University of Hertfordshire

School of Physics, Engineering & Computer Science

4FTC2099 - Electronic Product Development

Group Report

THIS COPY BELONGS TO:	**Group B**

Abstract

This report presents the design and development of a **Digital Visitor Counter with Enhanced LED Indicators**, an innovative system aimed at automating visitor tracking while offering real-time visual feedback. The system's design combines accuracy, simplicity, and scalability, with applications in libraries, offices, and event spaces., an automated system to track and display the number of visitors entering or exiting a monitored area. The project incorporates laser and LDR sensors for motion detection, a counting circuit to process signals, and LED indicators to provide real-time feedback. The system is designed to replace manual counting methods, offering applications in libraries, offices, and event spaces. Further developments include wireless connectivity and scalability for larger spaces.

Table of Contents

Contents

Abstract 2

Table of Contents 3

1. Group members 4
2. Circuit Design and PCB Layout 4

Figure 1 - Schematic view of design 5

3. Electronic Product Enclosure Designs and Fabrication 5

Figure 2 :circuit 2D design 6

Figure 3 : 3D design of the circuit 7

Figure 4: The routes of the design. (if we implemented our design in PCBboard,) 7

4. Electronic Product Assembling and Testing 7

Figure 10: During the testing before soldering (i) 9

Figure 11: during the testing before soldering (ii) 9

Figure 11: placing the components to solder 9

Figure 11: during the soldering 10

Figure 12**:** Mapping before soldering 10

..... 10

Figure 14 : View of the circuit after soldering 10

Figure 15: Testing after Soldering 11

Figure 16: The last view 11

5. Conclusions and Further Development 11

REFERENCES 13

BIBLIOGRAPHY 14

1.Introduction

The project aims to develop a **Digital Visitor Counter** capable of providing accurate and automated visitor tracking. The system uses laser and LDR sensors for detecting entry and exit, a signal conditioning circuit for stability, and counters to display the number of visitors. Key features include:

- **LED Indicators** for Entry, Exit, and Full conditions.
- **Modular Design** for future scalability.

The report outlines the steps involved in designing the circuit, creating an enclosure, assembling the product, and testing the system's functionality. It concludes with discussions on further development opportunities.

1. Group members

TABLE 1 GROUP MEMBERS

Name	Role/Task taking in this project
Dulina Nadith	Circuit Design
Kavishka Deshapriya	Soldering and Testing
Deeshana Medani	Documentation and Testing

2. Circuit Design and PCB Layout

Component Selection and Design Rationale

1. Laser and LDR Sensors:
   - Used for detecting motion by sensing beam interruptions.
   - Provides reliable input signals for counting.

2. 4093 IC (Quad NAND Schmitt Trigger):
   - Stabilizes noisy signals from sensors.
   - Ensures accurate triggering for the counter circuit.

3. CD40110 IC (Up/Down Counter):
   - Handles counting operations and drives the 7-segment displays.

4. LED Indicators:
   - Entry, Exit, and Full LEDs provide real-time visual feedback.

5. 7408 IC (AND Gate):
   - Implements logic for detecting the maximum count condition for the Full LED.

6. 7805 Voltage Regulator:
   - Provides a stable 5V DC power supply.

Tools and Software Used

- KiCad for schematic design and PCB layout.
- Multimeter and oscilloscope for testing.
- Tinker cad for simulate the circuit

PCB Layout

- The PCB design ensures minimal trace length for critical signals to reduce noise and improve signal integrity. High-priority components such as sensors and power lines were strategically positioned to optimize performance.

- Decoupling capacitors were added near power pins to reduce noise.

