

# Key Technologies in Low-cost Integrated Vehicle Navigation Systems: Performance Analysis of MEMS and Their Integration with Camera and GPS Observations

Yueming Zhao



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A vehicle navigation system can consist of several sensors: GPS, INS, odometers, cameras etc. The Micro Electrical Mechanical Sensors (MEMS) are cheap alternative to more expensive inertial sensors, but they suffer from larger errors. The MEMS stochastic errors are analysed with different methods. GPS/MEMS integration is introduced and navigation errors are analysed based on analytical error propagation studies and on real tests. Moreover, the GPS/MEMS combination is augmented by map matching and camera observations of detected objects (lines and points). The robust BLAVE (Balanced Least Absolute Value Estimator) method is introduced and applied on the estimation of camera motion parameters. Comparisons with the traditional RANSAC algorithm are also presented. Finally the dynamic GPS/MEMS error model is augmented with equivalent coloured noise model and its performance is tested on simulated data coming from multiple MEMS sensors.

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