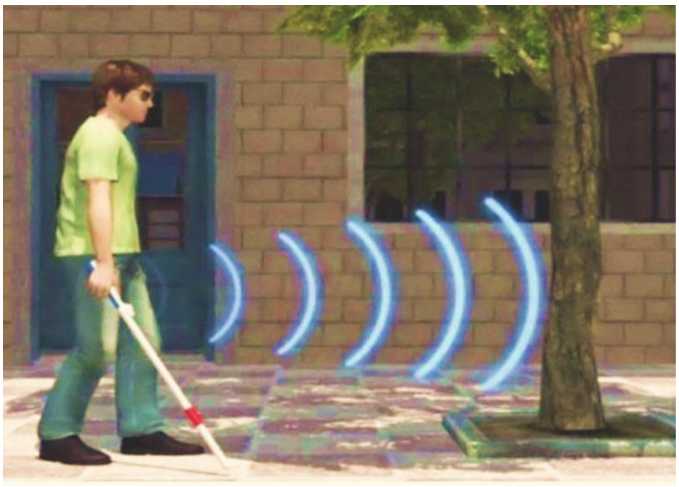

ECTE 250: ENGINEERING DESIGN AND MANAGEMENT 2

Deliverable 3

Design and Simulation

SMART WALKING STICK

GROUP G

- *NANDINI RAJAGOPALAN* (7352888)
- *HIBA AHMED* (7299205)
- *MUJIDAT JIBRIN* (6710608)
- *AHBAB ELTAHIR* (6564264)
- *KARIM SAFARINI* (7391560)

INDEX

1. INTRODUCTION

When navigating their environment, blind people encounter various challenges, including the risk of tripping or colliding with items. Several technologies targeted at enhancing the mobility and independence of visually impaired have been developed to address this issue. However, there's more scope to the existing development.

Our device, the smart walking stick, guides the visually impaired people in their respective direction by notifying them if any obstacles are present around them.

2. KEY FUNCTIONALITIES

The Smart Walking stick can perform the following functions:

1. Detect any direct Obstacle.
2. Detecting Underground obstacles.
3. Detects Moisture
4. Alerts user about the obstacle (output)
5. Locate the walking stick if misplaced.

3. SIMULATION PROCEDURE

1. The group first came up with an idea for the project.
2. Key functionalities were discussed, shortlisted, and finalized.
3. Based on the key functionalities, a State diagram was constructed and equations for the output were obtained from Boole duesto.
4. A block diagram was made using Tinker cad.
5. A 3D model was developed using Tinkercad.
6. Multisim of the circuit was made.

