Lab Report-4

Experiment-1

Experiment-1
(Multiplexer)

Name: Chanda Akshay Kumar

Roll number: 2024102014

Group number: 07 Teams(9)

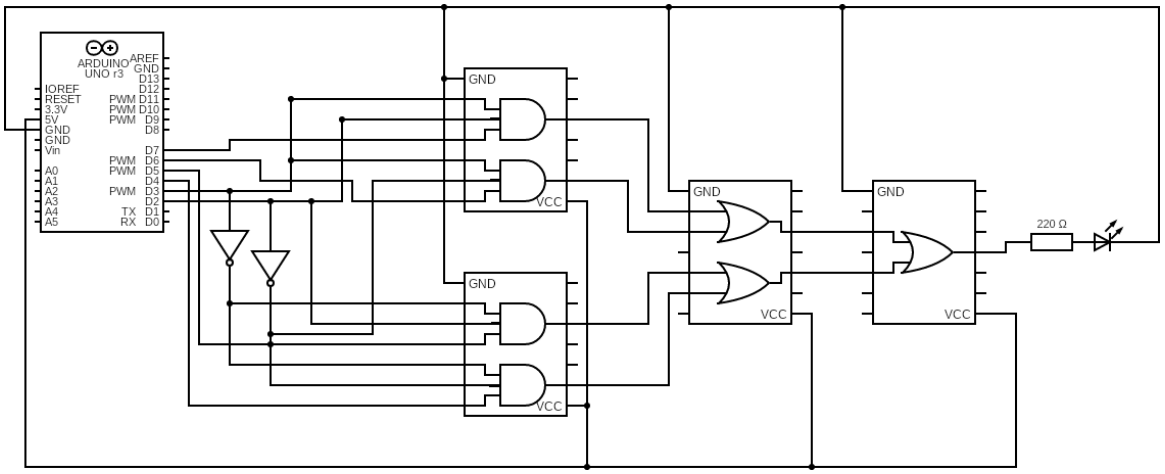
Objective:

To design, assemble and test a (4:1) Multiplexer using basic logic gates (whose select lines and inputs are through Arduino).

Electronic components used:

- Arduino Uno R3
- One NOT Gate (IC – 7404 OR Hex Inverter)
- Two Triple 3-Input AND Gate (IC - 7411)
- One QUAD OR Gate (IC - 7432)
- 220Ω Resistor
- USB-A to USB-B cable
- LED
- Connecting Wires

Reference Circuit:



Procedure:

1. Get S0 and S1 from the Arduino's buttons 2 and 3, and get I0, I1, I2, and I3 from the buttons 4, 5, 6, and 7.
2. Imagine S0 and S1 as regular switches. We'll use a NOT Gate to make them behave differently, calling them (S0)' and (S1)'.
3. Connect I0, (S0)', and (S1)' to a gate called the first AND Gate. This makes something we'll call Output 1-1.
4. Also, link I1, (S0)', and S1 to the same first AND Gate to make something called Output 2-1.
5. Connect I2, S0, and (S1)' to a second AND Gate, creating Output 1-2.
6. Similarly, connect I3, S0, and S1 to that second AND Gate to produce Output 2-2.
7. Now, put Output 1-1 and Output 1-2 into an OR Gate by connecting them to Inputs 4A and 4B. This makes Output 4.
8. Do something similar with Output 2-1 and Output 2-2, but use another OR Gate to make Output 1.
9. There's one more OR Gate. It combines Output 1 and Output 4, creating Output 2.
10. Finally, connect Output 2 to an LED. One leg of the LED goes to Output 2, and the other leg connects to a part called a "resistor." One end of the resistor goes into the ground.

11. In the Arduino IDE, execute the following code,

Observation:

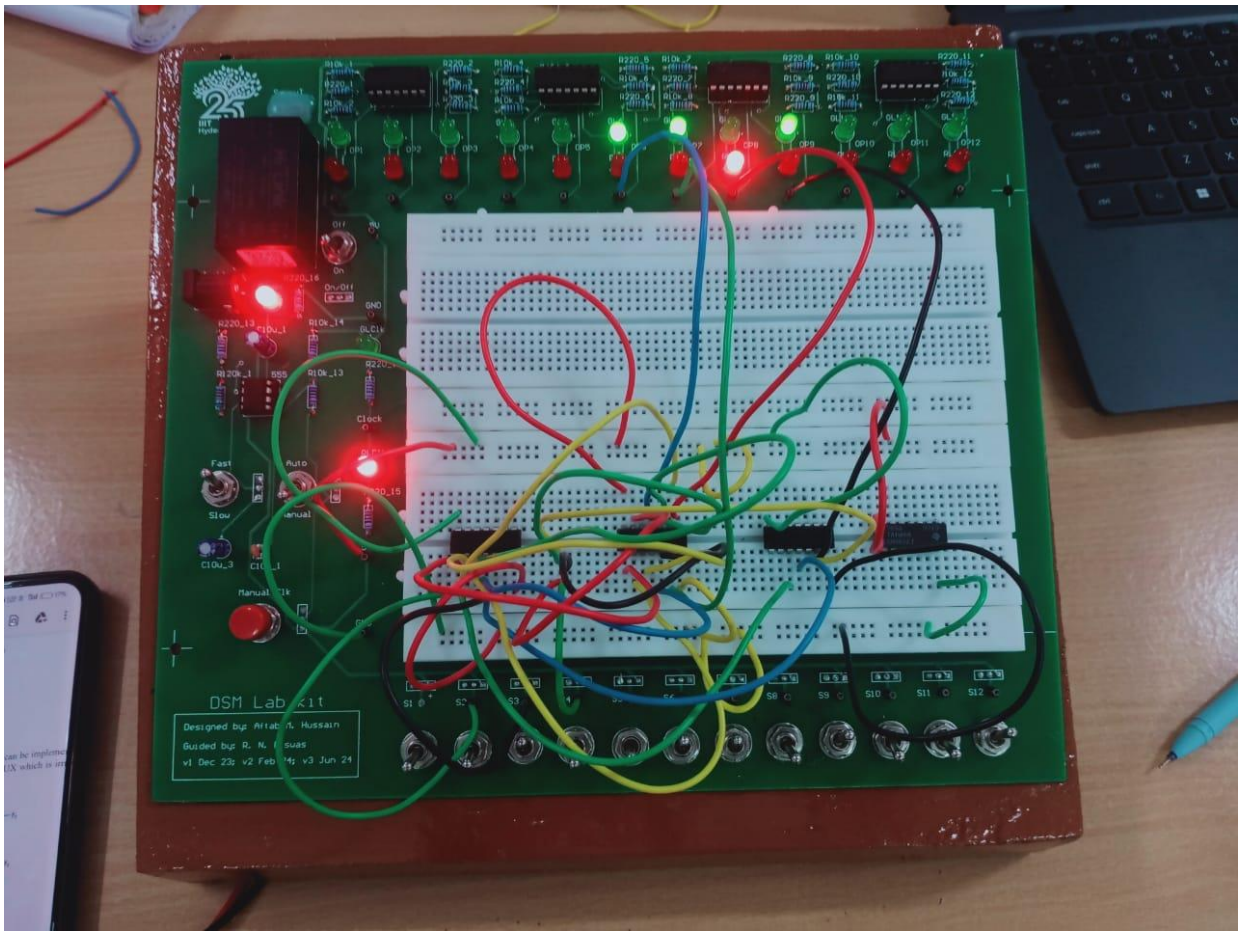
By executing the above code, if S0=0 and S1=0, the Output depends on the Input I0 (as follows from the below table). If the Input given to I0 is 0, the bulb does not glow. If the Input given to I0 is 1, the bulb glows. Similar observations can be made for the remaining three cases (as follows from the below table).

S_0	S_1	Y
0	0	I_0
0	1	I_1
1	0	I_2
1	1	I_3

Conclusion:

In this experiment, we achieved our goal of designing and implementing a 4-to-1 multiplexer using AND, NOT, and OR gates. We constructed the circuit, conducted tests with various input combinations and control signals, and confirmed its proper functioning.

