

Precise Localization of an Indoor Robot using Robotic Total Station and Error State Extended Kalman Filter

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SUMMARY

Through the digitalization of the construction sector, more and more robots are being used on the construction site. The construction site is normally unstructured, and the positioning of the robot (incl. position, velocity, and orientation) is, e.g., for safety, essential. In the context of existing buildings, the construction sites are indoor, and the Robotic Total Station (RTS) can be used for the precise localization of the robots. However, the RTS could not measure when the Line of Sight (LoS) to the target is lost. In this paper, the methods of integrating the RTS, odometer, and IMU data using the Error State Extended Kalman Filter (ES-EKF) were introduced. The ES-EKF is running in real-time on an indoor robot; measurements were carried out to evaluate the accuracy and also the robustness of the ES-EKF in the absence of RTS and odometer data.

The position difference between the ES-EKF and the laser tracker is about 0.31cm, and the standard deviation of the difference is 0.3cm. In our test, the results of EK-EKF will drift immediately if both the RTS and the odometer data are not available. If only the RTS measurement, e.g., in case of losing the LoS, is not available, the odometer could still be used to correct the drift of the IMU for a short time.