

D-register based network that enables complete functionality of a security pin system

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Course:	EE 224
Partners:	Aditya MEHTA (210260032) Shubham INGALE (210260022)
Instructor:	Professor Pradeep SARIN

1 Summary

The design of circuit is simple yet elegant. We used just normally utilized gates and D flip-flop to make this working model. The circuit built **does not rely on an external clock** and uses a D-register to store the user's 4 bit pin. . XOR and OR gates compare the correct and entered pins, and the signal passes to the next stage through an enter button. The counter is triggered to count on an incorrect pin attempt, and the circuit will freeze after three incorrect attempts. In the circuit, the IC 555 was implemented for de-bouncing and the 74ls174 was utilized for storing the user's and original pin bits.

2 Theoretical design

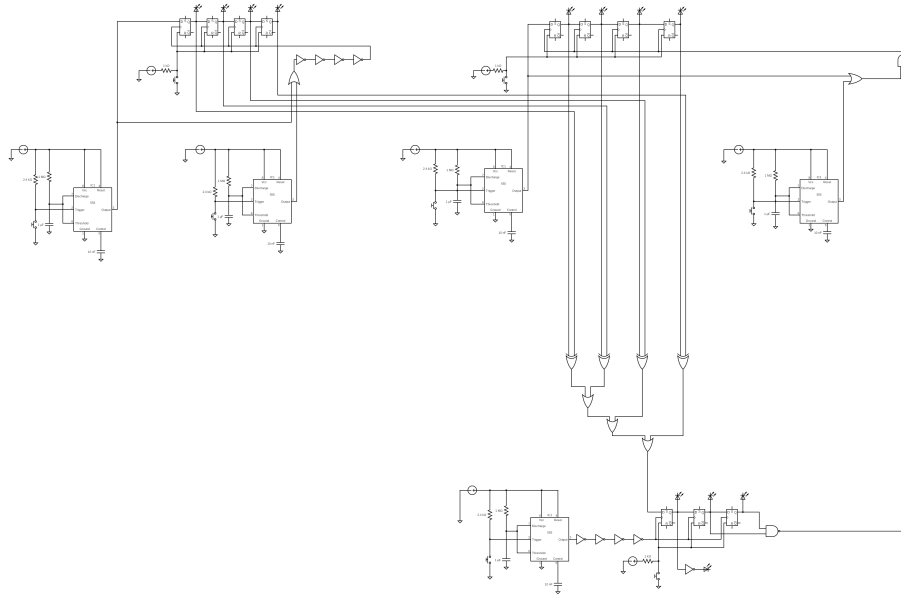


Figure 1: Circuit Diagram

3 Experiment Implementation

- The circuit will include eight push switches for various functions.
- Two switches will set the original pin, with one button to input 0 and one button to input 1.
- Two switches will enter the user's pin, with one button to input 0 and one button to input 1.

- Three switches will reset the respective D-registers, and one switch will act as an enter button.
- Four LED lights will indicate the original and entered pins, and one LED will show a successful match after pushing the enter switch.
- After three incorrect attempts, the clock will freeze and the system will stop taking inputs.
- To restart, D-registers will need to be reset.

4 Connection with Computer Science

The project involves the use of digital logic gates, which are fundamental concepts in computer science. The use of the D-register and the 74ls174 D-flip-flop are also key concepts in digital circuits and computer architecture. We have simulated bit storage in D-flip-flop without an external clock which gives total control to the user and it can have huge application in computer hardware and software. The project can be seen as a simple example of a digital security system, which is an important application of computer science.

5 Appendix

The process of designing the circuit presented a challenge, but it was also an enjoyable experience for both of us. Developing a non-trivial system was an exciting prospect that motivated us throughout the design process. Despite the difficulties we encountered, we remained committed to creating a high-quality circuit that met our needs. The satisfaction of successfully designing and implementing the system made the effort and perseverance worthwhile.

We faced a significant challenge in our journey of building the circuit due to push button de-bouncing. The problem was that we were not using any external clock for the D-register, and a clean pulse was required after a push switch was pressed. The absence of an external clock signal made de-bouncing a challenge, and it had to be resolved to ensure that the circuit functioned properly.

LTSpice simulation of the circuit for a specific case: https://drive.google.com/file/d/1TEMEQr1hpP4otEv_dzA-b6905TePnpm3/view?usp=share_link