National Institute of Technology, Tiruchirappalli

Digital Electronics Lab Project Report

Project Name:

OTP Generator and Login Authentication using Integrated Circuits

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OTP Generator and Login Authentication using Integrated Circuits

AIM:

To design an OTP generator (random two-digit number generator) and a Login Authentication using integrated circuits.

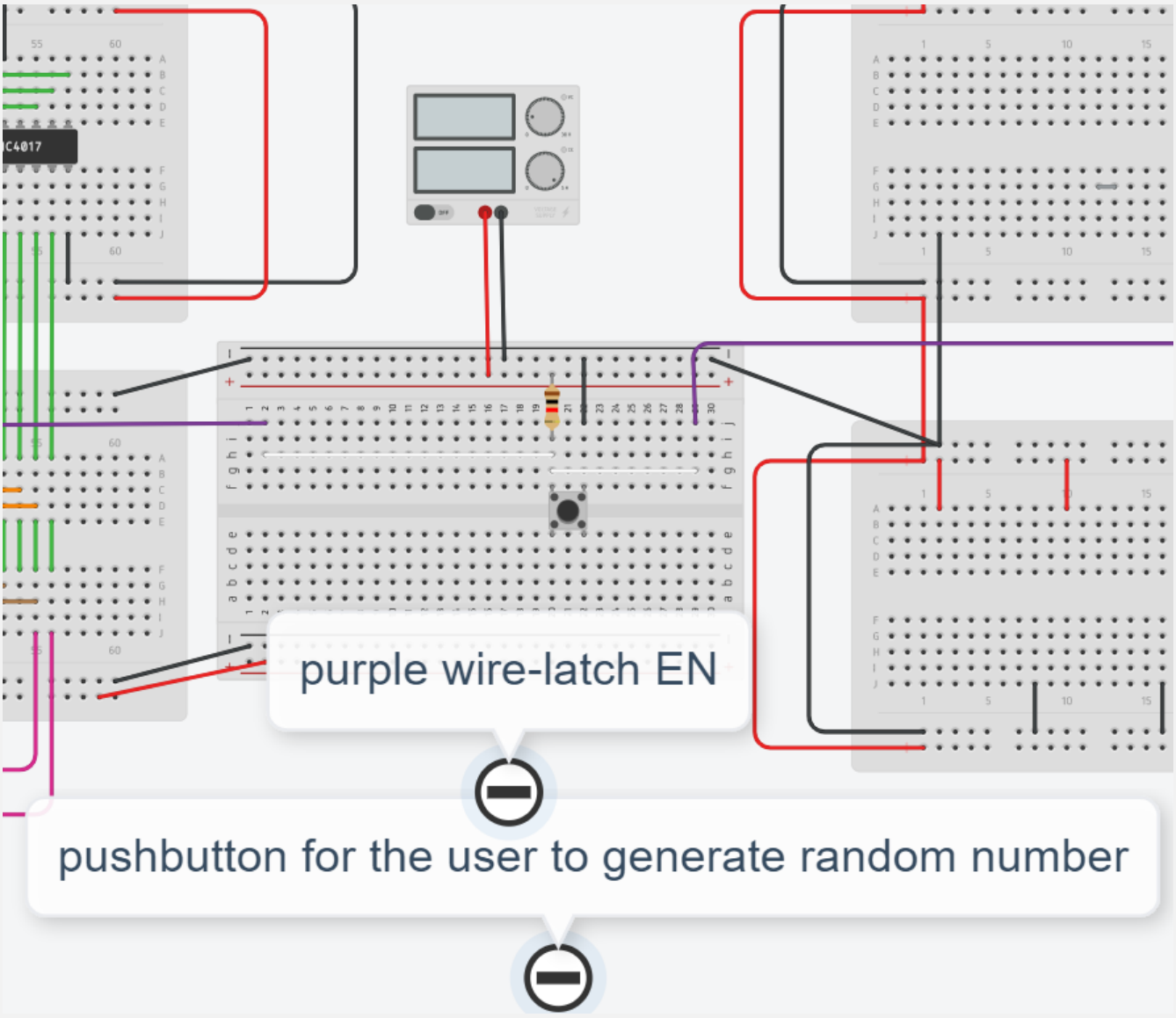
APPARATUS REQUIRED:

1. Power Supply - 5V
2. Breadboard
3. Resistors - 330Ω and 1KΩ
4. Pushbutton
5. MAN 72 common cathode seven segment display - 2
6. 74HC4017 Johnson Decade counter - 2
7. CD4511 7-segment decoder - 2
8. 7404 Hex Inverter NOT Gate
9. 7432 OR gate
10. 7486 XOR gate
11. 7402 NOR gate
12. Slide switch
13. Function Generator
14. Connecting wires

THEORY:

1)OTP Generator

The IC CD4511 is a binary to seven segment decoder. The pin 5, known as the Latch Enable Pin (ACTIVE LOW), should be driven LOW in order to enable the IC to take the binary inputs given to it. If this pin is driven HIGH by a voltage source, the previous state in which the Latch Enable Pin was LOW is maintained throughout. As a result the number displayed in the 7-segment display is maintained throughout.



Therefore, by driving the Latch Enable Pin LOW at random intervals of time using a Pushbutton, random numbers get generated on the 7-segment display.

See that a pull up resistor is used in the above figure.

10:4 BCD to binary encoder:

To convert the output of the 74HC4017 Johnson decade counter to a binary number so that it can be fed as an input to the CD4511 7-segment decoder we design a 10:4 BCD to binary encoder using OR gates.

The truth table is as follows:

From the truth table, we can deduce that:

A3 = Y9+Y8

A2 = Y7+Y6+Y5+Y4

A1 = Y7+Y6+Y3+Y2

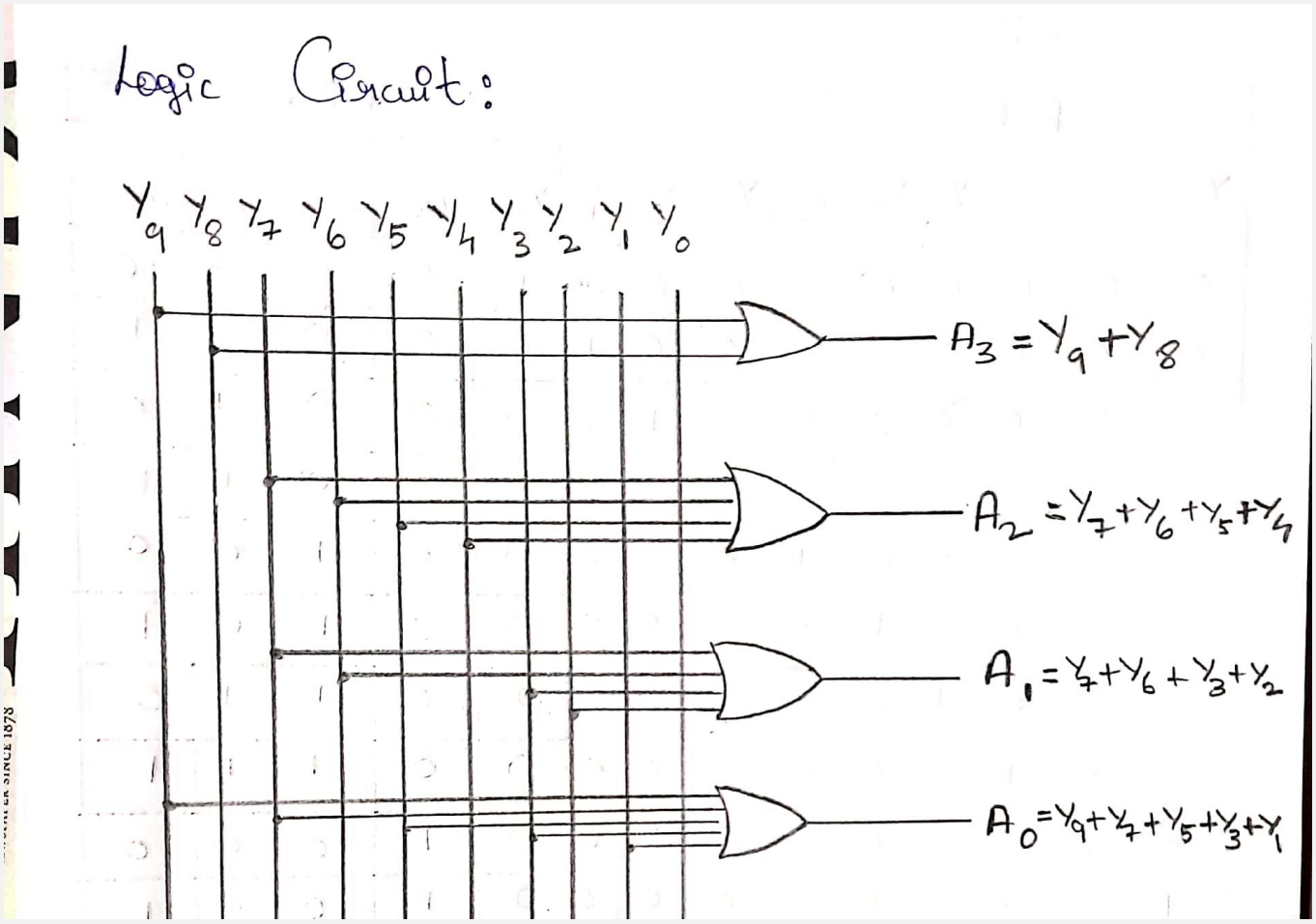
A0 = Y9+Y7+Y5+Y3+Y1

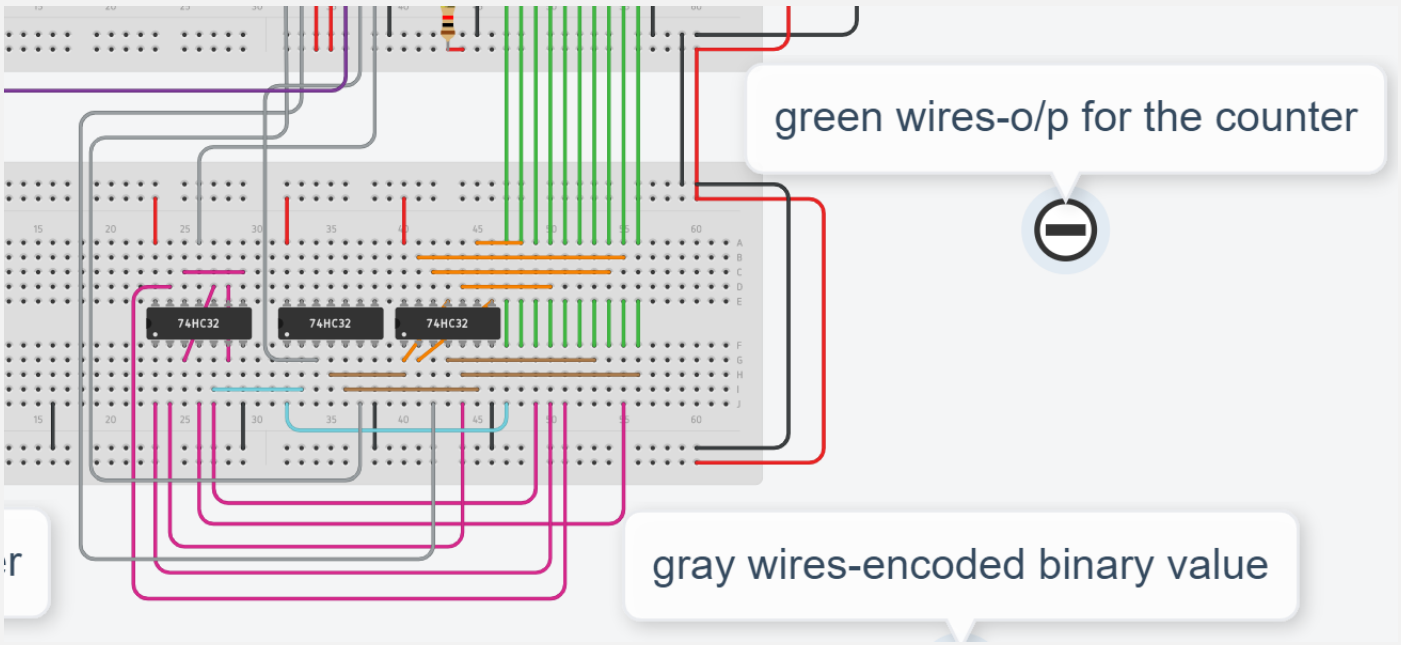
10:4 BCD to Binary Encoder:

Truth table:

BCD										BINARY			
Y_9	Y_8	Y_7	Y_6	Y_5	Y_4	Y_3	Y_2	Y_1	Y_0	A_3	A_2	A_1	A_0
0	0	0	0	0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	1
0	0	0	0	0	0	0	1	0	0	0	0	1	0
0	0	0	0	0	0	1	0	0	0	0	0	1	1
0	0	0	0	0	1	0	0	0	0	0	1	0	0
0	0	0	0	1	0	0	0	0	0	0	1	0	1
0	0	0	1	0	0	0	0	0	0	0	1	1	0
0	0	1	0	0	0	0	0	0	0	0	1	1	1
0	1	0	0	0	0	0	0	0	0	1	0	0	0
1	0	0	0	0	0	0	0	0	0	1	0	0	1

The logic circuit is as follows:





Orange wires-A3 Brown wires-A2 pink wires-A1 Turquoise wire-A0

Now finally these encoded values is given as an input to the CD4511 7-segment decoder to drive the 7-segment display.