4. SIMULATION RESULT

4.1 FLOW CHART

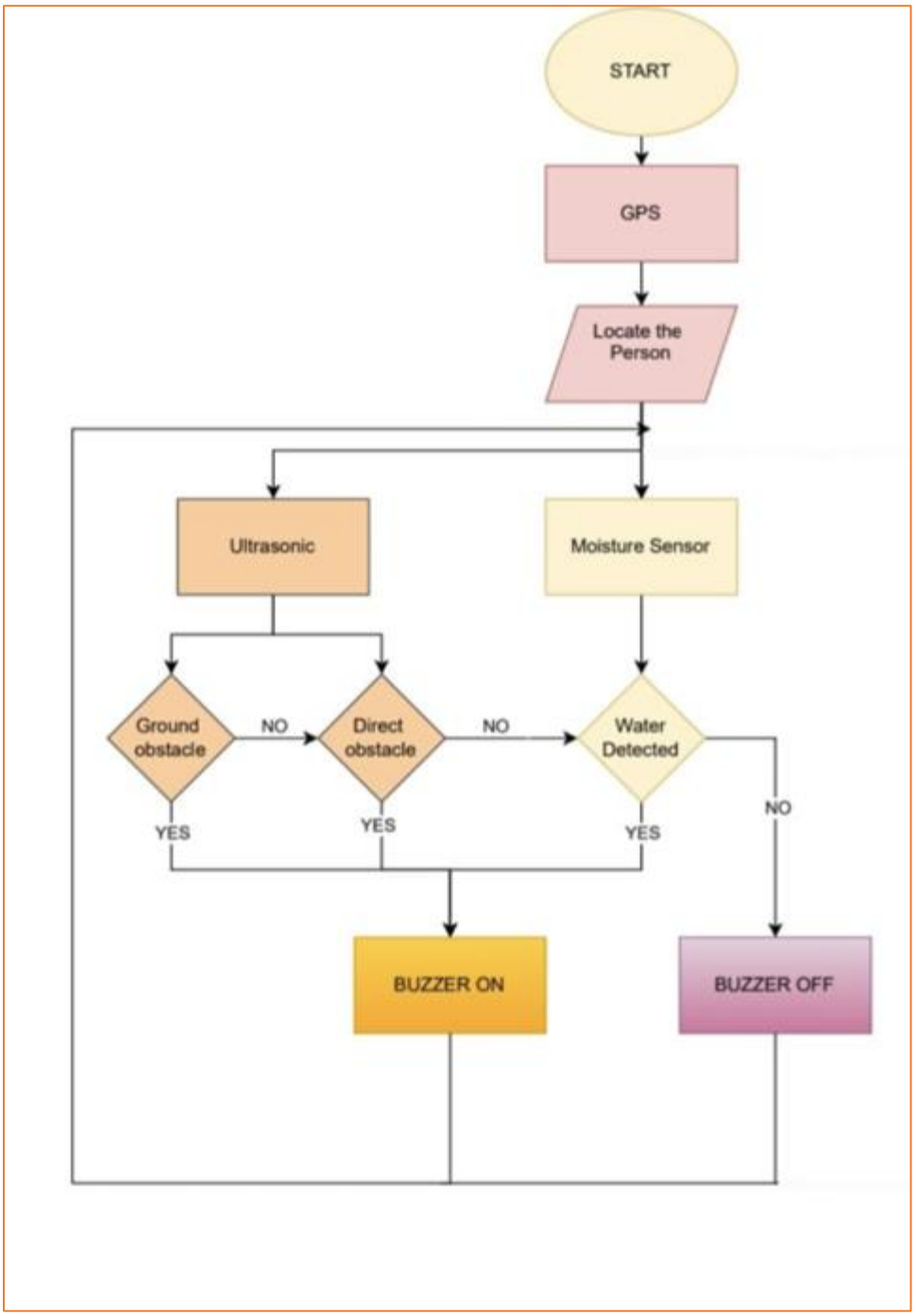

Figure 1 Flow Chart

The above figure is a schematic representation of the workings of the product. It involves a GPS module that is used to detect the location of the device. Its sent to saved emergency contacts so that they can be alerted in the case of an emergency. There are 2 types of sensors - 1 is a rain level sensor to detect wet surfaces, 2- ultrasonic sensor. The product makes use of 2 ultrasonic sensors, 1 is for direct obstacles and the other is for ground obstacles. If either obstacle are detected, a buzzer with a specific tone turns on.

