EE-102 Lab Report 7

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Section: *2*

Finite State Machine (FSM)

Purpose: Aim of this Lab-7 is to understand the concept and algorithm of the finite state machines which are vital in digital design, enabling the systematic modeling of sequential circuits, communication protocols, and control units in digital systems. They find widespread application in diverse fields such as compiler optimization, traffic light control, game design, and error detection. In this lab FSM is studied, to be more specific, Moore machine is used to address a problem related to security hut.

Equipment:

- D Flip-flop(74HC74)
- 2 XOR gate (SNx4HC86)
- 1 Not gate (sn74hc04n)
- LED'S
- Breadboard
- Jumper Cables
- Power supply
- Signal generator

Design specifications:

This circuit can be used to check the wanted conditions for security hut. Wanted condition is that: Only one person should stay in cabinet since absence of will cause security problems. On top absence of guards two guards in one hut can also be problem since they can distract each other. When the condition is not met red light will turn on and off rapidly as a warning (oscillate).

Design Steps:

Step 1:

Find the truth table first . Create a state diagram (Figure 1) for this design, employing a Moore machine with two inputs and one output. The design operates on the principle that if the two inputs differ, the output remains same ; conversely, if the inputs are the same, the output changes with each positive edge.

Truth Table

First_output	Input_1	Input_2	output
0	**0**	**0**	**1**
0	**0**	**1**	**0**
0	**1**	**0**	**0**
0	**1**	**1**	**1**
1	**0**	**0**	**0**
1	**0**	**1**	**1**
1	**1**	**0**	**1**
1	**1**	**1**	**0**

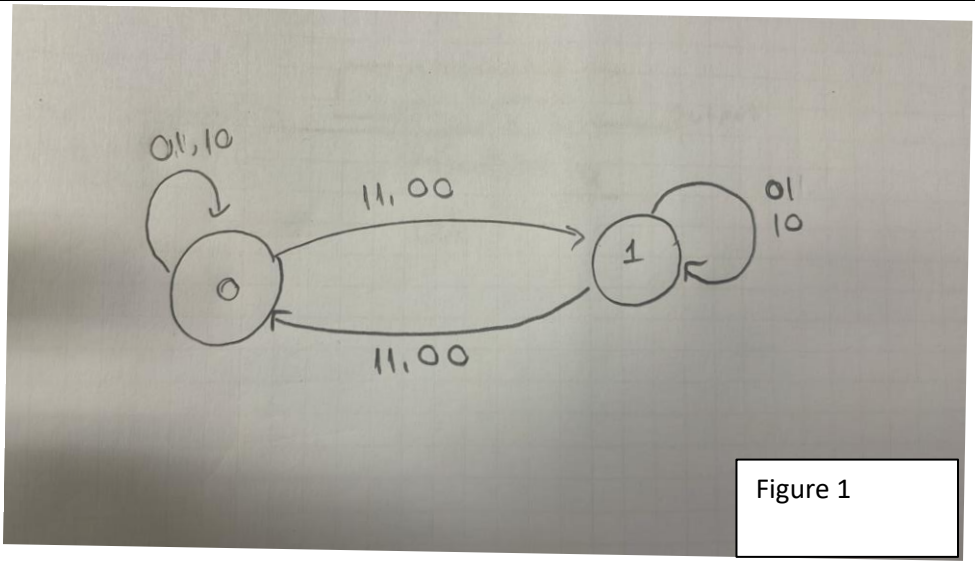


Figure 1

Step 2:

Circuit diagram is drawn (Figure 2)

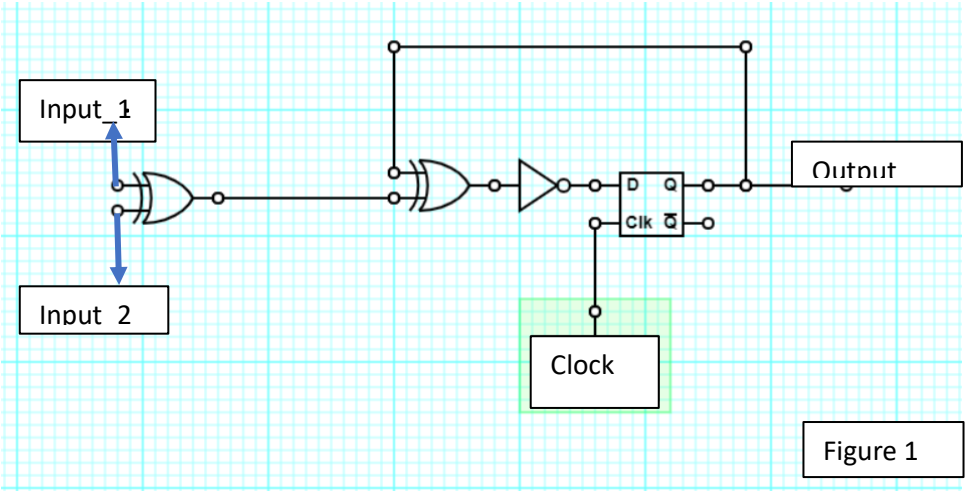


Figure 1

Step 3:

Circuit was built according to diagram drawn by using the components mentioned above in equipment section. Power supply was adjusted to 3.3 V (low voltage is chosen to protect LED's since resistor is not used to drop the voltage on LED'S). Signal generators frequency was set to 10 Hz for easy observation.

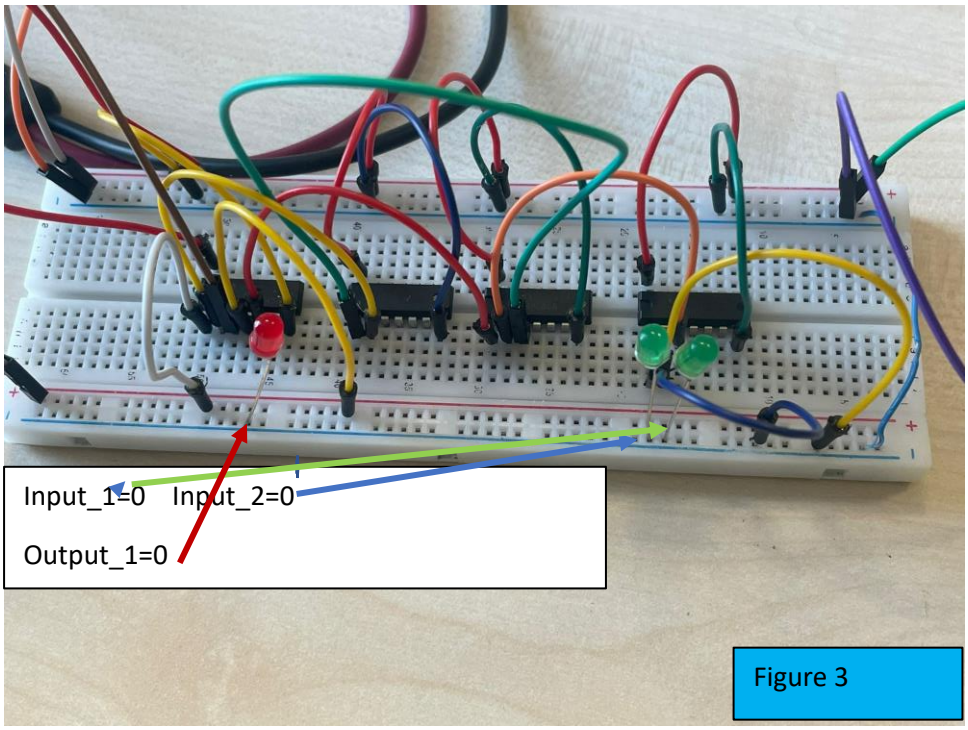


Figure 3

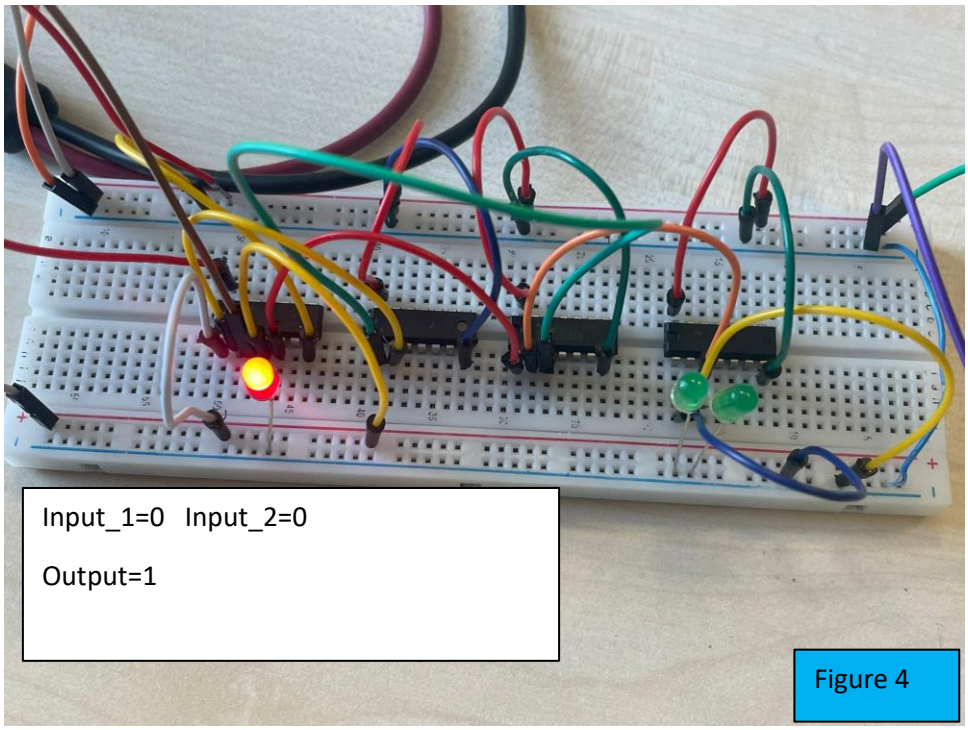
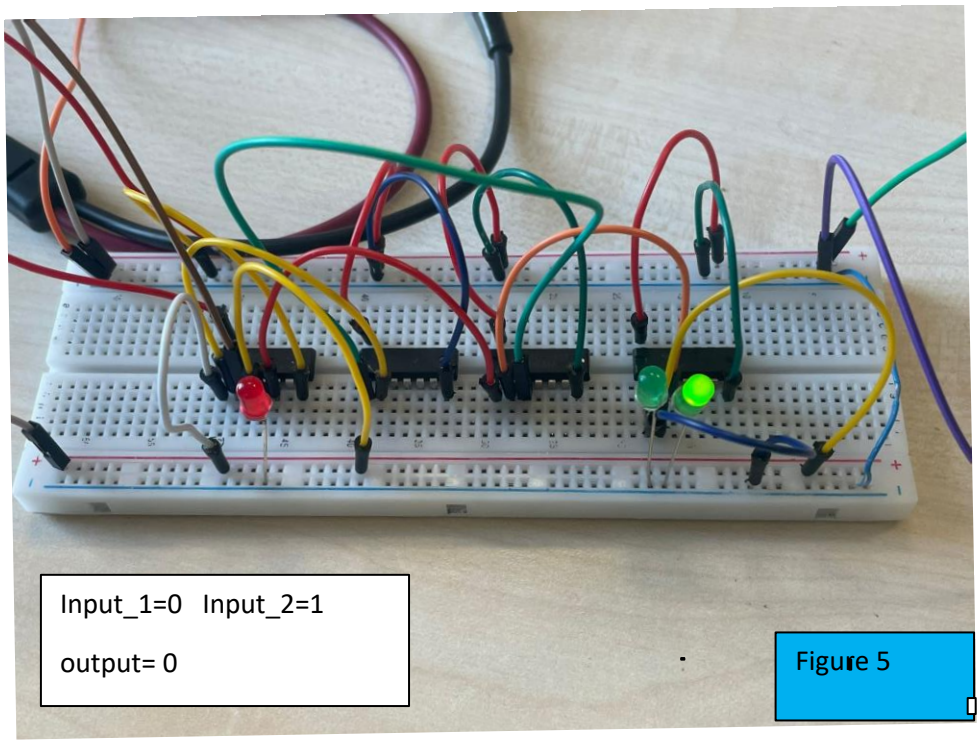


