BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

EEE 303 (January 2023)

Digital Electronics Laboratory

Final Project Report

Section: B1 Group: 07

Digital Cash Counter

Course Instructors:

Full Name 1, Assistant Professor
Full Name 2, Part-Time Lecturer

Signature of Instructor: _____

Academic Honesty Statement:

IMPORTANT! Please carefully read and sign the Academic Honesty Statement, below. Type the student ID and name, and put your signature. *You will not receive credit for this project experiment unless this statement is signed in the presence of your lab instructor.*

"In signing this statement, We hereby certify that the work on this project is our own and that we have not copied the work of any other students (past or present), and cited all relevant sources while completing this project. We understand that if we fail to honor this agreement, We will each receive a score of ZERO for this project and be subject to failure of this course."

Signature: _____ **Full Name: Md. Ishraq Anzum** **Student ID: 1906095**	**Signature:** _____ **Full Name: Md. Imtiaz Hossain** **Student ID:1906097**
Signature: _____ **Full Name: Md. Tanzid Hasan** **Student ID:1906096**	**Signature:** _____ **Full Name: Md. Sazzad** **Student ID:1906098**
Signature: _____ **Full Name: Md. Jarjis Mondal** **Student ID:1806068**	

Table of Contents

1 Abstract

- This project is a simple prototype of a cash counter that is used to record complicated transactions.
- We can specify product based on product code.
- We can assign number of stored products.
- We can specify price of the product.
- Upon customer order, calculations will be done automatically.
- We can return or give discount for products.

2 Introduction

Digital cash registers are a widely adopted tool with diverse functions and applications in various contexts. Modern cash counters are multifunctional, capable of tasks such as processing credit cards, verifying personal checks, managing inventory, and more. Nevertheless, their primary function revolves around accurately calculating financial transactions. These devices simplify human life by eliminating the need to remember prices or rely on calculators, and they also reduce the opportunities for dishonesty and negotiation. Some complexities are :

- Transaction Processing: As the volume of transactions grows, there's a potential issue with the time it takes for the system to handle each transaction, which could act as a bottleneck.

- Analytics and Reporting: If the digital cash register project incorporates features related to data analysis and reporting, the complexity assessment can focus on evaluating the computational efficiency of the algorithms used for generating reports and processing data.

- User Interface: In cases where the digital cash register project offers a highly customizable user interface, the complexity analysis can examine the computational demands, both in terms of time and memory, required for generating and displaying this interface. As the degree of customization and the number of interface elements increase, the amount of memory needed to store interface data could become a limiting factor.

- Signal Reception: In our project, we utilized TSOP receivers, which are quite sensitive to the signals they receive. The signal must match the specified frequency within a small margin, and it also needs to be modulated. If we transmit a signal at a certain frequency, it may initially recognize it but then disregard it. We have to transmit bursts of a specific duration followed by gaps of a particular duration.

