# Digital Logic

## Electronic Controller For Elevator

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Group Name : **False 9**

**False 9** Group Members :

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# 1.0 : Dedication and Acknowledgement

First of all, we want to express our sincere appreciation to our course lecturers, Mr Ahmad Fariz Bin Ali for the guidance, support and expertise that has been provided. All kinds of knowledge he taught related to the design of 3-bit synchronous counter circuit using JK flipflops and the use of Deeds-Dcs truly helped us in converting translating theory into practical simulations.

We would also like to thank to all individuals who were involve in helping to make our project a success. Especially to all group members who have shown great commitment.The cooperation of each members in discussing, generating ideas and a very hard-working in producing a video of demonstration is highly appreciated. Without the high passion of teamwork, this challenging project may not been possible to complete successfully .

# 2.0 : Report Content

## 2.1 : Background

In this project, we will implement an electronic controller for elevator in a hotel building, which allows it to input controller to detect visitor card hotel, to indicate door open/close and to use passcode using 3-bit synchronous counter ( count UP/DOWN ) to support 8 floors hotel elevator. The full circuit is drawn using DEEDS that includes sequential circuits and combinational circuits.

**Combinational circuit components include :**

- 4-bit Comparator
- 3-bit Comparator
- Basic gates
- Switches
- LED
- Seven Segment Display
- Encoder

