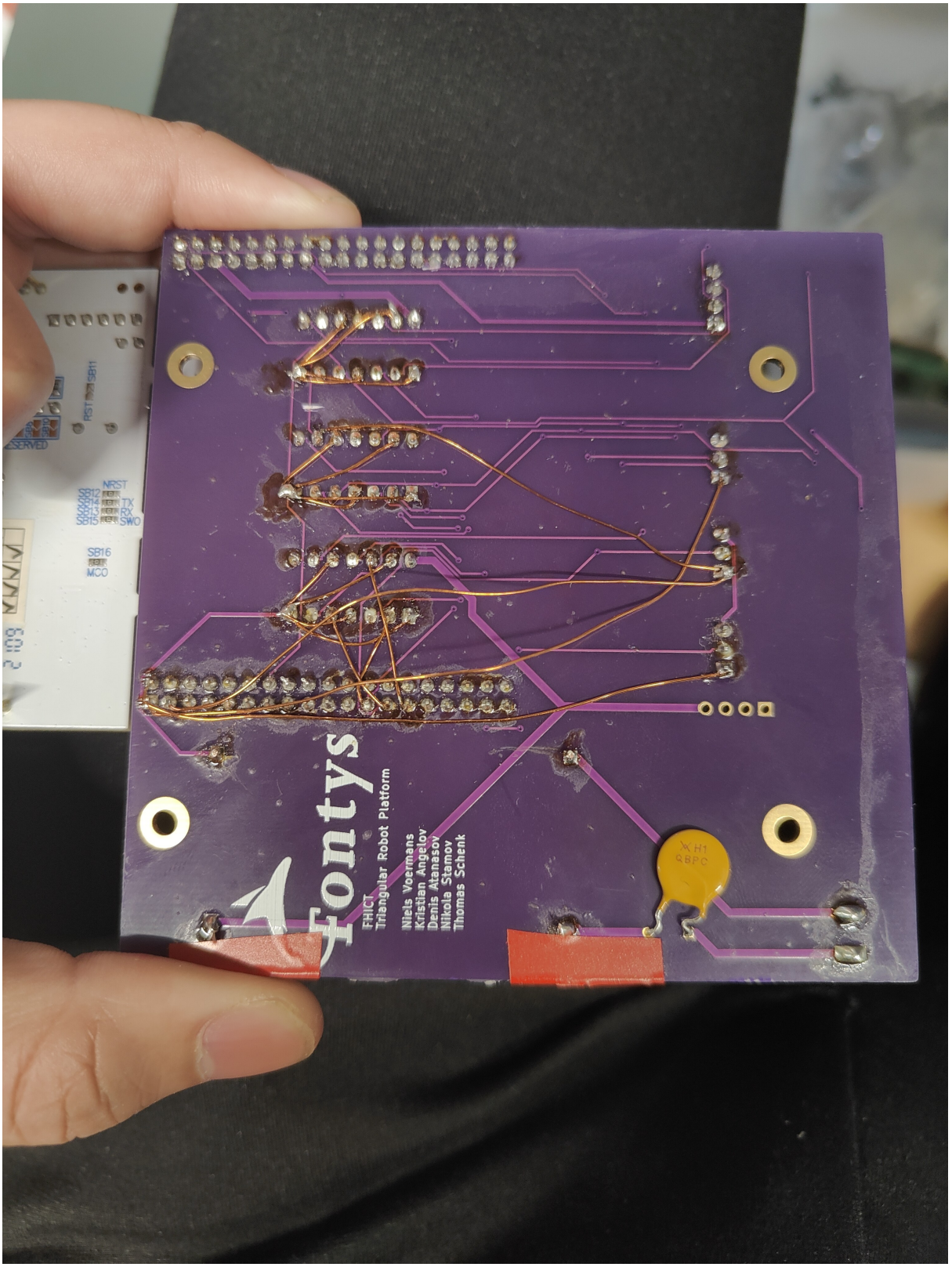
Process Report | Group Project

Introduction

In this report, I will summarize my involvement and contributions to the group project undertaken during this semester. The project titled “Triangular robot platform”, focused on developing a robust navigation, orientation and drive control over a kiwi drive robot platform. As a member of a 3-person team, my role primarily involved overhauling and brainstorming about both the hardware and software systems of the robot. Throughout the project, I actively participated in re-designing, manufacturing and re-assembling the platform as well as validating and re-introducing code from the previous semester. This report will outline my specific contributions, the challenges I encountered, and the lessons learned throughout this collaborative experience.

