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TOPIC: Digital Access Control System
COURSE: Bachelor of Software Engineering
SUBJECT: Digital Logic
LECTURER: Zhiar Yassin

Dedication & Acknowledgement

we would like to sincerely thank my lecturer for the guidance and support throughout this course. Even though we worked on this project remotely, the clear instructions and feedback helped us gain a much better understanding of digital logic systems. We are also grateful for having access to tools like the Deeds Simulator, which made it possible to build and test a digital circuit virtually. This experience helped us improve both our technical skills and problem-solving mindset.

Table of Contents

1. Background

In this mini project, that we designed a simple yet practical digital access control system. It mimics the way a secure system works: a user needs to enter the right password to gain access. Once access is granted, devices like a light and air conditioner turn on automatically if conditions are right (e.g. someone is in the room and the temperature is acceptable). The system also keeps track of wrong attempts and triggers an alarm if needed.

2. Problem

Today, digital access systems are everywhere from homes to offices. They must be smart, secure, and responsive. The challenge here was to design an elementary version of such a system using only digital logic components. It should identify a correct password, continue monitoring incorrect attempts, react to inputs from sensors, and drive corresponding outputs.

3. Proposed Solution

The solution involves building a circuit that:

1) Compares it with a preset (stored) password.
2) Lights up a green LED when the password is entered correctly.
3) Lights up a red LED and counts upwards when the password is entered wrongly.
4) Handles devices (like lights and AC) based on temperature and motion conditions.
5) Sounds an alarm when someone continuously enters a wrong password and there is motion.

4. Components & Requirements

1) XNOR Gates – To check each bit of the input password against the stored password.

2) AND Gates – To check for a complete match and control logic.

3) Switches – To input the password and to simulate environmental conditions.

4) LEDs – Green for correct input, red for wrong input, and another red for the alarm.

5) JK Flip-Flops – To count wrong attempts.

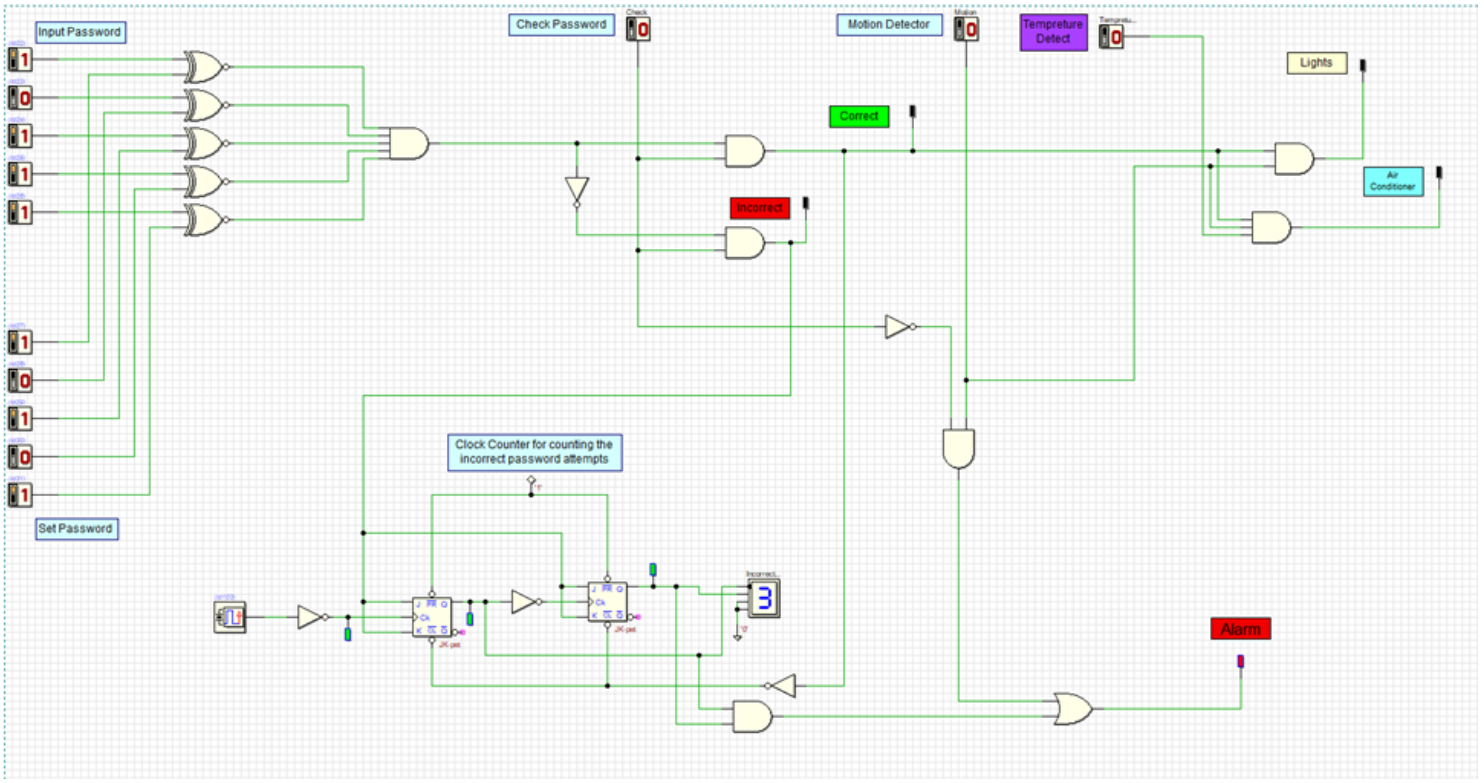
6) 7 Segment Display – To show the number of incorrect entries.

7) Clock Generator (2Hz) – Feeds the counter to update on each wrong try.

8) Simulated Motion and Temp Switches – Act like sensors to trigger smart functions.

9) Light & AC Blocks – Represent outputs triggered by correct access + sensor input.

5. The digital access control circuit



6. System Implementation

1) password matching:

The user inputs a 4-bit binary password using toggle switches. Each input is checked using XNOR gates against the stored password. If all four bits match, an AND gate outputs a high signal to confirm the match.

2) check button:

A simulated ‘Check’ button must be pressed to validate the password. If the input is correct, the green LED lights up. If not, a red LED turns on and the wrong attempt counter updates.

3) Counting Wrong Attempts:

With each wrong password attempt, the counter increases. JK flip-flops driven by a 2Hz clock keep track, and the number is displayed on a seven-segment display.

4) Smart device trigger:

If both motion and temperature inputs are active and the correct password has been entered, the system activates the light and AC blocks. This adds a layer of environmental awareness.

5)Alarm activation:

When someone keeps entering the wrong password and is still present (motion detected), the system turns on an alarm LED to simulate a security alert.

7. Conclusion

This project gave us hands-on experience designing a secure and responsive digital system. It was a great way to apply what we have learned about logic gates and digital circuits. the Deeds Simulator allowed us to test everything as if we were in a lab. we now better understand how digital logic systems can be built to solve real-world problems.

8. video link

https://youtu.be/YD0zkDXbfj8?feature=shared