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

EEE 304 (January 2023)

Digital Electronics Laboratory

Final Project Report

Section: A1 Group: 03

Password based Security Lock System with Anti-Fraud Alarm

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Academic Honesty Statement:

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"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."

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1 Abstract

This project report explores the design, development and implementation of our designated project - a Password based security system equipped with advanced feature, anti-fraud alarm. It aims to provide a user-friendly security measure in safeguarding commercial and residential settings. In the modern world, security concerns have taken on a pivotal role fueling the development of cutting-edge security systems. Our project addresses this pressing requirement. This report presents a comprehensive overview of the theoretical framework, software simulation, hardware design and experimental results along with other impacts of this project.

2 Introduction

Our project "Password-based Security Lock System with Anti-Fraud Alarm" showcases the innovative potential of digital electronics in addressing real-world security challenges in an ever-evolving technological landscape. It merges digital electronics with user-friendly features to establish an advanced security solution. Traditional lock and key mechanisms have lost their efficacy in safeguarding residences, offices and valuable premises in today's fast-paced world. That's why our project stands out as a significant advancement in the realms of digital electronics and security technology as it introduces an effective, customizable and cost-efficient solution for maintaining security and pressing fraudulent activities.

In the subsequent sections of this report, we will explore the functionalities of the Password based security system with anti-fraud alarm, discuss the design methodologies implemented in its construction, present the experimental findings concluding with its real-world applications and potential impact.

3 Design

3.1 Problem Formulation

3.1.1 Identification of Scope

Our project delivers these features-

Indoor side:

1. Owner can set a 4 number password with combination of numbers from 0-9
2. Owner can lock or unlock his door if he wants
3. Owner can stop the alarm if he wants

Outdoor side:

1. User has only 3 chances to correctly provide right password
2. But if the door is locked and alarm is ringing, user can not try again
3. Again, if the door is locked, the system cannot receive password anymore

Boundaries:

If you want to press one button 4 times, there is no problem. But for pressing different numbers, one has to press the push buttons very carefully. One can look into the outputs of shift registers to ensure if it is being pressed in right way or not.

3.1.2 Literature Review

We implemented this project based on our theore**t**ical knowledge about digital electronics. We did not take any help from any research paper**,** though we took help from many websites

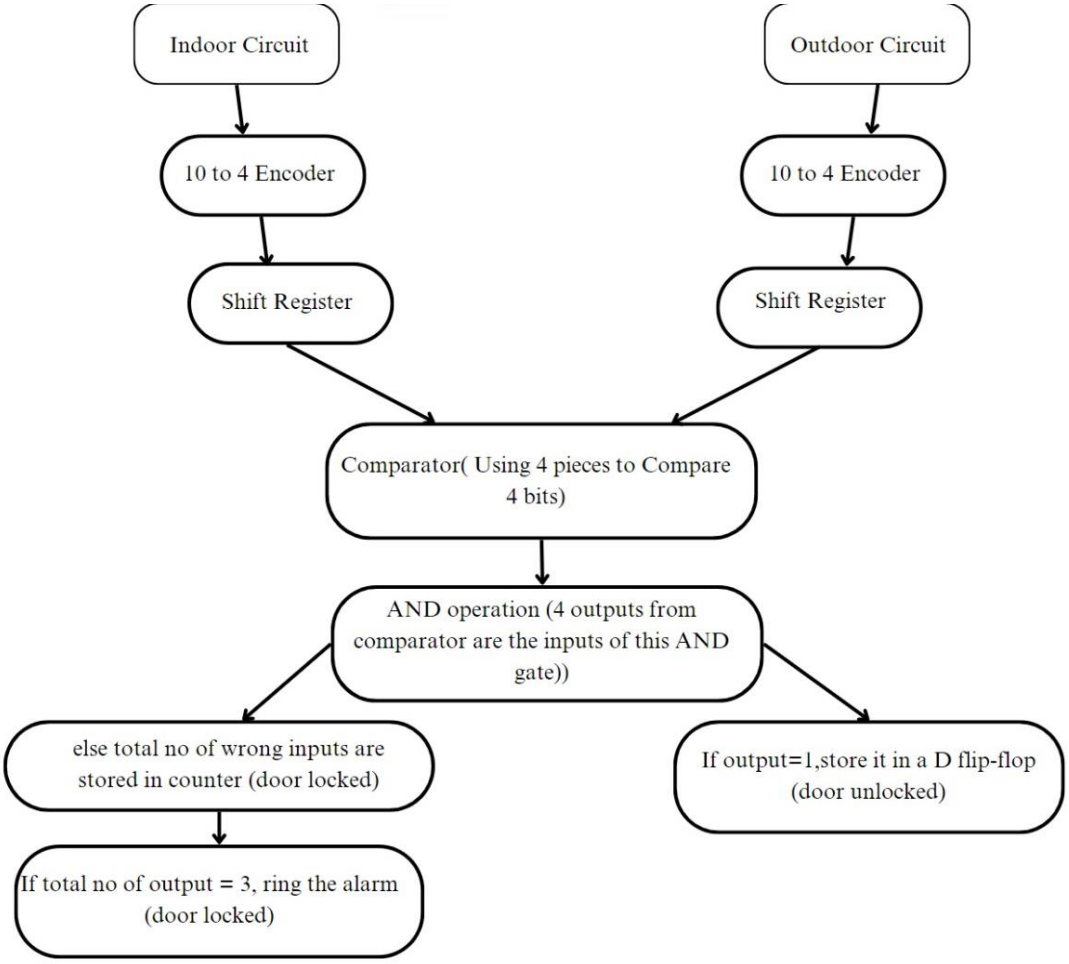
3.1.3 Formulation of Problem

We implemented our project in simple combinational logic circuits and sequential circuits. We used basic OR gates to implement encoder circuit. Also, the extra features of our projects are-

1. Owner can set a 4-digit password.
2. Once door is locked or unlocked, no password can be received by the system
3. Owner can lock his door if door_locked button is pressed
4. Owner can unlock his door if he wants.

