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

EEE 304 (July 2022) **A2**
Digital Electronics Laboratory

Final Project Report

Digital Cash Register

Ethics Statement:

IMPORTANT! Please carefully read and sign the Ethics Statement, below. Type the student ID and Write your name in your own handwriting. *You will not receive credit for this project 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), or copied from internet. We have 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."

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Evaluation Form:

STEP	Assessment Tool	Criteria	CO	PO	MAX	SCORE
1	Peer Assessment	Individual Contribution	CO5	PO9	10	
2		Teamwork	CO5	PO9	10	
3		Ethics	CO4	PO8	10	
4	Viva	Ethics	CO4	PO8	10	
5		Tool Usage	CO2	PO5	10	
6	Report	Technological Limit Evaluation	CO2	PO5	10	
7		Technical Details	CO6	PO10	10	
8		Design Considerations	CO3	PO3	10	
9	Project Demonstration		CO3	PO3	10	
10	Recorded Video Presentation		CO6	PO10	10	
	TOTAL				100	

Course Instructor:

1. **Mr. Hamidur Rahman**
2. **Barproda Halder (PT)**

Signature of Evaluator: _____

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1 Abstract

- *Our project is a prototype of digital cash register used for registering and calculating transactions.*
- *It reads the price tag from barcode printed on different products in a form of binary digits and then calculates the total price of the products.*
- *It also has the facility to not only add the price of the product but also subtract the price if the customer changes his mind to buy it.*
- *If any buyer buys multiple same product.Price will be multipled by product number.*

2 Introduction

Digital cash registers are a common tool. They serve various functions and have varying uses in various settings. Modern cash registers can serve various purposes like credit card processing, personal check verification, inventory checking, etc. , however the basic purpose is to calculate financial transactions.It makes human life easier.No need to memorize prices or use a calculator. In fact there is a less chances of cheating and bargaining.

2.1 Complexity Analysis

1. **Transaction processing**: As the number of transactions increases, the time it takes for the system to process each transaction could become a bottleneck.

2. **Analytics and reporting**: If the digital cash register project includes analytics and reporting features, the complexity analysis could evaluate the time complexity of the algorithms used to generate reports and analyze data.

3. **User interface**: If the digital cash register project includes a highly customizable user interface, the complexity analysis could evaluate the time and space complexity of the algorithms used to generate and display the interface. As the number of customizations and interface elements increases, the space required to store interface data could become a limiting factor.

4. **Receiving end**: In our project, we used TSOP receivers which are very finicky about the signal they receive. It must be at the specified frequency ± a few percent. It must also be modulated. If we produce a certain frequency,it will initially recognize it, then ignore it. We must produce bursts of a specific range of length followed by gaps of a specific range of lengths.

3 Technical Details of the Design

3.1 Design Method

Components Used:

Breadboards (7 pieces).

IR transmitters and receivers (4 pairs).

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

- In our project we used a 4-bit ripple adder circuit alongwith XOR gates for addition and subtraction operation. Positive edge d-flip-flops are used to store values.

- The input for the adder circuit comes from the IR sensors through the op-amp.

- Whether the operation of the adder will be addition or subtraction is decided by the add/sub switch.

- The output of the 4-bit ripple carry adder goes to the flip flops and the flip flop there stores it.

- The final output is displayed by BCD where the value gets converted from binary to decimal

