Master thesis proposal

Automatic coupling/decoupling of i-dolly (VERA auto coupling) used for local distributions

Background

Automation of local distribution using automated dolly technology could be a viable and productive alternative for future state of the art green terminals and local distribution of container trailers. This technology offers unmanned transports, reduced driver/operator cost and removed diesel fuel cost where the semitrailer units are towed by an intelligent and electrically propelled converter dolly (i-dolly) with automatic coupling and parking of semi-trailers. In this solution, autonomous dolly-semitrailer combination will be used to transport the containers between the dry port and company terminals. The dry port (green color) and the local distribution network (yellow color) of container transport are shown in Figure 1a. Thus, it is envisioned that the i-dolly could serve as a tractor for the semitrailer units thus reducing the use of diesel engine-based tractor for smaller routes. Figure 1b depicts the schematic diagram of the proposed vehicle combination with automatic coupling devices and i-dolly in which the electric propulsion is set on the rear axle (shown as green) and the steering on the front axle (shown as blue axle).

Figure 1. (a) Dry port in and local distribution routs (b) Schematic diagram of trailer and i-dolly

Project goals

The main goal of this thesis is to design a controller in which the i-dolly will automatically couple and decouple the semitrailer. The project work consists of the following parts:

- Studying the kinematic model of the combination vehicle
- Deriving single- or/and two-track kinematic vehicle models
- Synthesizing an automatic coupling and decoupling controller
  - Sensors evaluations
  - Path planning
  - Coupling/decoupling controller
    - Height control
    - Distance control
    - Heading control
- Building and simulating the system and the controller in Simulink
- Technical documentation of the project work

Number of students: 2

Desired qualifications: Knowledge in the modeling of mechatronics systems, vehicle dynamics and control theory, and experience with Matlab and Simulink

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Remuneration is provided by Volvo at completion of Master’s thesis.