Department of Electronic & Telecommunication Engineering,
University of Moratuwa, Sri Lanka.

3D Mapping Device for Object Tracking
Individual Contribution - Group B

Submitted By:
210031H Amarasinghe A.A.W.L.R.

Submitted in partial fulfillment of the requirements for the module

EN 2160 : Electronic Design Realization

23rd June 2024

When collaboration is concerned, most of the tasks were done collaboratively as it is essential for both members to have experience in all aspects of the design. However, when the responsibility for the completion of each task is concerned, some parts were taken by myself.

1 Circuit Design

Developing the circuit for the 3D scanner was the first task I engaged in. I had to consider various needs of our product, such as the best microcontroller for this task, the best IC for USB serial communication, how to connect two TOF sensors to the microcontroller, and choosing an I2C multiplexer for independent communication of the TOF sensors. Additionally, I had to ensure that the power supply design was robust enough to handle the varying loads and that all components were properly decoupled to minimize noise and interference. This required careful selection of capacitors and inductors to ensure stable operation. After finalizing the circuit and components, I ordered the components from Mouser in Texas, USA, and LCSC Electronics in Shenzhen, China. This step was crucial to ensure that all parts were available and matched the design specifications.

2 PCB Design

Designing the PCB was done by me. I had to consider the thermal management of the components and the signal flow of the circuit. I tried to keep the routing paths as short as possible for the smooth operation of the PCB. I followed the IEEE guidelines and the instructions given by the lecturer when designing the PCB. Furthermore, I had to design the layout to minimize electromagnetic interference (EMI) and ensure proper grounding. This involved creating a 2-layer PCB with dedicated power and ground planes. After finalizing the PCB design, I sent the design files to JLCPCB in China for manufacturing. This involved generating the Gerber files and Bill of Materials (BOM), ensuring all files were correctly formatted and included all necessary information for the manufacturing process. I chose JLCPCB due to their high-quality manufacturing standards and quick turnaround times, which were essential for keeping our project on schedule.

3 Visualizer Programming

In the 3D mapper, we get distance data from the TOF sensors and send it to the computer for processing. I created a 3D mesh with the distance data using Python libraries. Then, using 3D Delaunay triangulation, I was able to make the 3D visualizer. The visualizer needed to be efficient and capable of handling large datasets in real-time, so I optimized the code for performance. Additionally, I added features such as interactive zoom, pan, and rotate, as well as the ability to save and load 3D models. This made the visualizer a useful tool for both development and demonstration purposes.

4 Document Preparation

We had to prepare two main documents: the design document and the design methodology report. I prepared them using LaTeX according to the required sections. The design document detailed the specifications, schematics, and design choices for the 3D scanner, while the design methodology report described the process and rationale behind our decisions. I ensured that both documents were well-structured and free of grammatical errors, and included diagrams and figures to illustrate key points. Additionally, I incorporated feedback from my collaborators to refine and improve the documents.