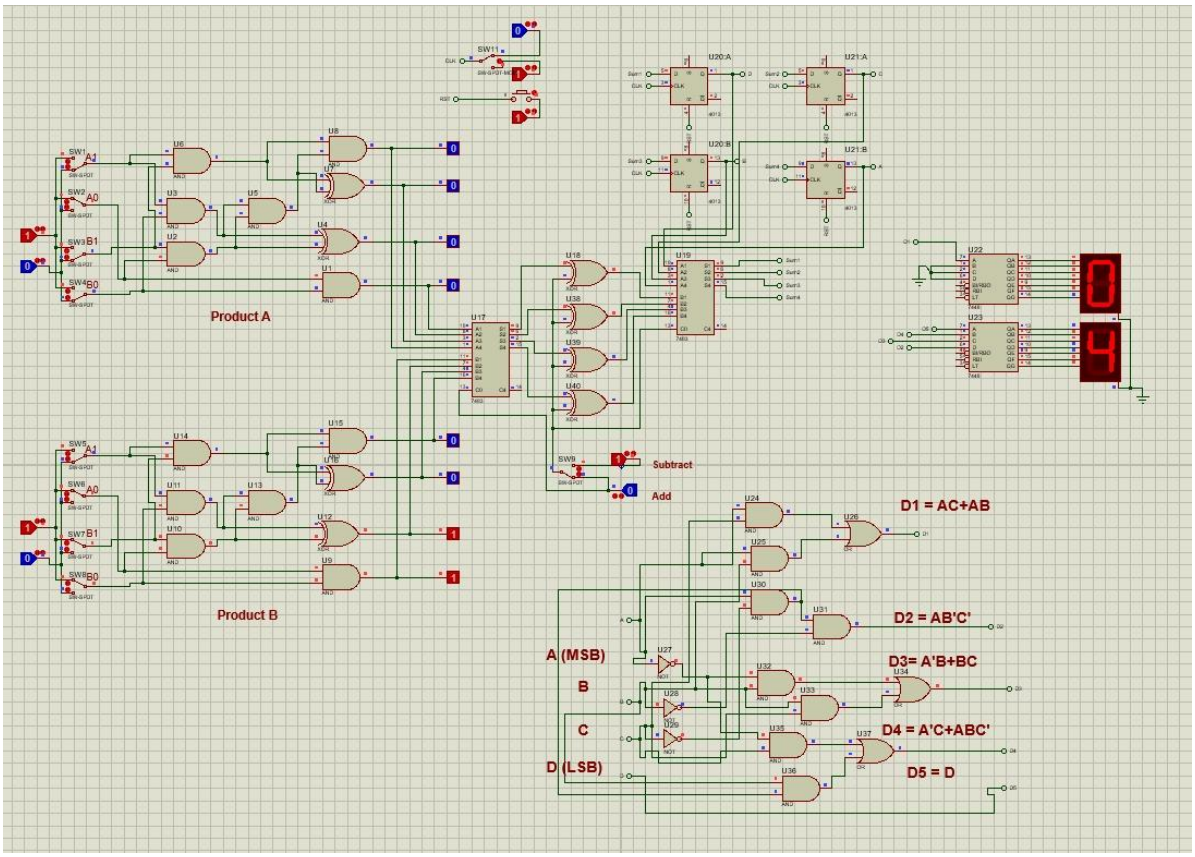
3.2 Novelty Statement

- **Scanning data from punch card:** Our design can act as a barcode scanner, read data from product punch card, converts it to binary, and sends it to the calculation segment.

