EEE 304 – Digital Electronics Laboratory

July 2022 Level-3 Term-II Section C2

Final Project Demonstration

DESIGN AND IMPLEMENTATION OF A PASSWORD-BASED COMBINATIONAL SAFETY LOCK SYSTEM

SUBMITTED BY – GROUP 7

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Outline

Title of The Project

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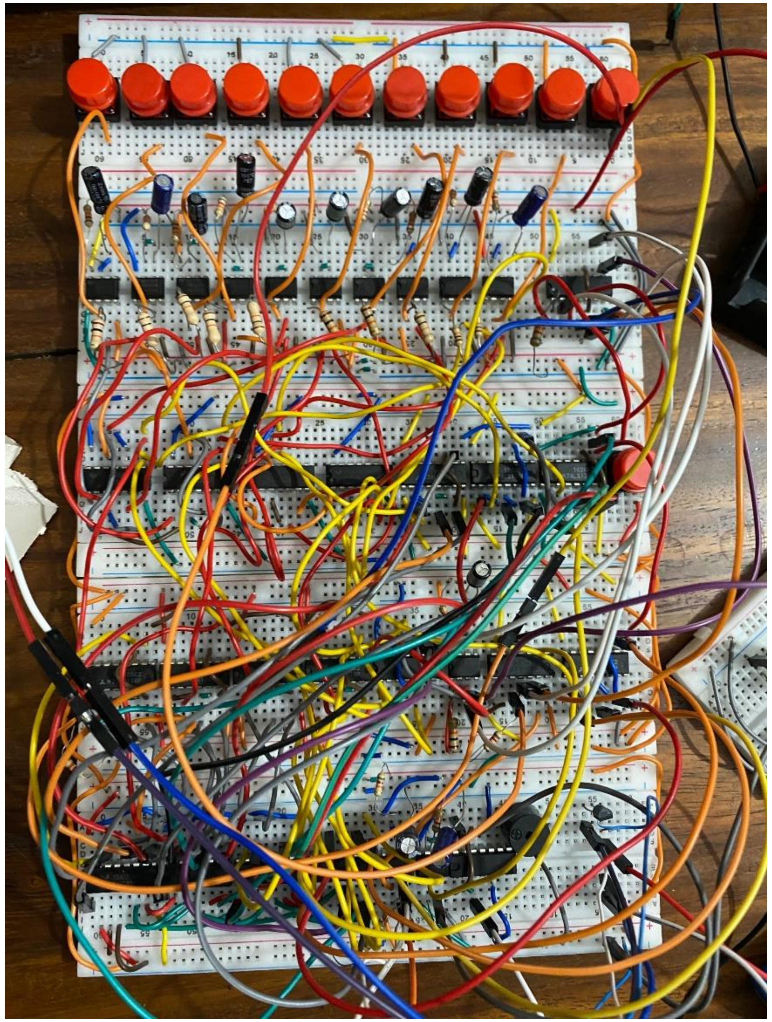
1. Summary / Abstract

Design and Implementation of Password-Based Combinational Safety Lock System

- Four shift registers used for password input and storage
- Another set of four shift registers for temporary password storage and comparison
- Comparator used to compare input and stored passwords
- Counter implemented to keep track of incorrect password attempts
- Buzzer alarm triggered after three consecutive wrong attempts
- Highly secure and reliable system design
- Methodology includes use of 555 timer, encoder, and logic gates
- Experiments demonstrate system's security and reliability
- Future development opportunities in this area



