EXPERIMENT – 8

DIGITAL UNLOCKING SYSTEM USING SHIFT REGISTER

Aim: To design and examine the digital unlocking system which compares the input sequencewith pre-defined sequence and able to open access by using shift register.

Components Required:

S. No	Component Name	Quantity
1	IC 7474 (D – Flip flop)	2
2	IC 7404 (NOT Gate)	2
3	IC7421 (Four input AND gate)	1
4	Breadboard	1
5	Trainer kit	1
6	Connecting Wires	Required number

Pre-lab:

1. What is a SISO shift register?

A SISO (Serial In Serial Out) shift register is a digital circuit that stores binary data and shifts it out bit by bit. Data is entered serially (one bit at a time) and exits serially as well.

2. What are the different types of shift registers?

There are two main types of shift registers:

- **Serial In Parallel Out (SIPO):** Data enters serially but exits in parallel from multiple output pins.

- **Parallel In Serial Out (PISO):** Data enters in parallel from multiple input pins but exits serially from a single output pin.

3. How can a SISO shift register be used in a digital unlocking system?

A SISO shift register can be used in a digital unlocking system by storing a pre-defined sequence of bits (the code) that acts as the unlocking key. The user enters their code serially (one bit at a time) through a switch or keypad. The shift register compares the entered sequence with the stored code. If they match, the lock unlocks.

4. What are some advantages and disadvantages of using a SISO shift register for unlocking?

Advantages:

- Simple and low-cost design.
- Relatively immune to guessing attacks as the entire code needs to be entered correctly.

Disadvantages:

- Limited code length due to the number of stages in the shift registers.
- Vulnerable to shoulder surfing attacks if the user exposes the button presses while entering the code.

5. What additional components might be needed to create a complete unlocking system using a SISO shift register?

- Input buttons or keypad for entering the code.
- Comparator to compare the entered code with the stored code.
- Control logic to trigger the unlocking mechanism (solenoid, motor etc.) based on the comparison result.
- Power supply.

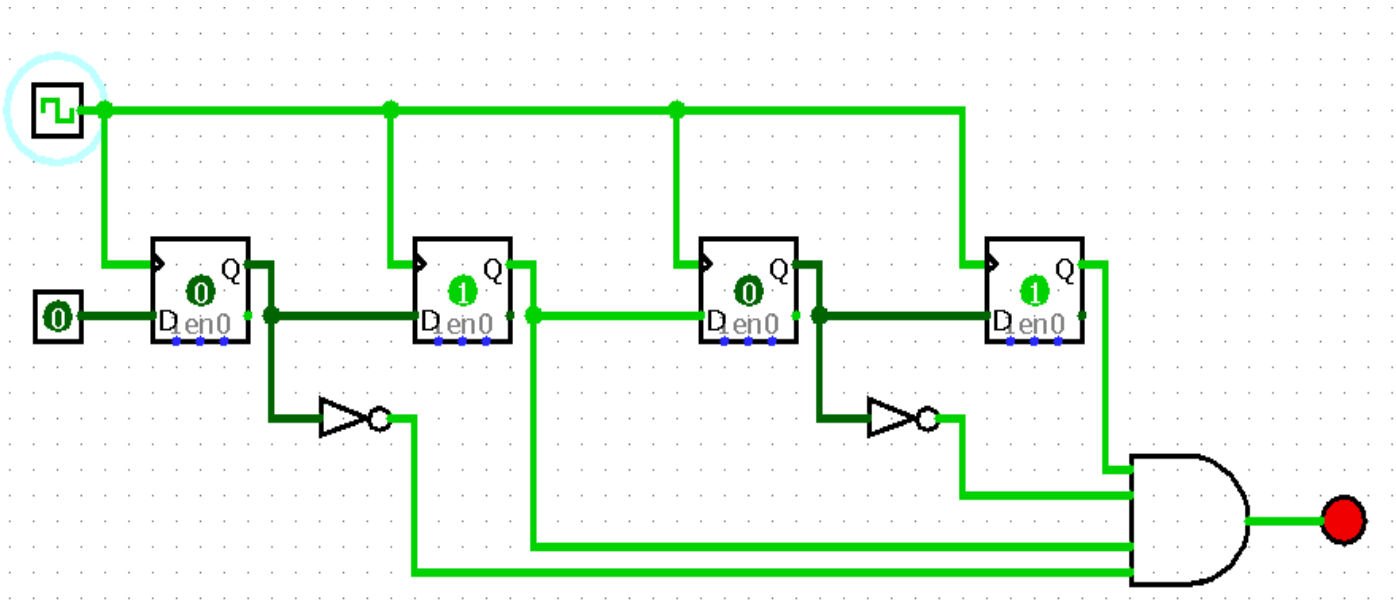
Theory:

A digital unlocking system using a SISO (Serial In Serial Out) shift register offers a simple and secure way to control access. The core concept revolves around storing a pre-defined binary code sequence, which acts as the secret key, within the shift register. The user interacts with the system by entering their code bit by bit, typically through a keypad or switch arrangement.

The SISO shift register functions like a digital memory, holding each entered bit and shifting it along its stages with each subsequent bit entry. Throughout this process, a comparator circuit continuously compares the incoming bit stream with the stored code. If the entire entered code matches the stored code precisely, the comparator triggers the unlocking mechanism, granting access. This approach ensures a high level of security as the complete code needs to be entered correctly to unlock, offering protection against basic code-guessing attempts.

Circuit Diagram:

Assume the digital unlock code is "0101", so the sequence of Bits to be applied one after another: 0101



Procedure:

1. Arrange the four D flip-flops as illustrated in the provided circuit diagram.
2. Apply a common clock signal to all the flip-flops to synchronize their operation.
3. Initiate the operation by giving **"1" bit at serial input and trigger clock signal** and observe the **"1000"** in the flip-flops, and **LED in OFF condition**.
4. Enter Next bit of code, give **"0" bit at serial input and trigger clock signal** and observe the **"0100"** in the flip-flops, and **LED in OFF condition.**
5. Enter Next bit of code, give **"1" bit at serial input and trigger clock signal** and observe the **"1010"** in the flip-flops, and **LED in OFF condition**.
6. Enter Next bit of code, give **"0" bit at serial input and trigger clock signal** and observe the **"0101"** in the flip-flops, and LED becomes ON condition, which means the unlocking of the system is successful.

Viva Questions and answers:

1. Explain the operation of a SISO shift register in the context of this unlocking system.

2. How does the system differentiate between a correct and incorrect code?
3. What are the limitations of using a SISO shift register for unlocking systems?
4. How can the security of the system be improved?
5. Describe some real-world applications of SISO shift registers beyond unlocking systems.

Result: The experiment successfully demonstrated the construction and operation of digital unlocking system using D flip-flops.