3 Design

3.1 Problem Formulation

3.1.1 Identification of Scope

3.1.2 Literature Review

3.1.3 Formulation of Problem

3.1.4 Analysis

3.2 Design Method

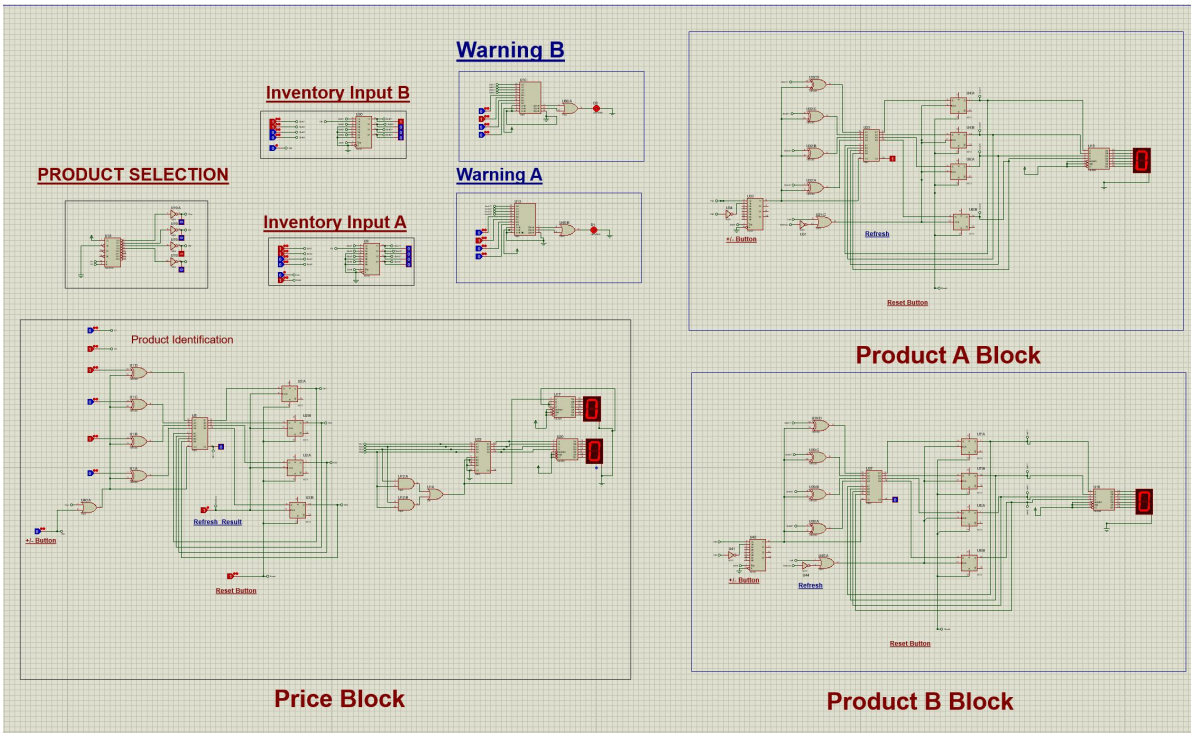
3.2.1 Components Used:

- Breadboards (7 pieces).
- OP-Amps (LM358, 2 pieces).
- XOR gate (IC SN74HC86N, 3 piece).
- 4 bit adder (IC HD74LS83AP, 2 piece).
- D-flip flops (IC CD4013, 2 pieces).
- BCD to 7-segment Decoder (IC HD74LS48P, 2 piece).
- NOT gate (IC HD74LS04P, 1 piece).
- 2 input AND gate (IC SN74HC08N, 6 piece).
- Common cathode 7-segment display (2 piece).
- Resistors (220Ω - 15 pieces , 10kΩ - 20 pieces).
- 5V , 2A Wall adapter (1 piece).
- SPDT switches (10 pieces).DIP Switch (4 pieces)Push buttons (2 pieces)
- Comparator (74HC85) 1 PiecesLed (20 Pieces)Jumper wires, Stapler wires,
- Telephone wires

