Pose Estimation System for a Masonry Robot

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Public Summary

A pose estimation model is designed for the startup ROPAX, which is developing a masonry robot. The robot uses a robot arm to place bricks, wheels to drive parallel to the wall, and is placed on a mobile climbing work platform (MCWP) to move up and down. The robot is challenged by the undesired movement of the MCWP due to wind, operators walking on the platform, and the movement of the robotic arm.
In this thesis, experiments are performed to quantify the disturbances, which are used to determine the requirements for the pose estimation model. Currently, a Total Station is used to determine the robot's position, which does not meet the requirements due to the low measurement frequency. An additional sensor is chosen to complement the Total Station measurements, and a sensor fusion algorithm is applied to achieve high precision and accuracy position and orientation measurements. The performance of the sensor fusion model is tested using a custom build Stewart Platform and an OptiTrack camera system as the ground truth. The Stewart Platform is specially designed to mimic the disturbances the robot experiences on the MCWP.
For the position estimation, an RMSE of 1.5 mm on oscillations with an excitation frequency of 2 Hz and an amplitude of about 8 mm is accomplished. An RMSE of less than 0.3 degrees for the orientation estimation is achieved.
A substantial improvement has been achieved with the sensor fusion model over using only a Total Station. The set error requirements for the pose estimation model for the given application are not met, but the first results are promising and give confidence that the requirements can be fulfilled with some adaptations.