4.2 STATE DIAGRAM

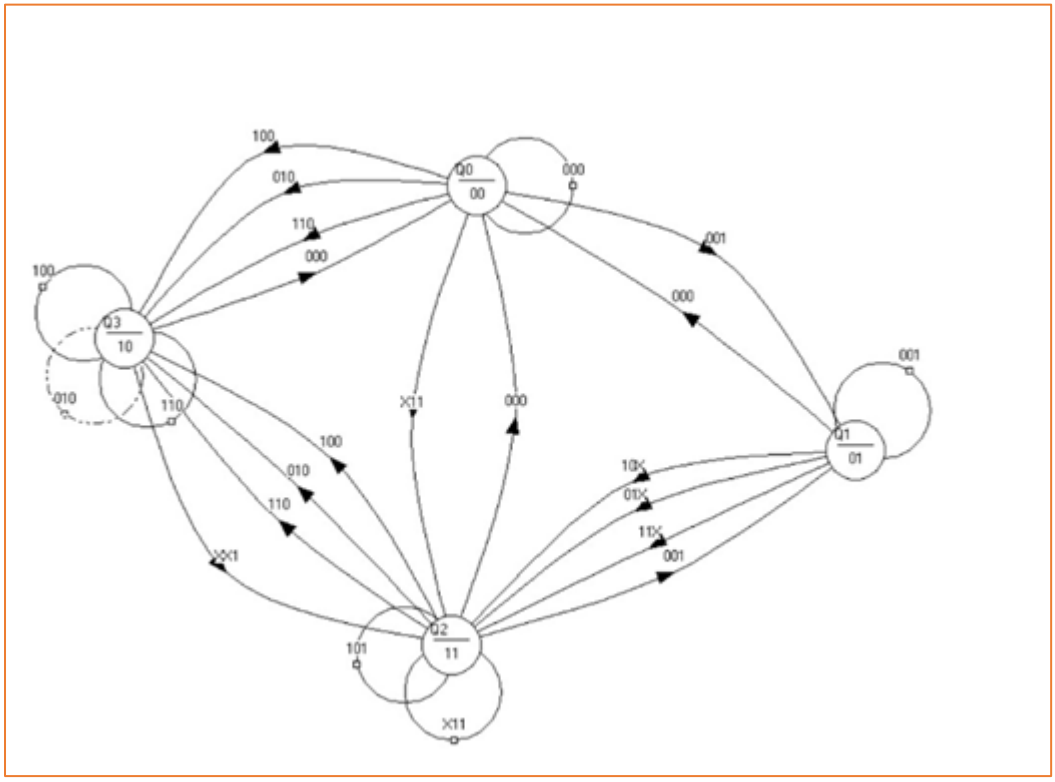

Figure 2 State Diagram

The first state is the idle state when none of the buzzer's sound. The second state is when a direct obstacle is detected and the buzzer with a high-pitched tone turns on. The third state is when both buzzers turn on, this occurs when both a wet surface and an obstacle is detected. And the

fourth state, is for when an underground obstacle is detected, here a low-pitched tone sounds from the buzzer.

4.3 BLOCK DIAGRAM

The block diagram is developed in a way that the sensors (Ultrasonic and Water Sensor) give input to the Arduino, the output is connected to a Buzzer.

The following diagram represents the block diagram of the Smart Walking stick.

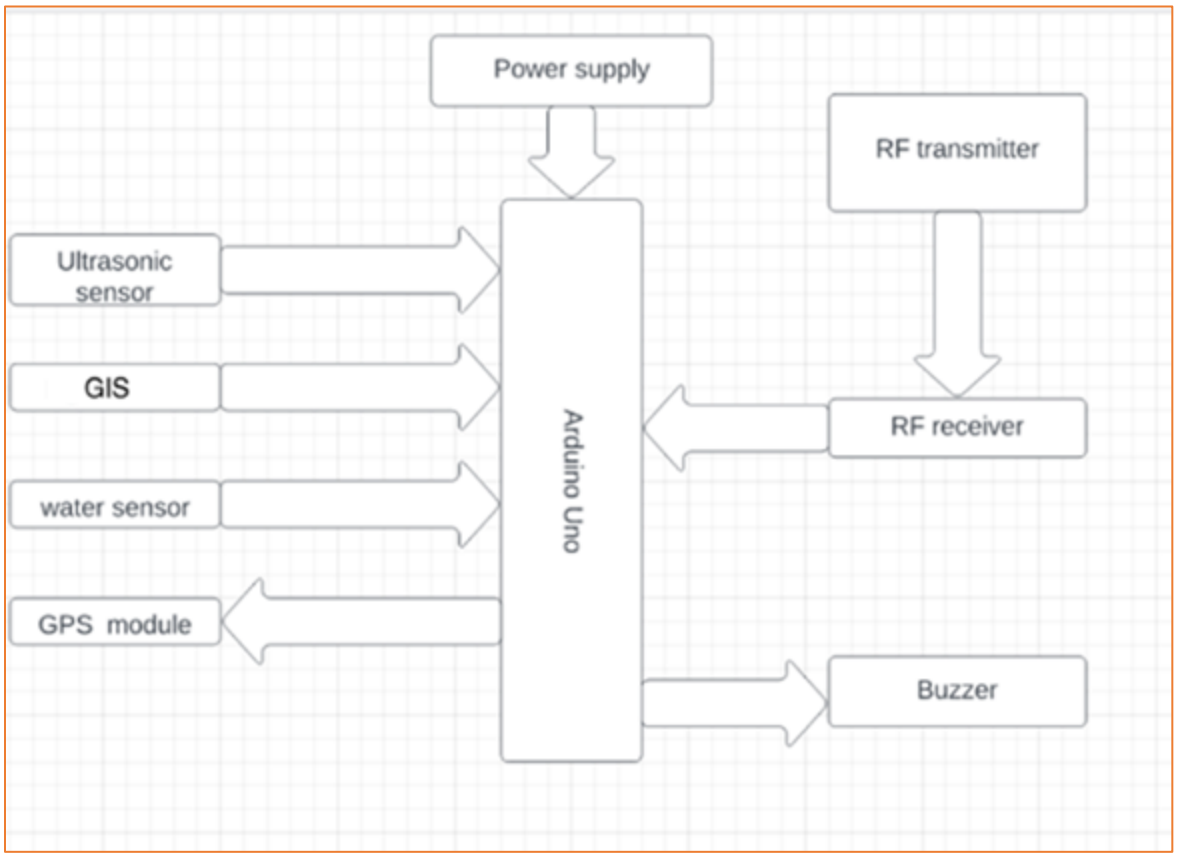

Figure 3 Block Diagram

4.4 MODEL WITH ARDUINO (ON TINKER CAD)

Using TinkerCad, the hardware components of the device were connected. The distance for the ultrasonic sensor to detect obstacles and the moisture sensor to detect the water level has not been decided yet.

