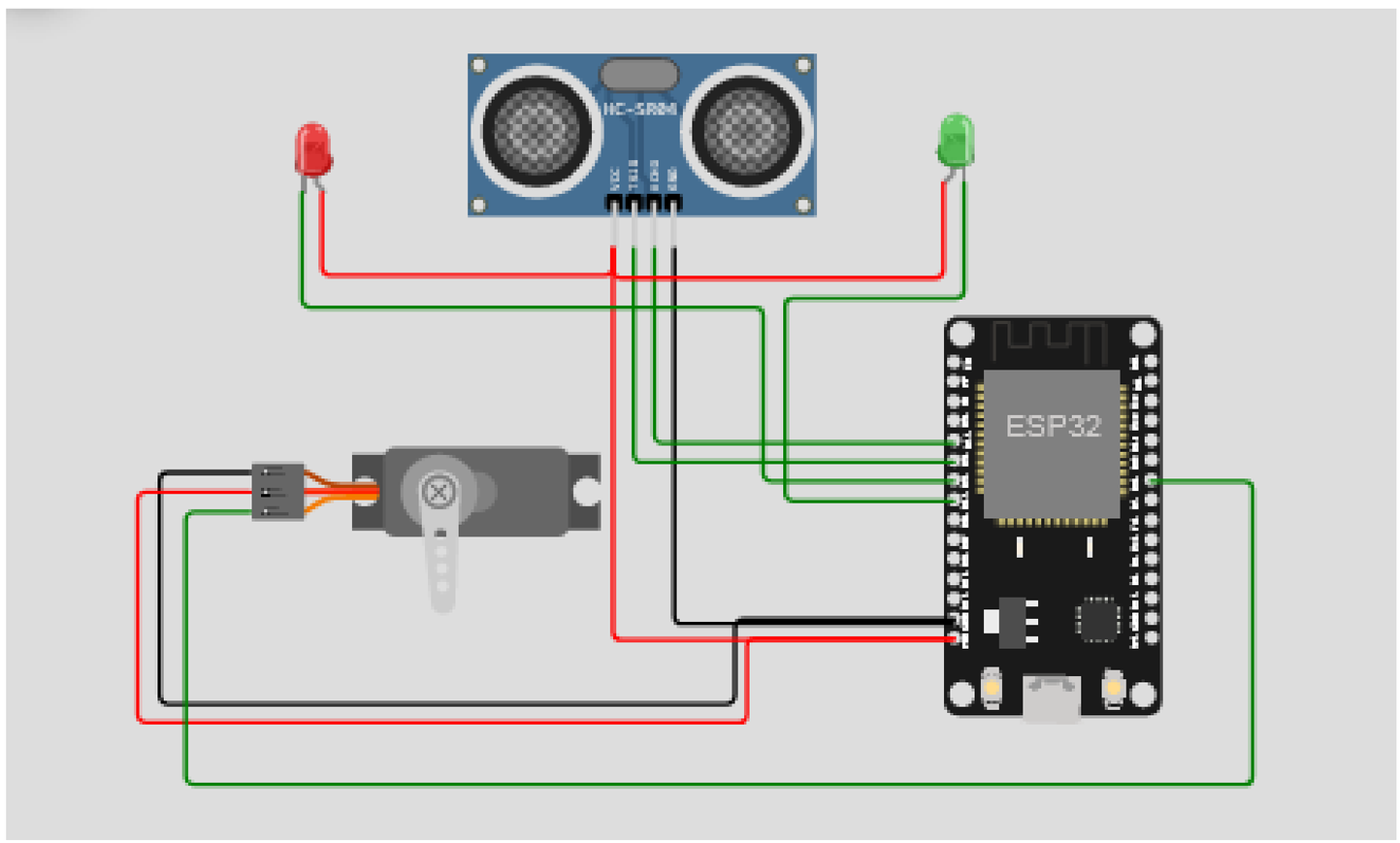
Smart Public Restroom

Introduction:

IoT, with its network of interconnected devices and sensors, allows for the collection, analysis, and utilization of real-time data to create smart and efficient solutions. When applied to public restrooms, this technology can bring about a myriad of benefits, enhancing the overall user experience while making maintenance and management more cost-effective.

