Department of Electronic and Telecommunication Engineering
University of Moratuwa

Electronic Design Realization

210728C - Wijewickrama W.K.D.D.D.

210031H - Amarasinghe A.A.W.L.R.

3D Surround Scanner Project Report

Application of Engineering Principles

During the last three semesters, we have learned various engineering principles that we applied in our project:

- **Design Principles**: We followed a systematic approach to design our 3D scanner. We started with a clear definition of the problem, identified the requirements, and then moved on to the design and testing phases. We also considered factors such as functionality, aesthetics, and user-friendliness in our design.
- **Analytics**: We used analytical methods to understand and interpret the data collected by our scanner. This helped us to make informed decisions during the design and testing phases.
- **Enclosure and PCB Designing Principles**: We designed a compact and robust enclosure for our scanner. We also designed a Printed Circuit Board (PCB) that houses all the electronic components of our scanner.

Application of Mathematics and Science

We applied various mathematical and scientific concepts that we learned during our A/L and the last three semesters:

- **Linear Algebra**: We used linear algebra for processing the raw data collected by our scanner into a 3D image.
- **Signal Processing**: We used signal processing techniques to filter out noise and extract the correct data from the raw data collected by our scanner.
- **Programming Skills**: We used our programming skills to write the software that controls our scanner and renders the 3D image from the processed data.

- **Cartesian Geometry**: We used concepts from Cartesian geometry to map the data points collected by our scanner into a 3D space.

Hands-On Skills

We applied various hands-on skills that we learned during the last three semesters:

- **PCB Design, Soldering, and Testing**: We designed the PCB for our scanner, soldered the components onto it, and tested it to ensure it works as expected.
- **Enclosure Design**: We designed a robust and user-friendly enclosure for our scanner.
- **Testing and Debugging**: We thoroughly tested our scanner and debugged any issues that we encountered.

Applicability of the Project for Solving an Industrial Problem in Sri Lanka

The 3D scanner project has versatile applications in Sri Lanka's industries:

- **Warehouse Management**: Improves inventory tracking for better supply chain management.
- **Construction**: Facilitates site surveying, BIM, and construction progress monitoring for efficiency.
- **Heritage Preservation**: Aids in documenting and preserving cultural sites and artifacts.
- **Disaster Management**: Assists in terrain mapping and infrastructure assessment for better resilience.

Cost of Main Components

The rough prices of our main components are as follows.

- 2 Nemma 17 stepper motors- Rs.3000
- Atmega 328 microcontroller- Rs.1500
- Time-of-Flight (ToF) sensor-Rs.1000
- A4988 Stepper Motor Driver-Rs.500

We use industry-level cost-effective components. The total cost of these components is within our budget.

Fig 1 : Nema 17 Stepper Motor

Fig 2 : Atmega 328P Microcontroller

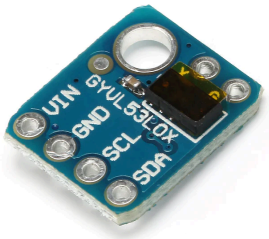

Fig 3 : Time of Flight Sensor

Suitability of the Project to Achieve the Learning Outcomes of the Electronic Design Realization Module

Our project aligns well with the learning outcomes of the Electronic Design Realization module. We applied various engineering principles, mathematical and scientific concepts, and hands-on skills that we learned during the module. We also learned how to work as a team, manage a project, and communicate our ideas effectively. Overall, this project provided us with a valuable opportunity to apply what we learned in the module to a real-world problem.

1.Identify a suitable design model for a given problem:

The report indicates a systematic approach to problem definition, requirement identification, and design. This demonstrates the application of design principles to address a specific problem, which aligns with this learning outcome.

2.Design testable PCBs complying with industry standards:

The project involves designing a Printed Circuit Board (PCB) to house electronic components. Although the report doesn't explicitly mention compliance with industry standards, the inclusion of industry-level cost-effective components suggests adherence to certain standards and practices.

3.Explain testing methodologies used in electronic manufacturing:

The report mentions thorough testing and debugging of the scanner, indicating an understanding and application of testing methodologies in electronic manufacturing.

4.Design product enclosures complying with industry standards:

The project includes designing a robust and user-friendly enclosure, which suggests consideration for industry standards related to product enclosure design.

5.Prepare proper documentation for electronic design:

While the report doesn't provide explicit details about documentation, the comprehensive description of the project's development process and components used implies a level of documentation suitable for electronic design projects.

6.Apply the knowledge gained to a commercial design project resulting in a working prototype:

The project involves the application of engineering principles, mathematical concepts, and hands-on skills to develop a working prototype of a 3D scanner. This aligns closely with the objective of applying knowledge to a commercial design project.