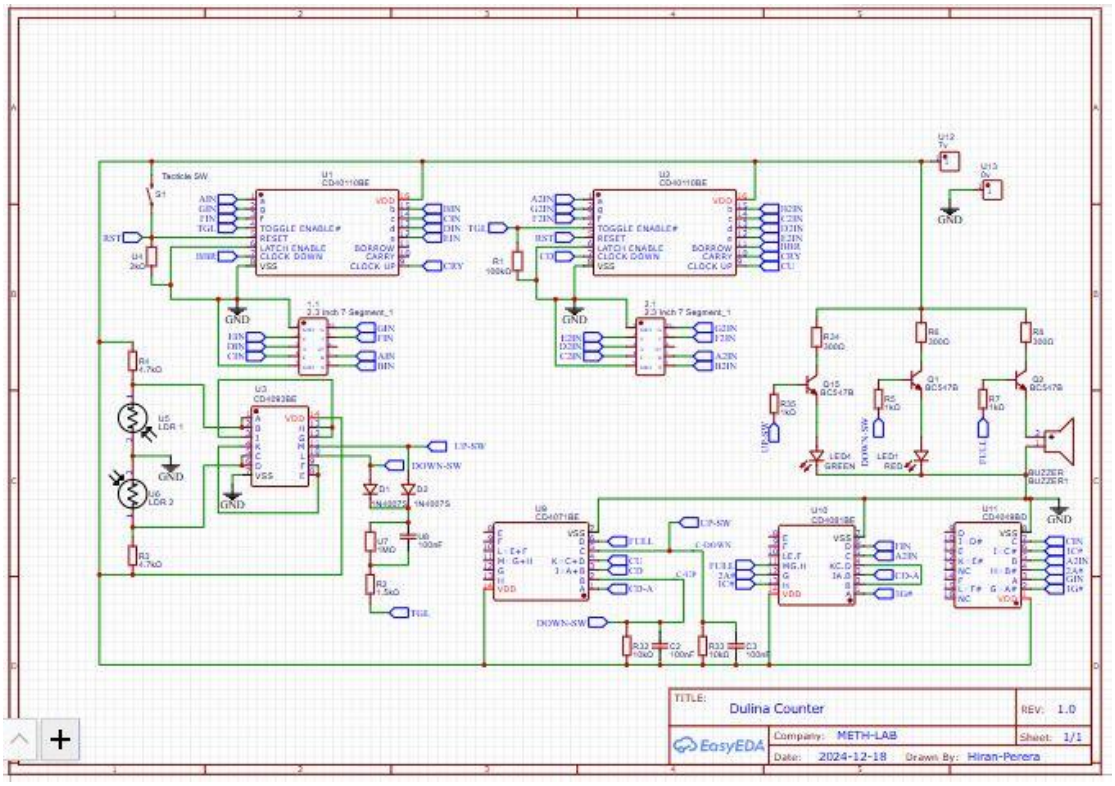

Figure 1 - Schematic view of design

3. <u>Electronic Product Enclosure Designs and Fabrication</u>

Enclosure Design

- The enclosure was designed using CAD software and fabricated using a 3D printer.
- Dimensions: [Insert dimensions here]

- Material: PLA for lightweight and durability.

Fabrication Process

- The design incorporates slots for sensors and LEDs to ensure accessibility and visibility, while also supporting easy maintenance. Additional structural features include mounting points for secure component placement.
- Ventilation holes were added for heat dissipation.