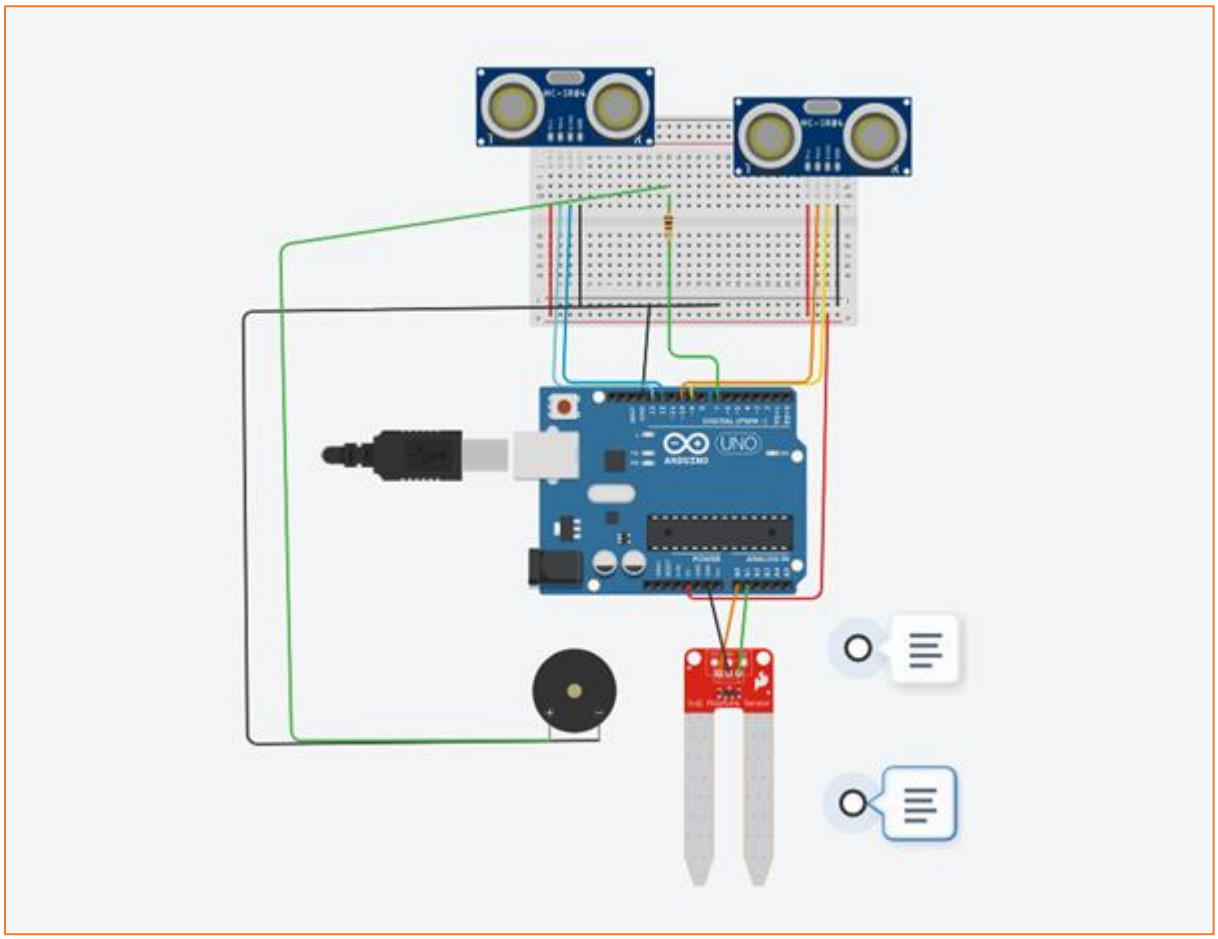

Figure 4 Tinker CAD Hardware

```
int sensor1=0;
int sensor2=0;
int moisture = 0;
long readUltrasonicDistance(int triggerPin,int echoPin)
{
  pinMode(triggerPin,OUTPUT);
  digitalWrite(triggerPin,LOW);
  delayMicroseconds(2);
  digitalWrite(triggerPin,HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerPin,LOW);
  pinMode(echoPin,INPUT);
  return pulseIn(echoPin,HIGH);
}

void setup()
{
  Serial.begin(9600);
  pinMode(A0, OUTPUT);
  pinMode(A1, INPUT);
  pinMode(7, OUTPUT);
  pinMode(4, OUTPUT);
}

void loop()
{
  sensor1=0.01723*readUltrasonicDistance(10,9);
  sensor2=0.01723*readUltrasonicDistance(13,12);
  Serial.println(sensor1,sensor2);
  if (sensor1 > 100) {
    //digitalWrite(4, HIGH);
    tone(7, 220, 100);
    //delay(200);
    //digitalWrite(4, LOW);
  }
  if (sensor2 > 200) {
    //digitalWrite(4, HIGH);
    tone(7, 800, 100);
    //delay(200);
  }



 delay(500);

 // Apply power to the soil moisture sensor
 digitalWrite(A0, HIGH);
 delay(10); // Wait for 10 millisecond(s)
 moisture = analogRead(A1);
 // Turn off the sensor to reduce metal corrosion
 // over time
 digitalWrite(A0, LOW);
 Serial.println(moisture);

 if (moisture > 0) {