**Sequential circuit components include :**

- Clock Enabler
- JK-flip flops **Extra Features**
- 2-digit password system

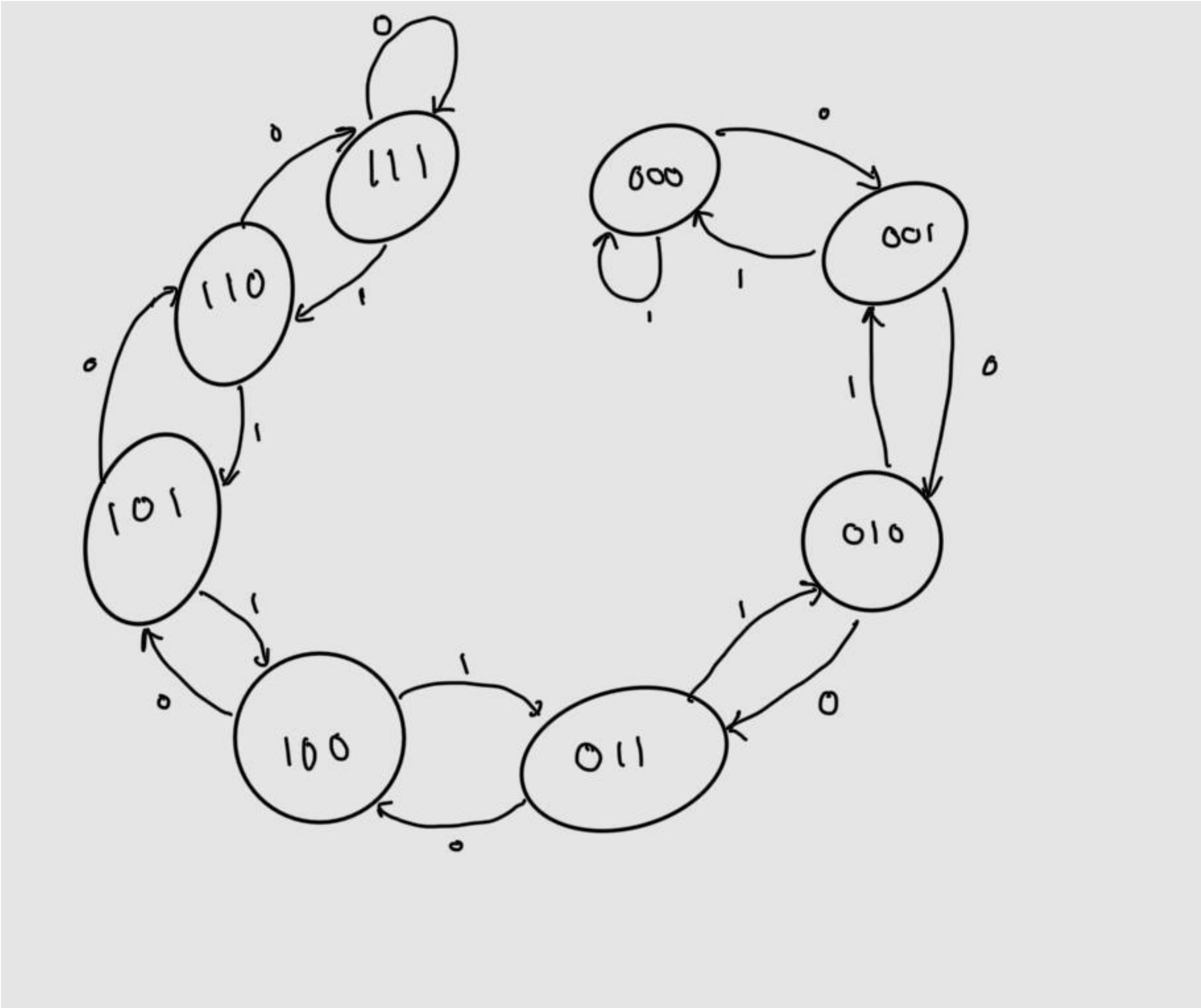
## 2.2 : Problem Statement

Door that opens by only scanning the visitor card hotel tends to be dangerous to the hotel residents. To solve this problem, we will create a new lift system, by using Digital Electronics Deeds Simulator to increase the security of the hotel, we have implemented a 2digits password to allow the user to input a 2-digits password. It requires various advanced electronic components for new system to make sure only authorized person are allowed to use it. It will increase the security of the elevator and make it more safer by addressing the current problem with unauthorized access

## 2.3 : Suggested Solution

To address the security problem, we implement a 2-digit password-protected solution The suggested solution involves the integration of advanced electronic components, including a 3bit comparator, basic gated , and JK- flip flops. Firstly, users are required to enter password to gain access to the elevator. The elevator will only be activated after the user had entered the correct password in the password reader. LEDs light up showing that the authentication is successful, then user can change the switch to 0 (indicate going up) and have the option to specify their desired floor. The elevator operation will stop upon reaching the desired floor by the user. If the user want to go down, the switch can be change to 0 (indicate going down) and have the option to specify their desired floor. The suggested solution will provide a reliable and efficient authentication mechanism and ensure only authorized user can use the elevator. The proposed system will be design using Digital Electronics Deed Simulator (DEEDS)