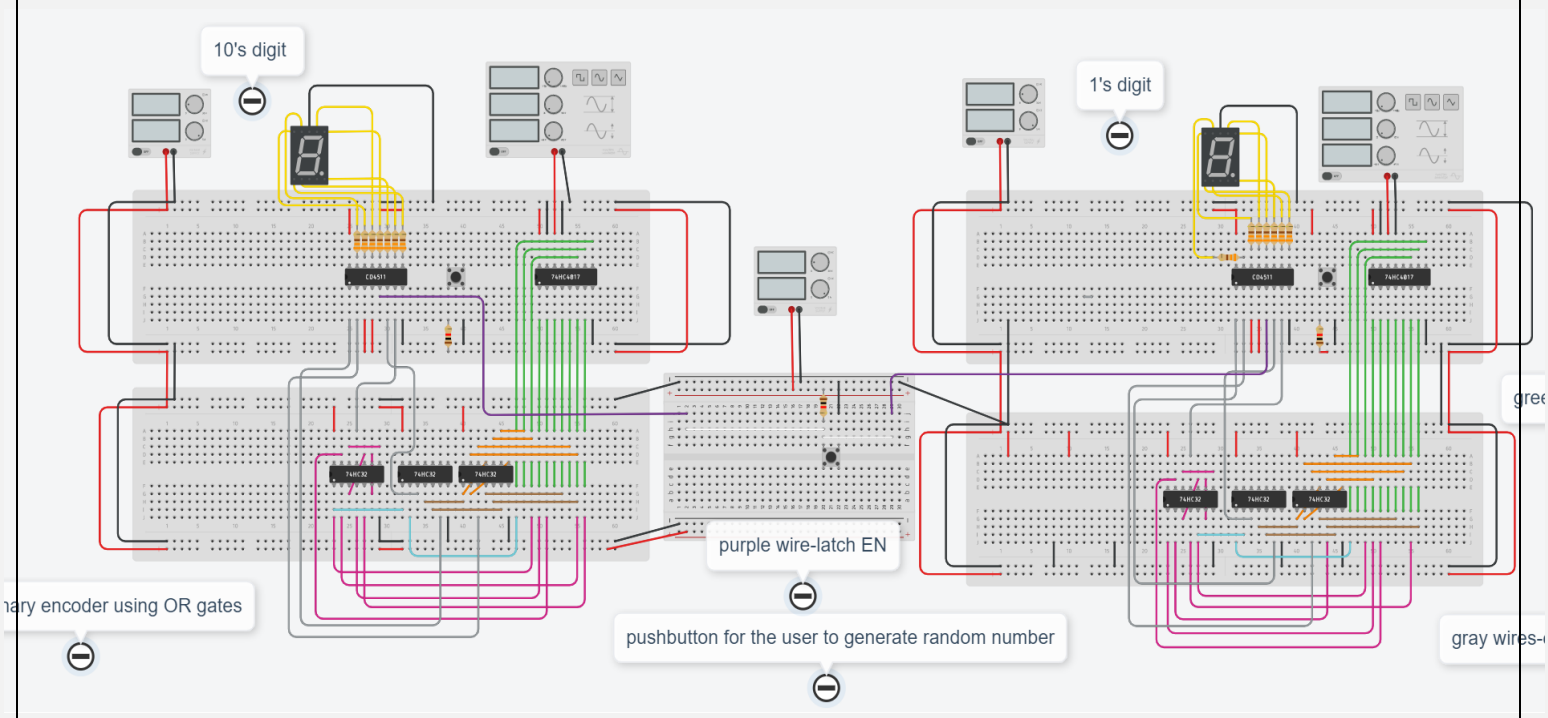
2)Login Authentication

When the user enters the generated OTP as a binary value (through a slide switch) we can use them as an input to the CD4511 seven segment display and build a **7-bit comparator** circuit (only to check equality) for the seven segment LEDs “a,b,c,d,e,f,g” using 7486 XOR gates to check whether the entered OTP by the user matches with the generated one or not.

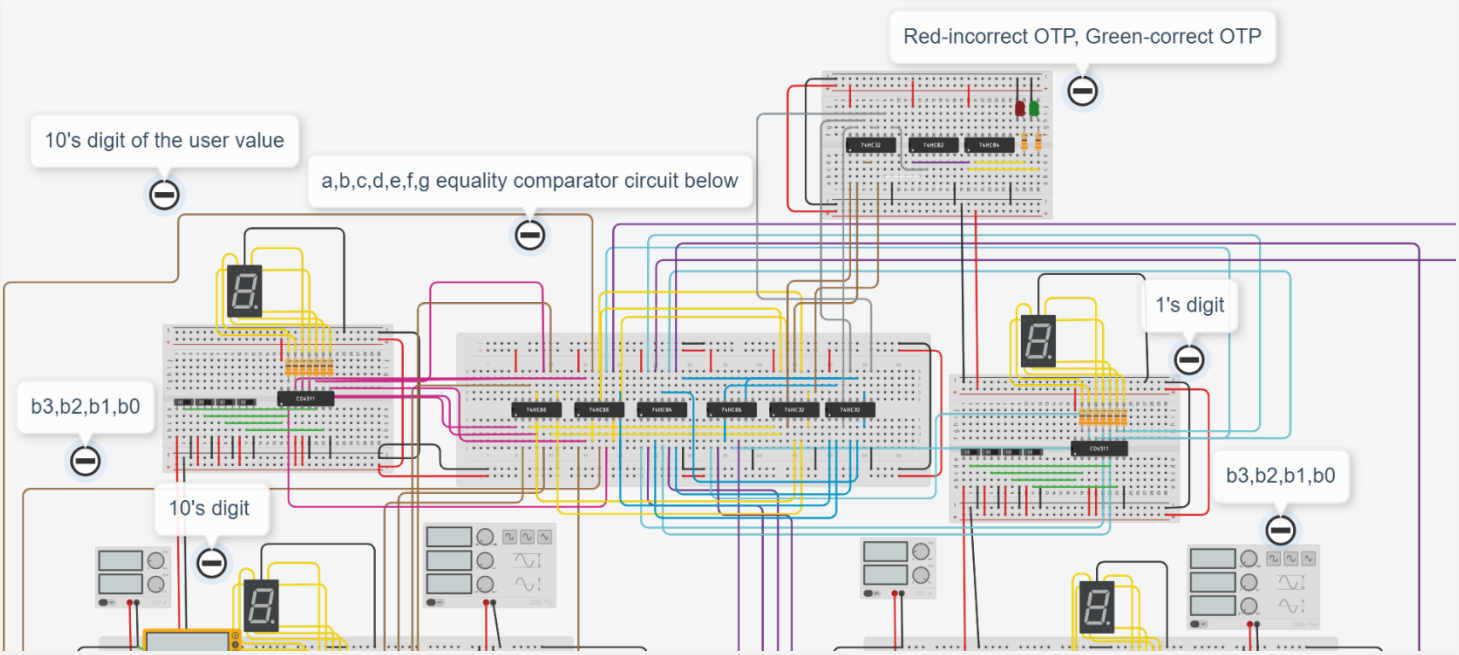
Therefore, the seven segment values of the generated OTP and user entered values are compared and tested for equality