We implement these features using basic knowledge of flip flop, counter, shift register, encoders. Also, it is to be noted that, 0000 is not taken to be a valid password

Block diagram:

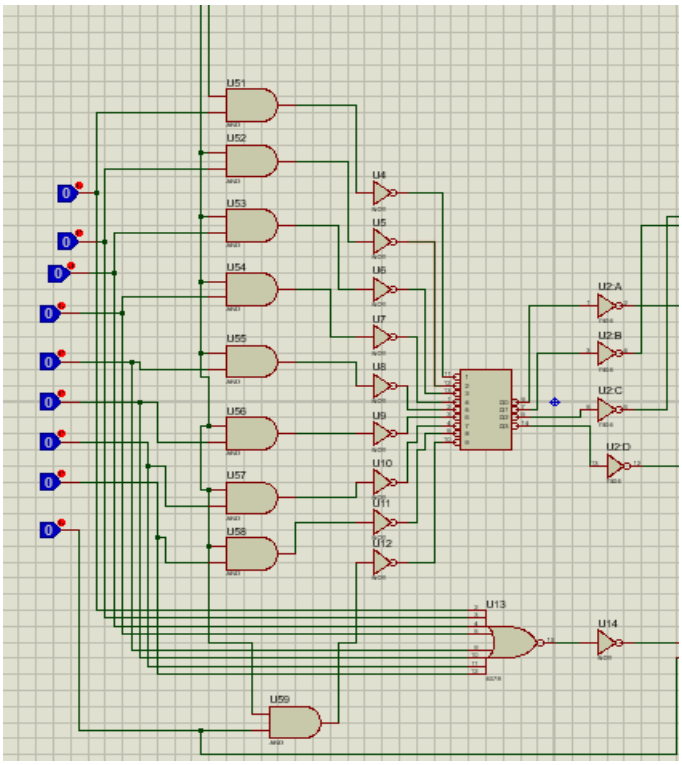


3.1.4 Analysis

We designed the whole project using our basic knowledge on digital electronics. When we started doing our project from the very first beginning of this term, we had not huge knowledge on these things. We took help from internet and built a proteus model. After we understood the basic working of latch and flip flop, we changed our methodology but did not show that in our proteus file.

3.2 Design Method

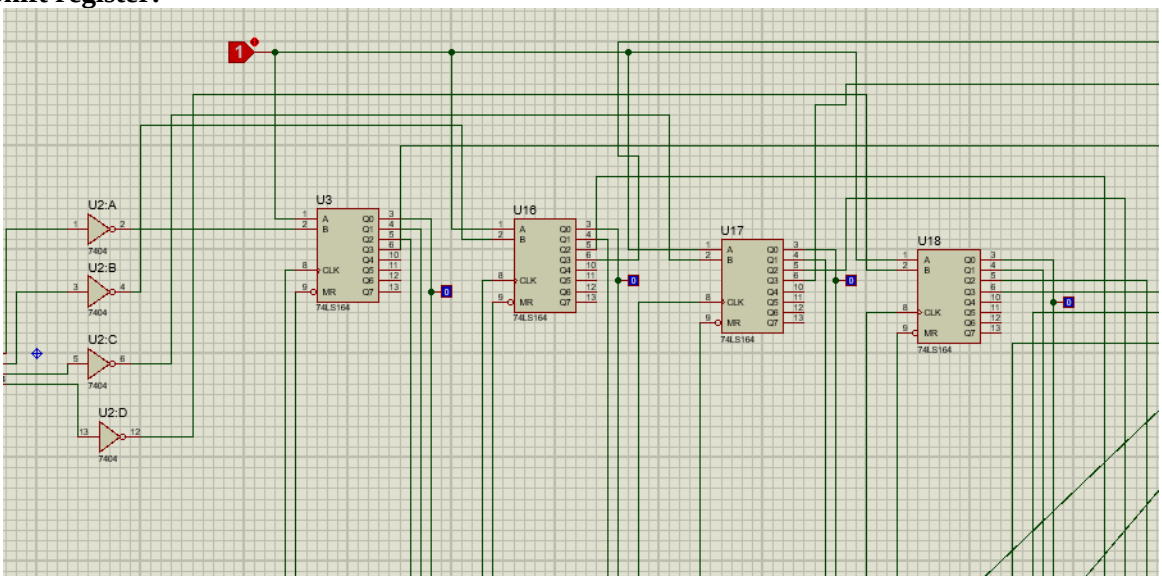
Encoder:



This is the proteus we designed. But, in practical implementation we used IC 74148 at first. But it did not work properly. So we changed the design and built 10 to 3 encoder using basic OR gates. This part is same for both user and owner circuit. We used three CD4072 and two 7432 ICs

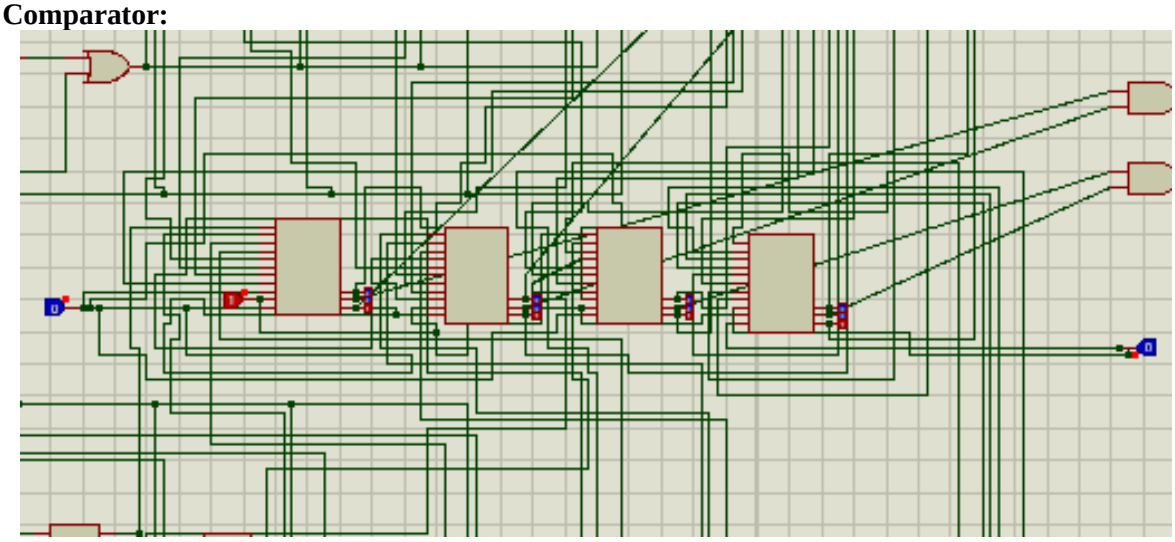
Here A0=Y1+Y3+Y5+Y7+Y9
A1=Y2+Y3+Y6+Y7
A2=Y4+Y5+Y6+Y7
A3=Y8+Y9