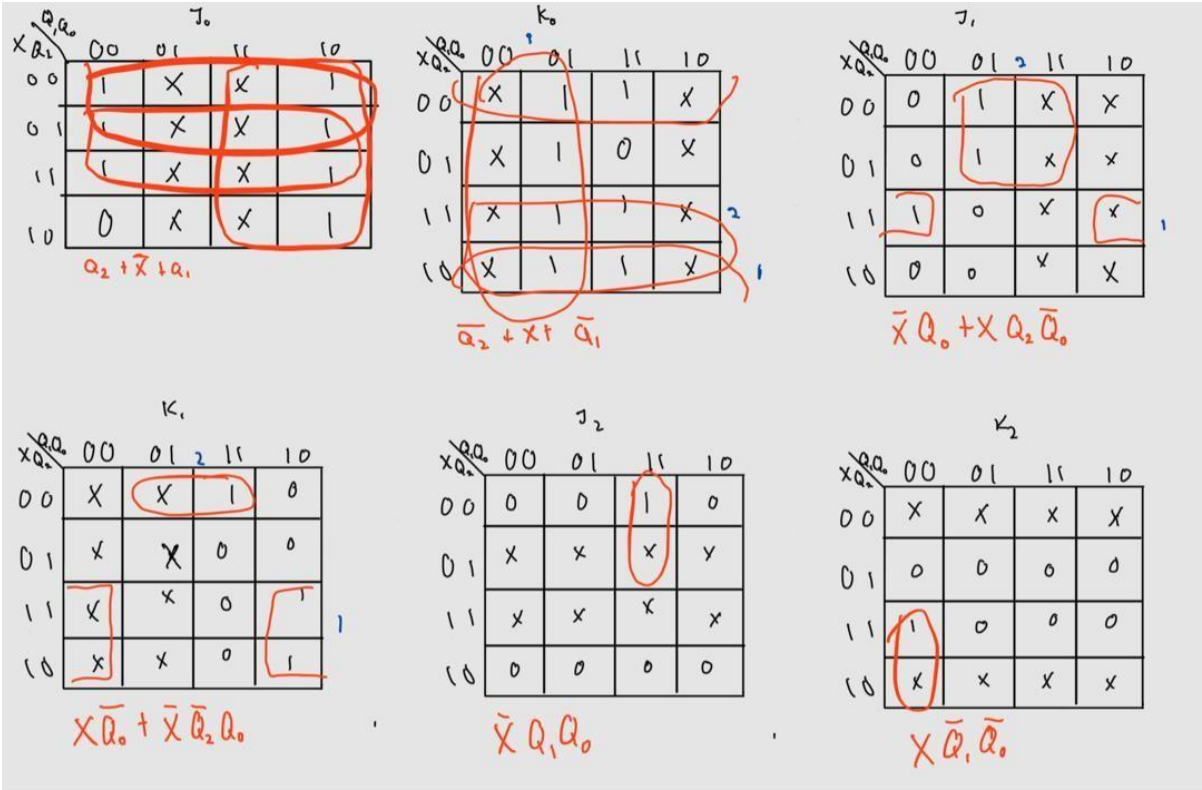
### 2.3.1 State Diagram



2.3.2 Next Step and Flip Flop Transition Table

| Direction (X) | Current State | | | Next State | | | JK FF | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q2 | Q1 | Q0 | Q2 | Q1 | Q0 | J2 | K2 | J1 | K1 | J0 | K0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | X | 0 | X | 1 | X |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | X | 1 | X | X | 1 |
| 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | X | X | 0 | 1 | X |
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | X | X | 1 | X | 1 |
| 0 | 1 | 0 | 0 | 1 | 0 | 1 | X | 0 | 0 | X | 1 | X |
| 0 | 1 | 0 | 1 | 1 | 1 | 0 | X | 0 | 1 | X | X | 1 |
| 0 | 1 | 1 | 0 | 1 | 1 | 1 | X | 0 | X | 0 | 1 | X |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | X | 0 | X | 0 | X | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | X | 0 | X | 0 | X | 1 |
| 1 | 1 | 1 | 0 | 1 | 0 | 1 | X | 0 | X | 1 | 1 | X |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | X | 0 | 0 | X | X | 1 |
| 1 | 1 | 0 | 0 | 0 | 1 | 1 | X | 1 | 1 | X | 1 | X |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | X | X | 0 | X | 1 |
| 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | X | X | 1 | 1 | X |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X | 0 | X | X | 1 |

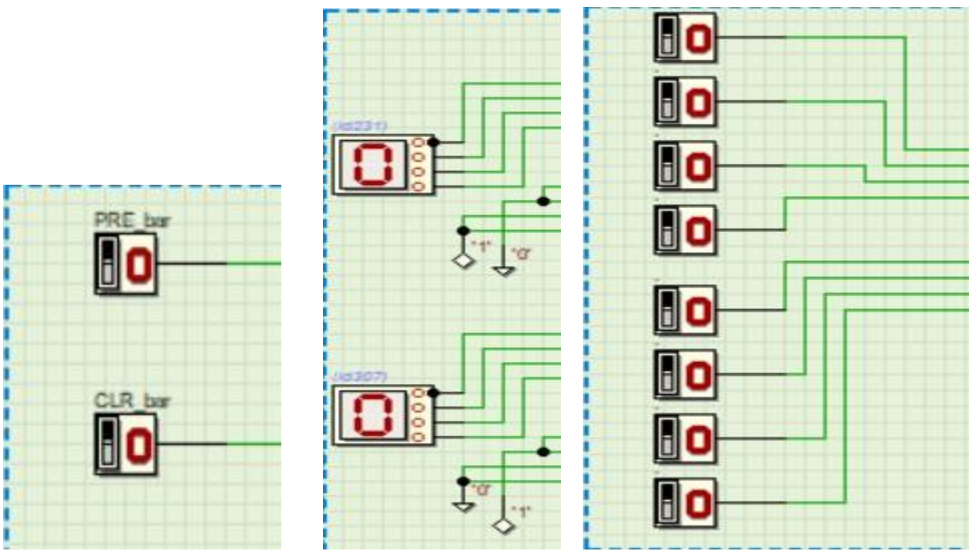
2.3.3 Karnaugh Map ( K-Map)