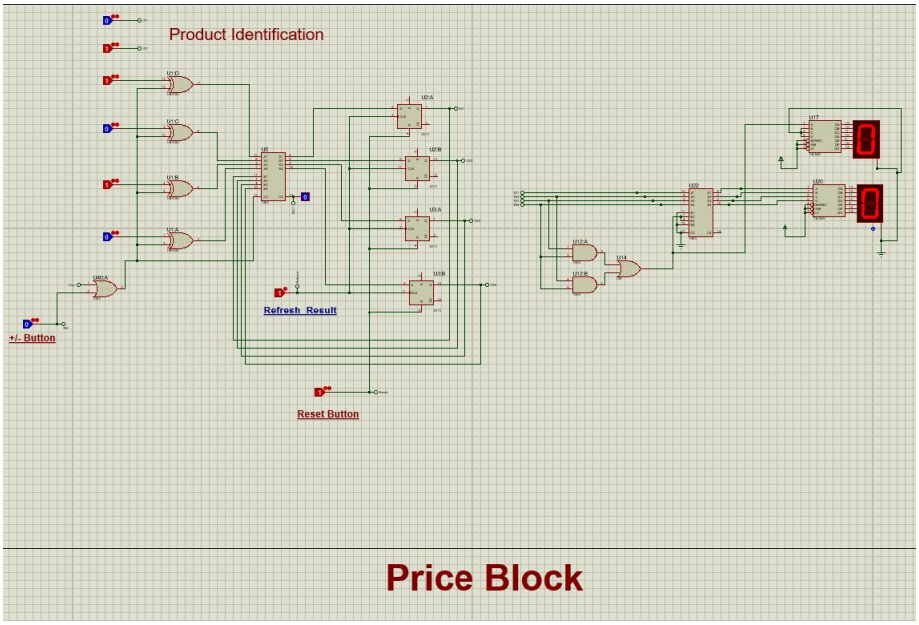
3.2.2 Design Description

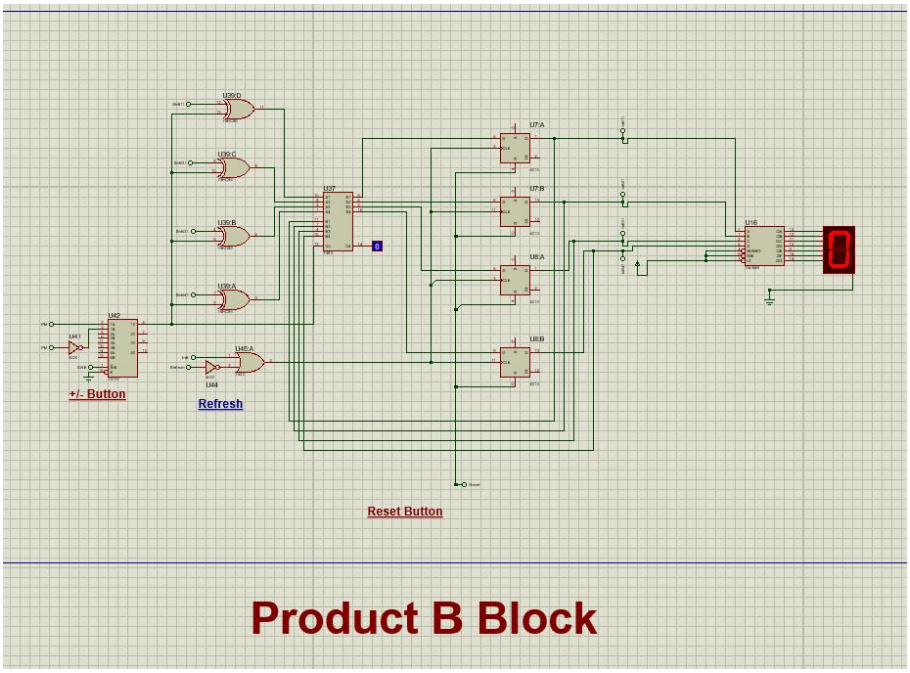
- In our project, we employed a 4-bit ripple adder circuit in conjunction with XOR gates to perform both addition and subtraction operations. We utilized positive edge-triggered D-flip-flops to store values.
- The choice between addition and subtraction operations is determined by the add/sub switch.
- The 4-bit ripple carry adder's output is directed to the flip-flops, which then store this information.
- The ultimate result is exhibited in Binary Coded Decimal (BCD) format, which involves converting the value from binary to decimal before display.

