New SLAM implementation for a formula student autonomous 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 car is composed of three main algorithms : track landmarks detection, car localization and landmarks mapping, and car control.

The estimation of the cone position position and their color detection is performed by the sensors fusion of a LiDAR and cameras.

The localization of the car and the mapping of the cones is performed by a **Simultaneous Localization And Mapping** (SLAM) algorithm. It accumulates observations from the landmarks detection algorithm on the one hand, and observations from the velocity, heading and position of the car on the other hand. The **SLAM** builds a virtual environment for the surroundings of the car. It is working simultaneously with a Data Association process stating whether a detected cone by the sensors is a newly detected cone, or a cone already mapped in the virtual environment.

The car control algorithm provides the command the car needs to apply, based on the virtual environment previously built.

Thesis objective:

Many different SLAM algorithms exist, e.g. https://ieeexplore.ieee.org/document/9596721, and only one has been implemented for now. This thesis is about searching, implementing, and evaluating a new SLAM algorithm.

Here below are listed the different objectives of the thesis.
- Research part : Find an interesting SLAM algorithm to investigate, supported by strong motivations (memory usage, flexibility of the algorithm, running time, …)
- Implementation part : Implement the chosen algorithm, instead of the existing SLAM, in the autonomous system.
- Evaluating part : Define well chosen criteria to test a SLAM algorithm (running time, memory usage,…), and evaluate both SLAM algorithms, i.e. the existing one and the one you implemented. The first possible end for your master thesis is to improve the current SLAM. Then you need to report how (using the criteria) and why (by looking inside both algorithms when running) the newly implemented SLAM. The second possible end is that the SLAM you implemented is not improving the current SLAM. Then you need to report why it is not the case by looking in detail at the way your SLAM is functioning.

Profile:

- Interested in autonomous software

- Can work in iteratively

- Creative

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

- Teamplayer

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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