Hardware Project Report

AI1110: Probability and Random Variables
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Aim:

To create a circuit which can generate a random number using a Seven-Segment display.

Components Required:

Breadboard, wires, Seven-Segment display, Decoder(7447), Flip Flop(7474), X-OR GATE(7486), 555 IC, Resistors(1KΩ and 1MΩ), Capacitor(100 nF and 10 nF), USB Type-A adapter.

Procedure:

1) Using the 555 IC, resistors and capacitors, make a clock and feed this clock signal to other flip flops.
2) Place the ICs in the following order on the breadboard: XOR Gate(7486), 2 Flip Flops(7474) followed by Decoder(7447).
3) Connect the long connected lines on either side to V_{cc} and GND of the USB adapter.
4) Connect the pin 14 of XOR gate, pins 1, 4, 10, 13, 14 of both the Flip Flops, pin 16 of the decoder to the common V_{cc}. Also, connect the pin 7 of XOR Gate, of both the Flip Flops, and pin 8 of the Decoder to the common ground.
5) Connect the output of the clock to pins 3,11 of both the Flip Flops.
6) Connect the pins as required between the ICs. Connect the required outputs of the decoder with the seven segment display.

Description of circuit:

The 555 IC generates a clock signal. The purpose of the signal is to provide enough delay for the number to be visible on the display as the time for each cycle in circuit is small.The clock does not allow information to propagate when clock signal is low. The frequency of the clock is determined by the value of capacitors. A capacitor of the order 10^{-6} provides the optimum frequency for proper visibility of the numbers.

This clock signal is fed to each of the Flip Flops. After the circuit is powered, initially the flip flops produce random outputs. The outputs from both the flip flops are then fed to the XOR Gate and the outputs both flip flops are then sent to the decoder. According to the input the decoder then decides which segments of the Seven Segment should light up. For example, if the input to the decoder is 0110 then a, f, g, e, d and c segments of the Seven Segment will light up.

The output of from the XOR Gate is once again fed into the flip flops and this time we get a different random number. New random numbers are generated in this way until the original number is obtained again. Now the same sequence of random numbers is generated continuously and this cycle repeats.

Circuit Pictures: Below are the pictures:

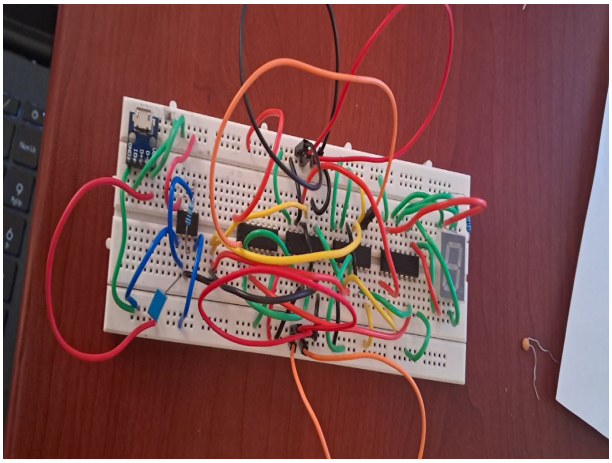

Fig. 6. Circuit

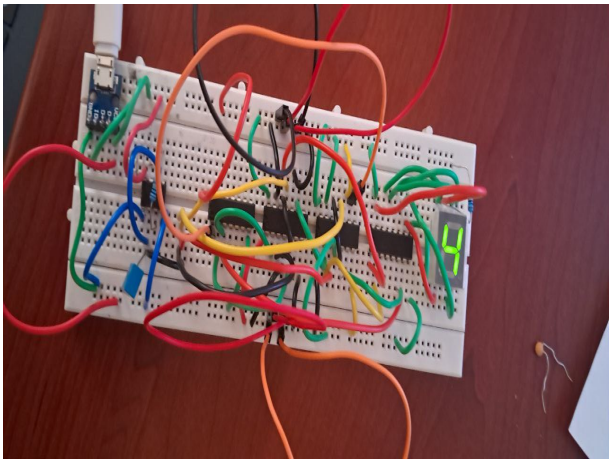

Fig. 6. Third number displayed

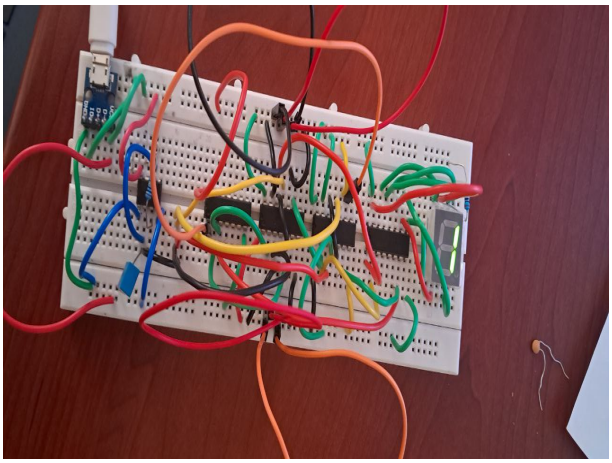

Fig. 6. First number displayed

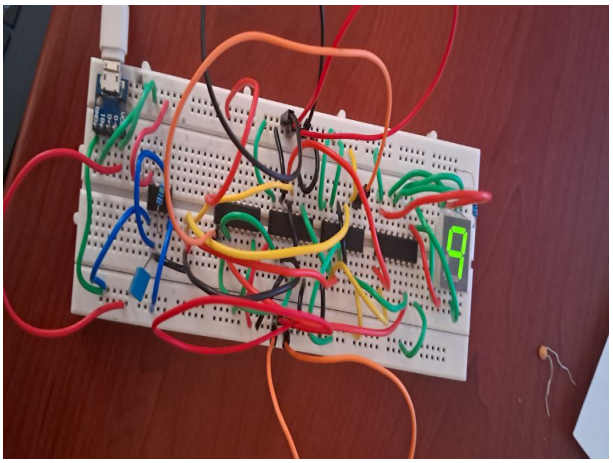

Fig. 6. Fourth number displayed

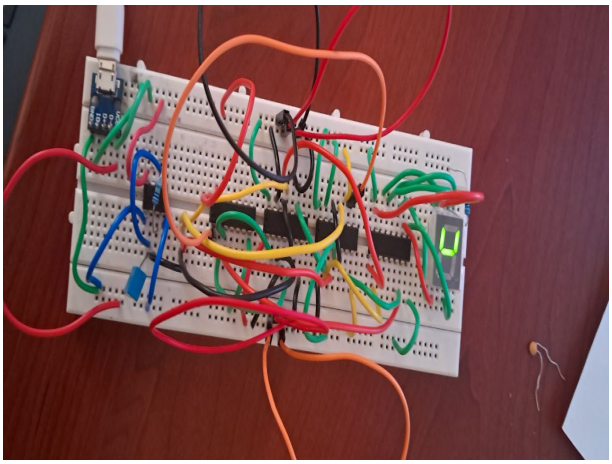

Fig. 6. Second number displayed

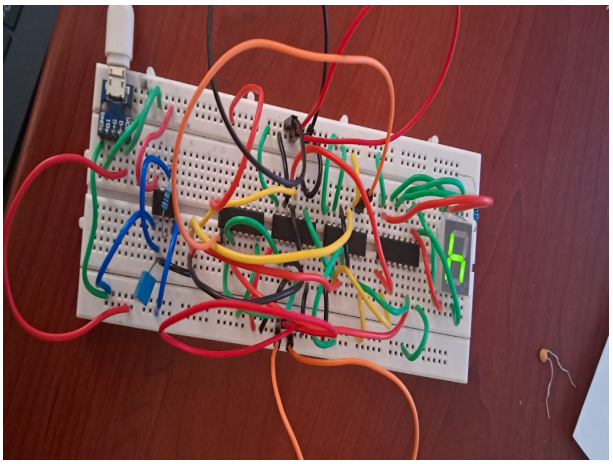

Fig. 6. Fifth number displayed

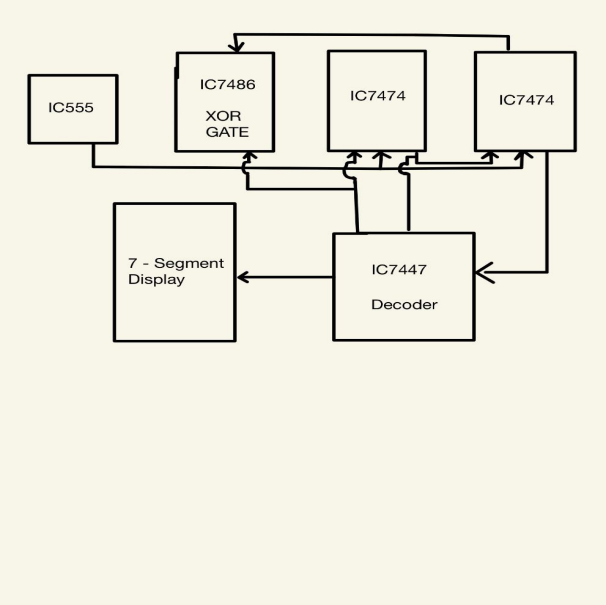

Fig. 6. Block Diagram

Conclusion: Thus we have successfully created a random number generator circuit using breadboard and ICs.