Shift register:



This is our shift register block for ‘Set password’ circuit. Also, this portion is same for “User_circuit”. Here, we used the sum of all encoder outputs as the clock pulse for the shift registers. We used IC 74HC164 for this serial in parallel out shift registers.

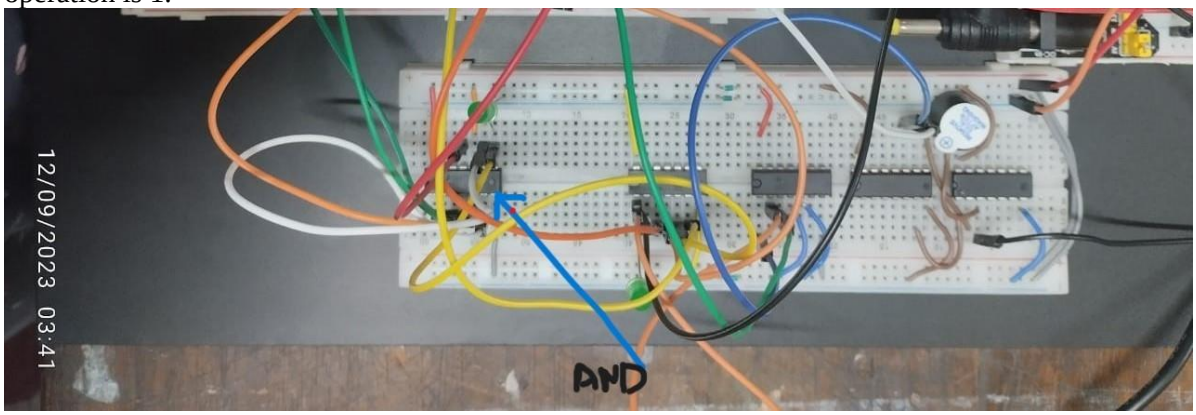
Comparator:



This is our comparator block. We used IC 4040 for this 4-bit magnitude comparator. In practical implementation we took output from pin6 which will be high if A=B. Then we took an AND operation of the outputs of these comparators

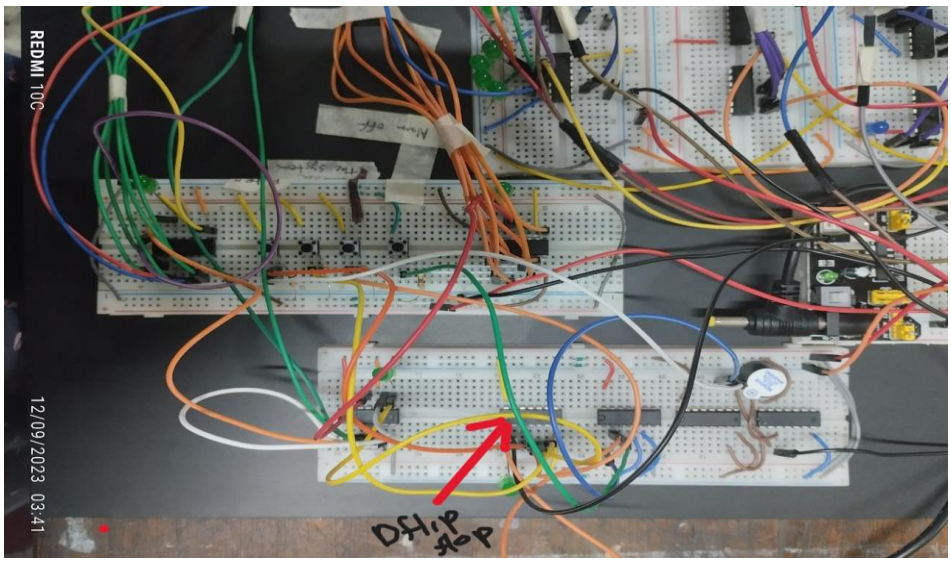
AND operation:

We derived the and operation of our comparators. If all the bits are same, then the output of all comparators will be 1. If we took “AND” operation of these outputs, output will be “high”. We implemented this logic on our practical circuit. But in proteus we built a different logic. The indicated block is the AND operation. The green led will lit up if the final output of the AND operation is 1.