3.3 Circuit Diagram



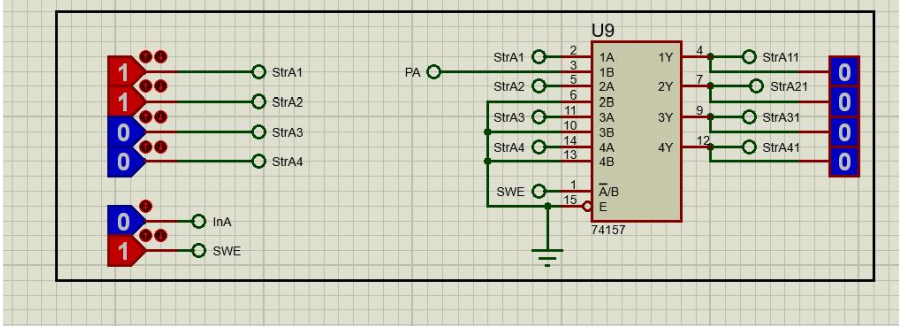
3.4 Simulation Model



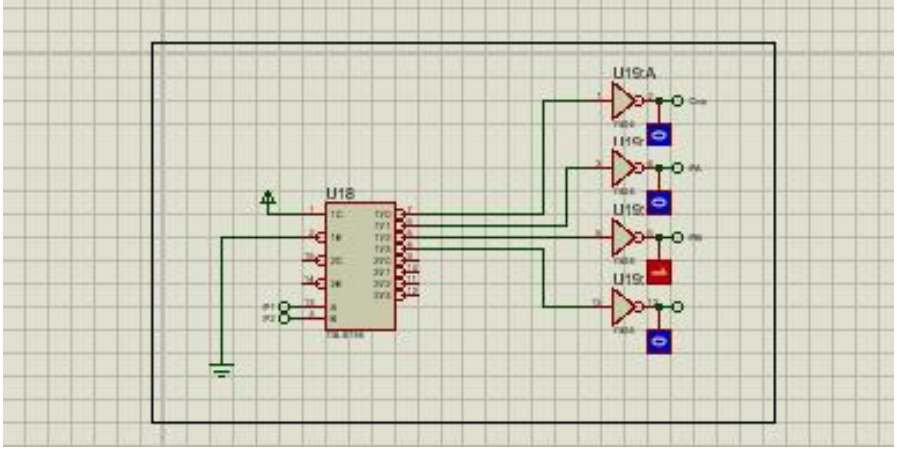


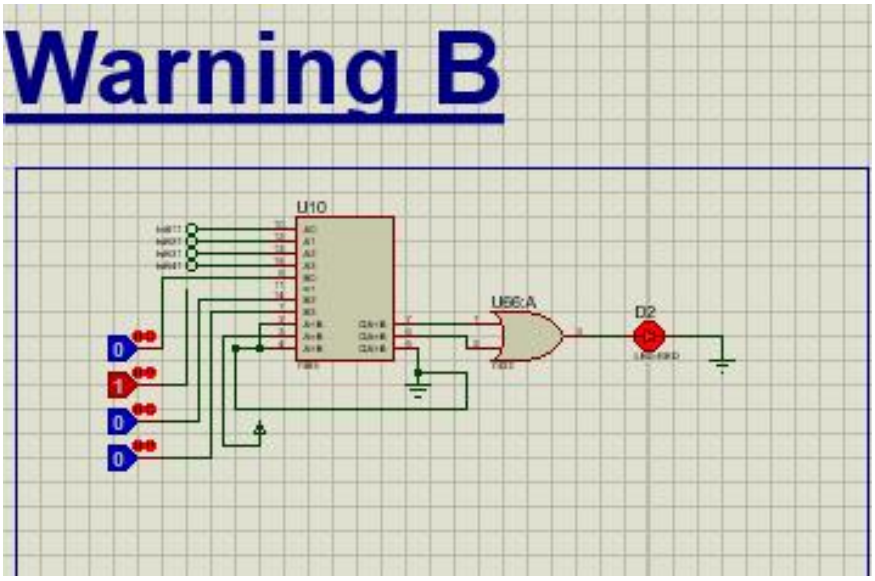
Product B Block

Inventory Input A

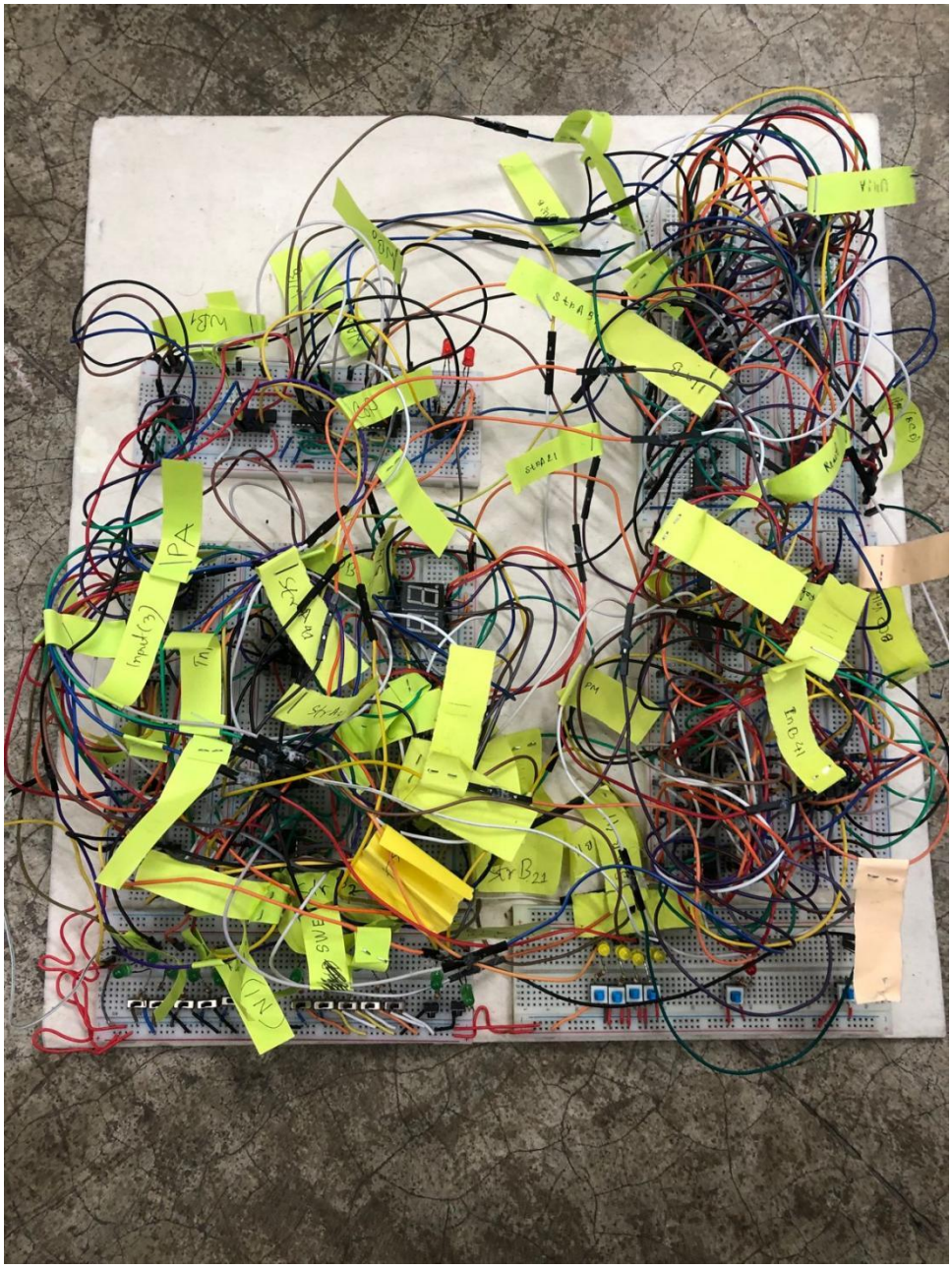


PRODUCT SELECTION




Warning B
U10
U66:A
D2
0
1
0
0

4 Implementation



4.1 Description

We divided the circuit into 4 blocks.they are :

- Price Block: This block is responsible for calculating the price and showing it in the 7 segment display.
- Product Block: This block is responsible for Calculating the inventory available and show it in display.
- Warning block: This block is responsible for giving warning if inventory is 2 or lower.
- Product Selection Block: This block is responsible for selecting the right product for the

specified code.

- Inventory Input Block: This block is responsible for taking the number of inventory as input in the beginning.

Figure 2: (Left) PCB Layout and (Right) Implementation of Design

4.2 Experiment and Data Collection

4.3 Data Analysis

4.4 Results

5 Design Analysis and Evaluation

5.1 Novelty

- Add or Subtract: The system offers the capability to perform both addition and subtraction operations for product prices. This allows for adjustments if a customer decides not to purchase a previously selected item.

- Multiplication: Additionally, users have the option to multiply the quantities of items if a buyer intends to purchase multiple units of the same product.

5.2 Design Considerations

5.2.1 Considerations to public health and safety

- Contactless Payments: Amid the ongoing COVID-19 pandemic, contactless payments have gained popularity as a means to reduce the risk of virus transmission. The digital cash register can contribute to the safety of both customers and staff.

- Hygiene Protocols: Cash registers are frequently touched by numerous individuals, increasing the potential for germ and virus transmission. Designing the digital cash register with hygiene protocols in mind, such as easily cleanable surfaces and touchless operation, can help mitigate the risk of transmission.

- Security Measures: Cash registers are susceptible to theft and fraud, which can jeopardize the safety of both staff and customers. Integrating security measures, such as AI-powered fraud detection and secure data storage, into the digital cash register can ensure the safety of transactions and prevent revenue loss.

