

Real-Time Sensor Fusion for Mobile Robot Localization in an Oil and Gas Refinery

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Abstract : Understanding the behavioral characteristics of sensors is a crucial step in fusing data from several sensors of different types. This paper introduces a practical, real-time approach to integrate heterogeneous sensor data to achieve higher accuracy than would be possible from any one individual sensor in localizing a mobile robot. We use this approach in both indoor and outdoor environments and it is especially appropriate for those environments like oil and gas refineries due to their sparse and featureless nature. We have studied the individual contribution of each sensor data to the overall combined accuracy achieved from the fusion process. A Sequential Update Extended Kalman Filter(EKF) using validation gates was used to integrate GPS data, Compass data, WiFi data, Inertial Measurement Unit(IMU) data, Vehicle Velocity, and pose estimates from Fiducial marker system. Results show that the approach can enable a mobile robot to navigate autonomously in any environment using a priori information.

Keywords : inspection mobile robot, navigation, sensor fusion, sequential update extended Kalman filter

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