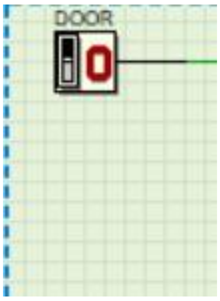


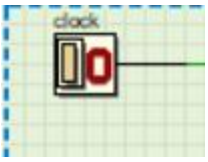
## 2.4 System Implementation

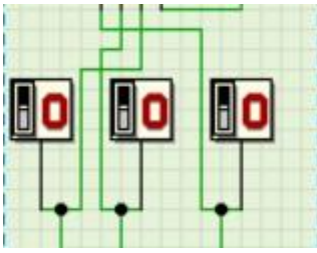
**a. Input Switch**

Input switches allow user to interact with the elevator and input relevant information. Specifically, there are 3 input switches for the user to select the desired floor number. The design of the switches represents a single bit respectively, which are Input 1, Input 2, and Input 3. Input 1 represents Most Significant Bit (MSB), while Input 3 represents Least Significant Bit (LSB). The user could select the floor level ranging from 0 to 7. The output of the input switch is connected to a 7-segment display to show the user's selected floor number. There are also 2 input switches for the user to to input the 2-digit password connected to the 4-bit comparator to determine whether password entered by the user is correct. Besides, there are also 2 input switches that allows the change of the floor level. Then, there are 8 input switches. It allows the user to scan the visitor card which affect the first 4 input switches and to determine whether the card is correct or not, first 4 input switches needs to be same with the last 4 input switches. Not only that, there are 1 input switches that controls the movement of the door whether the elevator open or close. Additionally, there are 1 switches that controls whether the elevator is going up or down. Lastly, there are 1 switches that will change the floor that is desired by the user.



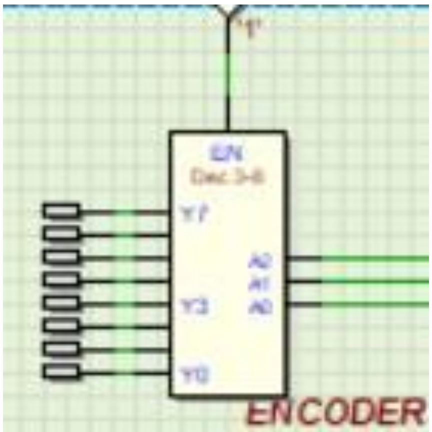






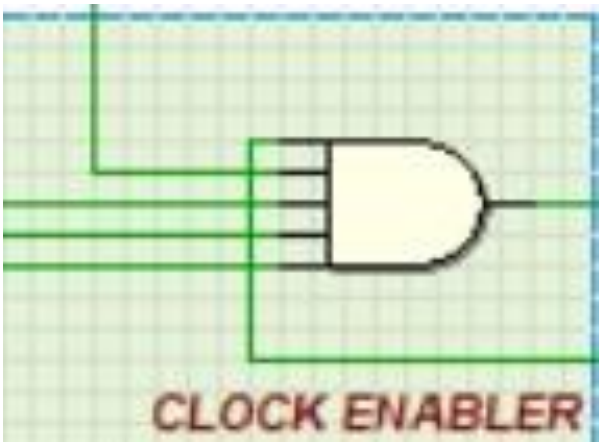
**b. Encoder**

In this project, we implement 3-bit encoder to allow the movement of the elevator to user's desired floor. We connected the 3 input switches that allow the user to select the desired floor number as an input for the 3-bit encoder to allow the elevator to arrive on the floor that is pressed by the user.



