An advanced simulator to support the development of an autonomous electric race car

We are looking for motivated master students Engineering Technology

Project description:

Formula Electric Belgium (**FEB**) is a team of highly motivated engineering students that build an electric formula student race car. Just like Formula 1 the team builds a brand-new car each year to compete in multiple international competitions during the race season. Formula Student is the largest international engineering and design competition in the world. The competition is characterized by combustion vehicles, electric vehicles and since recently also autonomous vehicles. Formula Electric Belgium strives towards innovations and the raw performance of technologies. It is for this reason that the team will focus on the autonomous/electric race cars. Research and development applications will be made by postgraduate students in collaboration with thesis students from the KU Leuven and bachelor students from Thomas More.

Thesis description:

An autonomous software is composed of three algorithms: **Track Landmarks Detection**, **Car Localization and Landmarks Mapping**, and **Car Control**. The first two blocks perform a sensor fusion (LiDAR & INS/GNSS & …) to simultaneously localize the car on the track and map the track landmarks. The Car control block aims to simultaneously keep the car within the track limits and maximizing the speed.

The development of an **autonomous software** for an electric race car requires a lot of tests in real conditions. However, these real conditions limit the scope of our tests, meanly regarding the time and the ease of preparation. Therefore, the Formula Student community has developed a driverless simulator that simulates the sensor data based on a given track, and the car motion. Even though this tool provides a platform to develop algorithms, the significant differences between this virtual environment and the real conditions do not allow us to fully replace testing by simulations and could also lead to a wrong development due to the lack of reality.

The purpose of this advanced simulator is to combine true-to-life sensor data simulations and a complete vehicle dynamics behaviour based on the car characteristics. Moreover, this tool aims to be easily adaptable (eg. adding a second LiDAR on the car, changing the sensor position, …). To reach our goal, we will benefit from the **support of two companies'** expert in the field of **synthetic data** and **car dynamics engineering**. The outcome of this new simulator will allow us to directly apply the conclusion/observation from the simulation to the real conditions.

Thesis objective:

This thesis aims to develop an advanced simulator based on the framework of our current simulator. This work will be divided in two parts: the **sensor data modelling** and the **car motion modelling**. Their developments will be validated by a comparison with tests in real conditions. The advanced simulator will full-fill several requirements/features:

- Easy to use
- Easy to change the parameters
- Easy to change the configurations
- Easy to bring updates
- Visualization interface

The simulator performances will be validated by a comparison with tests in real conditions.

Profile:

- Teamplayer
- Creative/Innovative
- C++, Matlab, Python

Are you interested? Please send your resume with accompanying motivation to:
recruitment@formulaelectric.be
Diestsesteenweg 692, 3010 Kessel-Lo

- Ability to learn new topcis
- Good sense of engineering

What do you gain?

- A unique engineering– and team experience where hard work and team atmosphere are central.
- Work with innovative technologies in a realistic environment/application.
- Create added value for your curriculum and the team

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