Hardware Redesign

After assessing the existing robot, the team and I determined that a significant redesign was necessary to enhance its functionality and performance. Key areas for improvement included wiring organization, ground isolation (a crucial requirement from the Product Owner), overall platform sturdiness, and space optimization. This involved removing unused components and strategically relocating motor drives and batteries to the base level of the robot.


Fontys
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Triangular Robot Platform
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Denis Atanasov
Nikola Stamov
Thomas Schenk
NRST
TX
RX
SWO
SB16
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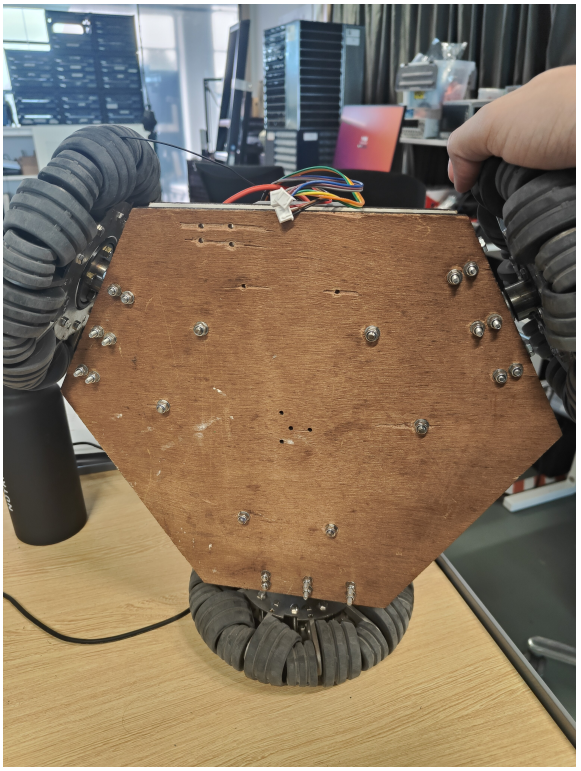
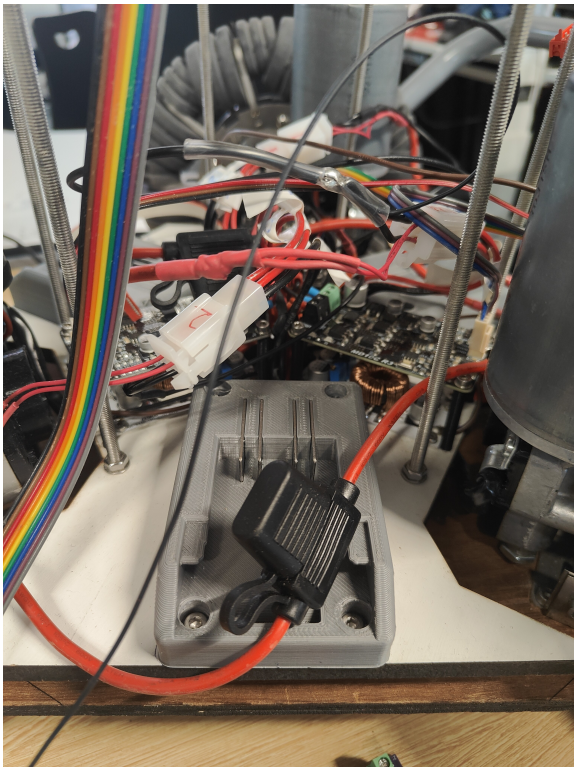
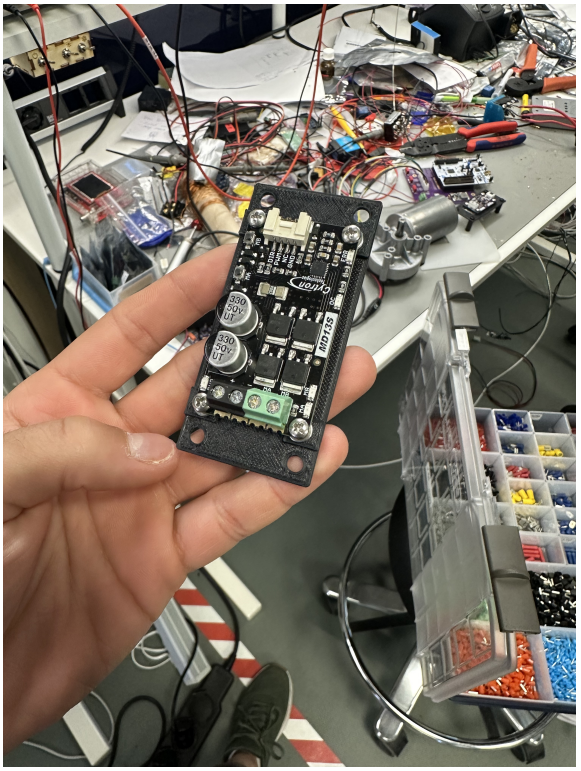
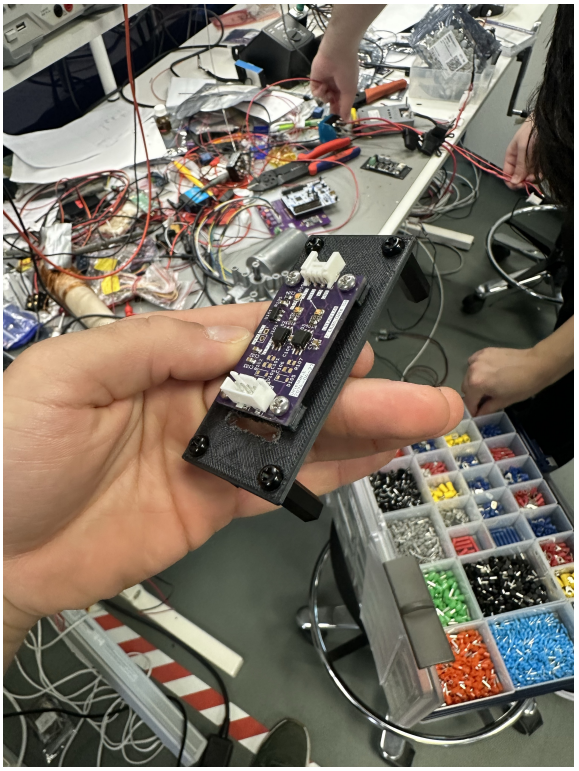