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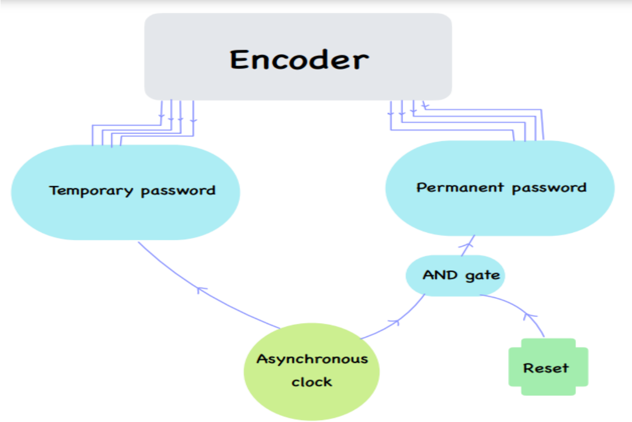
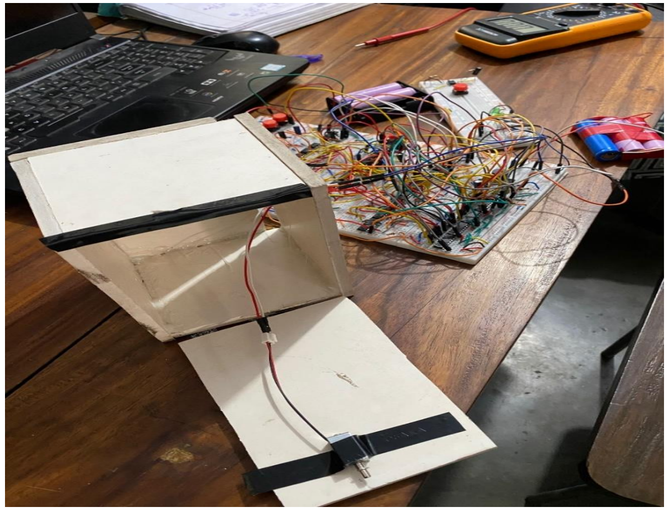
2. Introduction

- Introduction to the increasing popularity of electronic security systems, specifically password-based combinational safety locks
- Description of the proposed system design and implementation, including the use of shift registers, comparator, and a counter
- Discussion of the system's high level of security and reliability, as demonstrated by experiments
- Overview of potential future directions for development in this area
- Contribution to the development of high-security electronic locking systems and application of digital electronics concept





2.1 Complexity Analysis

- Password storage and retrieval
- Password comparison
- Unlocking mechanism
- Intrusion detection
- Overall complexity

