

Senior Project Confirmation Memo

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Navigation with Differential GPS and Inertial Sensor (N.G.I.)

Project Description:

The goal of this project is to build a low cost navigation system using an Inertial Measurement Unit (IMU) and a Global Positioning System (GPS). The IMU is much faster but the GPS is more accurate, so they will complement each other. The IMU will have six degrees of freedom, consisting gyroscopes on each axis (x,y,z) to measure angular velocity and accelerometers on each axis to measure acceleration. Inexpensive Micro-Electromechanical System (MEMS) IMUs will be researched and should be under \$1000. A problem with low cost IMUs is that they are susceptible to measurement drift in the accelerometer. This can happen even while the unit is physically stationary. A reasonably priced unit with the smallest amount of drift characteristics is ideal, but with signal processing the drift can be counteracted and the appropriate data can be extracted.

The other navigation component of the system is the Differential GPS, which may be in the \$100 price range. The output of the IMU will be compared to that of the more accurate GPS to generate an error signal. This will be fed into a Kalman Filter which will process the error signal. The output of the Kalman Filter will serve as a correcting signal, either being fed forward to the output of the IMU or fed back directly into the IMU signal processing system to correct the signal there.