

Vision based localization of remotely operable agricultural vehicles

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Abstract

This thesis addresses the problem of outdoor autonomous robot localization for agricultural operations. A 12hp power tiller, commonly known as the walking two wheel tractor is used as the test platform after introducing electrical actuators for its remote and autonomous operation. The mathematical model of the power tiller has been developed and simulated in MatLab SIMulink. A vision based outdoor localization system is developed using off-the-shelf electronic components, and its accuracy has been verified in small agricultural fields. Visual odometry using a downward faced camera is tested with better resolution for relative localization, and popular visual odometry algorithms were tested for speed and accuracy in agricultural fields. A stereo vision based range measurement system has also been developed and field tested as an absolute localization system that can bound the incremental error caused by the visual odometry system. The extended Kalman filter with measurement gating has been implemented using both visual odometry and stereo range measurement data. Experimental results verified that the proposed system as an effective low cost technique for outdoor localization of field robots in small agricultural fields.

To my parents Mr and Mrs Piyathilaka.



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