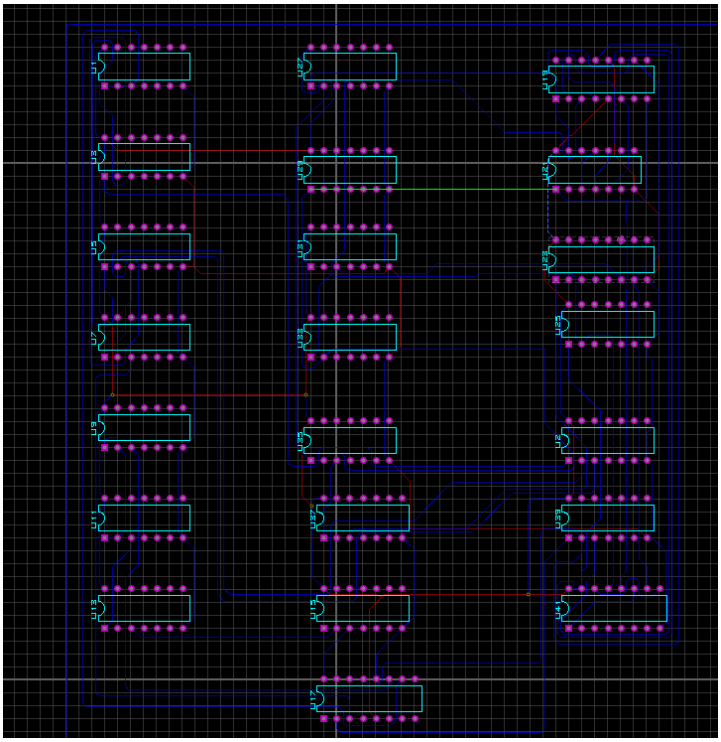
- **Add/Subtract**?: It also has the facility to not only add the price of the product but also subtract the price if the customer changes his mind to buy it.

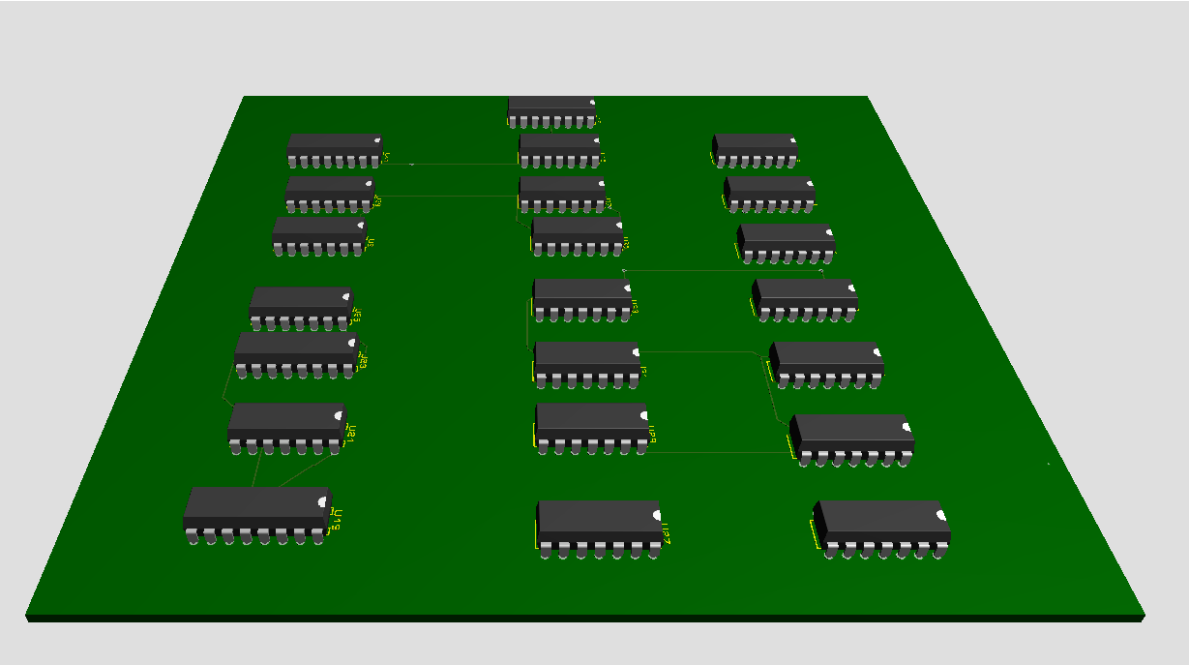
- **Multiplication:** The user can multiply items if any buyer wants to buy multiple amounts of the same product.