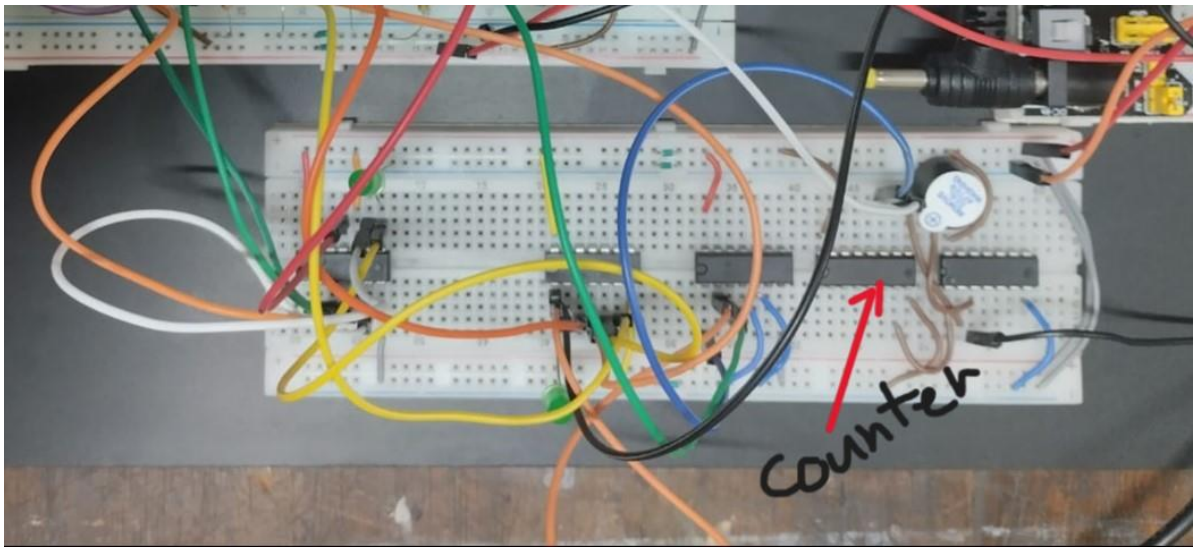
Storing the output in D flip flop:

We did not implement this logic in proteus. We implemented this different logic in our practical circuit. We used IC 4013 for this operation



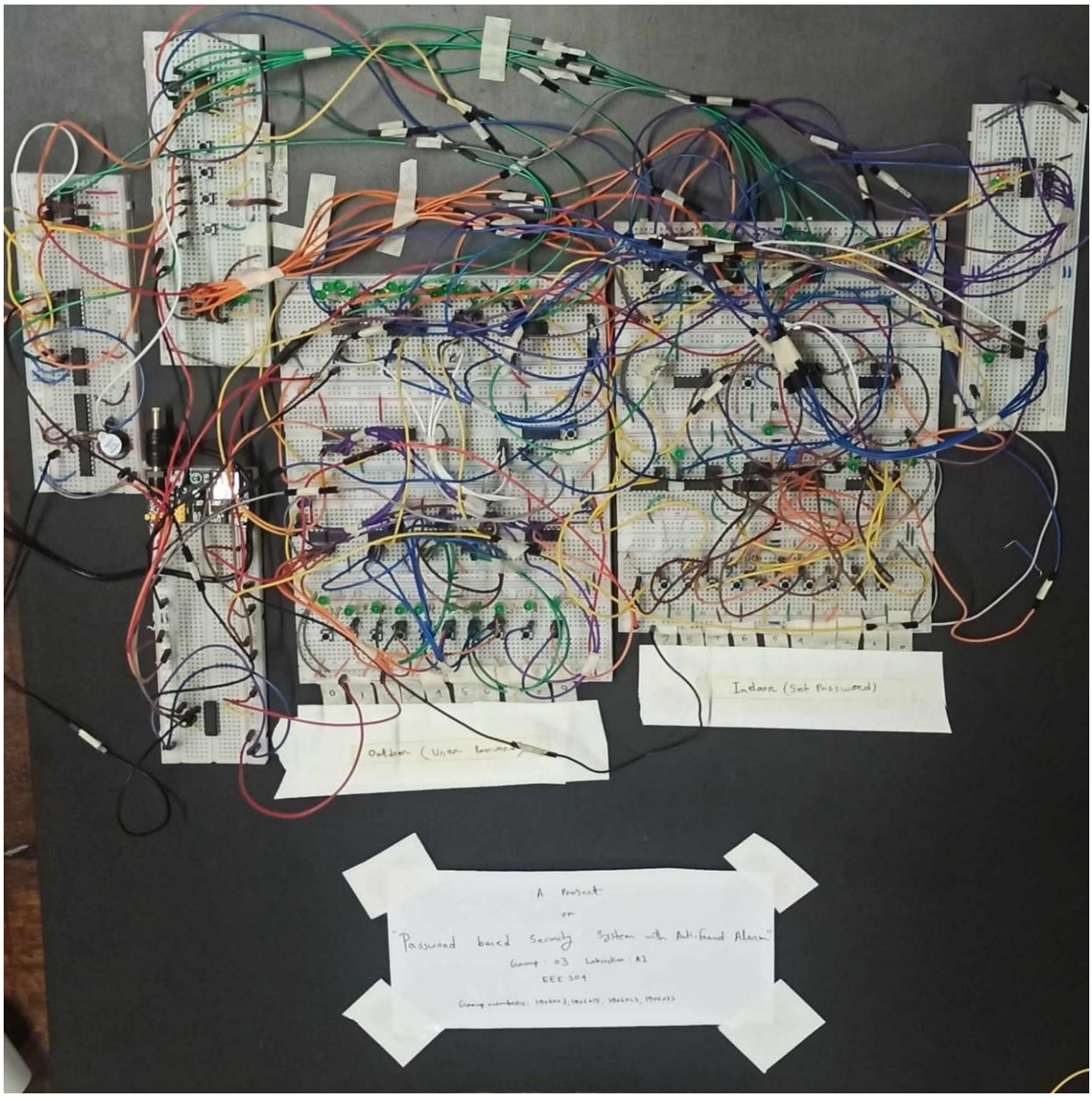
If the output of the flip flop is 1, the green led will lit up which means the “door is unlocked’. Owner can again lock the door using ‘door locked’ push button. Again, owner can unlock the door using ‘door unlocked’ push button. This is the reset and set of the flip flop which is being used by ‘Owner’.