Block Diagram:



Working Process Of Ultrasonic Sensor:

Generation of Ultrasonic Waves: The sensor generates a high-frequency sound wave, typically in the ultrasonic range (around 40 kHz), using a piezoelectric transducer. This transducer converts electrical energy into mechanical vibrations, creating the sound wave.

Transmission of Sound Waves: The sensor emits these sound waves into the environment, usually in a specific direction. The sound waves travel through the air until they encounter an object.

Reflection of Sound Waves: When the sound wave hits an object, it gets reflected back towards the sensor. The time it takes for the sound wave to travel to the object and back is recorded.

Time Measurement: The sensor measures the time it takes for the sound wave to return, and this time is typically measured in microseconds. This time is directly related to the distance between the sensor and the object. The longer it takes for the sound wave to return, the farther the object is from the sensor.

Conversion to Distance: Using the measured time, the sensor's microcontroller or processor converts this into a distance measurement. The speed of sound in the air (approximately 343 meters per second or 1125 feet per second at room temperature) is used to calculate the distance. The formula for distance calculation is typically something like: Distance = (Time * Speed of Sound) / 2.

Data Processing: The collected distance data can be further processed by a microcontroller or a computer to perform various tasks, such as controlling the movement of a robot, detecting obstacles in a car, or triggering an alarm.

Program for smart public restroom:

```
#include<ESP32Servo.h>
 #define   TRIGGERPIN 32
 #define   ECHOPIN      35
 #define   RED_LED      33
 #define   GREEN_LED 25

Servoservo_1; long

duration;
int pos, distance, i=0; void setup()
{
    servo_1.attach(18); Serial.begin(115200);
    pinMode(TRIGGERPIN,OUTPUT);
    pinMode(ECHOPIN, INPUT);
    pinMode(RED_LED, OUTPUT);
    pinMode(GREEN_LED, OUTPUT);

    Serial.println(" "); Serial.println("Sensing the
    Height"); digitalWrite(RED_LED, HIGH);
    digitalWrite(GREEN_LED, LOW);

    pos = 0; servo_1.write(pos);
}
  void loop()
{
    digitalWrite(TRIGGERPIN, LOW);
    delayMicroseconds(3); digitalWrite(TRIGGERPIN,
    HIGH); delayMicroseconds(12); // it may be 10 us
    digitalWrite(TRIGGERPIN, LOW);
// Reads the echoPin, returns the sound wave travel time in microseconds duration =
    pulseIn(ECHOPIN, HIGH);
// Calculating the distance distance =
    (duration/2) / 29.1;
```

```
// for Adult
if (distance >= 100 && distance <= 150)
    {
        i = 1;
        if (pos != 180)
        {
            servo_1.write(180); pos =
            180;
            i = 1;
        }
    }
// for Child
    else if (distance >= 200 && distance <= 250)
        {
            i = 1;
            if (pos != 0)
            {
              servo_1.write(0); pos
              = 0;
              i = 1;
            }
        }
    else if (distance > 300 && i == 1)
        {
            digitalWrite(RED_LED, LOW);
            digitalWrite(GREEN_LED,HIGH);
            delay(5000); digitalWrite(RED_LED,
            HIGH); digitalWrite(GREEN_LED,
            LOW); i = 0;
          }
    delay (500);
    Serial.println(" "); Serial.print("Free
    Level:"); Serial.print(distance);
    Serial.print("                ");
    Serial.print("Position:");
    Serial.print(pos);
    delay (500);
}
```

Output:

```
Sensing the Height


Free Level : 140   Position : 180

Free Level : 140   Position : 180

Free Level : 140   Position : 180

Free Level : 140   Position : 180
```

Conclusion:

The integration of sustainable materials, energy-efficient lighting, and eco-friendly cleaning solutions aligns with modern environmental and sustainability goals. By reducing the environmental footprint of restroom facilities, this project demonstrates a commitment to responsible and eco-conscious design