- User Training: Thoroughly instructing staff on how to effectively utilize the digital cash register is essential for safe and proper usage. This encompasses training in hygiene protocols, security measures, and any other pertinent safety considerations relevant to the project.

5.2.2 Considerations to environment

- Energy Efficiency: The digital cash register should be crafted to operate with optimal energy efficiency, reducing its energy consumption and environmental footprint. We incorporated low-power components to fulfill this requirement.

- Environmentally Friendly Materials: The materials utilized in the digital cash register project should be ecologically sustainable and responsibly obtained. We selected materials that are either recyclable, biodegradable, or derived from renewable sources.

- End-of-Life Considerations: The design of the digital cash register should take into account its disposal at the end of its life cycle, ensuring a safe and responsible end-of-life process. Our project was conceived to be easily disassembled and recyclable, with accompanying guidance and resources for proper disposal.

- Sustainable Supply Chain: The digital cash register project should prioritize supply chain sustainability, ensuring that all components and materials are sourced ethically and sustainably. We collaborated with suppliers who prioritize environmental sustainability and social responsibility in their operations.

5.2.3 Considerations to cultural and societal needs

- Cultural Practices: Diverse cultures may observe varying payment customs and norms. To ensure the digital cash register's acceptance among customers and staff from different cultural backgrounds, it should be adaptable and accommodating of these cultural differences.

- Accessibility: The digital cash register must be inclusive, providing accessibility to all customers, including those with disabilities or impairments.

- Privacy and Security: Customer concerns regarding the privacy and security of their personal and financial information should be addressed. Implementing robust privacy and security measures, such as secure data storage and encryption, can assuage these concerns and foster trust.

- Social Responsibility: Designing the digital cash register should incorporate principles of social responsibility, taking into consideration its impact on the environment, community, and society at large. This encompasses aspects like energy efficiency, sustainable materials, and fair labor practices.

5.3 Limitations of Tools

- We have to check for errors of IC regularly. If there is an error, the whole circuit may not work.

- There may also be errors on jumper wires, push buttons.

5.4 Impact Assessment

- This project is more likely to create a great impact on our culture.
- This is useful for saving our time in any shopping mall.
- Smart shopping will be ensured by accurate calculation and automated system.
- Life will be much easier implementing this technology.

5.5 Sustainability and Environmental Impact Evaluation

- This project is cost effective compared to its performance.
- Market demand and competition for digital cash counter is rising.
- A digital cash counter might replace one or two staffs from the shop reducing the salary expense for the owner.
- Gaining popularity for fast and accurate calculation.
- Environmentally sustainable as our project isn't associated with carbon emission or something like that.
- Easily adaptable

5.6Ethical Issues

Designing and implementing a cash register project can raise several ethical issues, particularly if the project involves the collection and processing of sensitive financial and personal information. Here are some ethical considerations to keep in mind:

- Privacy and Data Security: Protecting customer and employee data is paramount. Ensure that the project complies with data protection laws (e.g., GDPR, CCPA) and follows best practices for data encryption, storage, and access control. Unauthorized access to personal information or financial data can lead to identity theft and other privacy breaches.

- Transparency: Be transparent about how customer data is collected and used. Clearly communicate your data handling practices to customers and employees and obtain their consent when necessary.

- Fair Pricing and Billing: Ensure that the cash register accurately calculates prices and taxes. Misleading pricing or billing practices can harm customers and damage your company's reputation.

- Accessibility: Ensure that the cash register system is accessible to all customers, including those with disabilities. Failure to do so may be considered discriminatory.

- Employee Fairness: Treat employees fairly in terms of wages, working conditions, and job security. Automation through cash register systems should not result in job loss or exploitation of workers.

- Data Ownership: Define who owns the data collected through the cash register system. Is it the customer, the business, or a shared ownership? Clear data ownership can prevent disputes and ethical dilemmas.

- Data Retention: Establish a data retention policy that specifies how long customer and transaction data will be stored. Retaining data longer than necessary can be seen as invasive and unethical.

- Security Vulnerabilities: Regularly assess and update the system's security to protect against hacking and data breaches. Failing to secure customer data adequately can lead to legal and ethical consequences.

- Customer Consent: Ensure that customers are informed about the data collection and give them the option to opt out if possible. For example, if you collect email addresses for receipts or

marketing purposes, customers should have the choice to decline.