Counter:



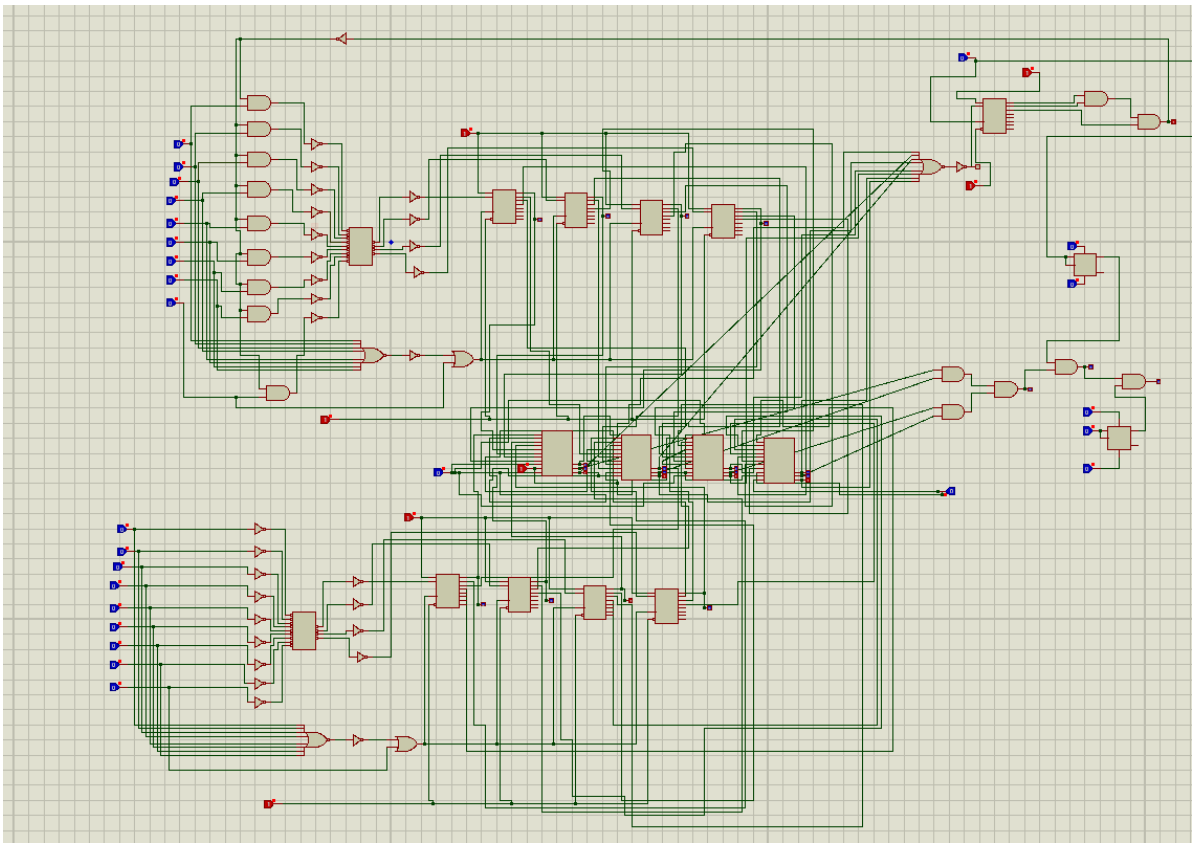
We used IC 4040 for counting. This counter can only up count to 3 as we only took output Q0 and Q1 to an AND operation. If user provide wrong password three times, then the counter will be activated and the buzzer will become ’ON”.

3.3 Circuit Diagram



We practically implemented our circuit in breadboard and got the desired output.

3.4 Simulation Model

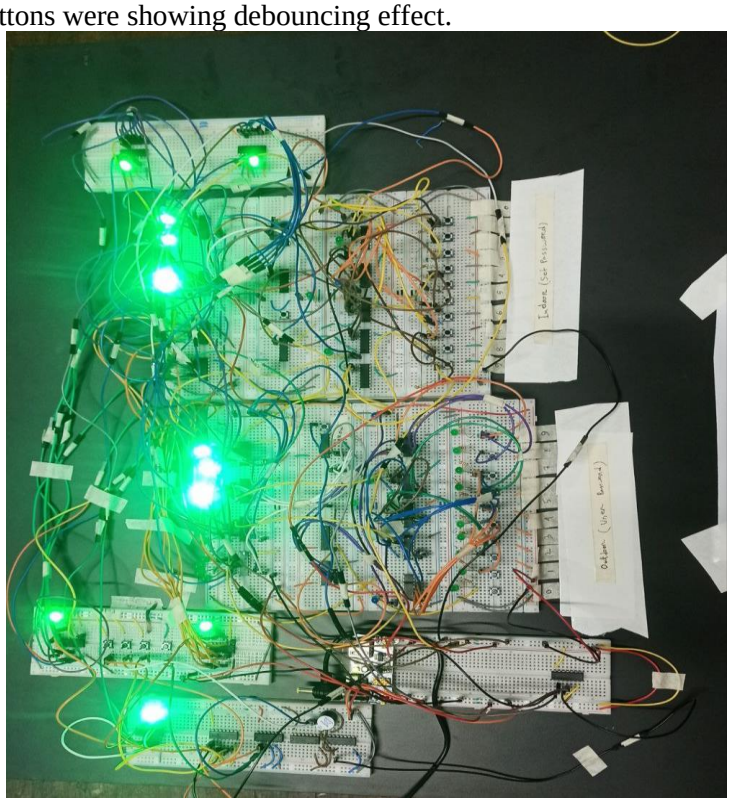


This was our primary plan. We changed the connection of comparator later and used the output from pin-6 only and as described earlier. We changed the connection to implement the circuit in an easy way. If we followed our proteus model then we needed more IC and breadboards

