting the sensors that will be equipped onto the train car and placement of the RFID tags. The position of the RFID tags as well as the train position data will be persisted into a database. The primary components of the new updated inertial navigation system consists of a graphical user interface (GUI), inertial navigation software, an IMU, and a position database. The GUI is to display the position information about a train. The IMU is to collect sensor information about the forces acting on the train. The inertial navigation software is used to calculate the train’s position from IMU data. The position database is used to provide feedback to correct for errors in the inertial navigation software’s position calculations and to provide a record of the train’s location over time. A secondary purpose of the database is to use its information to map the geometry of the train railway system.