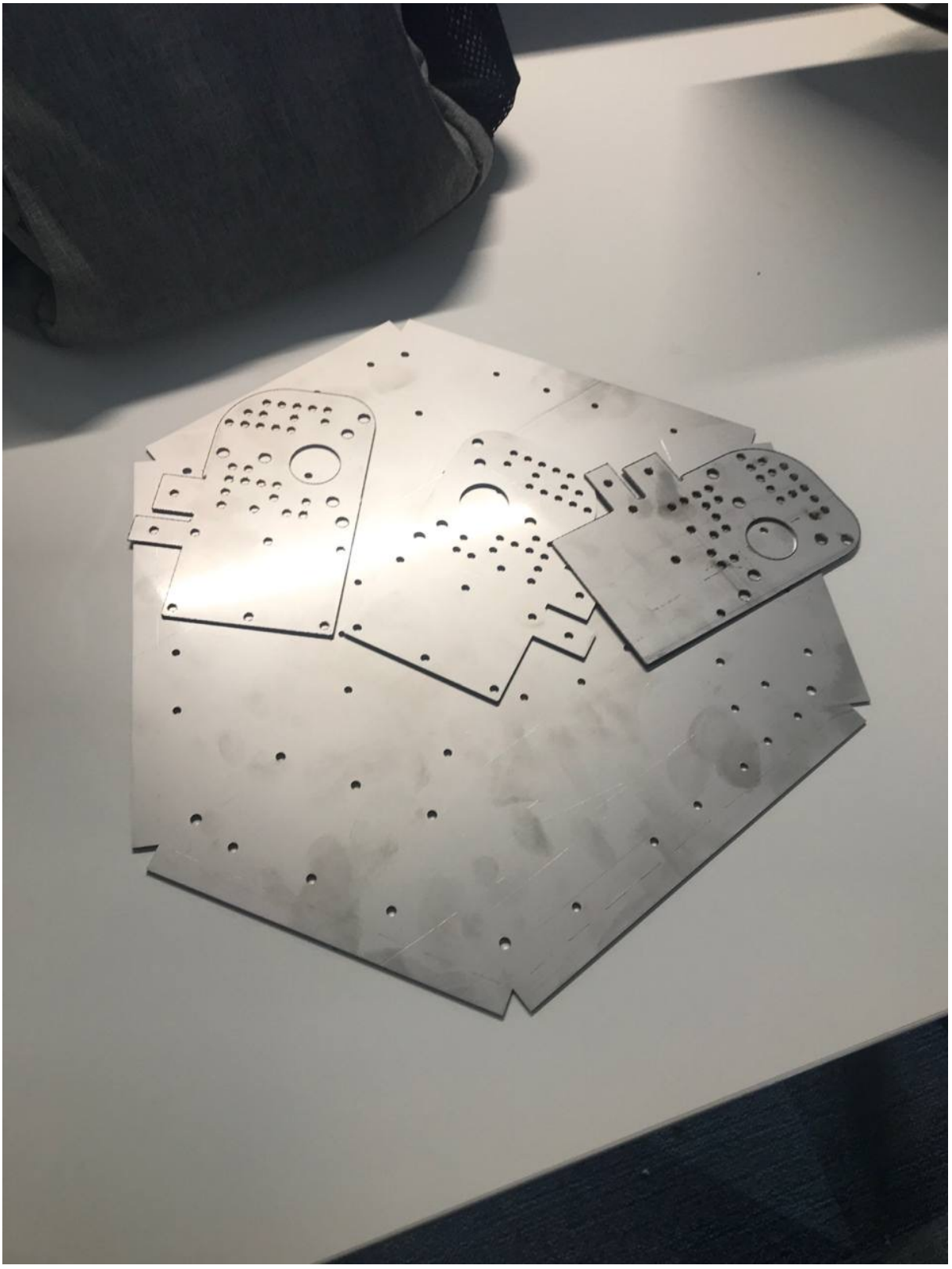
To initiate the redesign, I retrieved the CAD design from the previous group and carefully measured the dimensions of the new motor driver boards and opto-board. Using Fusion 360, I modeled these components and designed the first prototype of their mounting plates. Following printing and fit testing, I refined the designs and sent the final versions to Owen for printing.