4 Implementation

4.1Description

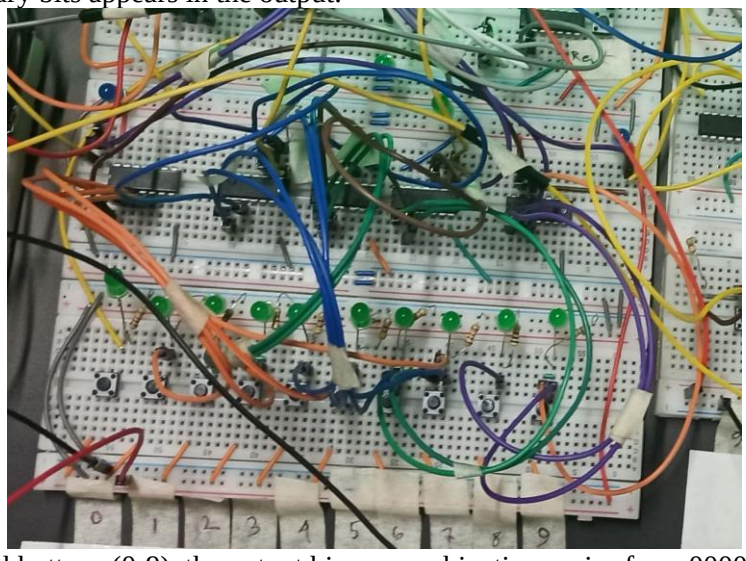
We could implement our project with all the features allotted. Just we faced problem with one part. That is- the pushbuttons were showing debouncing effect.



The different parts of our project are described below:

The encoder part:

We implemented our encoder part with OR gate. When we press any number through push button, the corresponding binary bits appears in the output.

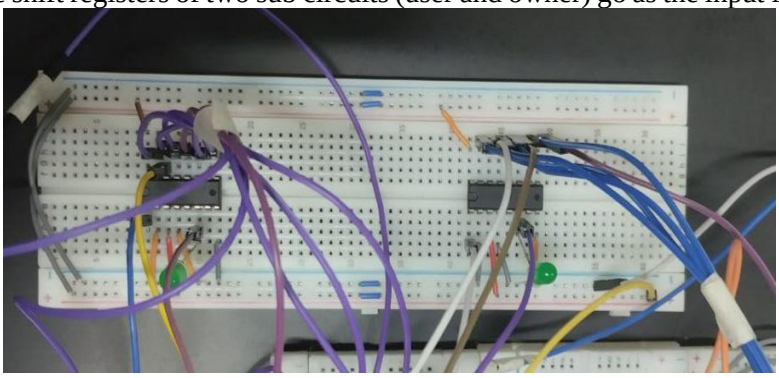


As we have 10 pushbuttons (0-9), the output binary combination varies from 0000 to 1001.

Then the outputs of the encoder are given at input of 4 SIPO (Serial in Parallel out) shift registers. The

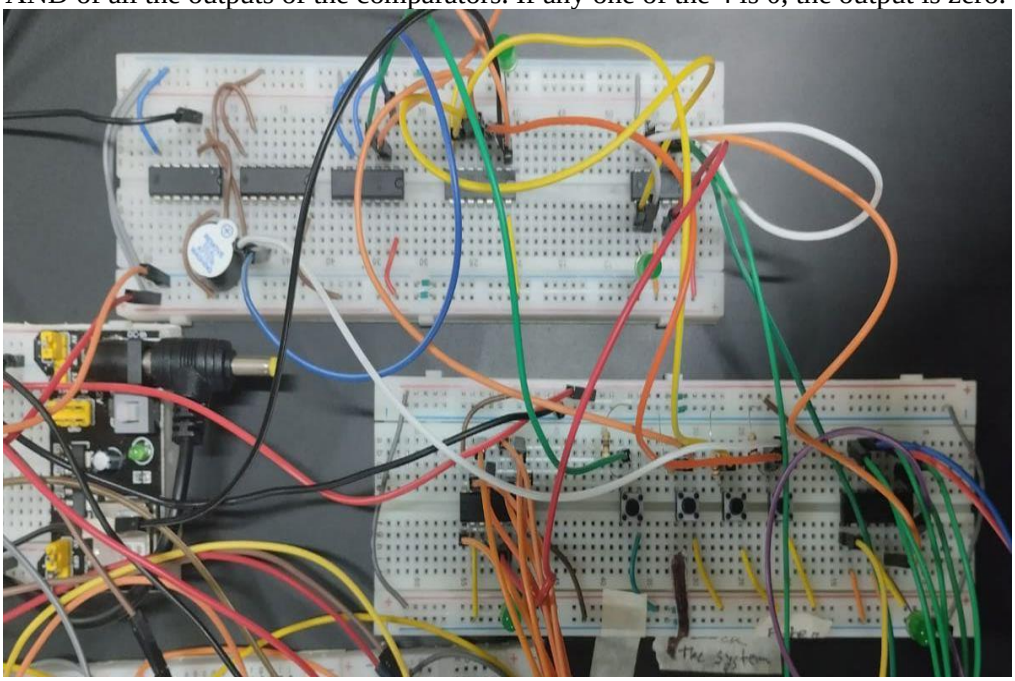
clock of shift register is the boolean sum of all inputs of the system from user side. Because we expect the system to store value if there is any press in the pushbuttons.
For minimizing the numbers of OR gates used, we did OR of the outputs of the encoder block with the input number '0'.
Each shift register has four parallel outputs. We connected LED lights across the outputs of the registers.
The reset pins of all the registers were shorted.
We implemented the user circuit register part to have reset in the following situations :
1) if the user press reset button to enter a new assumed password
2) if the system is unlocked
3) if wrong password is typed for 3 times and the alarm is buzzing.

Comparator block:
The outputs of the shift registers of two sub circuits (user and owner) go as the input for 4 comparators.



A comparator has 4*2=8 inputs (a0, a1, a2, a3, b0, b1, b2, b3). The 'a' sequence come from the indoor circuit. And the 'b' sequence from the user circuit. The comparator compares the bit sequence. If the streams differ at least in one binary bit, it gives zero output. Otherwise, the output is 1.
The input bit streams of the 4 comparators came from 4*2=8 registers of the two circuits. We connected all the LSBs of 8 registers in a comparator. The MSBs in another one. And the other positioned bits in the other two. If all of the comparators give output 1, then only we can comment that the user has typed right password.

