

High-Precision Localization for Mecanum-Wheeled Robots Using Sensor Fusion with ArUco Markers

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Accurate and robust localization is critical to the performance of autonomous mobile robots in complex environments, such as those encountered in international robotics competitions. Holonomic robots equipped with Mecanum wheels offer superior maneuverability but introduce significant localization challenges. Wheel slip-page leads to rapid accumulation of odometric errors, while inertial measurement units (IMUs) are prone to drift over time, compromising long-term reliability. Without an effective correction mechanism, these issues render precise navigation unfeasible.

This paper presents the design and implementation of a high-precision localization system for a Mecanum-wheeled mobile robot, operating in a structured and known environment representative of a competitive robotics field. The proposed system integrates an Extended Kalman Filter (EKF) to fuse data from the IMU's gyroscope and accelerometer with position estimates derived from an external vision-based localization method using ArUco fiducial markers. The complete solution is validated on a functional robotic platform, demonstrating improved stability and accuracy in navigation tasks.

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