Based on feedback from the Product Owner, I also redesigned the motor mounting brackets, corrected inaccuracies in the battery CAD models and hole alignments, and adapted the power switch mounting bracket to accommodate the new design.

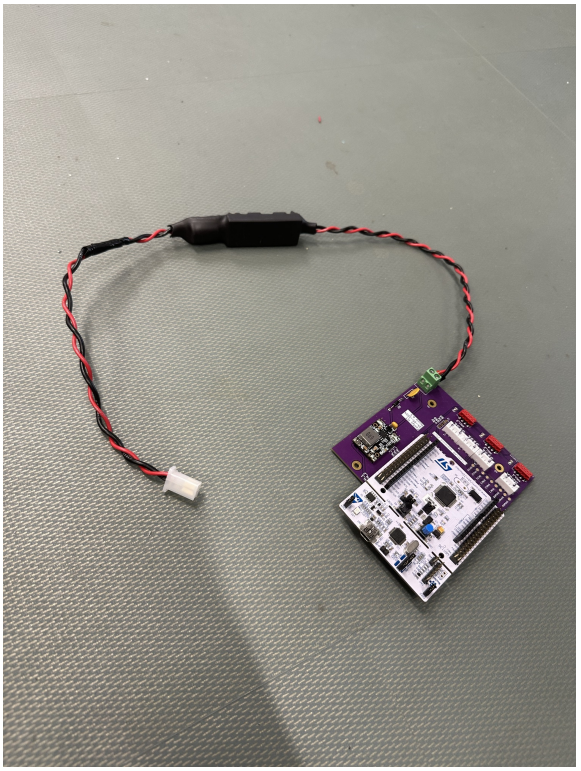
Leveraging the sheet metal tool in Fusion 360, I redesigned the base plate, ensuring the accuracy of all component mounting holes. The controller plate also underwent a redesign. The completed CAD files were then sent to the Product Owner for forwarding to Fontys Engineering for manufacturing.

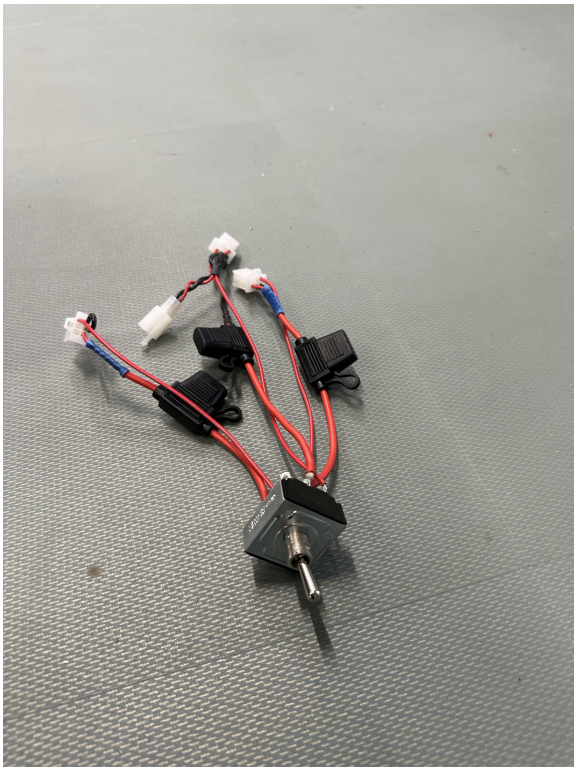


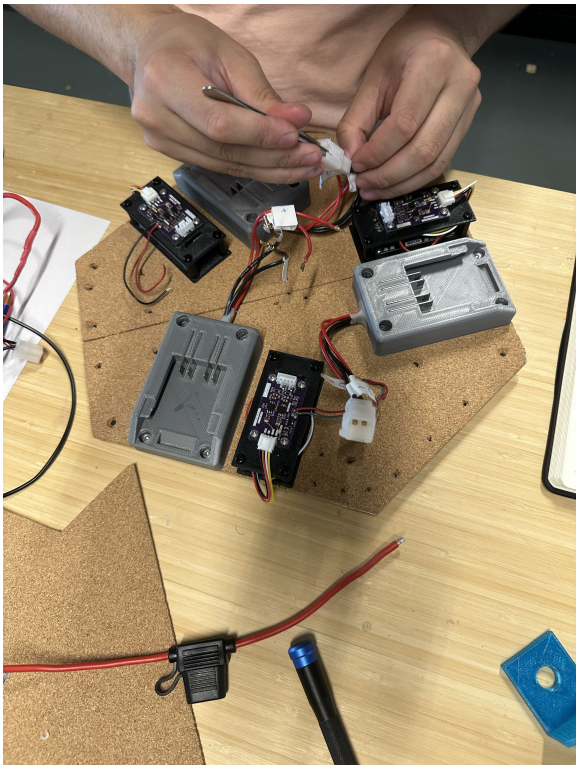
Upon receiving the manufactured parts, minor issues were identified, necessitating a trip to Fontys Engineering with the team. These issues included tapping holes in the base plate, removing burrs from the motor mounts, and adjusting their bend angles. To enhance ground isolation, a layer of cork was

