Autonomous Semi-Truck Docking

Overview
Our project concept was to devise a system that would manage the task of docking a semi-truck without any human input once the system was engaged. We were given a 1/14 scale model, battery-powered semi-truck to develop and test the system on. During the design process, we had to consider factors such as truck location, kinematics, and control algorithms as well as external variables like lighting and obstacle avoidance.

Objectives
Our objectives were to setup a controller on board the model truck to direct steering and speed, install an overhead camera to track the truck’s location, and establish communication between the camera, the controller, and a central computer which would process the information and determine the truck’s course of action.

Approach
- Acquired docking bay dimensions from Volvo Group Sponsors
- Concept generation to determine which program to use on central computer - LabView
- Testing and comparison to evaluate and select on board controller - MyRio
- Reviewed existing autonomous vehicle patents as well as path-following research papers
- Explored video capture and tracking methods and software – LabView Vision
- Designed CAD model of A-frame used to mount camera over docking bay
- Setup prototype for manual docking to determine path approach
- Encoded path and system decision structure into LabView for autonomous docking
- Conducted final tests with mixed outcomes

Outcomes
The primary autonomous docking system was unsuccessful, but the secondary approach had satisfactory results:
- The overhead camera was unable to identify points on the truck, so the tracking system failed
- Without the tracking system, the algorithm was unable to determine a course of action for the truck
- However, a backup system was developed that did not utilize the overhead camera
- The secondary system produced fairly accurate and consistent results