Tinkercad Simulation Link:


DSM Lab Kit
Designed by: Aftab A. Hussain
Guided by: R. N.
v1 Dec 23; v2 Feb
v3 Jun 24
Fast
Slow
Auto
Manual
Clock
Manual Clk
On/Off
GND
555

Lab Report-4

Experiment-2

Experiment-2
(Demultiplexer)

Name: Chanda Akshay Kumar

Roll number: 2024102014

Group number: 07 Teams(9)

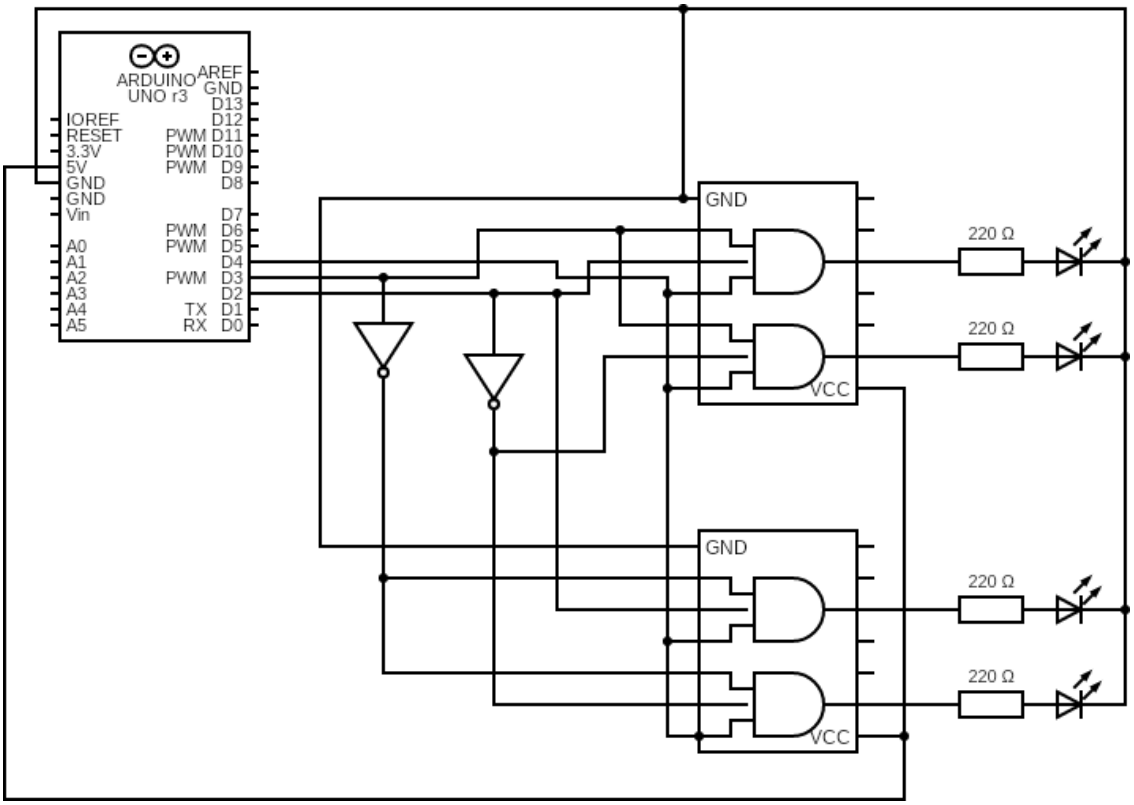
Objective:

To design, assemble and test a (1:4) Demultiplexer using basic logic gates (whose select lines and inputs are through Arduino).

Electronic components used:

- Arduino Uno R3
- One NOT Gate (IC – 7404 OR Hex Inverter)
- Two Triple 3-Input AND Gate (IC - 7411)
- Four 220Ω Resistor
- USB-A to USB-B cable
- Four LED
- Connecting Wires

Reference Circuit:



Procedure:

1. Take the choices S0 and S1 from Digital pins 2 and 3 on the Arduino, and input I from Digital pin 4 on the Arduino.
2. Use a NOT Gate to create the opposite of S0, which we'll call (S0)' and the opposite of S1, which we'll call (S1)'.
3. Connect I, (S0)', and (S1)' to the first AND Gate to make Output 2, which we'll call Y0.
4. Connect I, (S0)', and S1 to the first AND Gate to make Output 3, which we'll call Y1.
5. Connect I, S0, and (S1)' to the second AND Gate to make Output 2, which we'll call Y2.
6. Connect I, S0, and S1 to the second AND Gate to make Output 3, which we'll call Y3.
7. Take Output 2 from the first AND Gate and connect it to the long leg (Anode) of the first LED. Connect the short leg (Cathode) of the LED to the

second terminal of the first resistor, and the first terminal of the resistor should be connected to ground.