CIRCUIT DIAGRAM:

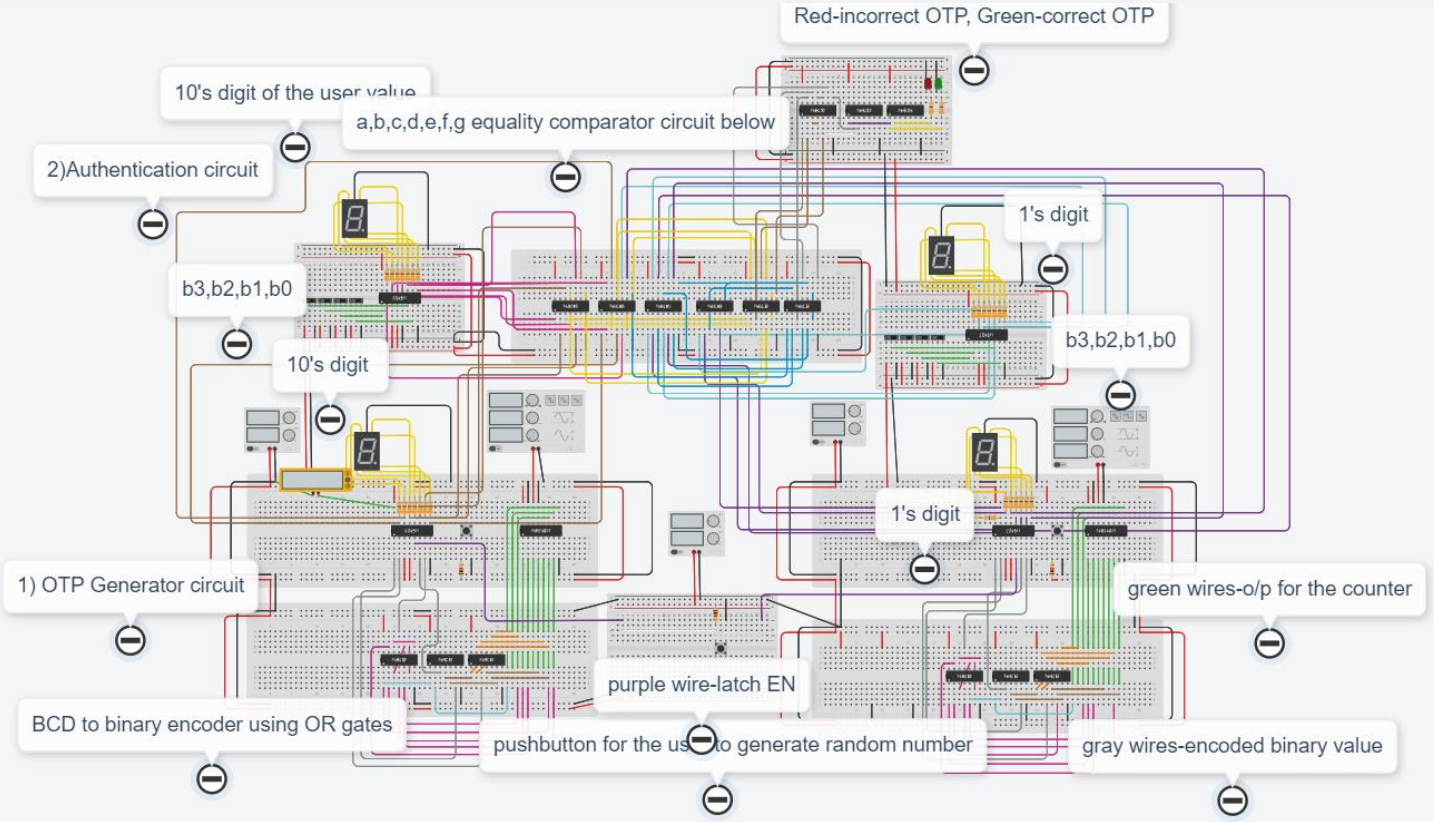
1)OTP Generator



2)Login Authentication:



3)Overall circuit:



PROCEDURE:

1. Check the ICs provided, using IC tester.

2. Mount the IC's on a bread board carefully.

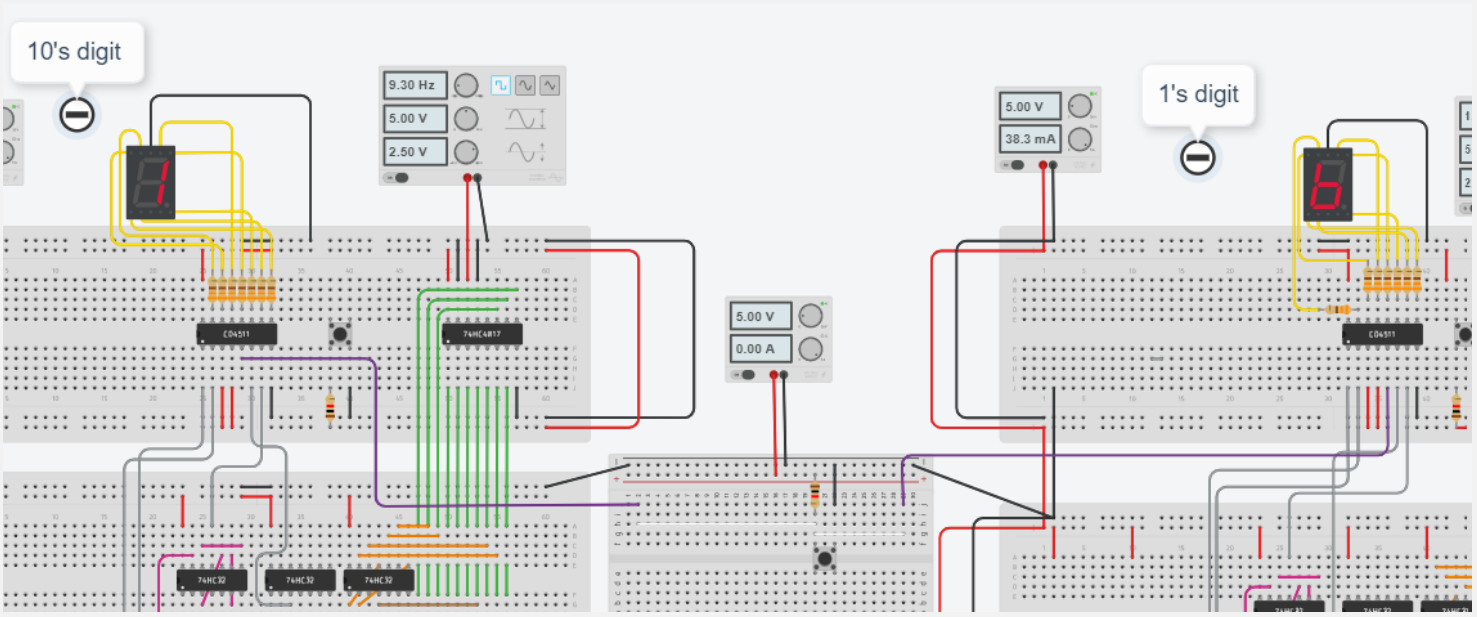
3. Connect VCC and ground pins of IC to the corresponding terminals in the power supply.