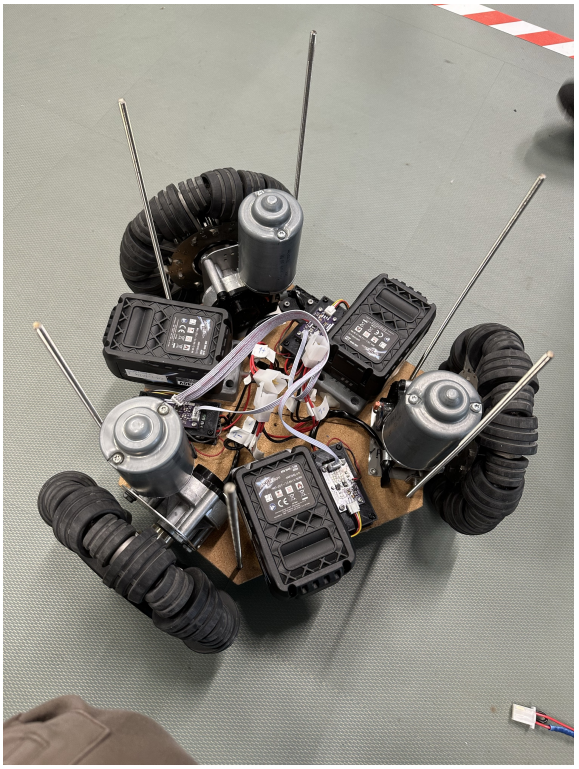
glued onto the metal base plate. However, due to an error in the bending process, the motor mounts had to be remanufactured.

To further streamline the robot's wiring and improve maintainability, I proposed the creation of a wiring harness and the addition of connectors. This idea was well-received by the team, and we collaborated to implement this solution, effectively troubleshooting and ensuring the correct connections were established.