   digitalWrite(7, HIGH);
   tone(7, 220, 100);
   delay(200);
 }
 delay(100); // Wait for 100 millisecond(s)
}
```

4.5 3D MODEL

One Moisture Sensor and Ultrasonic Sensor is kept on the tip, one Ultrasonic on the middle and one buzzer on the handle is placed on the walking stick.

The following pictures represent the 3D Model of the smart walking stick.

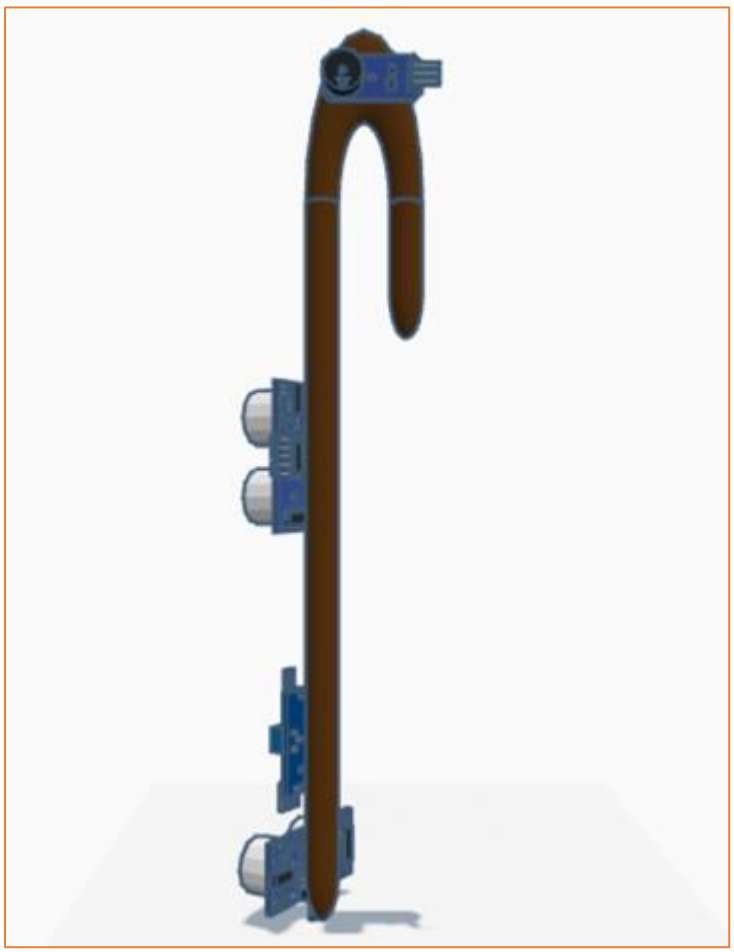

Figure 5 3D Diagram (3 Views)

4.6 MULTISIM AND STATE MACHINE CIRCUITS:

The below images are the state machine circuit for our walking stick. We used 4 not gates,9 and gates , 2 d flip flops and 4 probes which represent the sensors that are being used in the walking stick . We also used a switch to show the simulation and it can also represent an on/off button on the walking stick. When the circuit is simulated and one or more of the probes are switched on, this shows that the sensors are triggered and there is an obstacle. When the switch is off and the circuit simulated, the probes still switches on this could be as a result of the settings, because we have checked our circuit and it matches with the state diagram and transition table that we have done, which are all correct and accurate.

