CareBOTS

INTRODUCTION

I am Garoe Marichal, project leader, and I have been lucky to work with the following team members.

Powertrain specialized engineers: Hidde Millekamp and Erik Wortelboer.

Embedded systems engineers: Tim Roordink and Emiel Visser.

Mechanical engineers: Roman Kim and Ky Do.

Vehicle Electronics engineer: Youri Fonteijn.

Client: Jan Benders and Joep Selten.

Company: Ambee.

Senior engineer: Yanzheng Xiao

The main challenge was to design, manufacture and program a robot capable of delivering medicines and supplies inside hospitals. This was done to make workers more efficient and spend more time attending patients, giving better customer experience

JOURNEY & LEARNINGS

Our journey turned out to have a positive outcome, with certain challenges that led us to act rapidly to solve them.

Smart moves were aiming for clear communication, aiming at least 1 team meeting between members, this was done so everyone communicated their problems.

This led to all the members helping with the problems and continuing with the next tasks having the lowest delays possible.

Also splitting all the project tasks in the SCRUM table and Gantt chart was a smart move as we could understand the workload needed from every member of the project every week.

Suprises were the time it took for certain parts to arrive, either because of the bureaucracy of the HAN, or because of them not being in stock.

A main setback was when we had to present the different design choices to our client. We presented Mecanum wheels, which make the robot capable of yaw rotation.

However, he was against this choice and wanted another type of wheel. However, thanks to the powertrain engineers, they could defend the choice correctly, convincing the client to use this type of wheel.

Enhancing everyone to help each other helped the project to progress, having low number of blocked tasks.

When the road got bumpy, such as when a team member got stuck with a certain task, meetings were planned with different experts to get another point of view of the problem.

CANbus communication was a real challenge during the project. Therefore, the way of thinking had to be changed. This work was split into smaller tasks; this could give a better picture of this task. By doing this, Emiel could feel he was making progress every week, instead of only focusing on the real picture.

We also had to change our planning; this was because the parts were taking longer than expected, therefore many tasks were delayed.

OUTCOME & IMPACT

Our final product was a robot capable of operating, considering the conditions and boundaries set at the beginning of the project by the client.

Powertrain engineers were responsible for the motor choice and control. Thanks to their work on the VESC motor control program, they could achieve complete control of the motors. In the beginning of the project, a Simulink simulation was created, to understand what the motor requirements are, and battery specifications for the robot to maneuver around for 30 minutes.

Embedded systems engineers and the vehicle electronic engineer were responsible for the programming and electronics of the robot. They managed to use the Jetson Nano for remote control of the robot. BMS implementation for the correct monitoring of the batteries. In addition, PCB´s were created.

Also, a real time monitoring system was coded, this was made for checking the state of the motor and going in safe mode in the case there is a malfunction in the electronics.

Mechanical engineers made an aluminum-profile frame, which is modular, that can withstand the medical box and its compartments correctly. The frame is the correct size so it can maneuver around the hospital correctly. They performed simulations on every possible load scenario, with the correct safety factor, to understand what material and size were needed to support these loads correctly. In addition, they designed motor enclosures and mounts, for the correct mounting of them into the frame.

In the future, this robot could have many uses thanks to its modular design. It will help many sanitary professionals, reducing their efforts in the transport of supplies. If further R+D work is performed, it could be easily integrated into other fields, providing help to workers or replacing them.

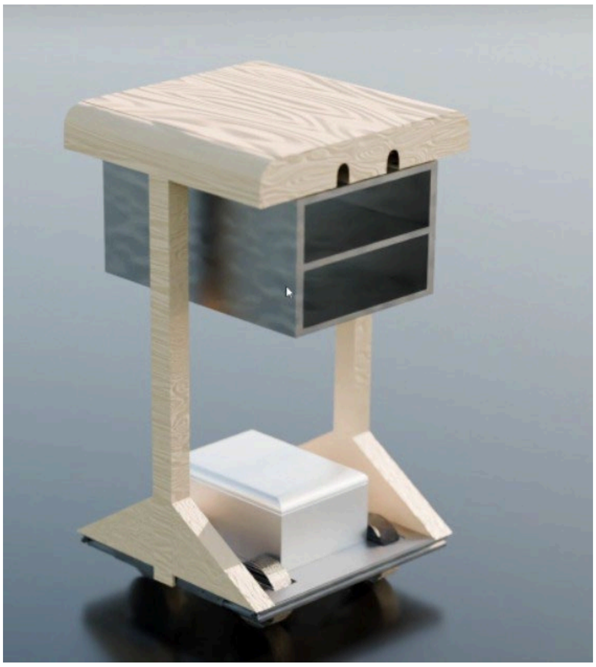
Sanitary workers will benefit from our work in the future. More stakeholders who would benefit from these would be patients and hospitals. It can make a big difference, as the medical appointments would be more efficient, taking less time to complete the appointment. In the long term, this could mean the doctors could have more time to plan more appointments every day.