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Summary

Introduction

Technical Details of Design

Practical Considerations

Reflection on Individual and Teamwork

Acknowledgement and References

3.1 Design: Methods

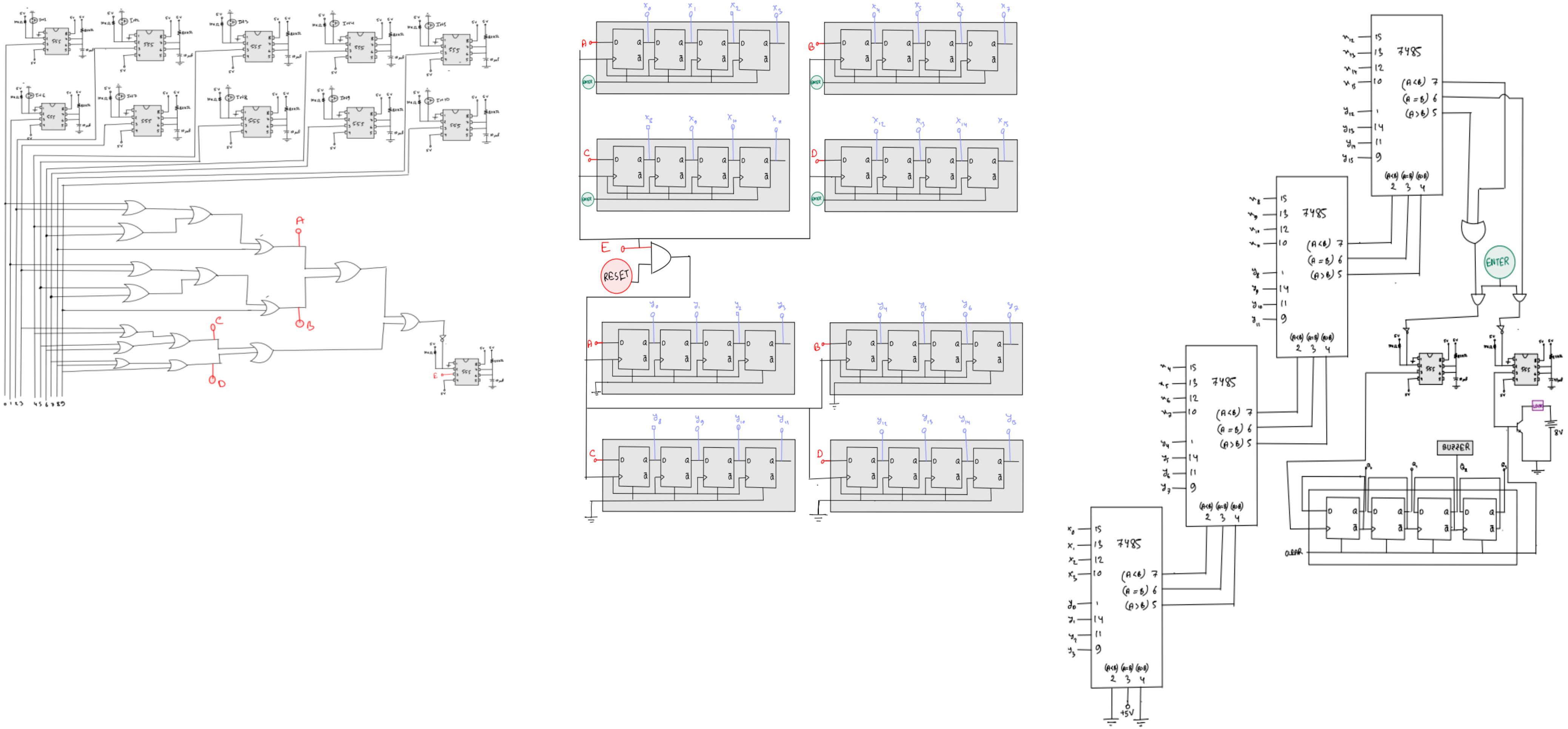
Component list:

- 555 timer - 13 pcs
- OR gate (SN74HC32AP) - 5 pcs
- D Flip Flop (N74LS174T) – 8 pcs
- Push button 12 pcs
- Counter (SN74LS93N)– 1 pcs
- BJT(BC547) – 1 pcs
- Electric lock
- Buzzer
- Resistor (82k,22k,10k,5.6k)
- Capacitor (47uF, 10uF)
- AND gate (SN74HC08N) – 1 pcs
- NOT gate (SN74HC04N) – 1 pcs
- Comparator (SN74HC85N) – 4 pcs
- Breadboards, jumper wires, LEDs, Power sources.