Enclosure Image

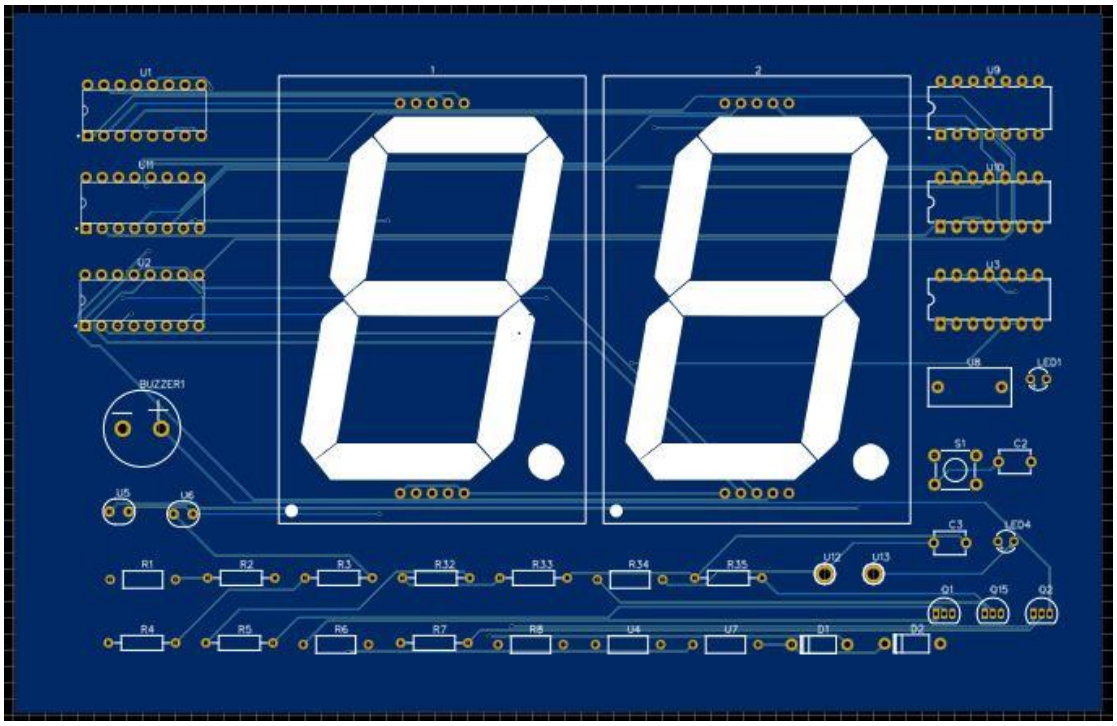

Figure 2 :circuit 2D design

Figure 3 : 3D design of the circuit

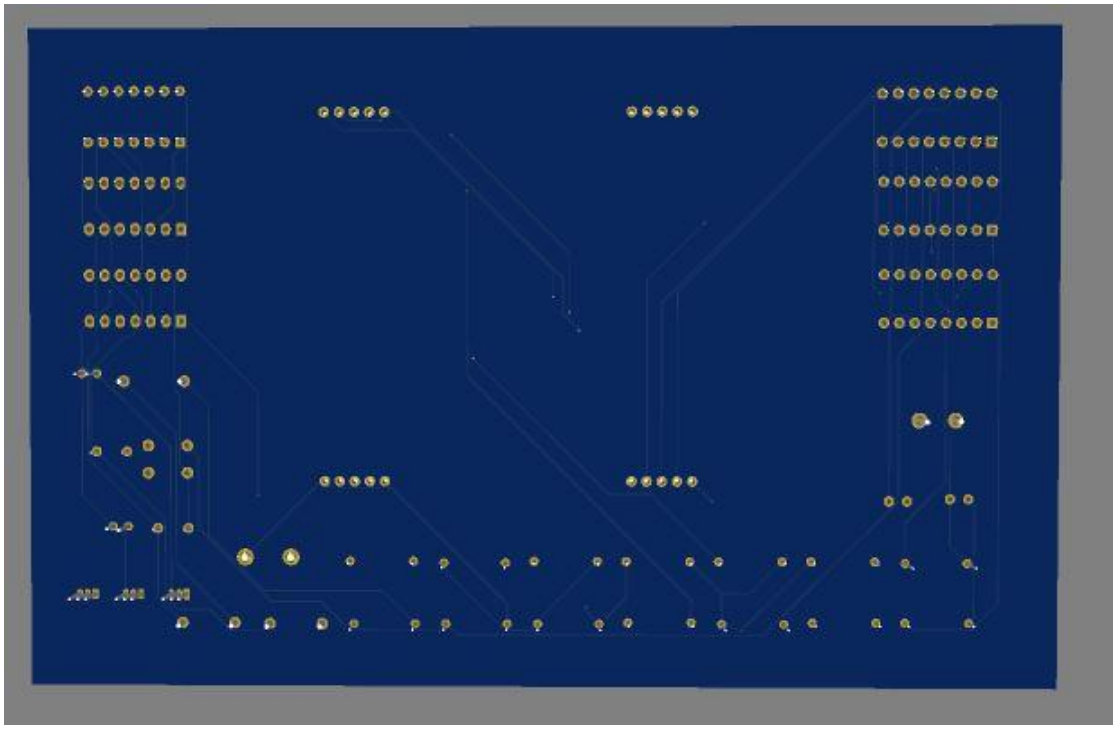

Figure 4: The routes of the design. (if we implemented our design in PCBboard,)

4. Electronic Product Assembling and Testing

Assembling Process

- Components were soldered onto the PCB following the layout.
- Sensors and LEDs were securely mounted onto the enclosure.
- Wires were routed neatly to avoid signal interference.

Testing Procedure

- **Sensor Calibration:** Laser and LDR pairs were tested under different lighting conditions to ensure accuracy.
- **Counter Functionality:** Increment and decrement operations were validated using simulated entry and exit signals**.**
- **LED Indicators:** Verified Entry, Exit, and Full LEDs for correct triggering.