We are proud to contribute towards making hospitals more efficient, making a difference soon, with the help the robot provides in medical facilities.

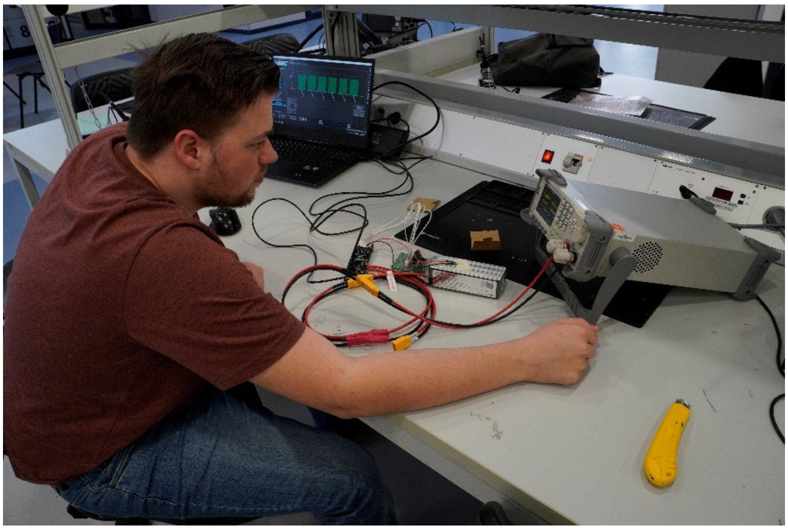
We are excited to show at the symposium the design of the robot, correctly explaining the different tasks done to complete this project. The robot will be controlled with a joystick controller, and perhaps the visitors of the symposium can control it during the day, giving them engaging experience of our project.

Frame design on Solidworks, by Roman Kim and Ky Do.

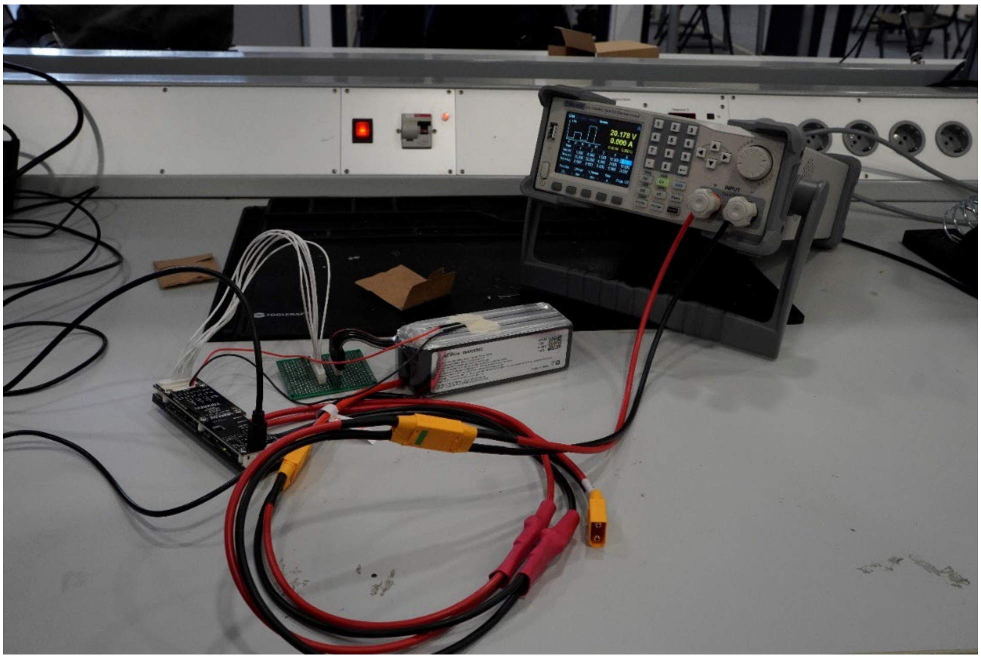
Aluminum profile frame, designed and manufactured by Roman Kim and Ky Do.