4. Wire up the circuit as per circuit diagram shown above

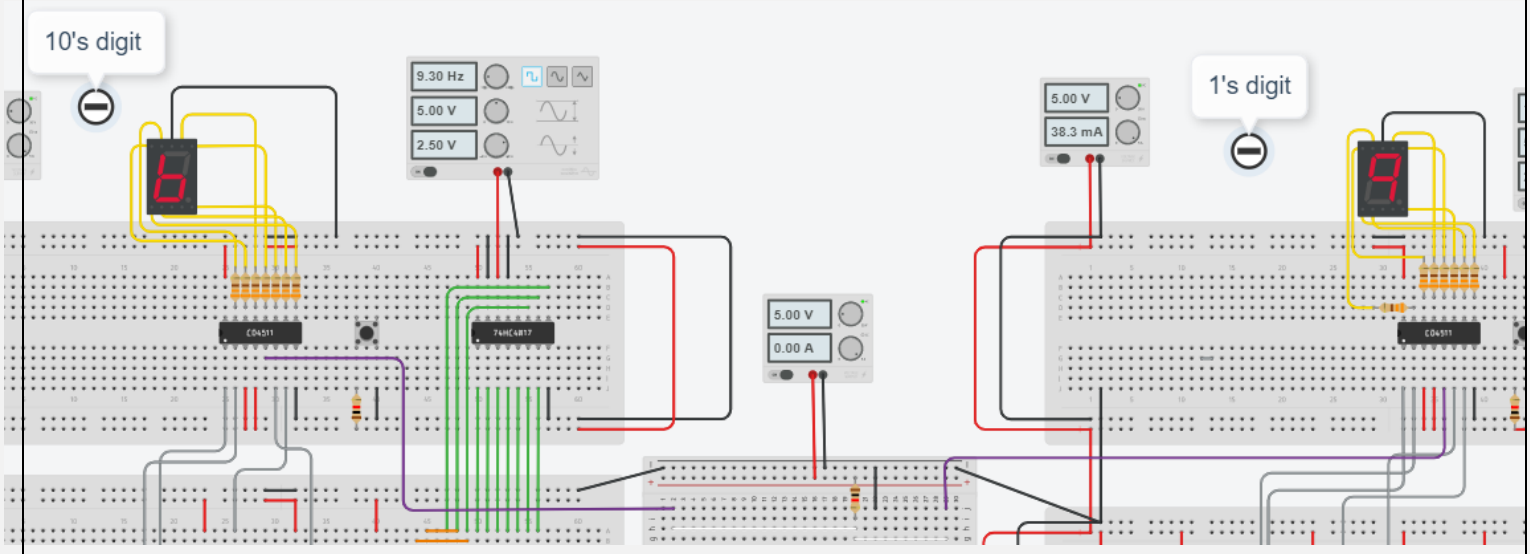
5. Use LEDs to test whether your circuit is right at the intermediate steps .

6. Press the pushbutton at various time intervals and check if a random number is being generated.

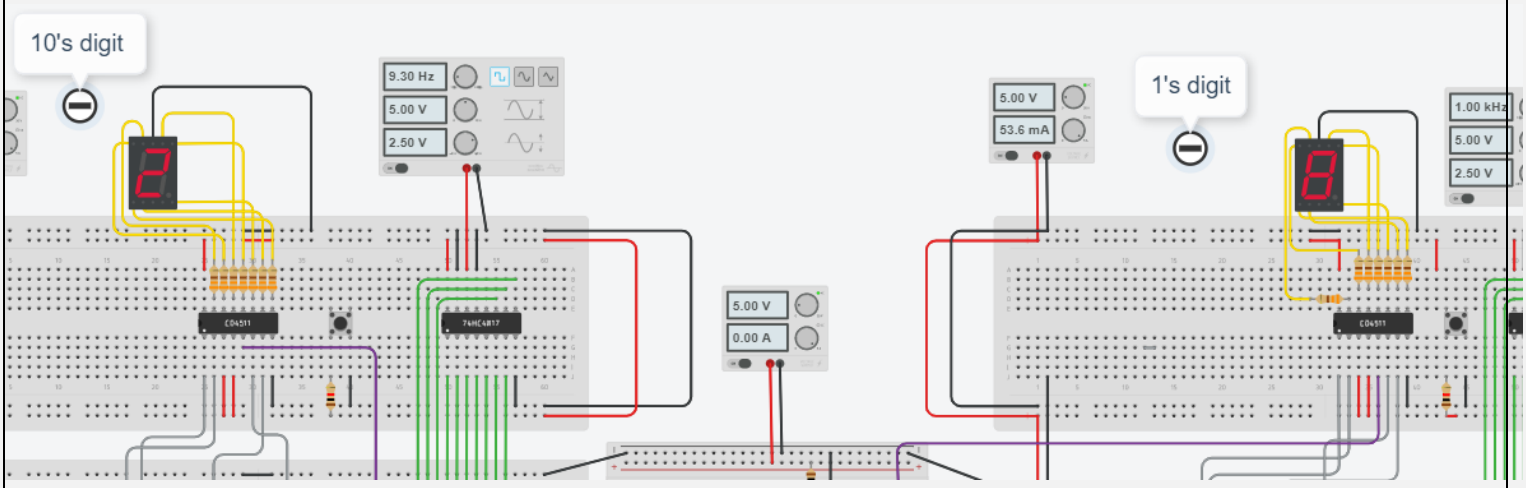
SIMULATION RESULTS IN TINKERCAD:



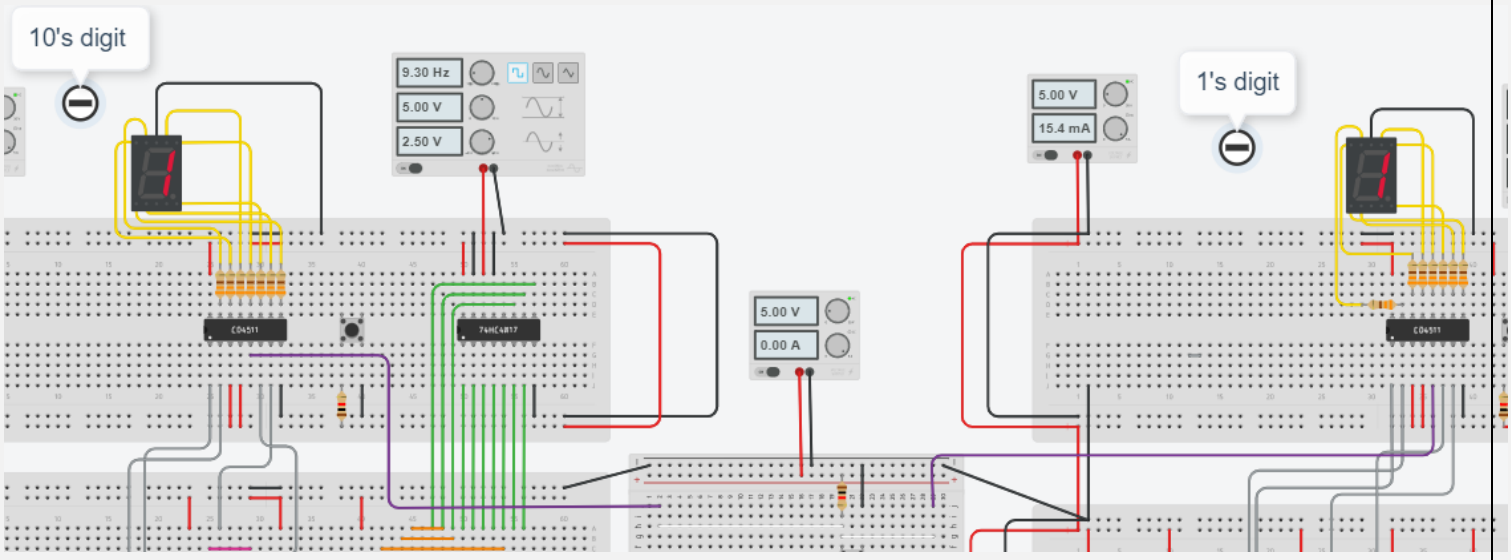
OTP 16 is generated



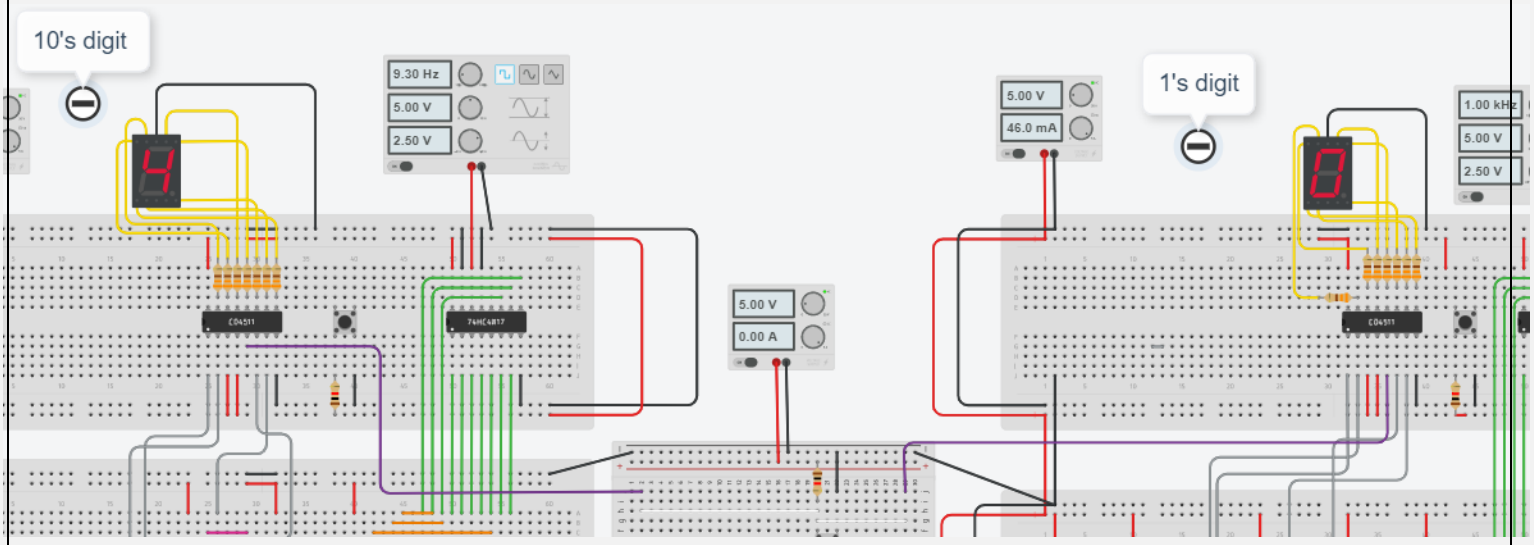
OTP 69 is generated



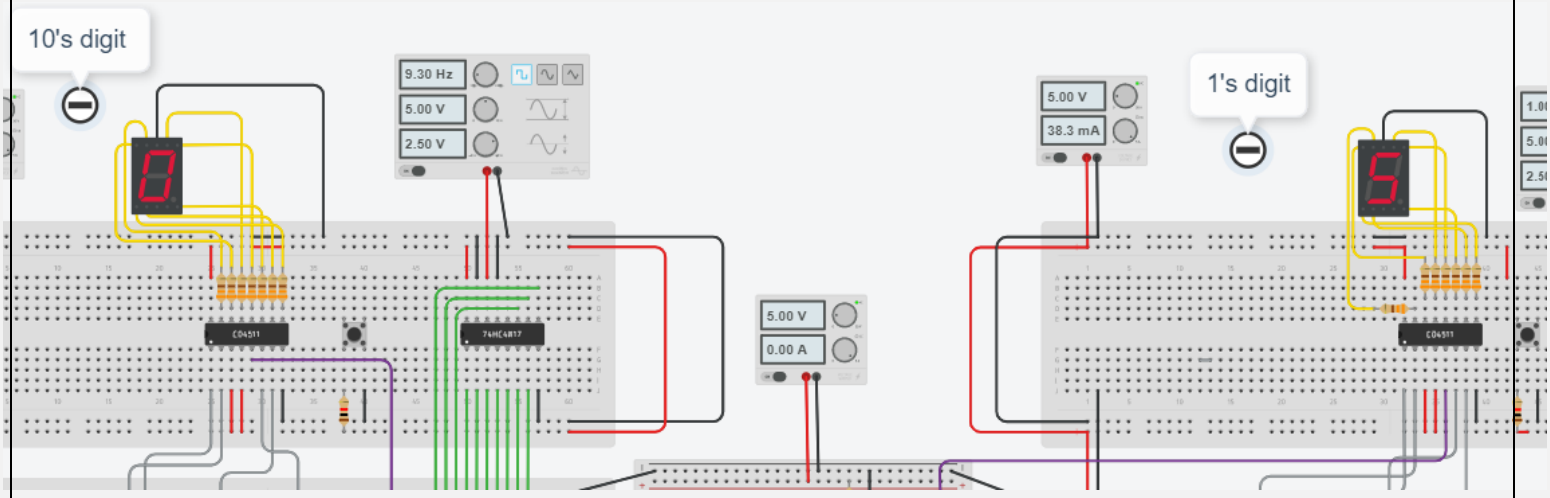
OTP 28 is generated



OTP 11 is generated



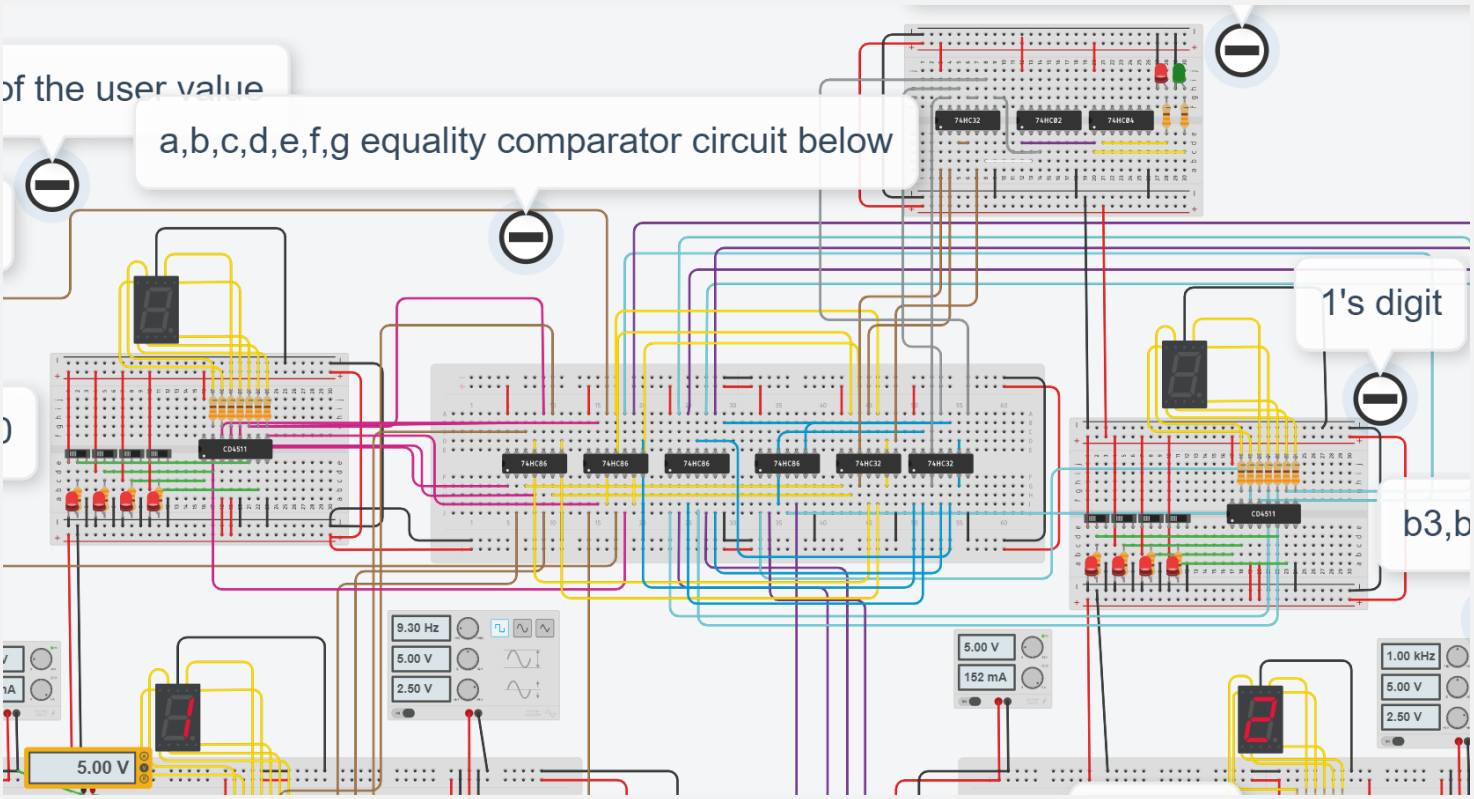
OTP 40 is generated



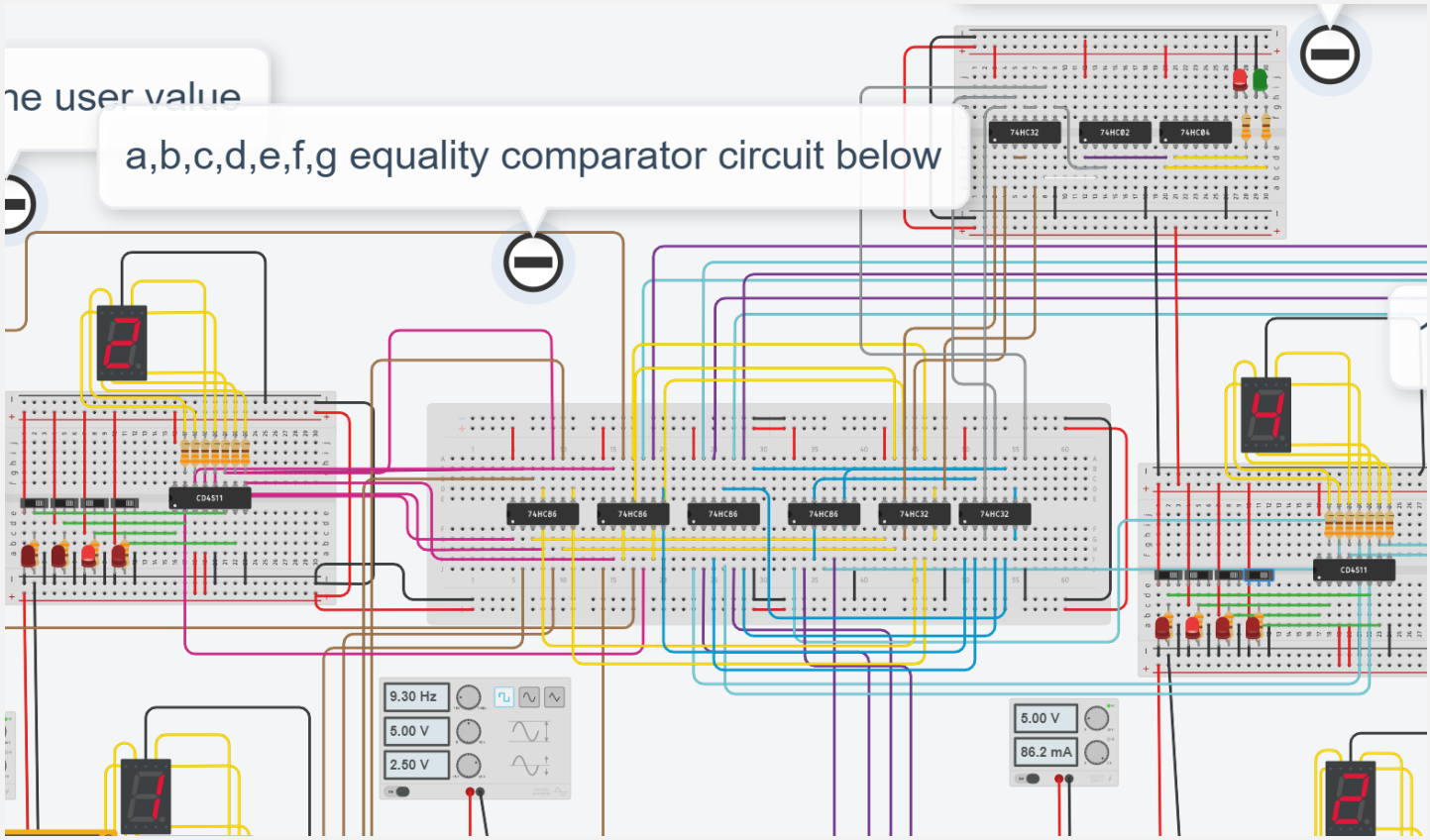
OTP 5 is generated