Final Product Image

Figure 5: The components what we need

Figure 6: The components

Figure 7

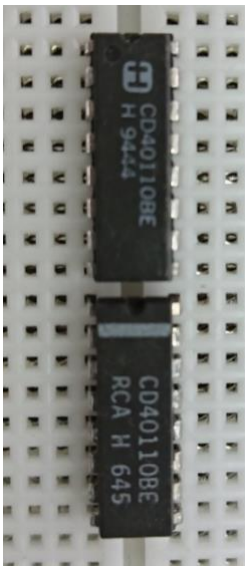

Figure 8

Figure 9

Some Components and other stuffs

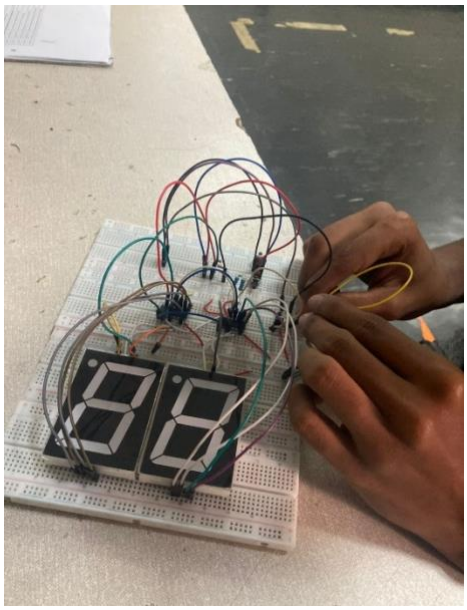

Figure 10: During the testing before soldering (i)

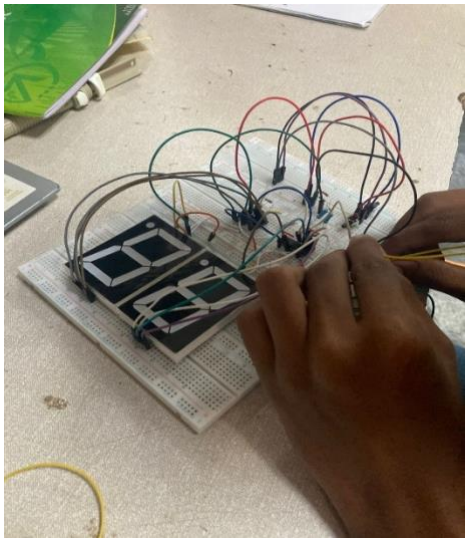

Figure 11: during the testing before soldering (ii)