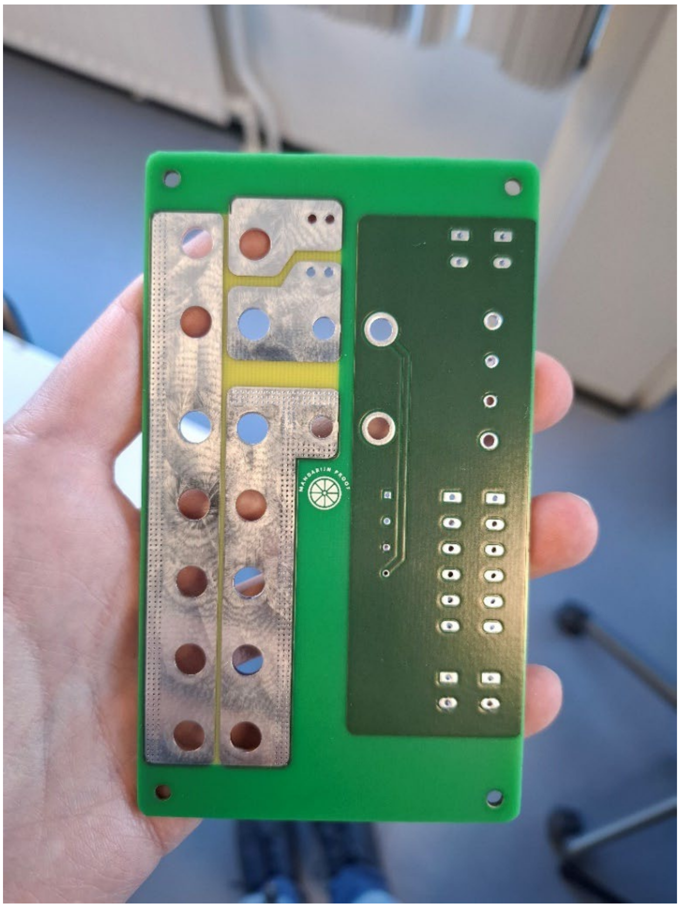
Blender simulation of the final aesthetic of the robot, by Ky Do.



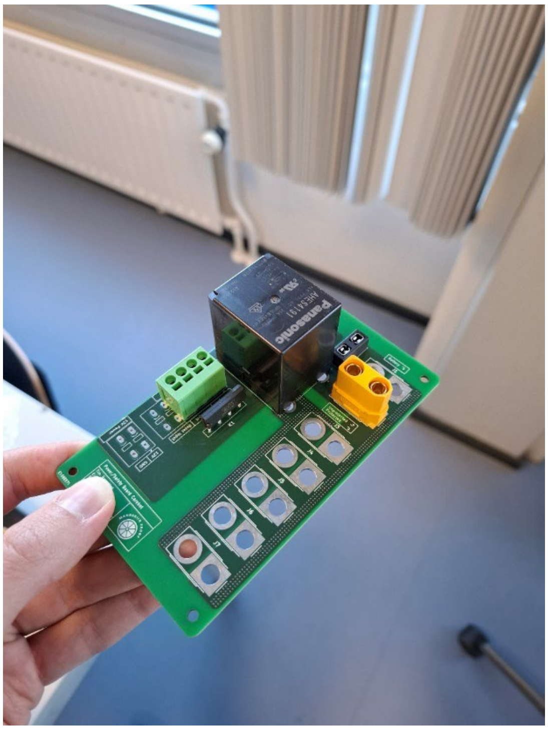
Tim Roordink, embedded system student, monitoring the battery management system (BMS) and battery performance.



BMS and battery testing.