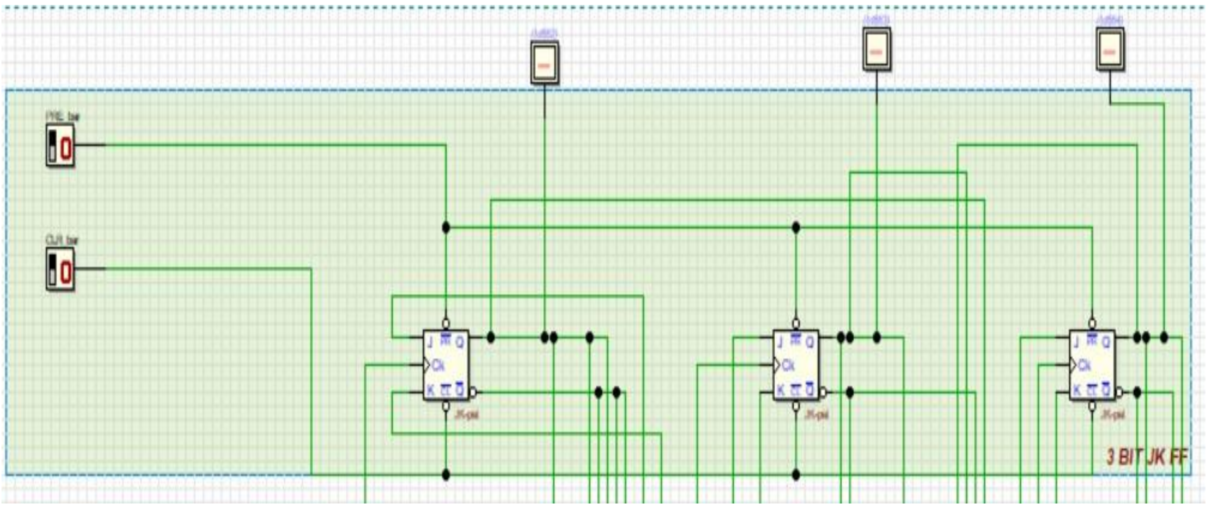

**c. Clock enabler**

We implement the Clock Enabler using a 5-input AND gate. This 5-input AND gate takes inputs from the door switch, clock switch, a signal from the password reader, a signal from the visitor card reader, and a signal from the comparator. The Clock Enabler will only become operational when all five input are in high state (1). The output of the 5-input AND gate is then linked to the clock input of the JK flip-flops. The 5-input AND gate is used to start and stop the operation of the lift when the user's selected floor number had arrived.



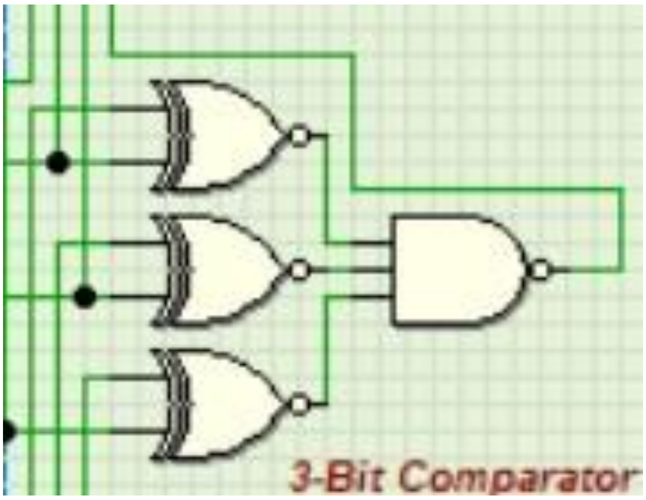

## d. JK Flip –flops

We implement 3-bit JK flip-flop in this elevator system project. The counter operates based on the clock generator ( Input Switch) which determine whether the elevator should continue to operatore or stop operation. It will start counting if the JK input is connected to high state (1) from the clock enabler, and vice versa. Upon correct password entry by the user, the AND gate in the password site will implement the active high (1) input. In the event of a wrong password, the counter remains inactive. The counting process will stop either when the clock pulse is no longer receiving or when the user-specified count is reached.