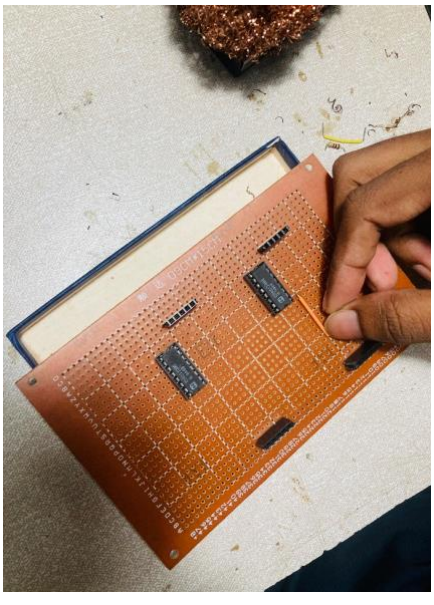

Figure 11: placing the components to solder

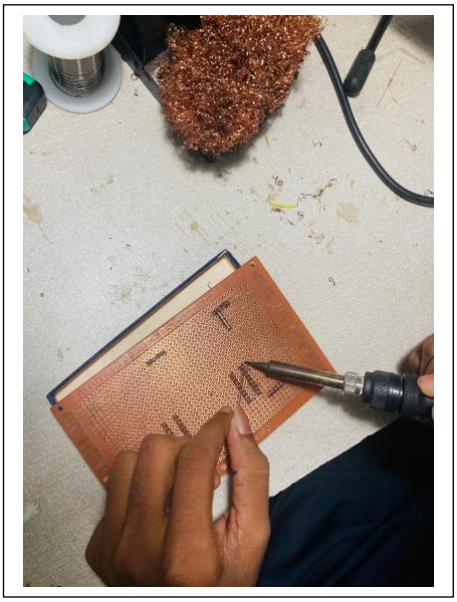

Figure 11: during the soldering

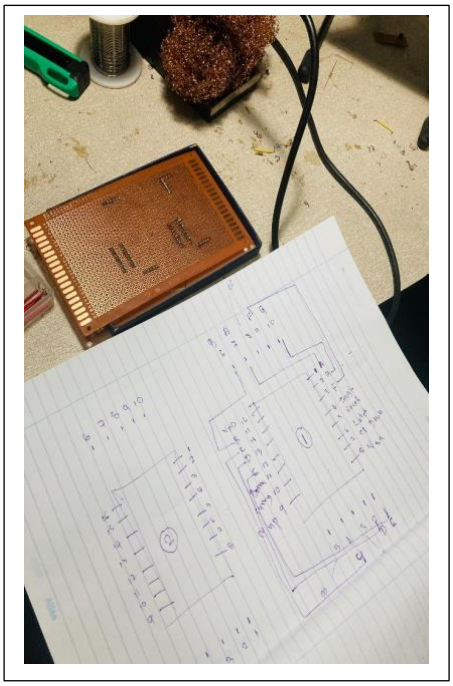

Figure 12**:** Mapping before soldering

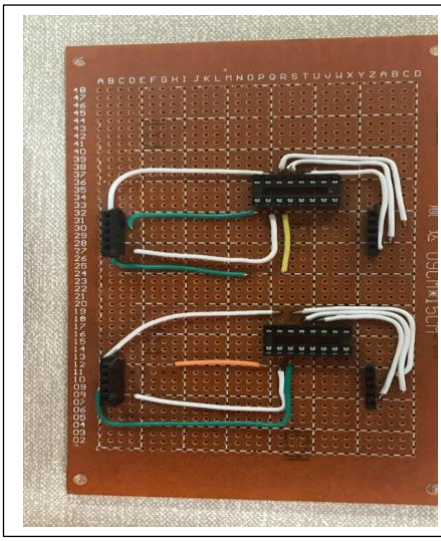

Figure 14 : View of the circuit after soldering

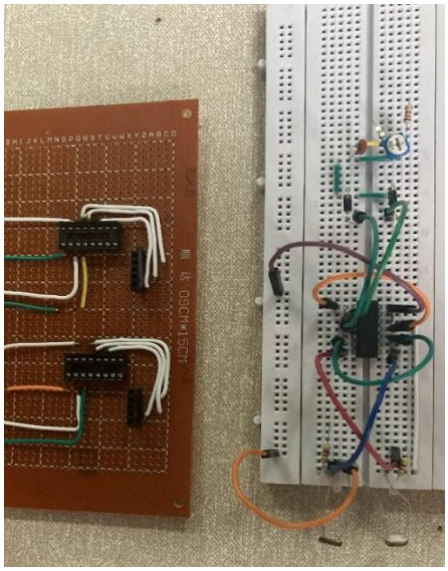

Figure 15: Testing after Soldering

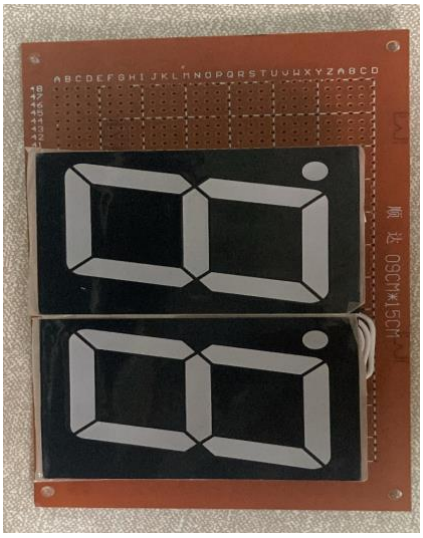

Figure 16: The last view

5. Conclusions and Further Development

Conclusions

The project successfully developed a functional Digital Visitor Counter, achieving:

- Accurate visitor tracking using laser and LDR sensors.
- Reliable counting with the CD40110 IC.
- Visual feedback via LED indicators.

Further Development

- Adding wireless connectivity for remote monitoring, such as Wi-Fi or Bluetooth, to allow real-time data transmission to external devices.
- Enhancing sensor performance to operate in diverse environments.
- Expanding the system to support larger areas with multiple entry/exit points.

REFERENCES

1. Texas Instruments, "CD40110B Decade Up/Down Counter Datasheet," 2015.
2. NXP Semiconductors, "4093 Quad NAND Schmitt Trigger Datasheet," 2016.
3. Vishay Intertechnology, "Laser Module and LDR Sensor Datasheet," 2021.

BIBLIOGRAPHY

[ENTER YOUR BIBLIOGRAPHY HERE - Books and other reading matter not specifically referred to in the text but considered useful reading matter should be listed in the Bibliography. The format of the items in the bibliography should be the same as for references i.e. there should be full information to allow a reader to obtain a copy of the text book or journal article.]