8. Take Output 3 from the first AND Gate and connect it to the long leg (Anode) of the second LED. Connect the short leg (Cathode) of the LED to the second terminal of the second resistor, and the first terminal of the resistor should be connected to ground.
9. Take Output 2 from the second AND Gate and connect it to the long leg (Anode) of the third LED. Connect the short leg (Cathode) of the LED to the second terminal of the third resistor, and the first terminal of the resistor should be connected to ground.
10. Take Output 3 from the second AND Gate and connect it to the long leg (Anode) of the fourth LED. Connect the short leg (Cathode) of the LED to the second terminal of the fourth resistor, and the first terminal of the resistor should be connected to ground.
11. In the Arduino IDE, write and run the code to control this setup as described.

Observation:

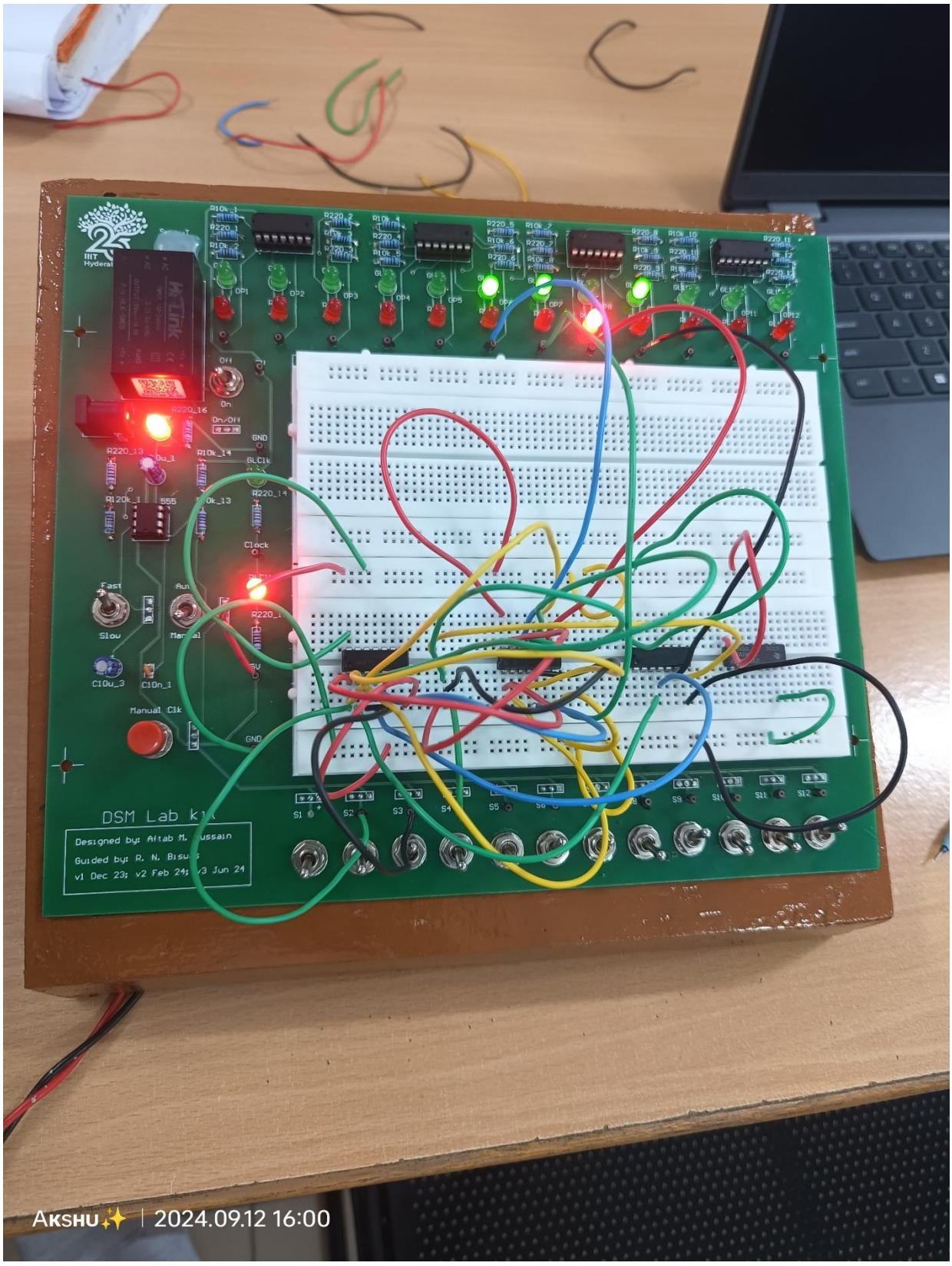
By executing the code, if S0=0 and S1=0 then the Output is Y0 which depends on Input I. If the input given to I is 0 then the 1st bulb does not glow and if the input given to I is 1 then the 1st bulb glows (Here I fixed the input of I as 1). Similar observations can be made for the remaining three cases (as follows from the below table)