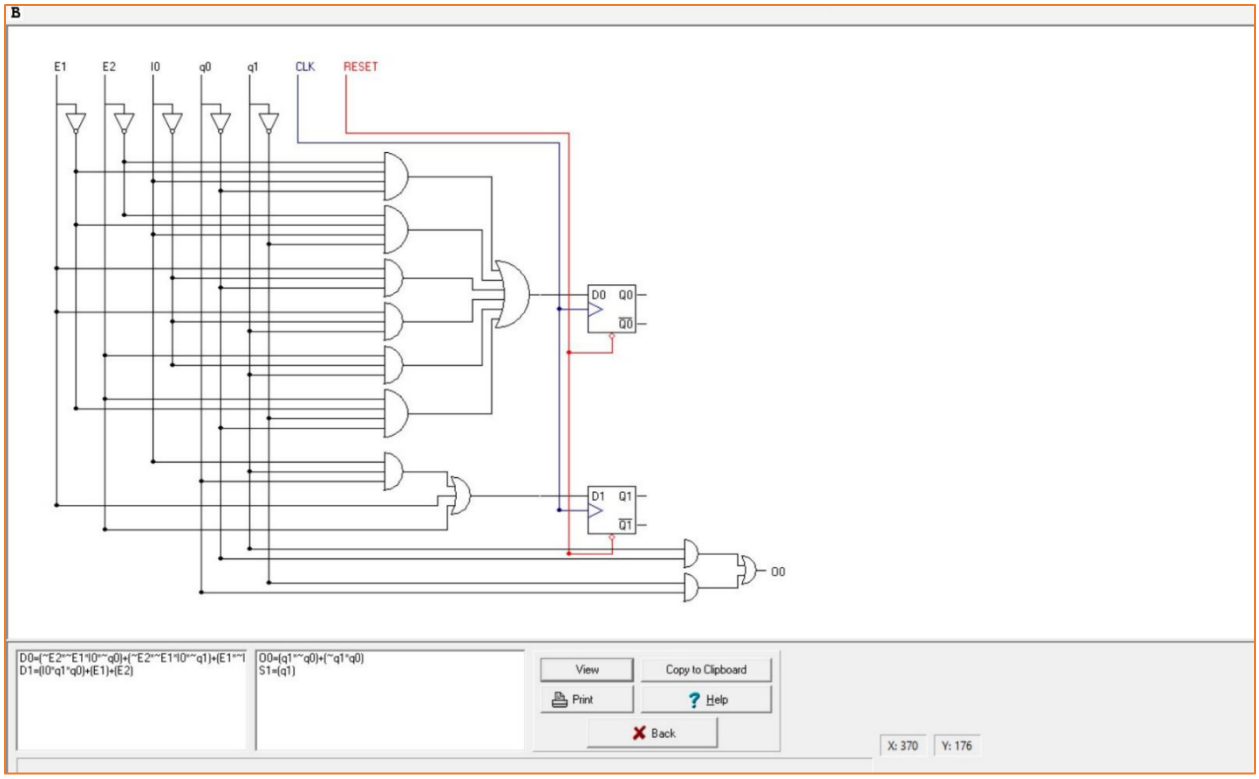

Figure 6 Boole Duexto Circuit (UltrasonicSensor)

