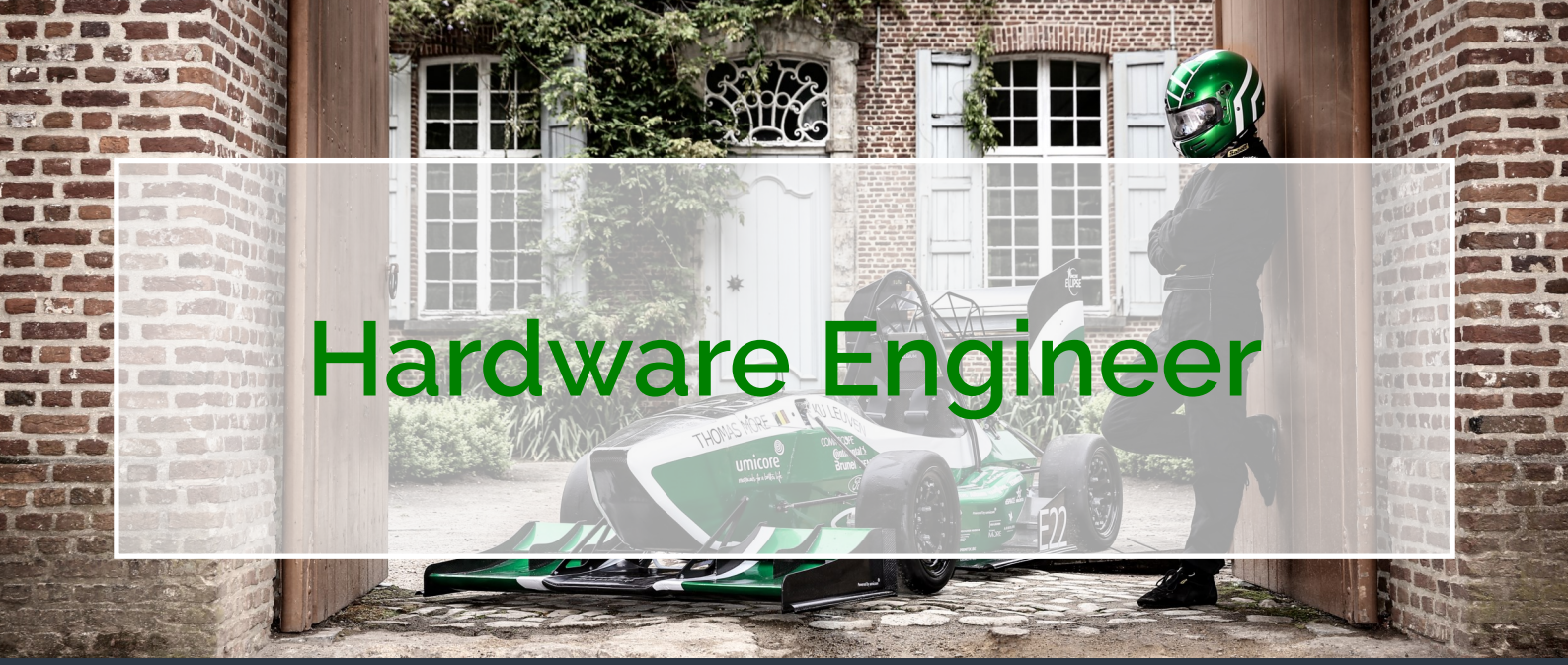

Hardware Engineer

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 during one or two years by applying for the '**Postgraduate in Innovation and Entrepreneurship in Engineering'.**

Tasks

As a hardware engineer, you will design, assemble and test **printed circuit boards and embedded systems** in our race car. You will be responsible for one or more of the tasks described below. Which tasks are your responsibility will be decided based on your interests. You can start with the designs made in the previous years or make something completely new.