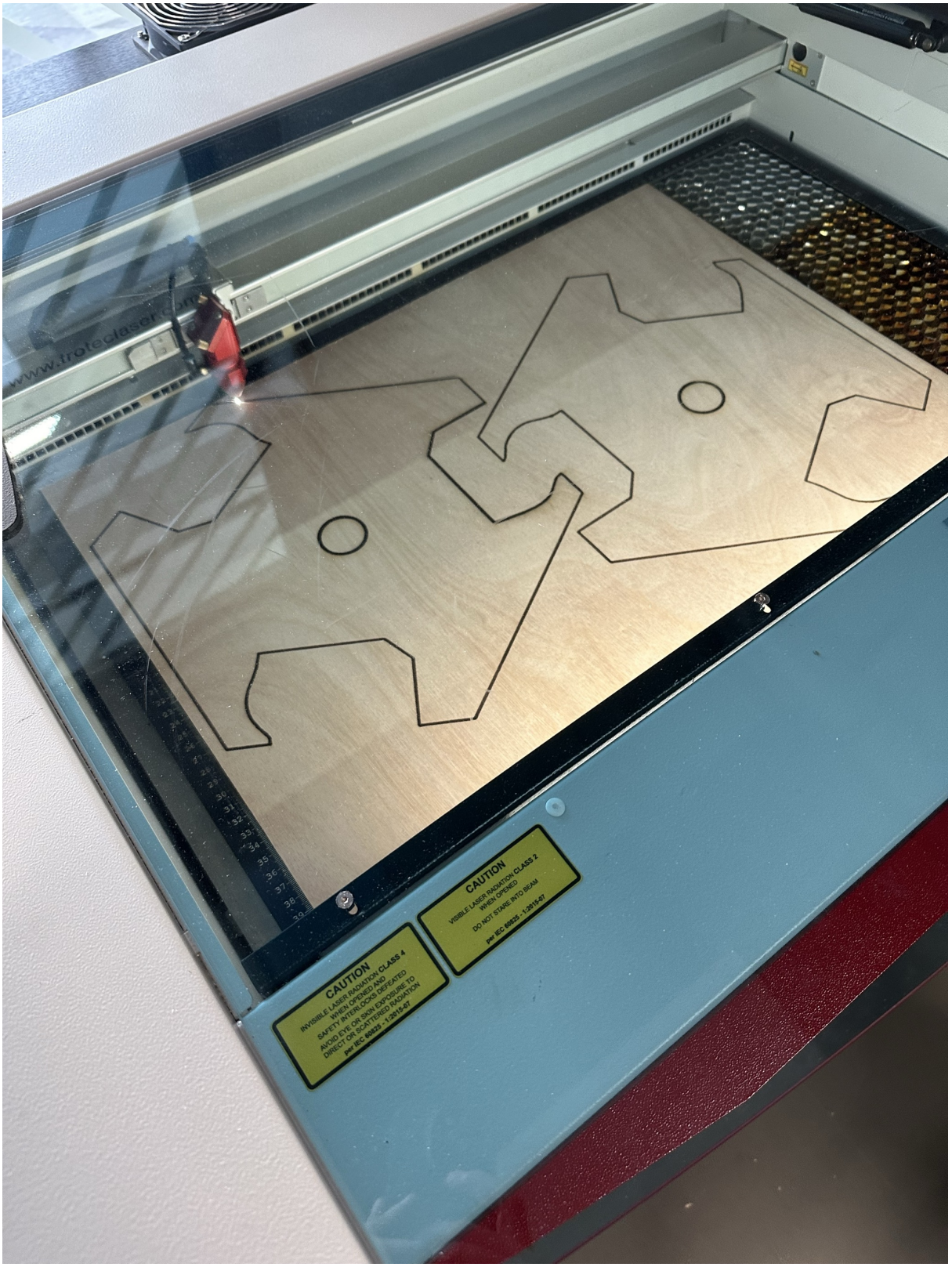






With the base level complete, we purchased some plywood to laser cut the new controller plate. We also laser cut it twice to create two identical pieces. These pieces were then glued together to form a thicker and sturdier controller plate,