3.3 Circuit Diagram

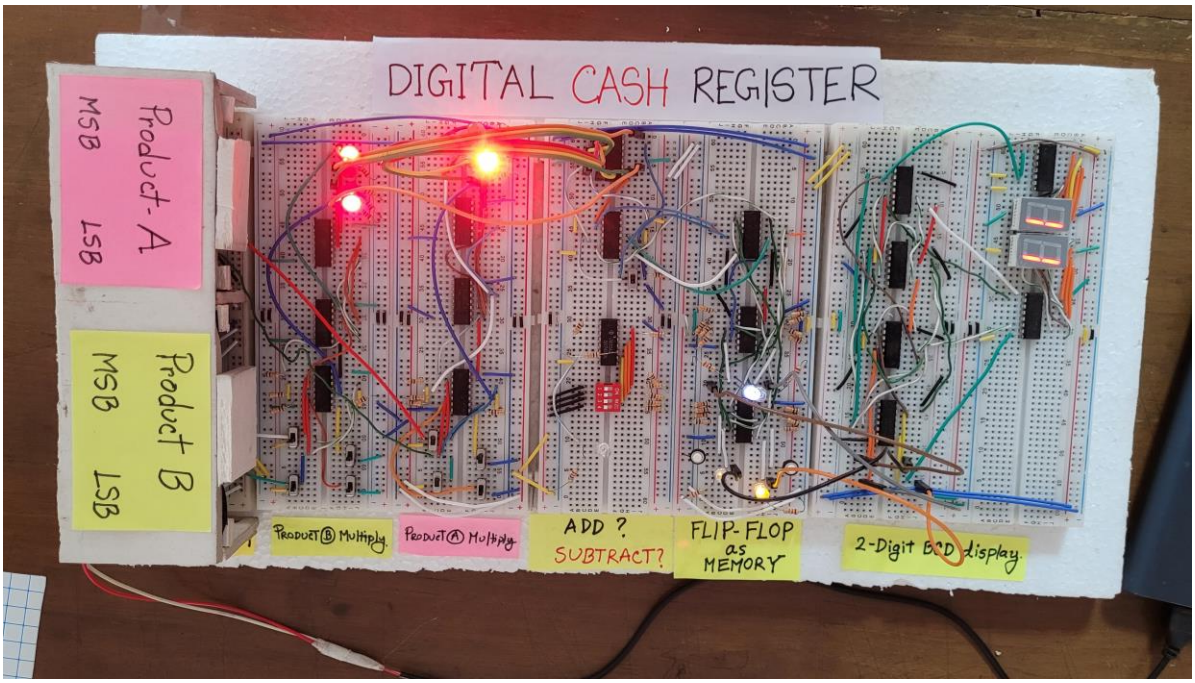


3.4 Printed Circuit Board Mask Layout

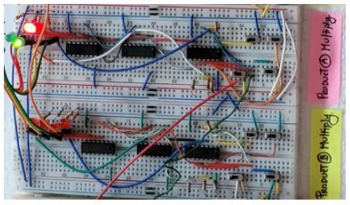




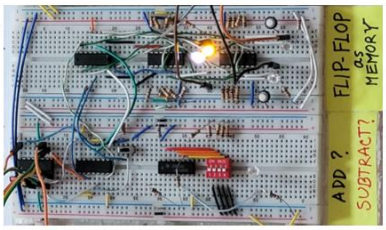
3.5Pictures of Final Implementation



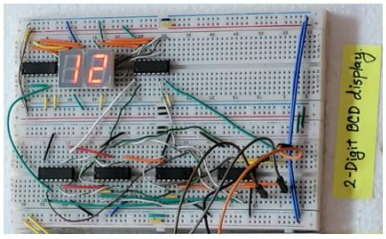
Takes binary price input from punch card and sends to multiplication segment.



Multiplies item number with price.



Memory block. Stores the data and add/subtracts them



Shows the output in 2 digit BCD.