7) Now fix a generated OTP and try entering different binary values via a slide switch and determine if the green LED turns green only when the correct OTP is entered.

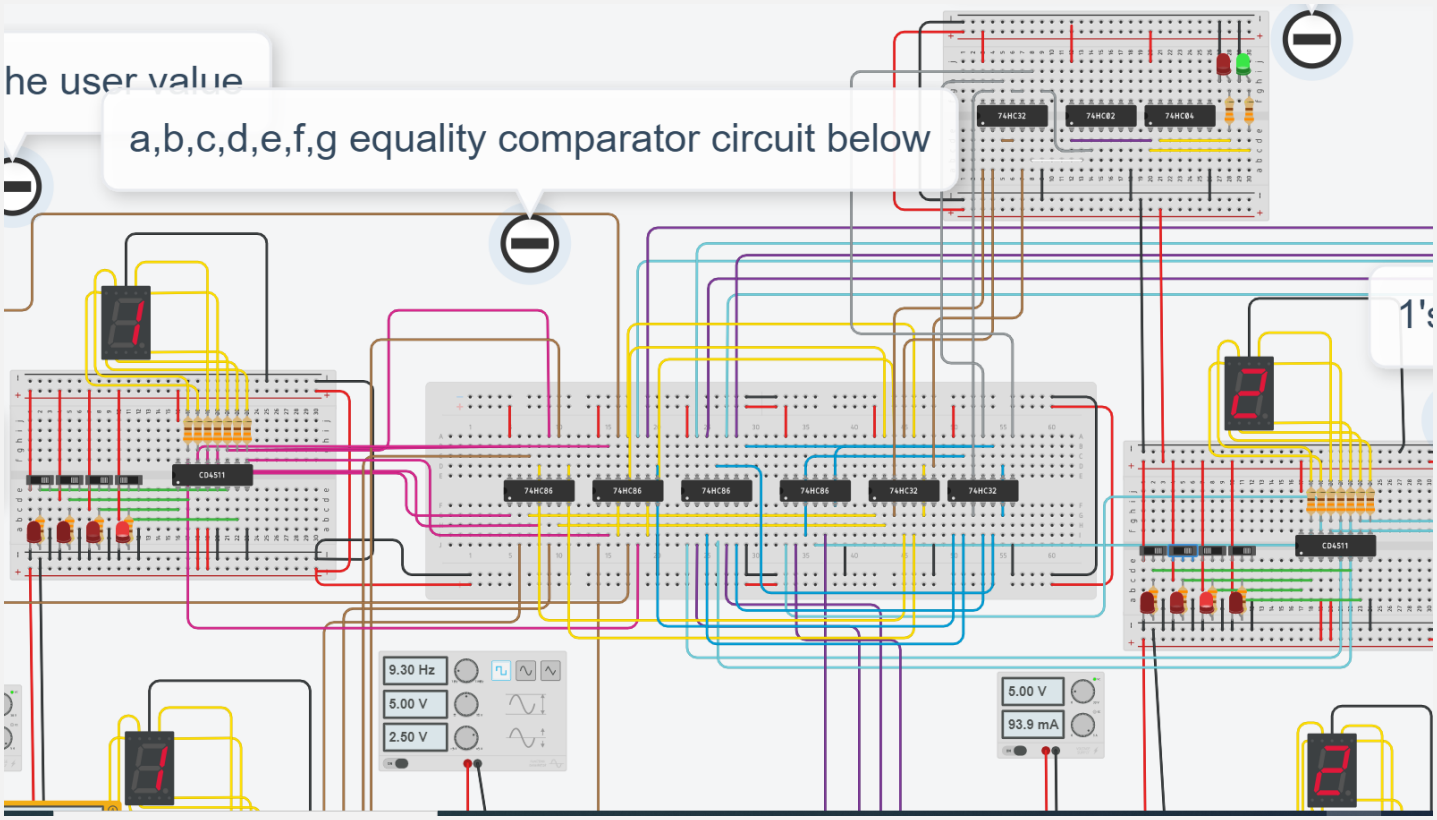
SIMULATION RESULTS IN TINKERCAD:



So, let us use this generated OTP 12 for authentication



As we can see, if the user enters 24 , the red LED on the top right corner glows indicating that the entered OTP is wrong.



Here, since the user has entered the correct OTP 12, we see that the green LED in the top right corner turns on!.

TINKERCAD LINK:

RESULT:

OTP generator circuit and authentication circuit was designed and random OTP numbers were generated and authenticated.

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