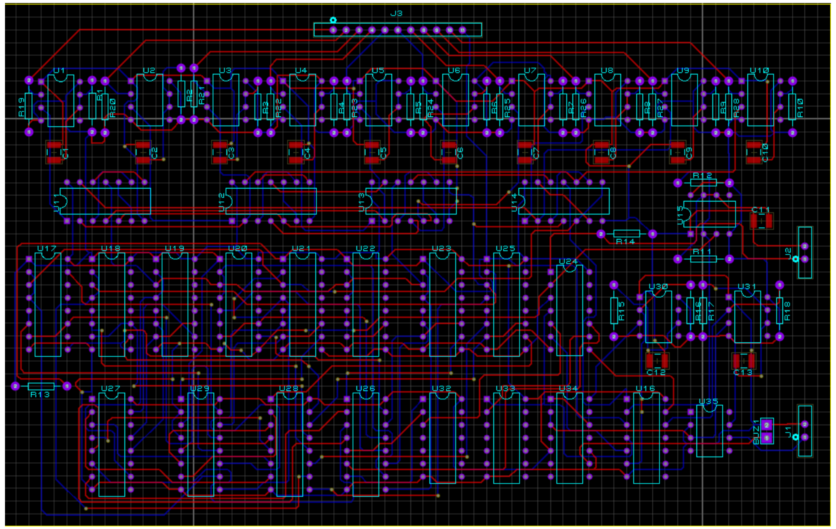
3.1 Design: Novelty

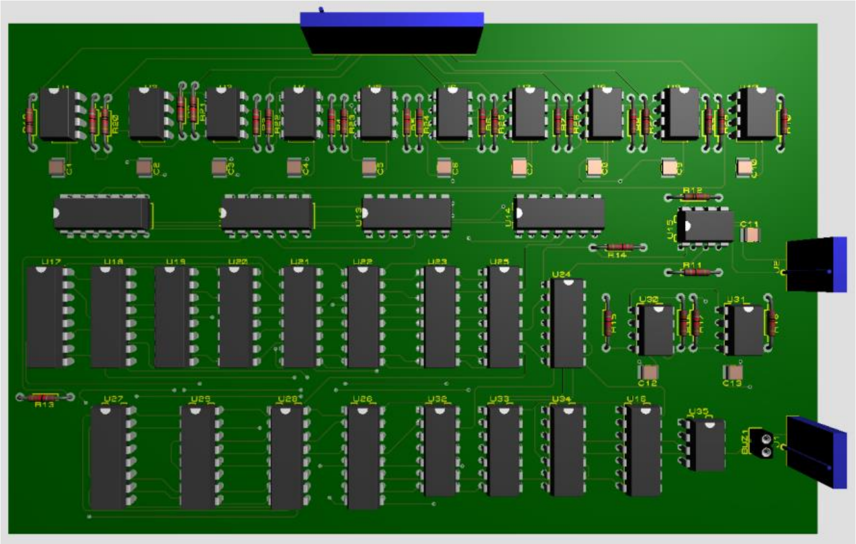
◦ Design of password-protected lock system with features such as shift registers, comparator, 555 timer, buzzer alarm, and a counter to keep track of incorrect password attempts. The system uses push buttons for input and storage of the password, and the comparator compares the input password with the stored password to trigger the buzzer alarm after three incorrect attempts. The counter is reset to zero after entering the correct password to prevent false triggering of the alarm.