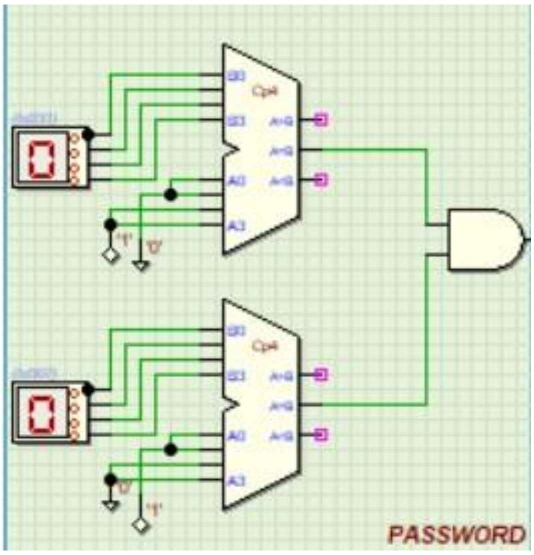
## e. 3-bit comparator

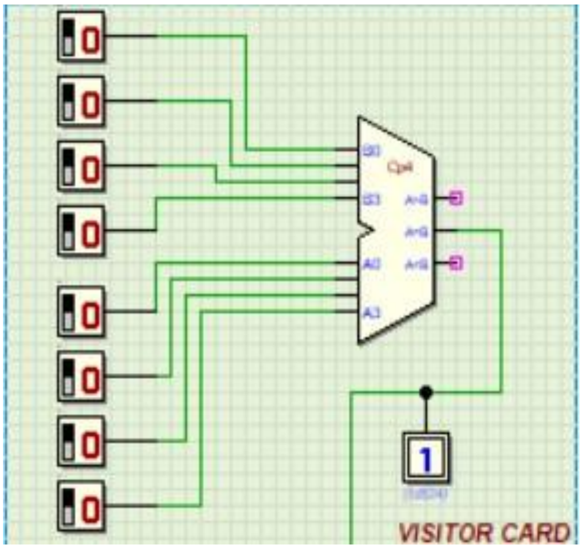
We implemented a NAND gate and three 2-input XOR gatees, as the 3-bit comparator in this project. These components are used to compare value from 2 sources which is the input switches, which are used to input the floor level number that is desired by the user, and the current floor level number. The first XOR gate compares the least significant bit (LSB) of the 2 sources. If current floor level number and the user's desired floor level number are the same, the ouput will be 0, and it will be sent to the NOT gate and converted into 1. The same principle can be applied for the second and the third XOR gate. Then, the signal from all three gates will be sent to a NAND gate as an input to convert it into the opposite signal as an output. Therefore, when the input of the NAND gate is received the high input (1) given from the input switches and the counter, it will send an output 0 to the clock enabler to stop the movement of the elevator.




## f. 4-bit comparator

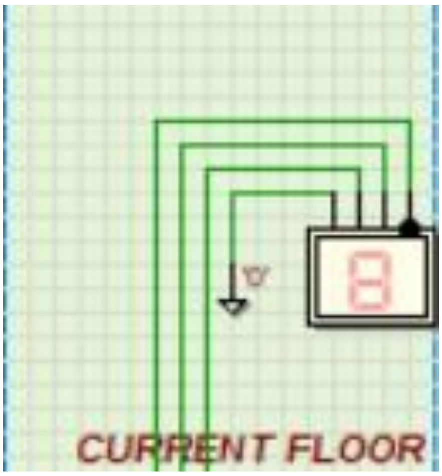
We implement 4-bit comparator in this project to determine whether the password entered by the user is correct or not. The input switches connected to 4-bit comparator as an input. The same principle can be applied for the second 4-bit comparator. The signal from the comparator will be input for the AND gate and both of the signal need to have high input (1) to obtain high output (1) for the AND gate.

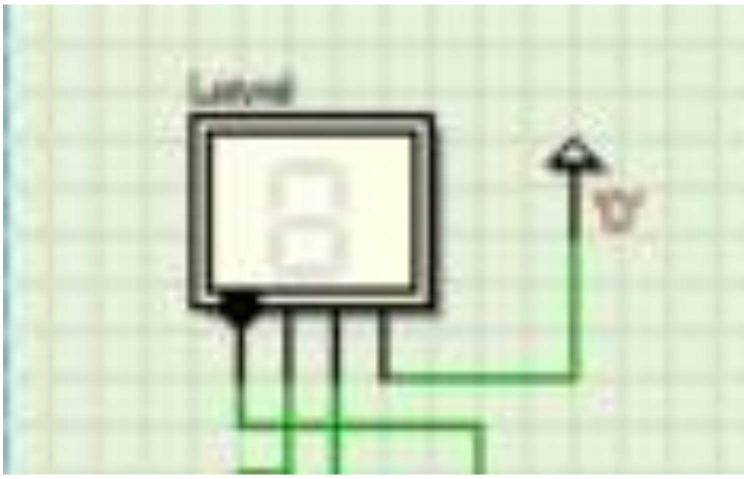



## g. 7-Segment display

The 7-Segment display displays the number based on the BCD value by converting the BCD code received into decimal numbers. This component will display the decimal numbers 0 to 9 by turning up the proper light of the 7-segment display. The floor level selector and current floor level are connected to a 7-segment display. The floor level selector will display the floor level number selected by the user, from 0 to 8, and the current floor level will display the current floor of the user.



## 2.5.0 : Conclusion

In conclusion, this project has been successfully implemented. The project developed an 8-storey hotel elevator control system that is fully functional using digital logic circuits. Through the use of a 3-bit synchronous counter with JK flip-flops, this system can effectively manage up and down movements between levels 0 to 7 based on the input entered by the user. Additional features such as hotel room card detection, the use of passcodes and door status indicators (open/close) have successfully increased the level of safety and system functionality according to the specified scenario. Overall, there is no doubt that this project can prove that digital logic theories such as state transition tables and K-Maps can be applied practically through DEEDS software simulation.