Figure 4

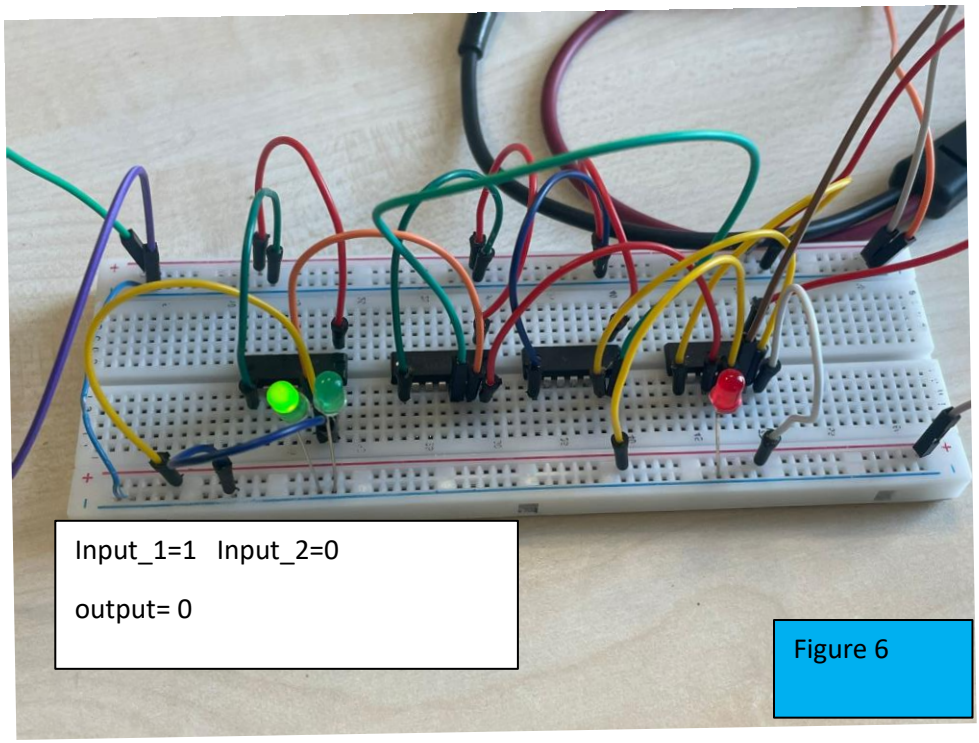
Oscillation can be observed in Figure 3 and Figure 4