3.2 Design: Circuit Diagram

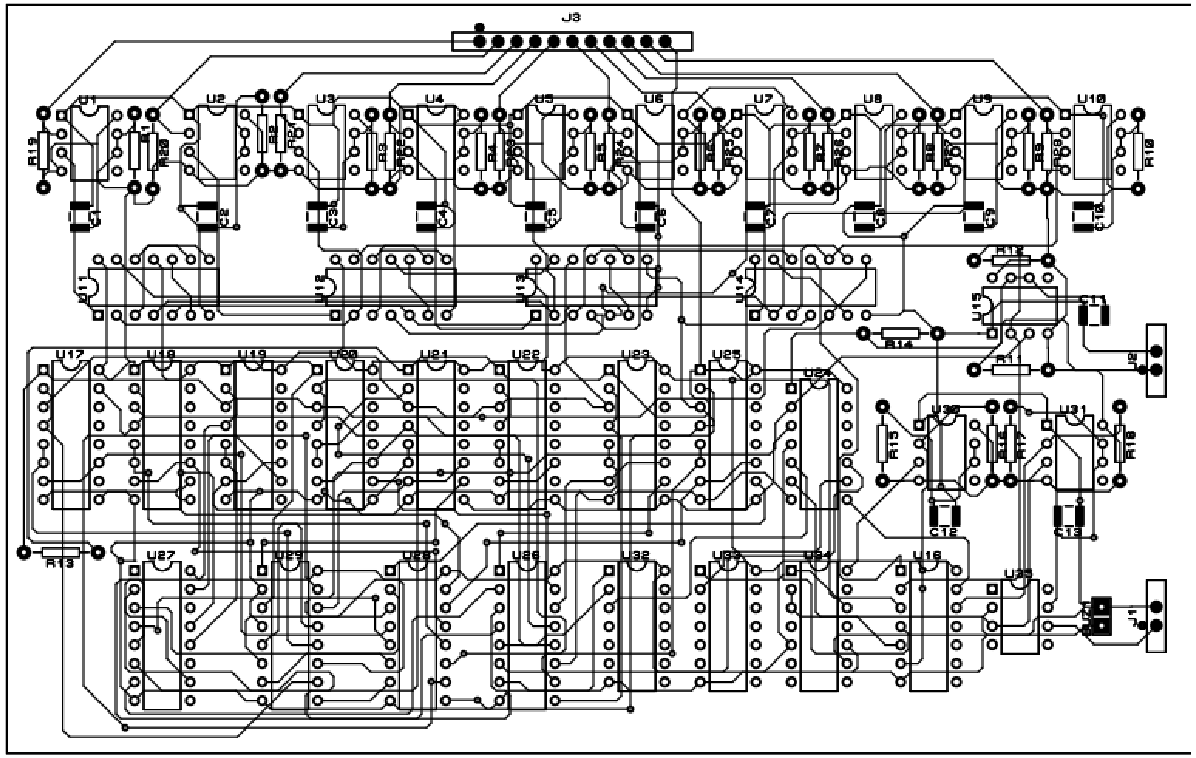


3.4 Design: PCB Layout and 3d rendering

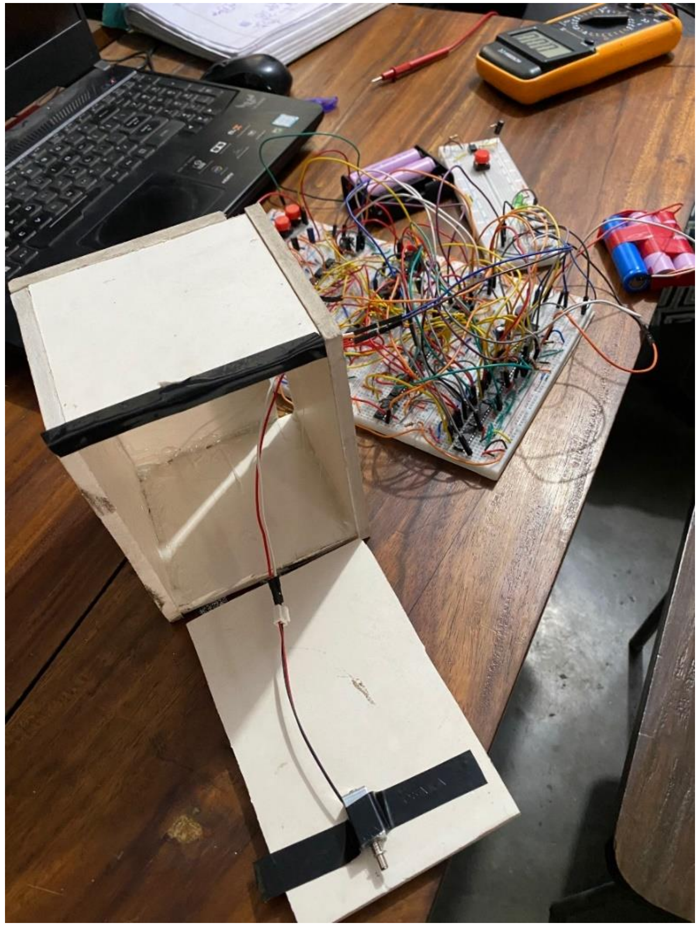


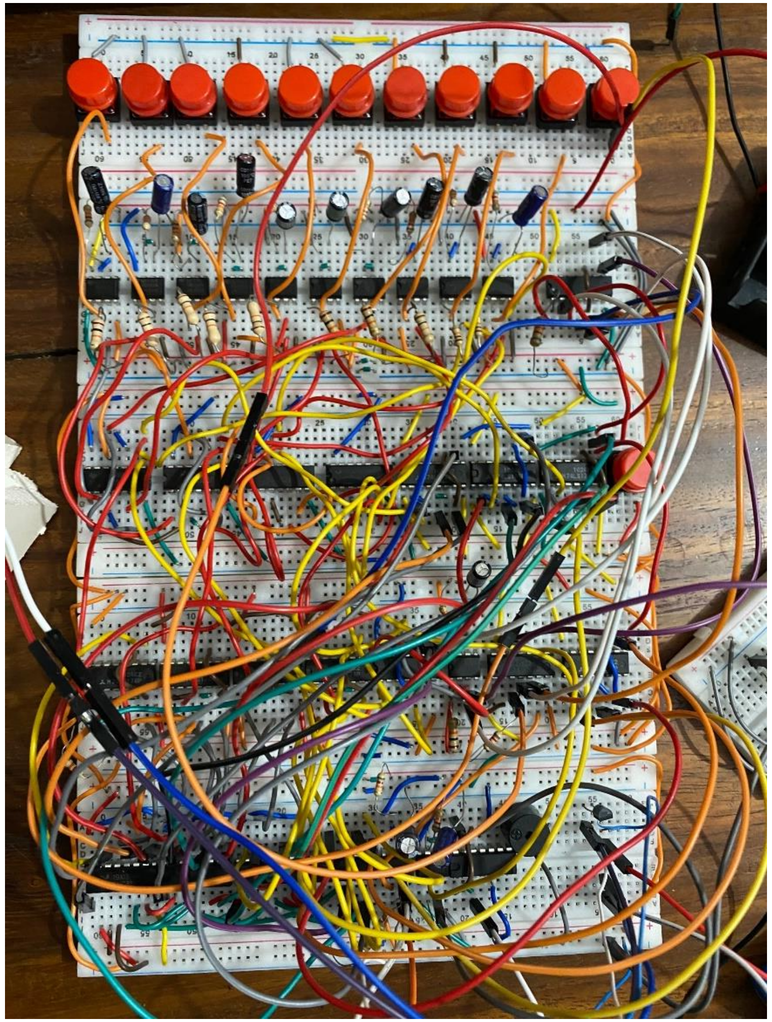


3.3 Design: Simulation (optional)



3.5 Implementation: Photo Gallary





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Demonstration Video

- https://drive.google.com/drive/folders/1p9AZMJLe7yjTRbRuChr5FAFHPedsjYZk?fbclid=IwAR3i1wCmVCgeqDbxDPaGfa6yzVc7opiyOgiMZpDP6c8ewnI7DFZa7D2Fua8

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4. Practical Considerations: Public Health and Safety

- The design and implementation of electronic lock systems require careful consideration of public health and safety implications. Security risks are a significant concern, and the system should be designed and tested to be as secure as possible to prevent unauthorized access. Electrical safety is also important, as the lock system requires a voltage source that can potentially cause hazards, and it is necessary to ensure that the system is designed and installed safely to prevent electrical shocks or other hazards.
- User errors are another concern, as the proposed lock system relies on users to input the correct password and press the correct buttons. It is important to provide clear instructions and user training to minimize the risk of user errors, such as forgetting the password or pressing the wrong button. Additionally, accessibility needs must be considered to ensure that the system can be used by all individuals, particularly those with disabilities.
- Finally, the lock system may require maintenance and repair over time, and it is crucial to ensure that the system is designed and installed in a way that allows for easy maintenance and repair without compromising security or safety. Therefore, public health and safety implications should be considered at all stages of the design and implementation process, including addressing security risks, ensuring electrical safety, minimizing user errors, considering accessibility needs, and planning for maintenance and repair. By doing so, the design and implementation of electronic lock systems can ensure the safety and security of all users.