3.6 YouTube Link

https://youtu.be/tfOODzNEQrQ

4 Practical Design Considerations

4.1 Considerations to Public Health and Safety

Contactless payments: With the ongoing COVID-19 pandemic, contactless payments have become increasingly popular as a way to reduce the risk of transmission of the virus. The digital cash register can help ensure the safety of customers and staff.

Hygiene protocols: Cash registers are frequently touched by many people, which increases the risk of transmission of germs and viruses. Designing the digital cash register with hygiene protocols in mind, such as easy-to-clean surfaces and touchless operation, can help reduce the risk of transmission.

Security measures: Cash registers are also vulnerable to theft and fraud, which can pose a safety risk to staff and customers. Incorporating security measures, such as AI-powered fraud detection and secure data storage, into the digital cash register can help ensure the safety of transactions and prevent loss of revenue.

User training: Proper training of staff on how to use the digital cash register can help ensure its safe and effective use. This includes training on hygiene protocols, security measures, and any other safety considerations that are relevant to the project.

4.2Considerations to Environment

Energy efficiency: The digital cash register should be designed to be energy efficient, reducing the amount of energy required to operate and minimizing its impact on the environment. We used low power consuming elements to serve this criteria.

Sustainable materials: The materials used in the digital cash register project should be environmentally sustainable and responsibly sourced. We used materials that are recyclable, biodegradable, or made from renewable resources.

End-of-life disposal: The digital cash register should be designed with end-of-life disposal in mind, ensuring that it can be safely and responsibly disposed of at the end of its life cycle. We designed the project to be easily disassembled and recycled, as well as providing instructions and resources for proper disposal.

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

4.3 Considerations to Cultural, and Societal Needs

Cultural norms and customs: Different cultures may have different norms and customs related to payment and transactions. Designing the digital cash register to be flexible and adaptable to different cultural norms can help ensure that it is well-received by customers and staff from diverse backgrounds.

Accessibility: The digital cash register should be designed to be accessible to all customers, including those with disabilities or impairments.

Privacy and security: Customers may have concerns about the privacy and security of their personal and financial information. Incorporating strong privacy and security measures, such as secure data storage and encryption, into the digital cash register can help alleviate these concerns and build trust with customers.

Social responsibility: The digital cash register should be designed with social responsibility in mind, taking into account its impact on the environment, community, and society as a whole. This includes considerations such as energy efficiency, sustainable materials, and fair labor practices.

5 Reflection on Individual and Team work

5.1 Individual Contribution of Each Member

ID 1806054 simulated the circuit in proteus and designed PCB and 3d print.

ID 1806056 implemented the scanning and reading data from punch card, and showed the output results in BCD display.

ID 1806057 implemented the multiplication part ,if any buyer wants to buy multiple numbers of same product.

ID 1806065 did the core calculation part,which is storing the data in FLIP FLOP and adds/subtracts them.

5.2 Mode of TeamWork

Effective teamwork and diversity are crucial components of any successful project. Here are some examples of how we promote teamwork and diversity in a project:

1.Clear communication: We established clear lines of communication among team members to ensure that everyone is on the same page. We communicated through whatsapp group and made sure members feel comfortable sharing their thoughts and ideas.

2.Role clarity:We clearly defined the roles and responsibilities of each team member at very first meeting of our project to ensure that everyone understands their specific tasks and how they contribute to the project.

3. Diversity : We divided our project into four major segments and divided the work between members.Thus we embraced diversity and inclusivity in the project team.

4. Flexibility: We encouraged team members to be creative and think outside the box to come up with innovative solutions to problems.

6 References and Acknowledgement

6.1 Acknowledgement

We would like to express my sincere gratitude to our course teacher for their guidance and support during the digital cash register project. Their knowledge and expertise were instrumental in helping us to develop a successful project.

We would like to extend my sincere gratitude to our groupmate who has contributed to the successful completion of the digital cash register project. This project has been a significant undertaking, and I am grateful for the support and hard work of everyone involved.

6.2 References

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