



Software Engineer

Green Innovation meets performance

Our Project

Formula Electric Belgium is a team of engineering students who build a **Formula-Student racecar** to compete in international competitions. We design and build a brand-new car every year and compete with other teams in multiple worldwide competitions during the summer months. Formula Student is by far the biggest **engineering competition** in the world and continues to grow. From next year on, we will be competing in both the **electrical** and **driverless** competition. You can join the project as a volunteer, this allows you to contribute to the next race car whilst keeping a flexible schedule.

Tasks

As a software engineer, you will be mostly working on one or more **algorithms** that are used in the car. These algorithms are made in various languages, including, **C++**, **python** and **java**. As a software engineer, it's important to write structured and clean code, as these algorithms will eventually have to work closely together. You will be responsible for one or more of the tasks described below.

Image processing

The driverless car, just like a driver, needs to be able to see. You will design/ improve the software stack that gets raw camera inputs and calculates the position of traffic cones (indicating the racetrack) relative to the car.

You will work with machine learning algorithms (YOLO) and use specialised image processing hardware (GPU) for this task

Lidar

The autonomous system doesn't only rely on cameras for mapping their environment. We also use LI-DAR technology that gives a 3D view of the surroundings. You will implement the software stack that interprets point clouds and determines which points resemble a cone.

State estimation

An autonomous and high-performance race car needs to know its complete state at all times. This means its position, speeds in all directions, acceleration, angular velocities and angular rates. You will implement all sensors needed and convert this into a digitized signal for the driverless pc and electronic control unit. For this part, you will work with the CAN-protocol, low-level code and IMUs. Often a Kalman filter is implemented for fusing all sensors together.

SLAM

Simultaneous localization and mapping, or SLAM is the software stack that receives information from our sensor algorithms (LIDAR, cameras and the state estimation) to build a map of the environment. It positions the car on this map, so the path-planning algorithm can calculate a path through the race-track. There are multiple approaches to tackle this problem. The challenge is to find the algorithm that performs the best (both in accuracy and performance).

Path-planning

The path-planning algorithm calculates how the car should drive through its environment. It takes as inputs the state of the car and map made by the SLAM algorithm. As outputs, it gives the instructions needed for the steering and throttle controls.

Telemetry

During races we monitor how the car handles itself on the track, we do this by sending sensor data over to a laptop on the side of the track. The sensor data gets read by the laptop using a serial port that communicates with a ZigBee transceiver module. The software on the laptop gives a clear overview of the data and is able to plot the data points in a graph. This interface is made in house and was previously coded in Java. Your job is to redesign this app to make it work in a web browser. There should also be the option to import data from an SD-card in the data logger that is present in the car. A nice-to-have feature would be the ability to share the web page using, for example, a local wifi hotspot to the other team members so they can follow as well. Therefore the web app should be compatible for multiple device sizes and form factors.

Torque vectoring & Semi-active controls

These algorithms are developed together with the mechanical department. These algorithms make use of a complex dynamic model of the car, in order to optimize the handling of the car. These algorithms are used both with and without the driver.

Profile

- Clean coding
- Team Player
- Communicative
- Willing to work with the newest technologies and state-of-the-art algorithms

Returns

- A unique engineering experience
- Developing your hard- and soft-skills in a company-like environment
- Work with the newest technologies and innovative companies
- Work in a team with a network of well over 120 partners
- A summer season packed with competitions all over Europe
- An experience of a life-time!

Up for the challenge?



Submit your **resume** and **motivation letter** (one page) to

<https://formulaelectric.be/vacancies-theses/>