Autonomous Vehicle for Convoys

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Significant improvements in this continuation project were made on a concept demonstration of unmanned vehicle convoys for military/commercial transportation. Last year's study resulted in Lego NXT robotic vehicles: a lead vehicle controlled by a human operator using remote control and a tracker vehicle autonomously following the lead using computer vision based on real-time edge detection. This year's goal was to improve the system robustness and to make tracking more accurate and smoother. In order to compare the performance of new vs. old algorithms, Key Performance Indicators were used to compare their robustness (percentage of completed rides), tracking error (Median Hausdorff Distance of trajectories), and ride smoothness (standard deviation of tracking distances). Comparison of algorithms using these KPIs required a computer vision system of its own in order to find and compare vehicle trajectories in video recordings of experiments. Evaluation on two tracks, one relatively easy, the other harder, showed improvements on all three KPIs and offered additional data for further system improvements. As a result of this work, visual markings on the lead vehicle have been made smaller and the system performance was significantly improved using color within the vision system and finer motor control. Lessons learned in this project can be translated to building an actual automated convoy of vehicles. For example, a camera with wider view angle would offer better scene coverage.

Awards Won: