Security Lock System

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Project: Security Lock System

Object:
- Create a 4 bit secure lock system using a switch
- Convert parallel data into serial data using a shift register
- Send the data with an LED
- Receive the code and convert the data into parallel
- Compare the received data with original code to ensure they match
- Latch the result to maintain signal
- Unlock the system
Purpose/ Possible Uses:

- TV-remote control
- Door lock
- Home Security
- Car lock system
Materials:

- Photodiode
- Amplifier
- Shift Register
- Switch
- Resistors
  - 470Ω
  - 100 KΩ
  - 1 KΩ
  - 1MΩ
- Transistor
- Latch
- Comparator
- AND Gate
- XOR Gate
- OR Gate
- Wires
- Lock
- Batteries
- Potentiometer
- LED
- Capacitor
- Push Buttons
Switch

Shift Reg

Resistor x 25

LED

Light

Ground

Potentiometer

Transistor

Push Button

Timer

Lock

5 Volts

Photodiode

Amplifier x 2

Comparator

Latch

Push Button

Ground

5 Volts

Switch

Push Button

5 Volts

5 Volts
Shift Register

- Acts as the digital memory of the system
- Contains 6 data inputs: Parallel and Serial data
- Has 3 controls including Shift controls (S0, S1) and Clock
- Has 4 outputs: Q0, Q1, Q2, Q3, which change clock from 1 to 0
Resistor

- Reduces the current so that it can travel to the LED. This stops the LED from burning out.
- Produces a voltage that is proportional with the current.

LED

- Uses light to transfer the data to the photodiode.
- Transfers the serial data wirelessly to the receiver.
Photodiode
- Receives the serial data from the LED
- Sends the data to the comparator

Amplifier
- Intensifies the signal of the photodiode to receive a higher voltage signal
Potentiometer
-Circular shaped object that varies the resistance on the circuit thereby changing the voltage to make it more suitable for the photodiode being used
Timer

- Input in the shift register that standardizes the time which the code is sent out from the LED.
- This results in box waves which could be seen on the Oscilloscope.
- The clock’s frequency is measured by this equation:

\[ f_{CLK} = \frac{1}{t_1 + t_2} \]
Comparator

- Is used to make sure the code being received is correct to unlock the lock.
- The comparator works by first containing the correct code as a reference and second by comparing the received code and the reference code.
- The comparator is made of XOR, AND, and NOT gates
Latch

- The latch maintains the signal so that the lock stays on.
  - Turn the system on
  - Reset the receiver \( \Rightarrow \) C=0
  - Wait for signal
  - Signal comes (A=0) \( \Rightarrow \) C=1

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Transistor

• Gives more power to the motor
• Amplifies the signal
• The transistor is important to the system because it intensifies the signal when it goes from the Receiver portion of the system to the Lock
Conclusion:

What we learned

- How to correctly create an electrical lock system using basic electronic chips and devices
- How to program our system with binary code (ex 1010)
- How to successfully build/use comparators, shift registers, and latches
- Sender

- Receiver
Final Product:
Thank you!