## 2.5.1 : Reflection

Through the implementation of this DEEDS project, the achievement we have achieved is the ability to innovate a basic 2-bit design to a fairly complex 3-bit system using JK flip-flops. The advantage applied by our team lies in creative problem-solving skills, especially in ensuring that the comparator and clock enabler work in parallel to be able to stop the elevator at the floor selected by the user. However, we also have weaknesses in the aspect of time management and initial difficulties in minimizing the use of logic gates in order to be able to summarize the circuit. As an improvement in the future, we plan to enhance this system with an overload sensor function to make it more efficient and safe for public use.

## 3.0 References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## 4.0:Appendices

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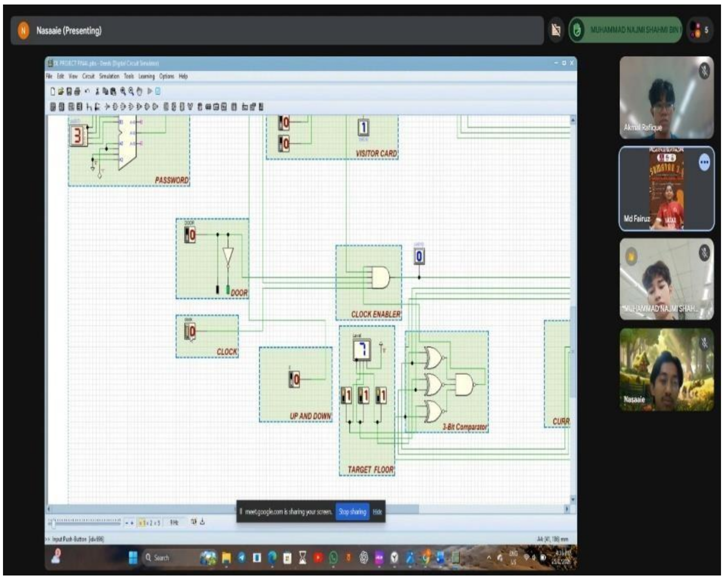
|---|---|
| NASAAIE BIN NORISKAMAR<br>A25CS0118 | - Report Writing ( Dedication & Acknowledgement )<br>- Report Writing ( Reflection )<br>- Report Writing ( Implementation ) |
| MUHAMMAD FAIRUZ BIN HERMAN<br>A25CS0267 | - Report Writing ( Implementation )<br>- Video Editor<br>- Report Writing (Background ) |
| MUHAMMAD NAJMI SHAHMI BIN MOHD LATPI<br>A25CS0279 | - Report Writing ( Suggested Solution )<br>- State diagram<br>- State table<br>- transition table |
| AKMAL RAFIQUE BIN AHMAD RAPHAIE<br>A25CS0181 | - Report Writing ( Problem Statement )<br>- Solve K-Map<br>- Circuit Simulation<br>- Deeds Drawing |

Table 1.0:Task Distribution



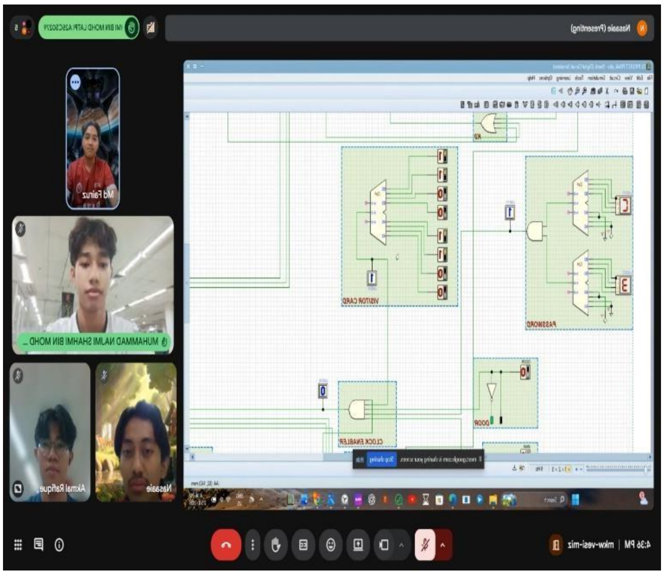



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Table 2.0:Discussing and Designing Phase