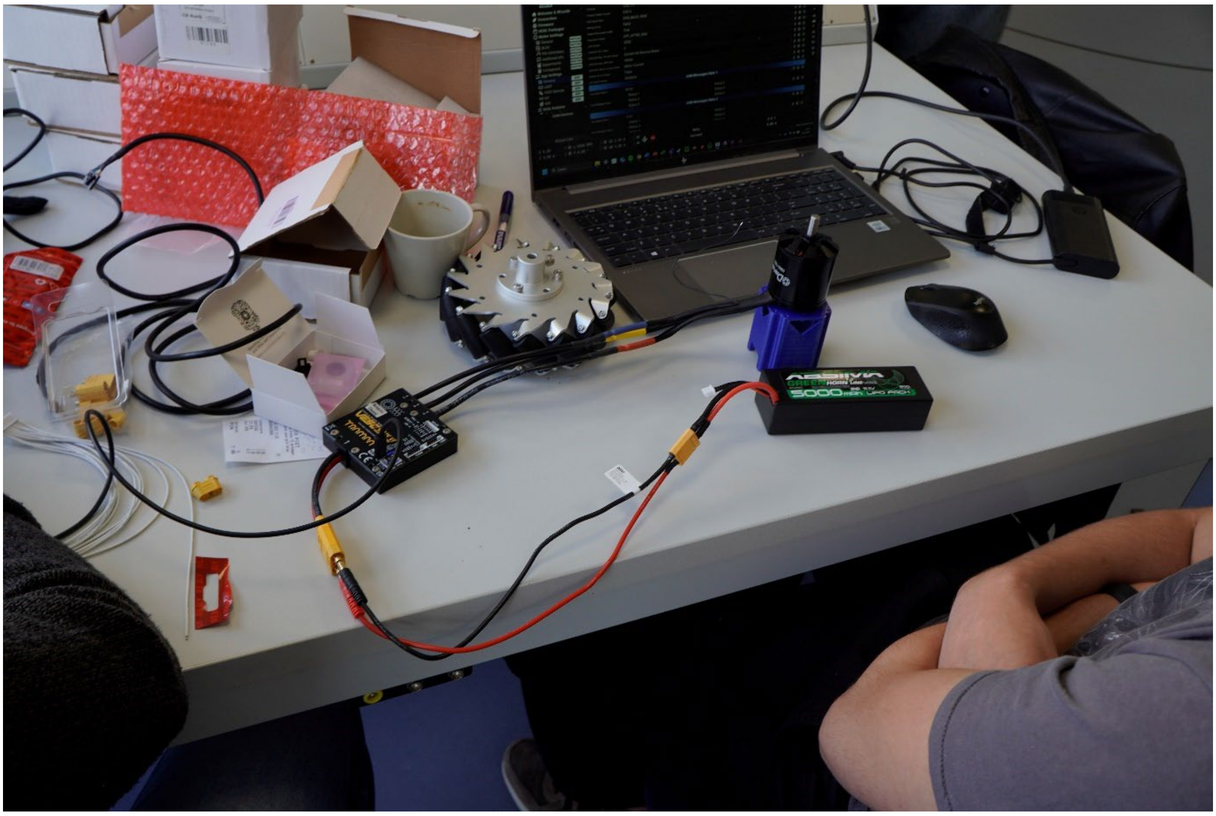


Empty printed circuit board (PCB), designed and manufactured by Tim Roordink.



Electric components assembled on printed circuit board (PCB)

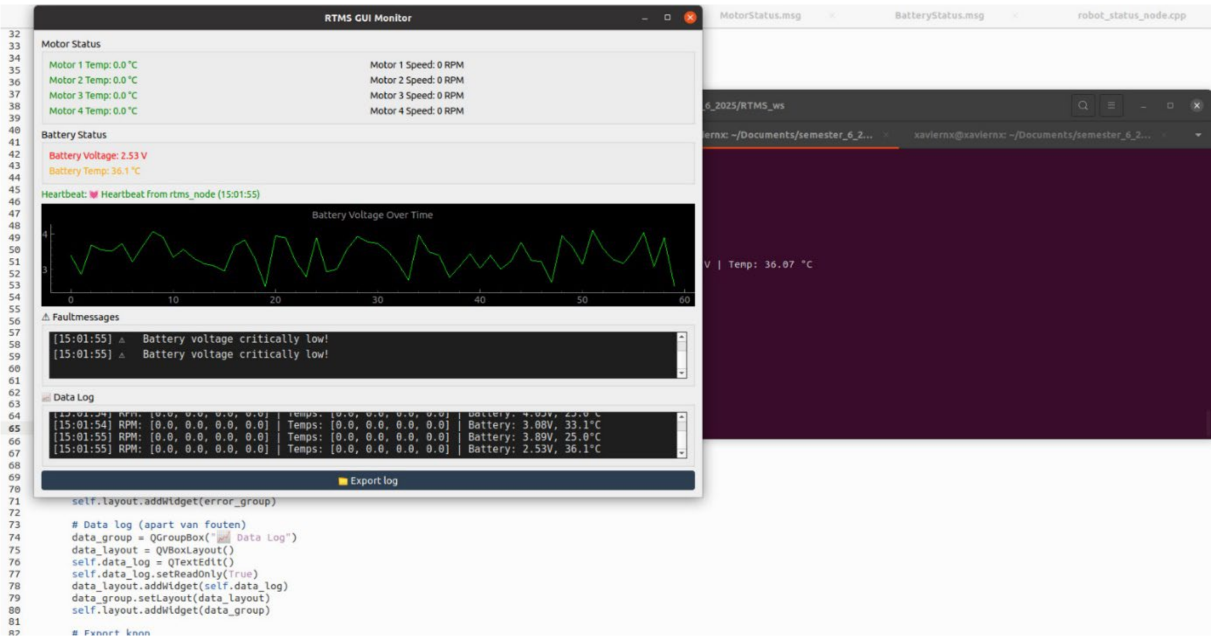
Students studying the VESC program for motor control, performed by Hidde Millekamp and Erik Wortelboer.



