Hardware Project - AI1110

Mayank Parasramka
AI22BTECH11018

Description:-
In my assignment I've made a Random number generator using decoder, flip flops, XOR gate, 555IC

Contents

1 Components used

(i) Breadboard
(ii) Seven Segment Display - Common Anode
(iii) 7447 Seven Segment Display Decoder
(iv) 7474 D FlipFlop x2
(v) 7486 XOR gate
(vi) 555 precision timer
(vii) Resistor 10MΩ
(viii) Resistor 1KΩ
(ix) Capacitor 47nF
(x) Capacitor 470nF
(xi) USB micro B breakout board
(xii) Jumper wires

2 Setup

1) This circuit uses 5V from microusb.
2) This acts as the Vcc of the circuit.
3) The buses are at Vcc, Ground and Clock.

3 Description

1) The random number generator circuit is designed to generate random numbers using shift registers, providing a versatile and reliable solution for applications that require randomness. The circuit incorporates various components, including a breadboard, seven-segment display, decoder, flip-flops, XOR gate, 555 timer IC, resistors, capacitors, and jumper wires.

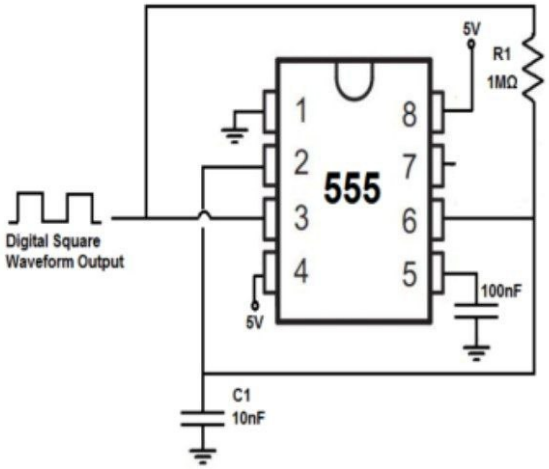

Fig. 1. Connection in 555 timer circuit

2) At the core of the circuit is the shift register, constructed using two D flip-flops (7474 ICs) and an XOR gate (7486 IC). The shift register operates based on the clock signal generated by the 555 timer IC. The clock signal serves as the synchronization mechanism, ensuring the precise shifting of data within the shift register.
3) The clock signal generated by the 555 timer circuit is connected to the CLOCK input of the D flip-flops, enabling the sequential shifting of data through the flip-flops. This shifting action creates a cascading effect,

allowing the circuit to generate a sequence of random bits.

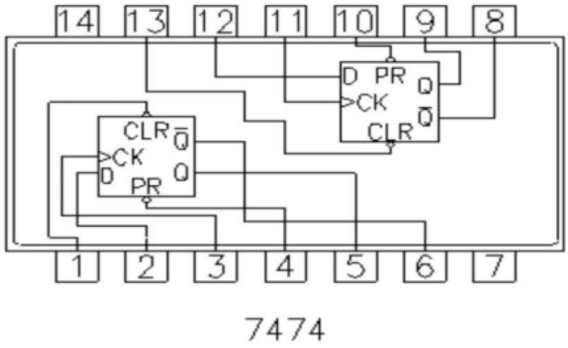

Fig. 3. Connection in 7474 IC

4) The output of each D flip-flop is connected to the Decoder IC (7447 IC), which converts the binary input into a corresponding output that can be displayed on the seven-segment display. The connections between the flip-flops and the decoder are carefully established to ensure the proper mapping of binary values to the display segments.

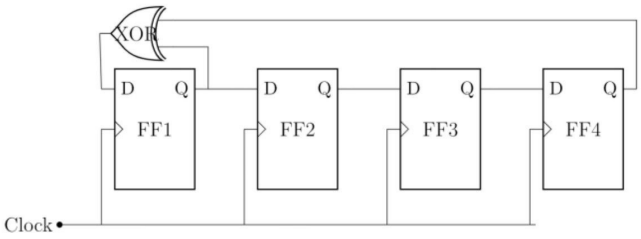

Fig. 4. Connection in XOR gate

Fig. 4. Connection in Decoder gate

5) The seven-segment display, a common anode type, is connected to the Decoder IC (7447 IC) following the prescribed pin connections. This display arrangement allows the generated random numbers to be visually represented in a human-readable format. Refer to the table 5 and the figure 6.