- Fair Competition: Do not engage in unethical competitive practices, such as price fixing or unfair business tactics that harm competitors or consumers.

- Environmental Impact: Consider the environmental impact of the technology used in the cash register system. Are there sustainable options available, and are you disposing of electronic waste responsibly?

- Vendor Ethics: If you are purchasing or using a third-party cash register system, consider the ethical practices of the vendor. Ensure that they follow ethical principles and comply with relevant laws and regulations.

- Accountability: Establish clear lines of accountability within your organization for the ethical use of the cash register system. Have a plan for addressing ethical breaches or complaints.

- Community Impact: Consider the broader impact of your cash register project on the local community, including economic and social aspects. Strive to contribute positively to the community.

It's essential to conduct regular ethical assessments and engage in ongoing dialogue with stakeholders, including customers, employees, and regulators, to ensure that your cash register project adheres to ethical principles and values. Ethical considerations should be integrated into the project's design, implementation, and ongoing operations.

6 Reflection on Individual and Team work

6.1 Individual Contribution of Each Member

- ID 1906097 did the calculation part of product block, which is storing the data in FLIP FLOP and adds/subtracts them.
- ID 1906098 implemented the multiplication part ,if any buyer wants to buy multiple numbers of same product.
- ID 1906096 simulated the circuit in proteus.
- ID 1906095 did the calculation of storing goods to the inventory.
- ID 1806068 implemented seven segment display part

- We were 5 people in our group.
- We formed 2 sub groups of two people and manually implemented the circuit design in breadboard.
- And the another person continuously monitored the circuit and checked each of the Ics.

6.2 Mode of TeamWork

Effective teamwork and diversity play pivotal roles in the success of any project. Here are instances of how we foster teamwork and diversity in our project:

- Transparent Communication: We established transparent communication channels among team members to ensure everyone is well-informed. We utilized a WhatsApp group to facilitate open sharing of thoughts and ideas.

- Role Clarity: We provided clear definitions of each team member's roles and responsibilities during our initial project meeting. This ensured that everyone comprehended their specific tasks and their contributions to the project.

- Embracing Diversity: To embrace diversity and inclusivity within the project team, we divided our project into four key segments and distributed the workload among team members.

- Encouraging Flexibility: We encouraged team members to think creatively and explore unconventional solutions to challenges, promoting innovation.

In our project, we prioritize transparent communication, role clarity, diversity, and flexibility as essential elements for effective teamwork and project success.

6.3 Diversity Statement of Team

6.4 Log Book of Project Implementation

Week	Activity
4th Week	Submitted project proposal
6th Week	Completed calculation part
8th Week	Simulation in Proteus
9th Week	Purchasing necessary equipment
11th Week	Implementing circuit diagrams
12th Week	Assembling and testing

7 Communication

7.1 Executive Summary

This project attempts to make a smart cash counter that counts the total amount of receivable cash from any customer in a mall. The product selection block is used to select the product during a purchase. The cost of each of the products is saved. We have used an adder circuit to add the total cost. In the inventory block, the number of leftover product is calculated by a subtractor circuit. Warning block turns on the LED if the number of products A or B reaches the threshold level. Incase we return the product, the circuit will add the returned product in inventory block and subtract its cost from the total cost.

7.2 User Manual

8 Project Management and Cost Analysis

8.1 Bill of Materials

Equipment	Cost
Breadboards (11 pieces).	1430
XOR gate (IC SN74HC86N, 3 piece).	80
4 bit adder (IC HD74LS83AP, 4 piece).	150
CD4013 (flip flop)-6 pieces	180
Comparator (IC 7485)-2pieces	120
Jumper wires	450
Stapler wire	150
AND gate, NOT gate, OR gate	380
Demux(74155) and Mux(74157)	250
Switches(SPDT)	150
LED(20 pieces)	100
Battery(2 pieces)	150
Total	**3590**

9 Future Work

10 References

https://www.geeksforgeeks.org/4-bit-binary-adder-subtractor/
https://circuitcellar.com/research-design-hub/design-solutions/how-to-eliminate-switch-bounce/
https://www.electronics-tutorials.ws/sequential/seq_4.html
https://www.researchgate.net/publication/344378749_Design_and_Implementation_of_Automatic_Money_Counting_and_Sorting_System