Hardware Project Report

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AIM :- To generate random numbers using shift resistors.

Components Used :-

1) 10M Ω Resistor x1
2) 10μ F Capacitor x1
3) 100μ F Capacitor x1
4) Jumper Wires
5) USB-Type A adapter
6) Breadboard x1
7) Seven Segment Display x1
8) Decoder(IC 7447) x1
9) Flip Flop(IC 7474) x2
10) XOR Gate(IC 7486) x1
11) 555 IC x1
12) 10K Ω Resistor x1

Description of the Circuit :- The 555 IC is commonly employed as a clock signal generator in electronic circuits. When the circuit is initially powered up, the flip-flops within the 7474 ICs (each IC containing two flip-flops) may produce random outputs.

To process these outputs, the first and last flip-flops' results are fed into an XOR gate, which performs an exclusive OR operation on the input signals. Simultaneously, the outputs of all the flip-flops are connected to a decoder.

The decoder analyzes the input values it receives and determines the appropriate segments of the seven-segment display to activate or deactivate. For example, if the input to the decoder is 0101, it instructs the display to illuminate segments a,c,d,f and g while keeping the remaining segments turned off.

After powering up the circuit, the initial random outputs from the flip-flops are passed through an XOR gate. The resulting output is then fed back into the flip-flops. This feedback loop causes the flip-flops to generate a new set of outputs, resulting in different segments of the seven-segment display being activated or deactivated.

This process continues until the flip-flops generate the original set of outputs again, completing one cycle. From this point onward, the same sequence of random numbers repeats in a continuous cycle.

The clock signal serves an important purpose in the circuit by ensuring that each number displayed has sufficient time to be visible and doesn't change instantaneously. It achieves this by preventing the propagation of information when the clock signal is in its low state. The duration of this low period in the clock signal is determined by the values of the capacitors used.

By selecting capacitors with smaller values, the clock period decreases, resulting in faster generation of random numbers. However, in this particular circuit, the capacitors are chosen to have values on the order of $10^{-}6$ (microfarads) or larger. This deliberate choice is made to increase the display duration, ensuring that each number remains visible for an adequate period of time.

This approach strikes a balance between generating random numbers quickly and allowing sufficient time for each number to be displayed on the seven-segment display.

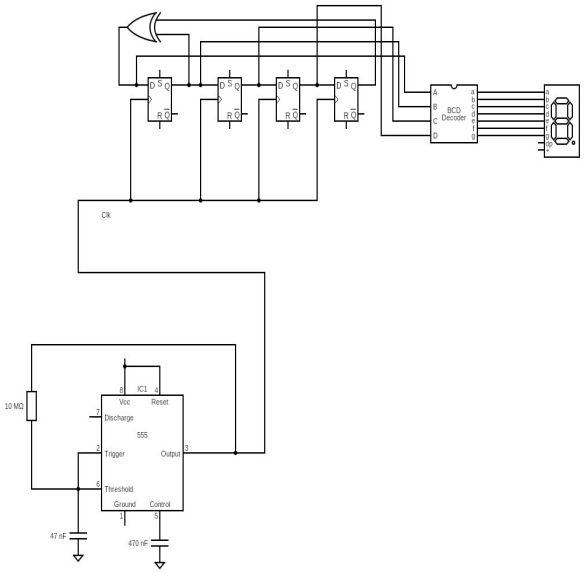
In order for the components to function properly, it is essential to connect each component to the power supply and ground. This is typically achieved by establishing connections to the positive supply voltage, denoted as Vcc, and the ground reference, denoted as GND.

The brightness of the Seven Segment Display is influenced by the value of the resistor used to connect it to the Vcc supply. As the resistor value increases, the brightness of the display diminishes. Conversely, a smaller resistor value results in a brighter display.

The circuit is powered by employing a USB-Type A adapter. This adapter serves as the power source, providing the necessary voltage and current for the circuit to operate.

By following these connections and power arrangements, the components are adequately powered, and the brightness of the Seven Segment Display can be controlled by selecting an appropriate resistor value.

Block Diagram of the circuit:-



Circuit :-