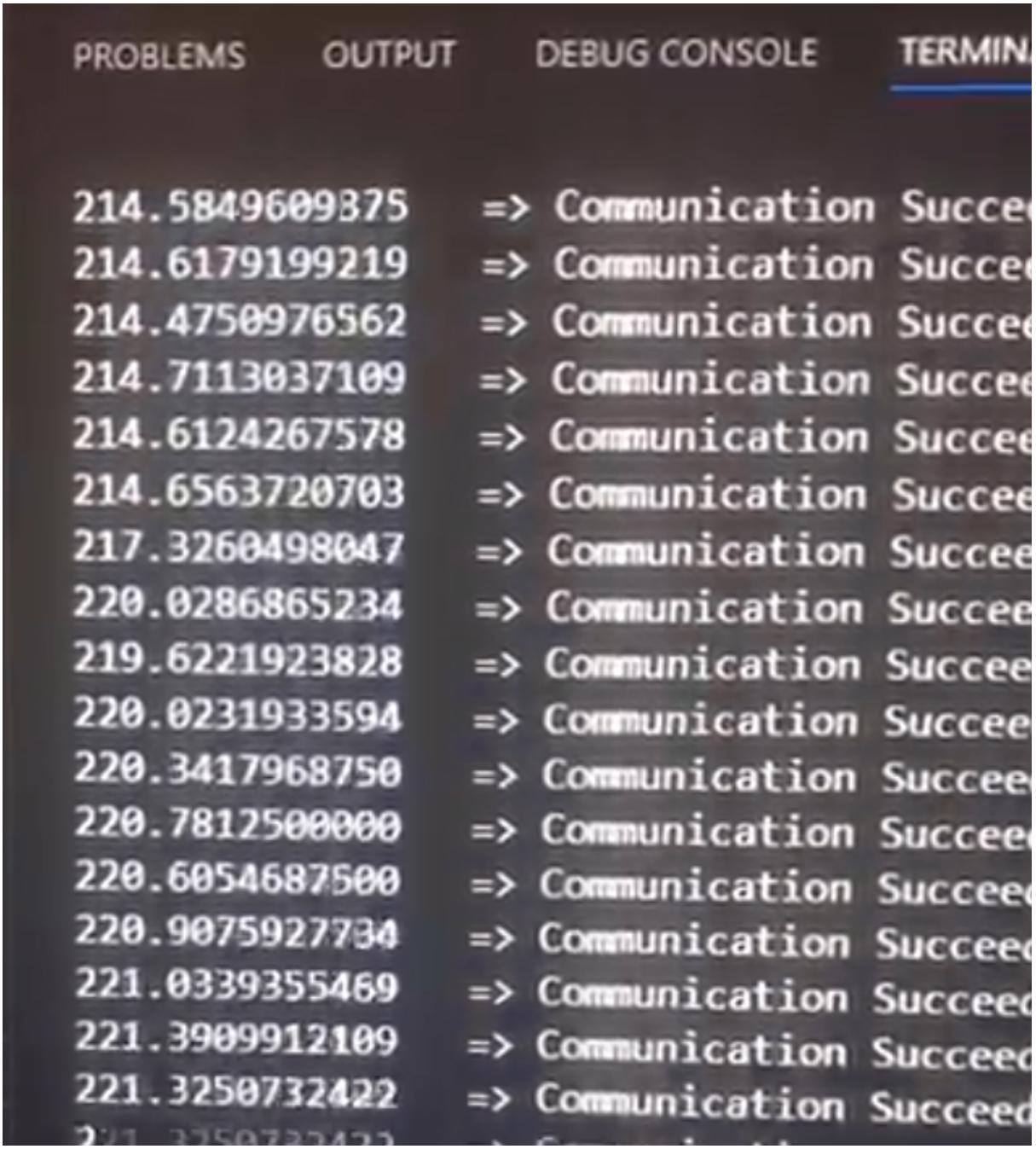
providing a more robust platform for the robot's controls. I then drilled the necessary holes for mounting the studs.



The cumulative efforts of these hardware redesigns resulted in a significantly improved robot platform. The new design addressed the issues identified in the original model, enhancing its functionality, reliability, and maintainability. The optimized space, enhanced wiring, and robust ground isolation significantly contributed to a more efficient and effective platform for future development and testing.

Software Validation

In the final project weeks, I was tasked with validating the previous group's code on the redesigned platform. While testing the hall effect sensors, I encountered difficulties with the provided code. To resolve this, I found a library from the original manufacturer, which, despite not listing our specific model, successfully enabled the sensors to read angle values with minimal error of around +/-1 deg of rotation.



I also examined the IMU and remote control code. Due to time constraints, the IMU functionality remains unverified. However, the new opto-coupler boards introduced an overcurrent issue in the motor driver, causing jittering. This was resolved by reducing the PWM frequency to 20kHz and constraining the maximum and minimum motor speed values in the code.

Conclusion

In conclusion, my active participation in the "Triangular Robot Platform" project allowed me to apply and develop a range of skills, from CAD design and prototyping to troubleshooting hardware and software issues. The challenges encountered during the redesign process, particularly those related to manufacturing and assembly, served as valuable learning experiences. Despite these obstacles, the collaborative effort of our team led to a significantly improved robot platform, characterized by enhanced functionality, reliability, and maintainability.

While the software validation process revealed areas for further investigation, particularly regarding the IMU functionality, the successful resolution of the opto-coupler-induced overcurrent issue demonstrates my problem-solving abilities. The experience gained during this project will undoubtedly be an asset in future endeavors, and I look forward to applying the knowledge and skills acquired to new challenges in the field of robotics.