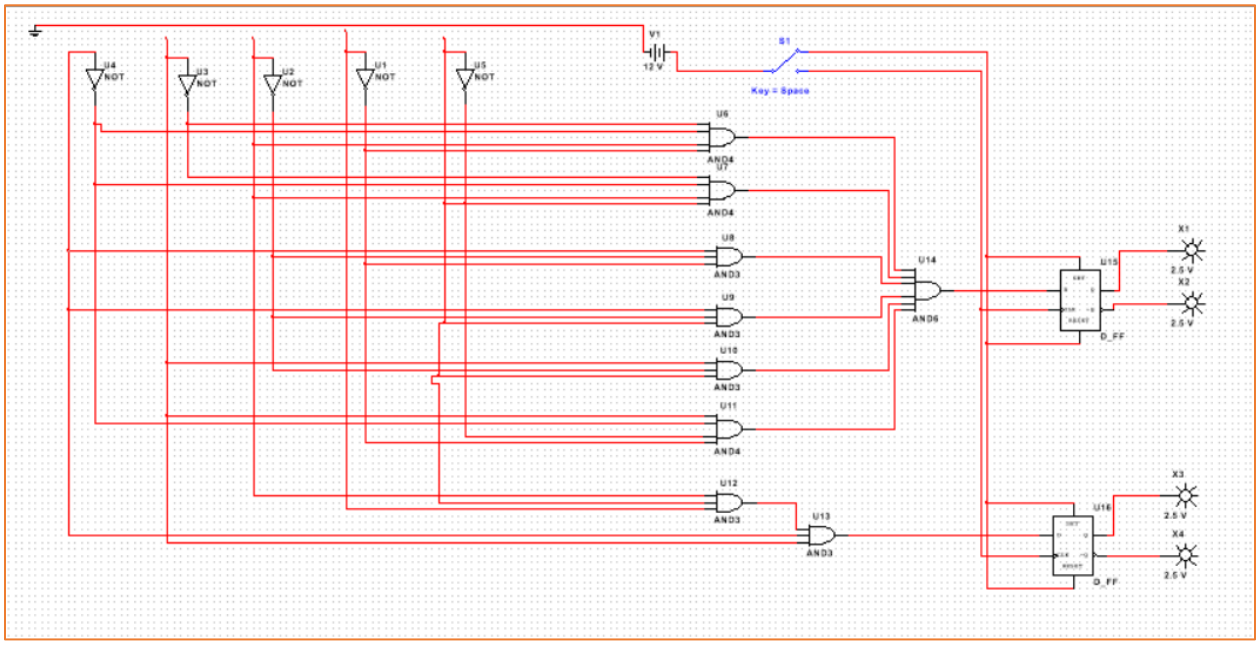

Figure 7 Ultrasonic Multisim

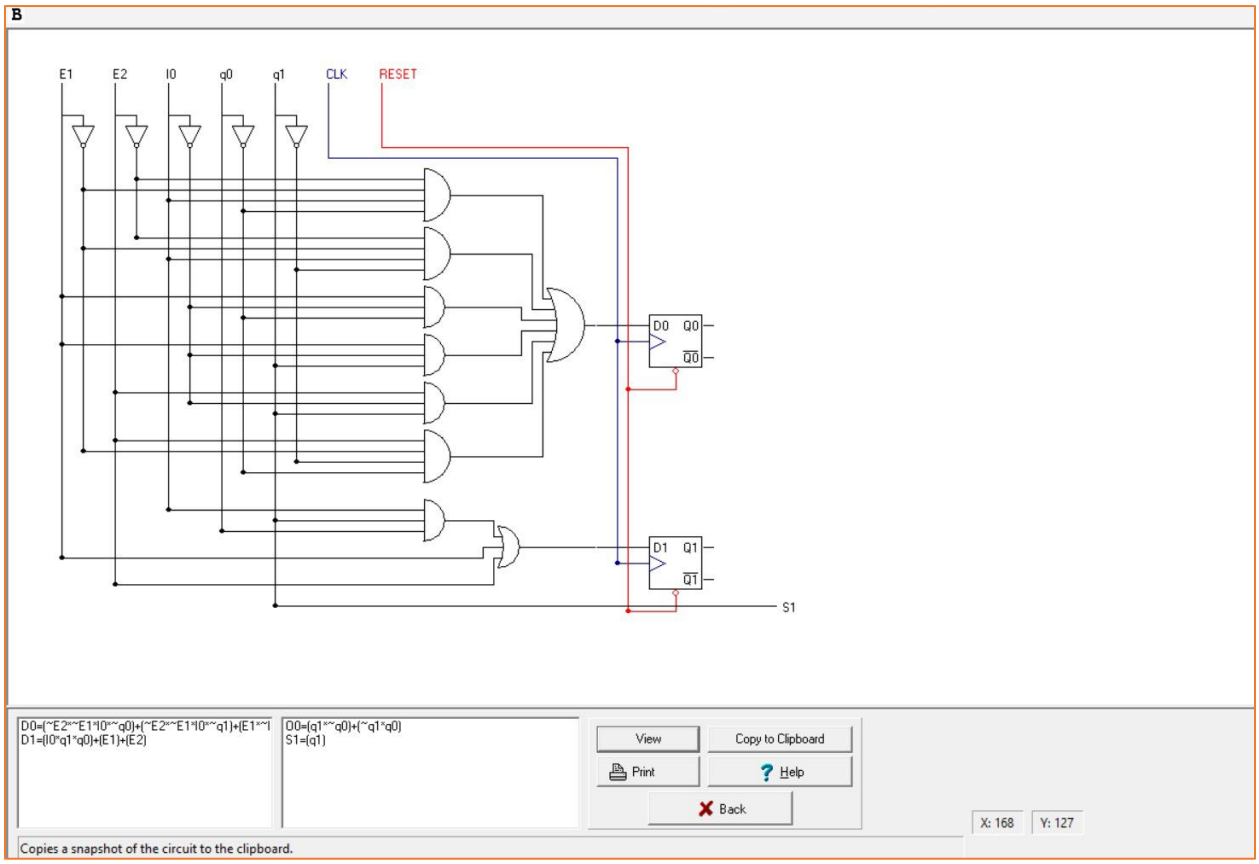

Figure 8 Boole Duexto Circuit (WaterSensor)

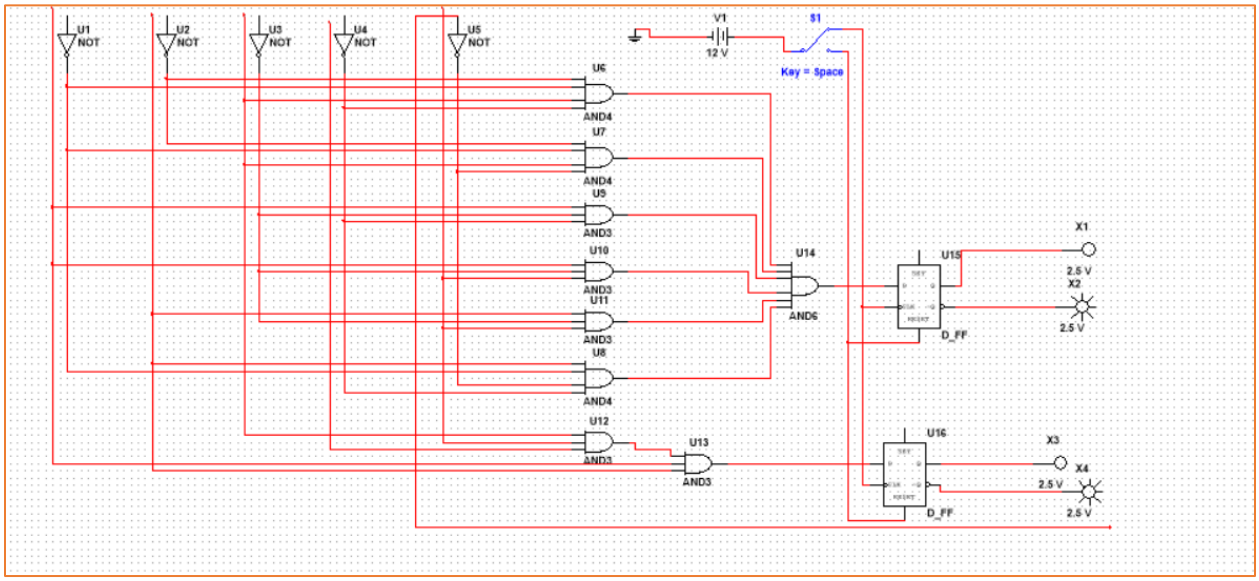

Figure 9 Water Sensor Multisim

MENTOR'S FEEDBACK:

The team would like to appreciate the mentor for giving his time and for the detailed feedback. To start, the improvements that were required from us in deliverable 2 from the mentor was the explanation the design was needed in a more descriptive way as well as regarding the research marketing section the price of Arduino was not equivalent compared to the original price. While in the report format, the in-text citation and reference in Harvard were missing in the report.

The above feedbacks were considered for deliverable 3. In this report, a short explanation is given about the design.

Keeping the improvement aside the good feedback that was received in deliverable 2 was overall it was a good well-structured, convincing, clear, and interesting report. The report had a good flow of thoughts and ideas, a clear structure, coherent and solid conclusion. Moreover, good succinct message in the report

CONCLUSION

Our Smart Walking Stick's major goal is to make it possible for those who are blind to go safely and independently. The objective of this project is to design and create a stick that will help blind people identify hazards and safely navigate their surroundings. By alerting the visually impaired individual to any obstructions around, our device directs the person in their intended course.

The team has completed all milestones and tasks according to Plan. Flowchart, state diagram, block diagram, hardware using tinkercad and 3D Diagram were completed. However, modifications has to be done regarding the hardware part.

In this deliverable, the feedback from the mentor has been considered and necessary changes were made.