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USING STEREO VISION CAMERA SYSTEMS TO ANALYZE PATH EXECUTION AND CORRECTION FOR ROVERS

Abstract

Mobility in sandy or any environment that is not completely solid causes variation in movement due to shifting of the soil underneath, slippage due to gravity, and the imperfect execution of commands to the actual motors that drive the movement. These errors can be easily compounded if not frequently corrected, diverging from the path by a significant margin over time.

Correction can be achieved by human drivers assessing the slippage or other environmental factors and counteracting them, or by autonomous driving algorithms that compare the intended path to its current ones. Unmanned rovers in unexplored environments have the most difficulty in addressing these situations due to the lack of preexisting markers in the environment, and the limited sensor packages they carry that can be utilized for path correction.

This study investigates an alternative solution that uses stereo vision mounted on a stationary "mothership" to correct the path discrepancy of the "child" rover. This configuration is often found for space exploration missions where the mothership acts as both a communication and energy hub for the rover. Such an arrangement is especially advantageous as the vision system on the mothership captures data from greater heights than is possible for the rover itself, and can better map the rover's location with regards to its environment.

This study develops a stereo-vision-driven coordinate system that takes the mothership as the origin point. This coordinate system is then applied to accurately map the rover's speed and location in a three-dimensional space, which can then be applied to calculate the deviation from the rover's expected path to the actual taken.

This study can serve as a prelude for future attempts to develop algorithms to correct rover behavior based on such mothership stereo vision configurations, and possibly even to prevent expected deviations arising from soil composition and terrain characteristics.