Path Tracking of Articulated Earth Moving Machinery

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Certain earthmoving applications require machines to work in tandem to complete the work faster. This project aims at developing a suitable Leader-Follower algorithm for a pair of articulated machinery that can perform a four-stage work cycle of Load, Haul, Dump and Return assuming the leader has a human operator and the follower is completely autonomous. The key challenges in enabling a suitable leader-follower algorithm are (1) development of a suitable path tracking algorithm (2) development of a suitable velocity control algorithm (3) Fault detection and correction methods. Various path-tracking algorithms such as Pure Pursuit, Follow the carrot have been implemented in a simulation environment. A new path-tracking algorithm is introduced and is demonstrated to work more effectively than standard algorithms. This algorithm takes in the desired curvature values from the standard algorithms and weighs them in relation to certain parameters to obtain a hybrid curvature value. GPS receivers at attached to both the vehicles give out information of the current location of the vehicle. The position, heading of the leader at each time step is recorded onto the follower vehicles on board computer. The follower uses one of the tracking algorithms to track these electronic breadcrumbs left behind by the leader. The velocity control algorithm also uses derived velocity information from the GPS units to issue acceleration commands to the follower based on the velocity of the leader. The velocity of the follower is controlled so as to maintain a safe distance of separation between the two machines in operation. Inertial navigation units on board the machines are used to supplement the GPS data during GPS Dropouts in certain locations. We are developing a leader follower algorithm that addresses the above concerns along with the various safety issues that are associated with them.