Counter block:
We did AND of all the outputs of the comparators. If any one of the 4 is 0, the output is zero.



When password is right: When the right password is typed, the output of AND gate is 1. And then a

LED gets brightened indicating that right password has been entered and the system is unlocked.
When password is wrong: When a wrong password is typed, the output of AND gate is zero. Then its inverted form is passed to the input of a counter through a D flip-flop. If the input to the counter is 1, it counts up. When the count value is 3, the buzzer gets activated.

4.2 Results

The final results are that the buzzer turns on in case of providing wrong pass 3 times. If correct password is given then the door opens. There are no numerical data or calculation in this project so the parts have been left out

5 Design Analysis and Evaluation

5.1 Novelty

Our project investigates into a method of implementing security lock with reset using digital logic IC's. It is novel in its approach as it allows the user to input wrong password up to 3 times and also permits resetting password. Changing the connection of the counter IC will allow the user to change how many times he may input wrong password. Moreover, the circuit design is scalable in the sense of number of digits in the password and also the number of different digits that can be used as inputs of the system – it would only require more ICs and breadboards. These along with the ability to reset the 4-digit password, each digit being a decimal digit, is what makes this project novel.

5.2 Design Considerations

5.2.1 Considerations to public health and safety

While making the project various considerations were made regarding public health and safety. The input voltages of all the circuits are between 5V to 7.5V and all the ICs, LED's and pushbuttons operate at these voltages. Much current is not drawn by the circuit too. Moreover, all the operating voltages and currents are DC. As such, there very small chance of getting electric shock while using the circuit. Due to such low voltages and currents involved and also due no open wires present in the circuit, there is also no possibility of fire getting caused by the circuit. No sharp edges or breakable components are used that might inflict injury. Overall, the project is very much safe and poses no harm to health.

5.2.2 Considerations to environment

All the components used in the project are non-toxic, non-volatile and mostly inflammable. No carbon emission is created from the project itself. Although the project uses plastic breadboards and ICs made of silicon and other elements, their usage can be reduced and also the space required by the project can be reduced to a large extent, thus reducing its impact on the environment. All these considerations were made while designing and implementing the project.

5.2.3 Considerations to cultural and societal needs

The project was chosen keeping cultural and societal needs in mind. Theft, burglary, breach of privacy, loss of assets are all things that harm a society and put its members at risk. Higher crime rates create panic among the citizens and hamper the normal way of life. To discourage such criminal activities, strong preventive measures are very important. Herein lies the utility of our project. Using a smart security lock like ours which is both cheap to build, easy to set up but manages to protect our

households, shops and other valuables while ensuring the access of the owner can protect the society from such criminal activities. This was the social need of our project.

On the cultural side, the project will discourage crimes and create a healthy culture of honest work which in turn will lead to a righteous and just society. This was the cultural side that was taken into account during the design and implementation of our project.

5.3 Investigations

5.3.1 Literature Review

The project did not involve much digging into literature, rather the knowledge gathered from the laboratory and various resources on the internet guided the project.

5.3.2 Experiment Design

The design process has been discussed thoroughly in the design and implementation sections (Section 3 and 4)

5.3.3 Data Analysis and Interpretation

Data analysis and the interpretation of the data has been discussed in section 4

5.4 Limitations of Tools

The project is not without its limitations. The limitations of our tools can be categorized into the following categories:

- **Voltage level maintenance:** Using the same voltage source for the whole circuit sometimes creates problems as the voltage drops after connecting several IC circuits and so separate voltage was needed to be used. But after using a power supply module to input voltage from the AC line supply, one source can be used to power everything.
- **Separate Voltage and ground:** Due to using separate ICs for each small subtask, separate V_{cc} and ground connections were needed for each IC. As such, the circuits became messy with wires. It would be greatly reduced of things could be implemented by fabricating everything on one PCB altogether.
- **Pushbuttons:** Pushbuttons need to be grounded via a resistance otherwise they keep their input high even when not pushed. Moreover, pushing them once cause them to get pushed twice sometimes. Different kind of buttons might give better results. This has been solved, albeit unsatisfactorily, by inputting password again after this occurs.
- **Size:** The circuits require many breadboards. Real life implementation would necessitate PCB design.
- **Password strength:** The strength of the password can be increased by using more characters and digits but as of now, using 4 decimal digits as password makes it not so strong.
- **Password storage:** Constant power is to be provided to the system. In case of power failure, the shift registers forget the stored value and store garbage values instead. The set password is to be reset from Inside House and new password is to be set before using Outside House board to input password

5.5 Impact Assessment

5.5.1 Assessment of Societal and Cultural Issues

The social and cultural impacts of a password-based security lock are the following:

- **Sense of security:** A cheap and easy to implement password-based security lock will ensure the safety of the owner's valuables, household or shop and thus instill a sense of security and peace in the owner and reduce fear.
- **Protecting personal space and privacy:** A security lock will protect the owner's personal space and privacy and also uphold the culture of ensuring and respecting other's privacy.
- **Reducing criminal activity:** Usage of security locks will act as a crime deterrent, reducing crimes and forcing criminals to look for better ways of survival.
- **Changing community living standard:** Using password-based locks will allow the people in a community to live in peace without fear of the safety of their valuables. As a consequence, they will be able to focus more on their daily tasks and live prosperous lives with mental peace.

5.5.2 Assessment of Health and Safety Issues

The health and safety issues are the prime focus of a security lock. The lock can protect valuable things and also valuable lives from outside threats while keeping those protected by the lock safe. Thus, it can ensure safety. Moreover, the lock features no harmful elements and so there is no risk of electrical fault and harm caused by it from the lock itself. In a nutshell, the lock will affect the health and safety of the user positively.