4.2 Practical Considerations: Societal and Cultural

◦ When designing a combinational lock system, it is essential to consider the cultural and societal needs of the users to ensure its effectiveness and user acceptance. Accessibility should be a primary concern to make the lock system usable for people with disabilities, such as visual impairments and limited mobility. User-friendliness should also be considered to ensure that people of different ages and backgrounds can easily operate the lock. The system should be designed to protect user privacy, which is especially important for personal and sensitive information. Security is a critical aspect of the lock system to ensure that the user and their belongings remain safe. Cultural sensitivity should be taken into account to accommodate different cultural norms and practices that may impact the lock's design and usage. The lock system should be aesthetically pleasing and fit in with its surroundings, considering the cultural and societal values of the users. Customizability of the lock system is important to meet the specific needs of different users and cultural contexts. By considering these factors, the lock system can be designed to meet the needs and expectations of its users, enhancing its effectiveness and user acceptance.

4.2 Practical Considerations: Environment

- The electronic combinational lock design discussed in the paper has environmental considerations that should be taken into account. The design uses rare earth minerals and metals in its electronic components, which can have significant environmental impacts from extraction and production. The lock and buzzer require a power source, which should be chosen with the environment in mind. Renewable energy sources or efficient power management can help minimize the environmental impact. Additionally, the design uses a printed circuit board (PCB) for assembling the electronic components, and PCB disposal can also have significant environmental impacts. Proper disposal or recycling of PCBs is therefore necessary. Finally, the design uses a physical lock, which requires metal components. The environmental impact of the production and disposal of these metal components should also be considered.
- Overall, the design should prioritize minimizing environmental impact through the choice of materials and energy sources and proper disposal or recycling of electronic components and materials. This can include using renewable energy sources, efficient power management, responsible sourcing of materials, and proper disposal or recycling of PCBs and metal components. Taking these environmental considerations into account can help ensure that the design is sustainable and environmentally responsible.

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6. Reflection on Individual and Team work

6.1 Individual Contribution of Each Member

6.2 Mode of TeamWork

6.3 Diversity Statement of Team

6.4 Log Book of Project Impelementation

6.1 Individual Contribution of Each Member

- **Aupurbo Chowdhury:** Responsible for collecting materials and implementing hardware.
- **Ayenul Azim Jahin:** Responsible for planning hardware simulation, software design, and PCB design.
- **Fazle Rabbi:** Responsible for implementing the circuit, buying materials, and writing the report.
- **Indrojit Sarkar:** Responsible for buying necessary items, collecting resources for the project, and writing the report.

6.2 Mode of TeamWork and Diversity

- Our team comprises individuals from diverse backgrounds, experiences, and perspectives. We hail from different regions, cultures, and ethnicities, which has enriched our team's approach to problem-solving and decision-making. This diversity has enabled us to tackle challenges from multiple angles and has fostered a more inclusive and welcoming environment for all team members. We value and respect each other's differences, viewing them as strengths that have contributed to the success of our project.
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- Fazle Rabbi is from Chattogram, one of the major port cities in Bangladesh situated on the southeastern coast of the country. Aupurbo Chowdhury's hometown is Comilla, a city located in the eastern part of Bangladesh, near the Indian border. Ayenul Azim Jahin was born and raised in Noakhali, a coastal district in the southern part of Bangladesh. Indrojit Sarkar hails from Pabna, a district located in the north-western part of Bangladesh. Our team's diversity has allowed us to bring different perspectives to the project, leading to more innovative solutions and a greater appreciation for different cultures and backgrounds.

Also explain how you completed the project as a team. Add pictures if necessary (even funny pictures are okay here).

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7. References

- [1] https://www.circuitbasics.com/555-timer-basics-monostable-mode/#:~:text=In%20monostable%20mode%2C%20the%20555%20timer%20outputs%20a,off%20automatically%20after%20a%20predetermined%20length%20of%20time.
- [2] https://circuitdigest.com/electronic-circuits/555-timer-monostable-circuit-diagram
- [3] https://www.geeksforgeeks.org/shift-registers-in-digital-logic/
- [4] https://www.geeksforgeeks.org/encoder-in-digital-logic/
- [5] https://datasheetspdf.com/
- [6] https://www.youtube.com/watch?v=xh3a_o_9yIE