Input_1=0 Input_2=1

output= 0

Figure 5



Input_1=1 Input_2=0

output= 0

Figure 6

State remains the same

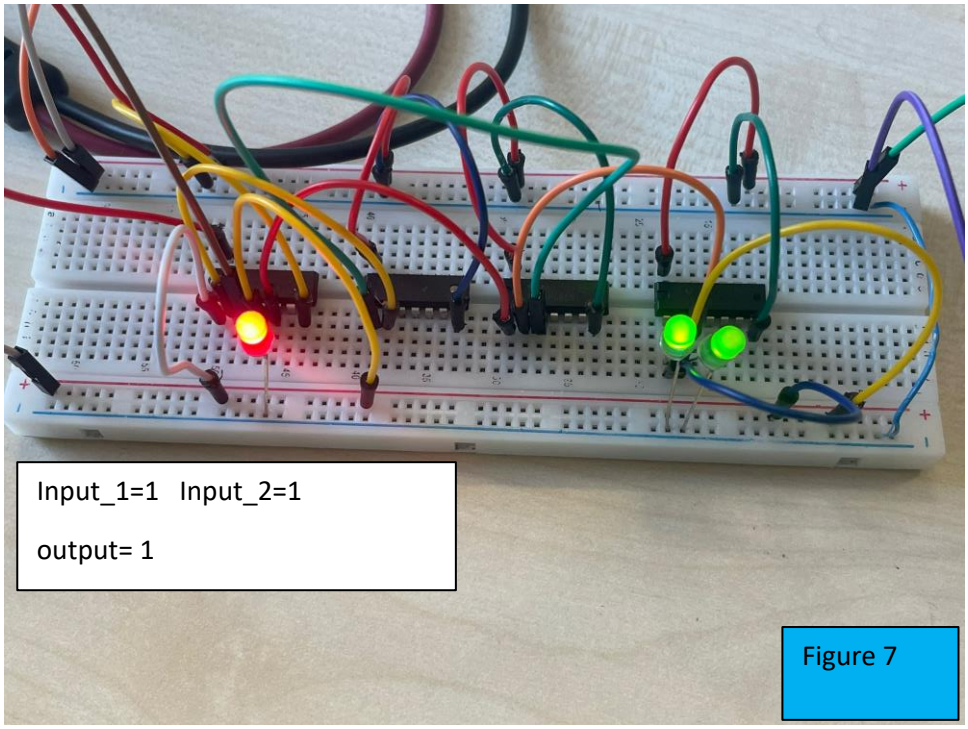


Figure 7

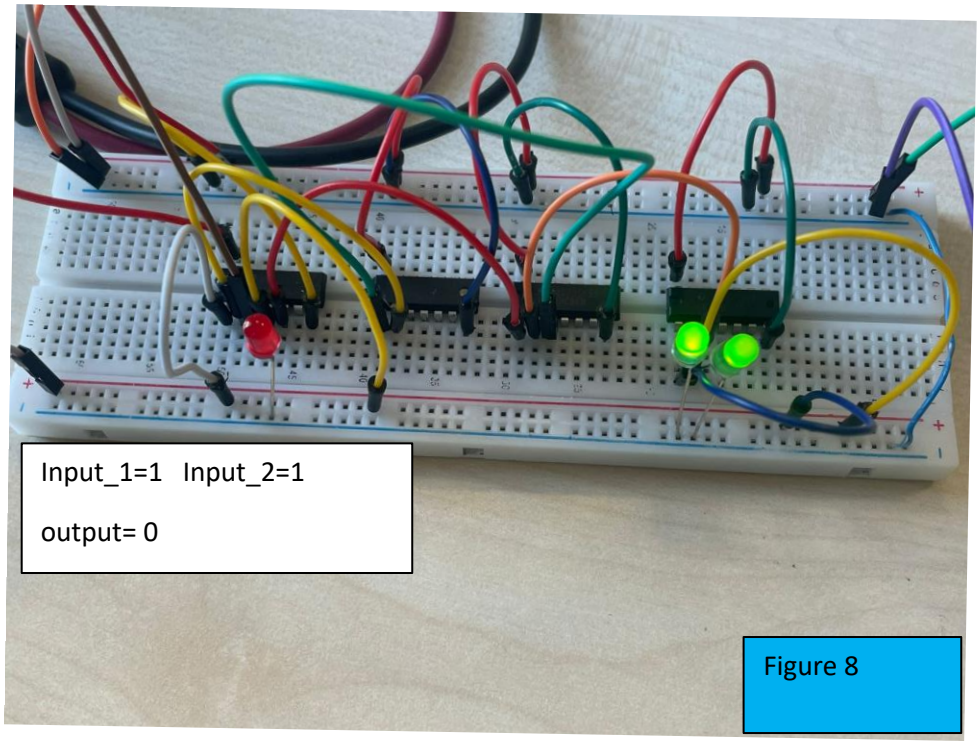


Figure 8

Oscillation can be observed in Figure 7 and Figure 8

Further Implementations and Ideas:

These system can be integrated into real life by using IR sensors (ky-032 IR sensor). The sensor used to enhance the project has 4 legs (Vcc, ground, enable pin, data pin). Pins are connected properly and the sensor is integrated into circuit (Figure 9). Unfortunately, I was not able to use two sensors because of lack of sensors, but the idea is clear: Instead of changing the inputs by hand inputs will be the output of the IR sensors. Sensor sends signal '1' (High) when it is triggered, otherwise it sends '0'(low). RED led is off

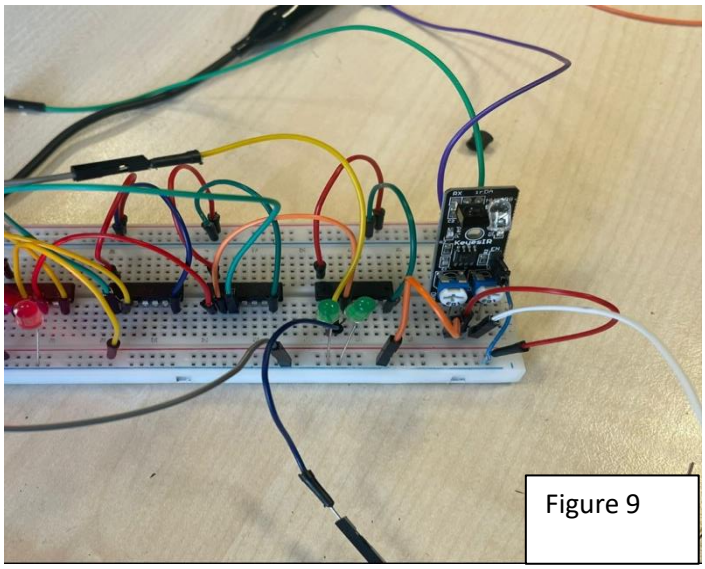


Figure 9

Conclusion:

This lab activity was designed to help you become more proficient with designs for finite state machines (FSMs). First, basic tasks such as creating state diagrams and implementing components into breadboard were completed. These were then converted into logic functions and implemented with logic gates and flip-flops. The circuit was put together in accordance with the carefully designed schematic. The truth table underwent thorough testing, and the findings achieved were consistently in line with the predicted values listed in the truth table. In addition to demonstrating the usefulness of converting theoretical ideas into functioning circuits, this practical experience strengthened comprehension of FSM principles. At the end of the day we managed to create a system that guarantees us that the condition of 'only one guard should stay in hut' is met all the times.