5.5.3 Assessment of Legal Issues

Usage of a lock and its installation might involve some legal issues. So, how the lock is used and whether its installation and usage is legal or not has to be ensured. The use of such locks will improve the crime situation and as a result, the legal machinery will have to deal with lesser criminal cases. But at the same time, disputes regarding the usage of such locks at various places have to be handled. Unnecessarily placing locks everywhere without need might call in legal attention and also the irritation of people.

5.6 Sustainability and Environmental Impact Evaluation

While making the project, a strict eye was kept on the sustainability and environmental impact. The components used in the project are not harmful to the environment. Although they are not biodegradable, the amount of plastic and silicon used can be reduced. Again, the whole project runs on very small amount of voltage and electricity and thus the overall load on the power grid is negligible considering the benefits that it provides. Moreover, the implementation of the project is not very expensive and it can be implemented quite easily within a small budget. The components are not very faulty within acceptable operating conditions. Overall, the project is both economically viable and sustainable on one hand, and has low environmental impact on the other hand.

5.7 Ethical Issues

Indiscriminate and unnecessary usage of security locks does impose an ethical issue. At the same time, the widespread use of such locks will reduce crimes as it would not be so easy to rob valuables bypassing the security lock. Thus, it will encourage people to find more ethical means of survival and not involve in unethical and criminal actions.

6 Reflection on Individual and Team work

6.1 Individual Contribution of Each Member

The individual contributions are listed below:

1906003:

- Made the schematic of the whole circuit and simulated it on proteus
- Built the various breadboard circuits

1906015:

- Helped in making the schematic of the whole circuit and its simulation in proteus
- Built the various breadboard circuits

1906023:

- Ordered components online and also went to shop (Patuatuli, New Market) to buy components
- Made the encoder circuit using basic ICs and assisted in building the various breadboard circuits
- Helped debug the problem with pushbuttons

1906033:

- Ordered components online, went to Patuatuli and Newmarket to buy components
- Made the encoder circuit using basic ICs and assisted in building the various breadboard circuits

6.2 Mode of Teamwork

The work was coordinated and completed by allocating individual tasks to everyone and then sitting together and merging the parts done individually. So, both individual work and team work was implemented. The final assembling of all breadboards and setting them up on a board was done together.

6.3 Diversity Statement of Team

The team consists of three girls and one boy, so the gender diversity is maintained in the team. Also, all of the team members are from different backgrounds and have different set of soft and hard skills. Thus, the tasks were done suiting the skills of each member. As such, diversity is also maintained in terms of backgrounds, skills and aptitudes

6.4 Log Book of Project Implementation

Date	Activity	Comments
27 June	Proteus done	Was successful
5 August	Went to Patuatuli	Bought necessary components
7 August	Built 8 to 3 Encoder Circuit	Was successful
18 August	Built 10 to 4 Encoder Circuit	Was successful
19 August	Built Comparator Circuit	There were problems in IC
21 August	Rebuilt Comparator Circuit	Worked
22 August	Ordered new ICs for flip-flop and shift register	Ordered online

23 August	Received necessary components	Components were in good condition
25 August	Built Shift Register Circuit	Worked
26 August	Built Shift Register Circuit	Worked
3-4 September	Did AND operation and built D flip-flop and counter	Was successful
7 September	Started interconnecting circuits and added buzzer	Was successful
11 September	Rechecked the circuits and observed if it's working properly	Was successful
11 September	Went to New Market	Bought other necessary equipment

7 Communication

7.1 Executive Summary

Our project was to create a smart lock having password reset and alarm. The purpose of the project is to protect user's valuables by creating a password-based smart lock that raises alarm when wrong password is given for 3 times and permits password change after providing correct password. The whole circuit was built using encoders for inputting password, shift registers for storing, comparators for matching and counter for keeping count of number of wrong inputs. The system can be used as a security lock for protecting valuables.

7.2 User Manual

The project is very user friendly. The following few steps need to be followed:

Step 1: Provide power using the AC to DC adapter by plugging it in

Step 2: Set the password on the Inside House portion, the project requires constant power or else it will forget the password. Reset and provide again in case of pushbuttons getting pushed twice.

Step 3: Input password at Outside house portion. Reset and provide again in case of pushbuttons getting pushed twice. Not being able to provide correct password thrice will raise the alarm.
These are the few steps of the whole functioning of the project.

8 Project Management and Cost Analysis

8.1 Bill of Materials

Name of Components	Per piece price	Number of units used	Total cost
Large breadboards	130	12	1560
Power supply module	120	1	120
AC to DC adapter	90	1	90
IC 4063	45	10	450
IC 4013	15	11	165
IC 4040	30	5	150
IC 74164	30	10	300
IC 7411	20	3	60
IC 7408	15	4	60
IC 7432	15	3	45
IC 4072	35	3	105
IC 7404	15	8	120
Pushbuttons	2	36	72
LED light	3	25	75
Jumper wires x40	80	2	160
PVC Board	130	1	130
Total			3662

9 Future Work

There is much scope for future work. Firstly, the current model can be reduced in size by using PCBs and other fabrication techniques. Secondly, the currently decimal system can be upgraded to hexadecimal or other system having more numbers and characters as possible input of password by increasing the number of ICs. Moreover, the number of digits of the password can also be increased by increasing the number of ICs. It is also possible to work with the password storage and make sure that the password does not get forgotten in case of power failure. Also, a stand-alone power source for the system can also be designed. Finally, there is scope of further work in minimizing the circuit cost of ICs by using different configurations.

10 References

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https://www.javatpoint.com/encoders-digital-electronics#:~:text=In%2010%20to%204%20line,code%20in%20the%20output%20side
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IC 7432-
https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.futurlec.com%2F74%2FIC7432.shtml&psig=AOvVaw0mRu7w78YmWn4saoZKXozE&ust=1694579359819000&source=images&cd=vfe&opi=89978449&ved=0CBEQjhxqFwoTCOjHv5iepIEDFQAAAAAdAAAAABAE

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IC 74164-
https://microcontrollerslab.com/74ls164-serial-in-parallel-out-shift-register-ic/