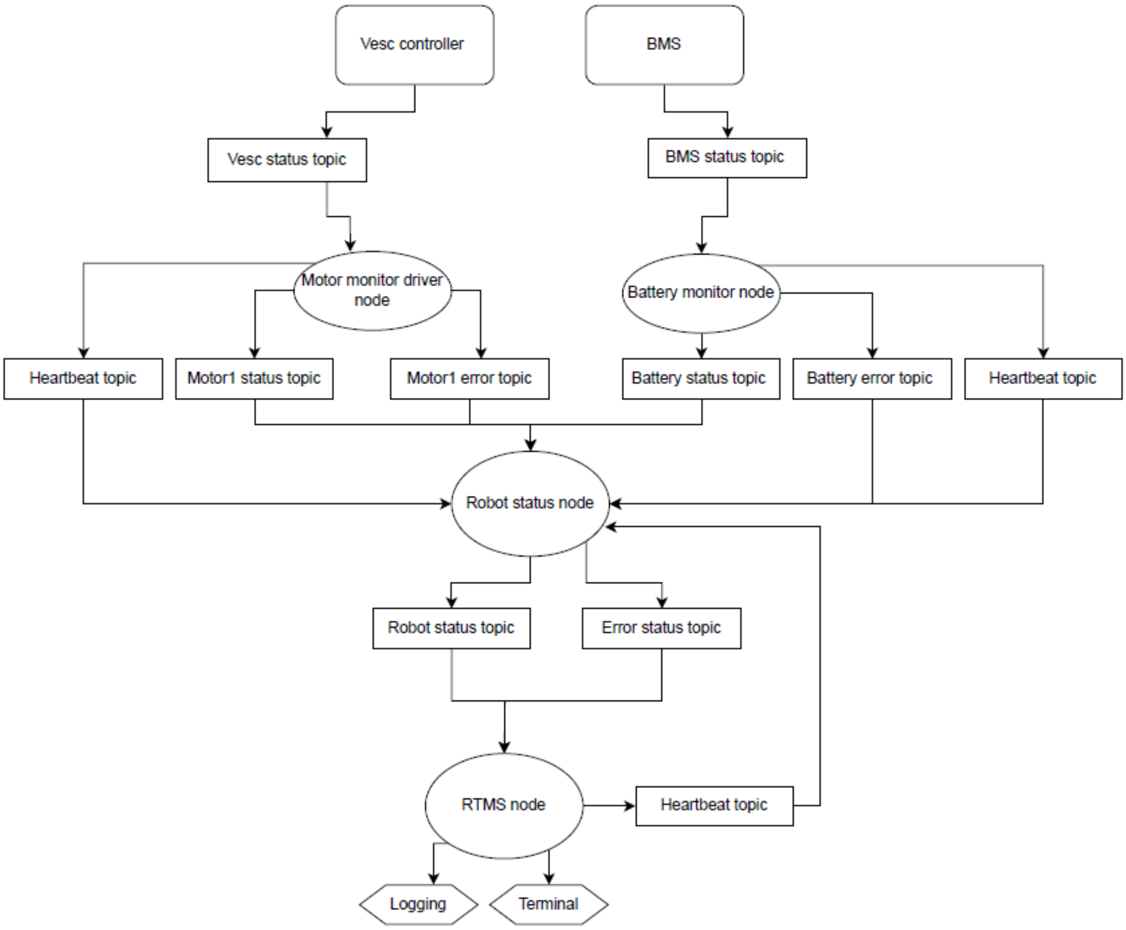
Motor control after VESC motor control program has been studied, performed by Hide Millekamp and Erik Wortelboer.

Emiel Visser, testing motor control with Jetson Nano, a powerful computer often used in robotics projects.

X-box controller implementation for motor control, by Emiel Visser.



Real time monitoring system (RTMS) simulation, this software ensures the correct functionality of the components, and a warning in the case the parameters are not within the expected range. This system was implemented by Youri Fonteijn, an electronics student.



RTMS schematic drawing, by Youri Fonteijn.