S0	S1	Y0	Y1	Y2	Y3
0	0	I	0	0	0
0	1	0	I	0	0
1	0	0	0	I	0
1	1	0	0	0	I

Conclusion:

In this laboratory experiment, we achieved our goal of designing and implementing a 1-to-4 demultiplexer using AND and NOT gates. We constructed the circuit, conducted tests with various input combinations and control signals, and confirmed its proper functioning.

Tinkercad Simulation Link:


DSM Lab k
Designed by: Aftab M. ussain
Guided by: R. N. Bisu
v1 Dec 23; v2 Feb 24; 3 Jun 24
Manual Clk
Clock
Fast
Slou
Aut
Manual
555
Off
On
On/Off
GND
5V
AKSHU✨ | 2024.09.12 16:00

Lab Report-4

Experiment-3

Part-C (MUX+DEMUX)

Name: Chanda Akshay Kumar

Roll number: 2024102014

Group number: 07 Teams(9)

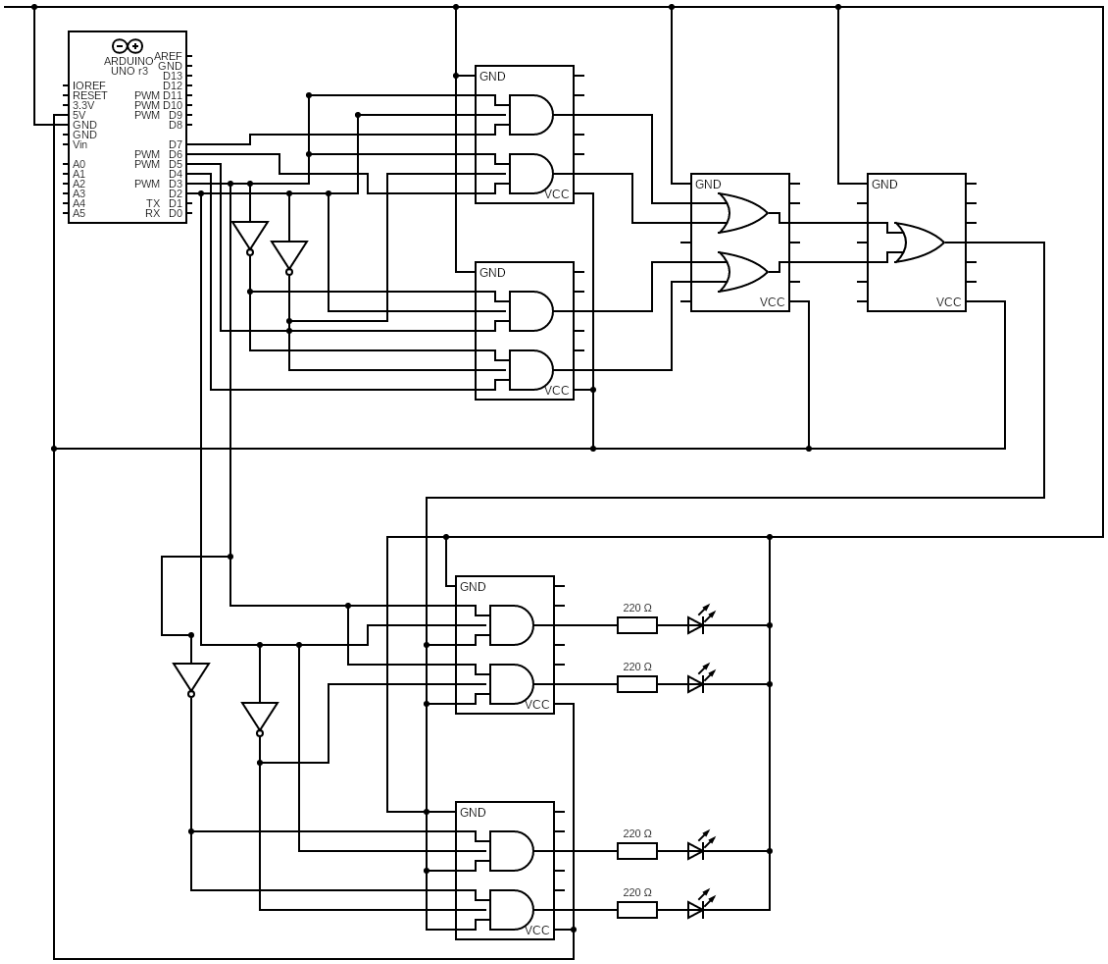
Objective:

To design, assemble and test a (4:1) Multiplexer and (1:4) De-multiplexer using basic logic gates (whose select lines and inputs are through Arduino).

Electronic components used:

- Arduino Uno R3
- Two NOT Gate (IC – 7404 OR Hex Inverter)
- Four Triple 3-Input AND Gate (IC - 7411)
- One QUAD OR Gate (IC - 7432)
- Four LED Lights
- Four Resistors
- Connecting wires

Reference Circuit:



Procedure:

1. We're using some buttons on the Arduino. S0 and S1 are like switches connected to pins 6 and 7, and we have more buttons named I0, I1, I2, and I3 connected to pins 4, 5, 6, and 7.
2. Imagine S0 and S1 as regular switches. We'll use a NOT Gate to make them behave differently, calling them (S0)' and (S1)'.
3. Now, we're using a gate called an AND Gate. We connect I0, (S0)', and (S1)' to this gate, and it creates something we'll call Output 1-1.
4. Similarly, if we connect I1, (S0)', and S1 to the same gate, it makes something called Output 2-1.
5. We also do this for I2, S0, and (S1)' with another AND Gate to make Output 1-2.

6. Likewise, if we connect I3, S0, and S1 to the same kind of gate, it generates Output 2-2.
7. Now, let's combine Output 1-1 and Output 1-2 with another gate called OR Gate by connecting them to Inputs 4A and 4B. This gives us Output 4.
8. We do something similar for Output 2-1 and Output 2-2, but this time with a different OR Gate, making Output 1.
9. We have one more OR Gate. It takes Output 1 and Output 4 and combines them to create a final thing we'll call Output 2.
10. Now, take Output 2 from the last OR Gate and connect it to another part on the board as input I.
11. We'll use another NOT Gate for S0 and S1 again to make (S0)' and (S1)'.
12. Connect I, (S0)', and (S1)' to a new gate called an AND Gate. This makes something called Output 2, which we'll call Y0.
13. Also, connect I, (S0)', and S1 to another AND Gate. This creates Output 3, known as Y1.
14. Take I, S0, and (S1)' and connect them to a different AND Gate to make Output 2, which we'll call Y2.
15. Lastly, connect I, S0, and S1 to another AND Gate to generate Output 3, known as Y3.
16. Connect Output 2 of the third AND Gate to the long leg (Anode) of the first LED. Connect the short leg (Cathode) of the LED to terminal 2 of the first resistor, with terminal 1 of the resistor connected to the ground.
17. Connect Output 3 of the third AND Gate to the long leg (Anode) of the second LED. Connect the short leg (Cathode) of the LED to terminal 2 of the second resistor, with terminal 1 of the resistor connected to the ground.
18. Take Output 2 of the fourth AND Gate and connect it to the long leg (Anode) of the third LED. Connect the short leg (Cathode) of the LED to terminal 2 of the third resistor, with terminal 1 of the resistor connected to the ground.
19. Connect Output 3 of the fourth AND Gate to the long leg (Anode) of the fourth LED. Connect the short leg (Cathode) of the LED to terminal 2 of the fourth resistor, with terminal 1 of the resistor connected to the ground.
20. In the Arduino IDE, execute the following code,

Observation:

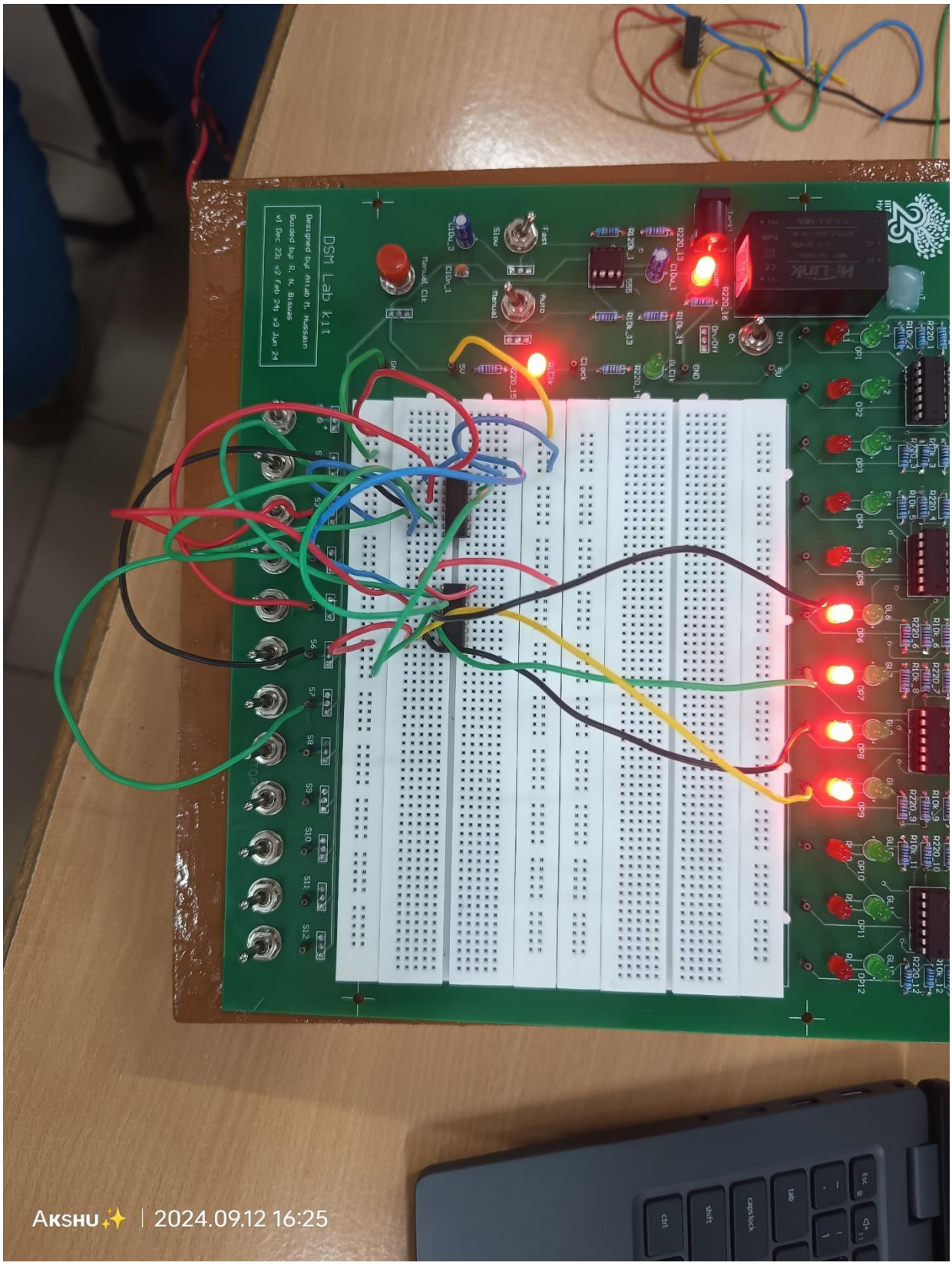
By executing the code, if S0=0 and S1=0, the Output 2 of OR Gate depend on the Input I0. If the Input given to I0 is 0, the bulb does not glow. If the Input given to I0 is 1, the bulb glows. And then, the Output in DMUX is Y0 which depends on Input I. If the Input given to I is 0 then the 1st bulb does not glow and if the input given to I is 1 then the 1st bulb glows. Similar observations can be made for the remaining three cases (as follows from the below table)

S0	S1	Y0	Y1	Y2	Y3
0	0	I	0	0	0
0	1	0	I	0	0
1	0	0	0	I	0
1	1	0	0	0	I

Conclusion:

In this laboratory experiment, we achieved our goal of designing and implementing a 4-to-1 multiplexer using AND, NOT, and OR gates, 1-to-4 demultiplexer using AND and NOT gates. We constructed the circuit, conducted tests with various input combinations and control signals, and confirmed its proper functioning.

Tinkercad Simulation Link:


DSM Lab kit
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v1 Dec 23, v2 Feb 24, v3 Jun 24
Fast
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On
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5V
GND
Akshu✨ | 2024.09.12 16:25