Sensor nodes

Sensor nodes are small embedded systems that read in sensors, digitize them and send them to the central computer. They also serve as controllers for the different actuators in the car. You will work with Altium Designer for the PCB and program the microcontroller (Atmega/ STM chip) in C-code. You'll also learn to work with CAN, a robust communication protocol used widely in the automotive industry.

Semi-active nodes

Our car makes use of a semi-active suspension, this means we can change the damper characteristics on the fly. This system needs a high-performance current control system. You will design or improve a system that controls the current through 8 inductive valves (PID-controller), and measures the displacement of the springs at each wheel. You will work with the CAN-protocol, STM-chips, and Altium for the PCB-design. You will work together with the suspension department, as they will give you the speed requirements.

Brake actuator and EBS

Even the best cars sometimes need to brake, this is the same for driverless cars. You will work together with the mechanical department in the design of the brake actuators and emergency brake system. This has to be done in a way that failures always end in the brakes activated. You will use Altium for the design of the hardware.

Telemetry

While driving, it is always nice to be able to monitor all the systems in the car on the side of the track. That way we can quickly view the current status of the car, like for example the speed, battery status, status of the safety circuits and more. With this information, we can quickly diagnose and solve errors or improve the handling of the car without having to plug in a computer into the ECU. When working with a driverless car, the telemetry is also essential in debugging and fine-tuning the autonomous algorithms. We can view the decision making of the driverless computer in real-time and therefore improve our algorithms efficiently.

Your task is to make the board that receives all sensor information over the CAN-busses and send it over ZigBee to a receiver at the side of the track. You will work with Altium for the PCB-design and provide the code for the Atmel or STM-chips used in this design.

Dashboard

The dashboard is an essential part of all cars. It visualises the current status of the car to the driver and displays him the current speed, battery state and more. It consists out of a colour display, multiple buttons and LEDs. The buttons control the state of the car by communicating with the ECU to for example bring the car into ready-to-drive mode and switch on the high voltage from the battery pack. The dashboard also makes the driver control how the car's driving characteristics should be for the currently selected event (acceleration, endurance, time lap...). The dashboard also handles the push-to-talk communication for the driver to the team members at the side of the track.

Your task for making the dashboard is to design a PCB using Altium with an STM- or ATMEL-chip that handles the button inputs and that controls the LEDs and a colour display. Changed settings and the sensor data displayed on the dashboard are communicated using the CAN-protocol. You are responsible for making the embedded software on the STM- or ATMEL-chip and the interface design/logic of the colour display.

Steering

The driverless car obviously needs to be able to steer, so you will make the sensors and control electronic control system for the driverless steering actuator. You will work closely together with the mechanical department for this task. You will design a PID-system, dependent on a setpoint given by the driverless algorithms and sensor inputs.

Safety systems

A racecar made by students still needs to be safe, as we drive at speeds up to 120 km/hour and work with 120A @ 600V. Therefore you will design safety features, following the rules of Formula Student. This means implementing voltage and current monitoring for the high voltages, monitoring our brake system, designing the shutdown circuit (a circuit that cuts the supply of the car, when something's wrong) and more. Most of these features are completely made in hardware, so you will work a lot with Altium designer.

Battery

Without a battery, our car won't drive very far. You will design the setup of our battery, choose the right cells, design the high-power PCBs, use the newest technologies to design and produce these PCB's and make sure the battery is compliant to the Formula Student rules. For this task, you will work with high currents (120 A) and high voltages (600V), which means you will have to work safely and responsibly.

ECU

We make our own Electronic Control Unit (ECU), that acts as a board computer. It uses the information it gets from the different communication lines for the controls of the electromotors and other actuators in the car (cooling fans, DRS, semi-active controls...) You will design this PCB and work on the framework that puts the higher-level algorithms together.

Profile

- Interested in PCB-design with industry software (Altium Designer)
- Familiar with C
- Team Player
- Basic knowledge of electronics
- Eager to learn new technologies
- Responsible
- Communicative

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!

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