7447	$\bar{a}$	$\bar{b}$	$\bar{c}$	$\bar{d}$	$\bar{e}$	$\bar{f}$	$\bar{g}$
Display	a	b	c	d	e	f	g

Fig. 5. Connection of seven segmented display with decoder

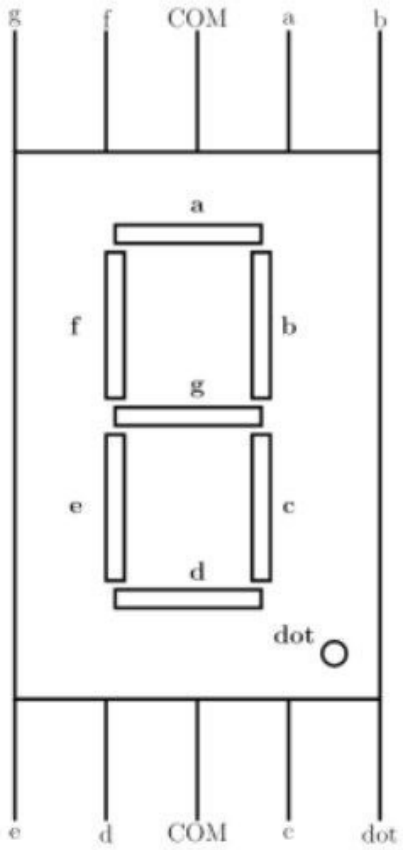

Fig. 5. Seven segmented display

6) Power and ground connections are established for all components to ensure proper operation and signal integrity. The circuit requires a stable power supply, and the voltage specifications of each component should be respected to prevent damage and ensure accurate performance.

4 Applications

The random number generator circuit using shift registers has several potential applications. Here are some common uses of such a circuit:

a) Simulations: In computer simulations, random numbers are often required to introduce randomness and variability into the simulated environment. The circuit can be used to generate random numbers that accurately reflect real-world scenarios, enhancing the realism and accuracy of the simulation.

b) Gaming: Randomness is a crucial element in many games, such as dice rolls, card shuffling, or determining the outcome of events. The random number generator circuit can provide a reliable source of random numbers for gaming applications, ensuring fairness and unpredictability.

c) Cryptography: Random numbers play a vital role in cryptographic systems. Randomness is needed for generating cryptographic keys, initialization vectors, and nonces. The circuit can be used to produce high-quality random numbers required for secure communication and encryption protocols.

d) Testing and Quality Assurance: Randomness is often necessary for testing purposes, such as stress testing, software validation, and quality assurance. The circuit can generate random inputs or simulate random events to thoroughly test the functionality, performance, and robustness of systems or software.

e) Decision-Making and Randomized Algorithms: Randomness is employed in decision-making processes and randomized algorithms to introduce uncertainty and avoid biases. The circuit can supply the necessary random numbers to ensure unbiased decision-making or enable the execution of randomized algorithms.

5 Output

The circuit generates random numbers on the seven segment display. The output is shown in figure 6

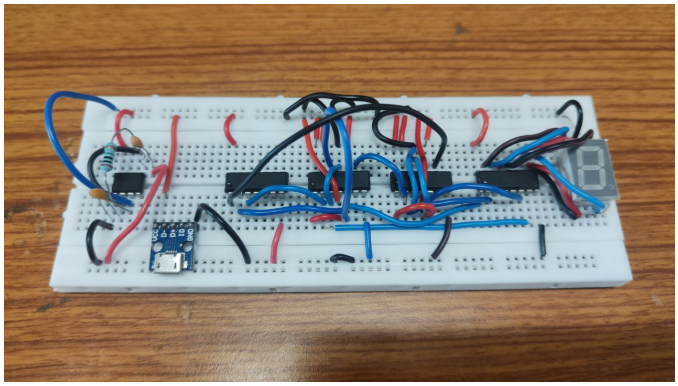

Fig. 6. output

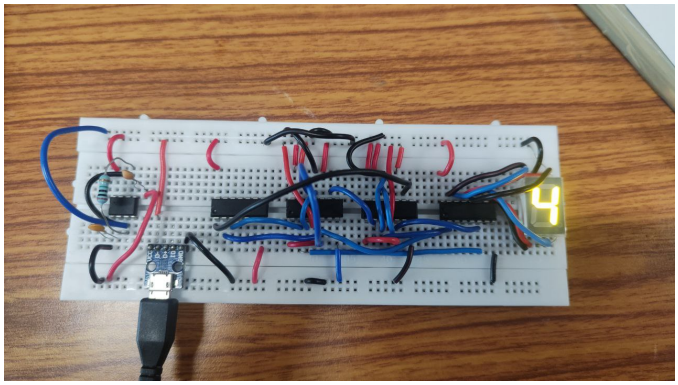

Fig. 6. output

6 Block Diagram

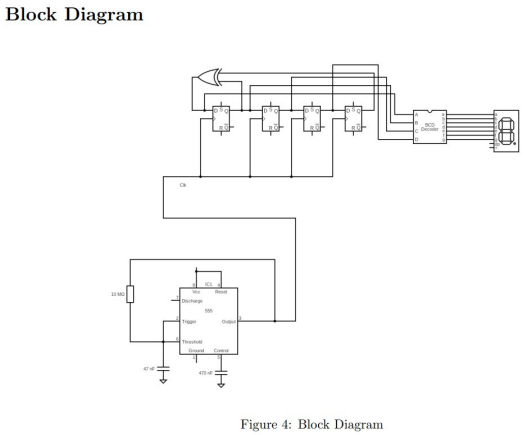

Figure 4: Block Diagram

Fig. 6. Block Diagram