## **SMART PUBLIC RESTROOM**

#### **INTRODUCTION:**

IoT (Internet of Things) technology has enabled a wide range of applications in various domains, and one such domain is the management of public restrooms. The use of IoT technology in smart public restrooms can provide better service to users, optimize maintenance and cleaning schedules, and save water and energy.

Here are some of the IoT applications in smart public restrooms:

Automated monitoring: IoT sensors can be installed in public restrooms to detect the

occupancy of each stall, the availability of toilet paper, soap, and other supplies. Automated monitoring can help staff to respond promptly to the needs of the restroom users.

Predictive maintenance: IoT sensors can

IoT Applications in Smart Public Restrooms

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Predictive maintenance: IoT sensors can

A smart washroom is a customizable solution that integrates operational and environmental smart washroom sensors and IoT technology, in commercial and retail washrooms, to provide a clear view of data in real-time.

Smart restroom sensors and mobile device integration make smart restroom technology enablement seamless and easy. The opportunity to improve restroom management is here. And the time to get smart about restrooms is now.

Building leaders must be strategic about deploying their cleaning resources with a heightened awareness of building hygiene in today's post-pandemic era. Their efforts must be visible and reassure building occupants that their health and safety are at the forefront of the facility management team's efforts. Adding smart restroom technology that makes it easy for building managers to meet the public's expectations is not only suitable for occupants, but it's also good for business.

### 1.PROJECT DISCRIPTION:

- ❖ Say goodbye to unsanitary restrooms! Smart toilets utilize self-cleaning technology and touchless operation tominimize contact with germs. With integrated UV sterilization and antibacterial surfaces, these toilets ensure a safer and healthier restroom experience for everyone. Smart toilets are designed with universal accessibility in mind. Featuring adjustable heights, handrail support, and braille instructions, these facilities cater to individuals with diverse needs. By promoting inclusivity, smart toilets are transforming public restrooms into welcoming spaces for everyone
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### **2.PROJECT IMPLIMENTATION:**



Fig:2.1 Transparent public restroom.

Modern public restrooms are often cramped, dirty, and smelly. They are also usually located in the middle of a busy street or in a crowded mall. This makes it difficult for people to use them without feeling uncomfortable. Smart toilet restroom technology aims to improve the design and overall user experience of public restrooms. Making them more comfortable and convenient for everyone. One way to improve the design of smart public restrooms is by making them more user-friendly. For example, some restrooms now have touch screen-controlled toilets that allow users to select various settings such as water pressure and temperature. Other features that can make public restrooms more user-friendly include automatic flushing toilets, hands-free soap dispensers, and paper towel dispensers.

Another way to improve the design of public restrooms is by making them clean and sanitary. This can be done by installing automatic flush toilets, hands-free soap dispensers, and paper towel dispensers. Automatic flush toilets help to keep the <u>Clean Toilet Bowl</u> and sanitary by flushing it after each use. Hands-free soap dispensers help to prevent the spread of germs by allowing users to wash their hands without having to touch a dirty soap dispenser. Paper towel

dispensers help to keep the restroom clean by allowing users to dry their hands without

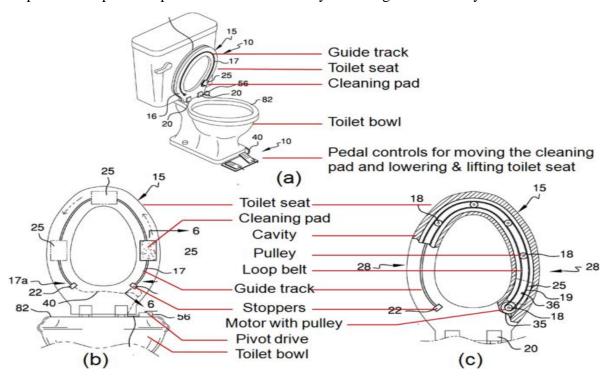


Fig:2.2 Smart punlic restroom implimentation

# **3.CIRCUIT DIAGRAM:**

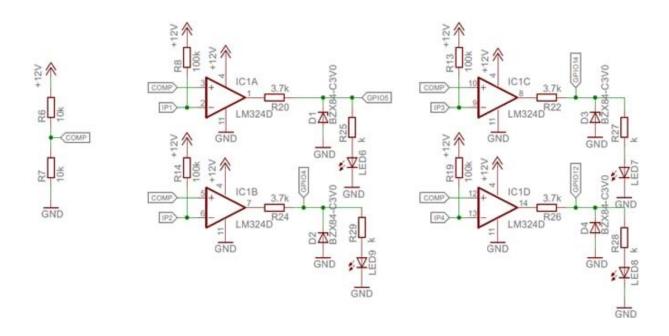


Fig:3.1 Smart public restroom Circuit diagram

### 4. SOURCE CODE:

### **FRONT END CODE:**

```
#include<ESP32Servo.h>
#define TRIGGERPIN 32
#define ECHOPIN 35
#define RED_LED 33
#define GREEN_LED 25
Servo servo_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 \geq 200 && distance \leq 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);
BACK-END CODE:
        {
 "version": 1,
 "author": "Budhaditya Biswas",
 "editor": "wokwi",
 "parts": [
  { "type": "wokwi-esp32-devkit-v1", "id": "esp", "top": 57.34, "left": 242, "attrs": {} },
```

```
{
  "type": "wokwi-hc-sr04",
  "id": "ultrasonic1",
  "top": -69.03,
  "left": 9.5,
  "attrs": { "distance": "139" }
 },
 { "type": "wokwi-servo", "id": "servo1", "top": 84.81, "left": -96.4, "attrs": {} },
  "type": "wokwi-led",
  "id": "led1",
  "top": -44.13,
  "left": -86.2,
  "attrs": { "color": "red" }
 },
  "type": "wokwi-led",
  "id": "led2",
  "top": -48.8,
  "left": 227.13,
  "attrs": { "color": "limegreen", "flip": "1" }
 }
],
"connections": [
 [ "esp:TX0", "$serialMonitor:RX", "", []],
 [ "esp:RX0", "$serialMonitor:TX", "", []],
 [\ "servo1:GND",\ "esp:GND.2",\ "black",\ [\ "h-44.1",\ "v112.72",\ "h280.67",\ "v-35.33"\ ]\ ],
 ["esp:VIN", "servo1:V+", "red", ["h-100.83", "v41.03", "h-297.33", "v-0.67"]],
 [ "servo1:PWM", "esp:D18", "green", [ "h-31.43", "v133.06", "h520.67", "v-2.67" ] ],
 [ "ultrasonic1:GND", "esp:GND.2", "black", [ "v183", "h8.03" ] ],
 [ "ultrasonic1:VCC", "esp:VIN", "red", [ "v191", "h166.2" ] ],
 [ "ultrasonic1:TRIG", "esp:D32", "green", [ "v0" ] ],
 [ "ultrasonic1:ECHO", "esp:D35", "green", [ "v0" ] ],
 [ "led1:A", "ultrasonic1:VCC", "red", [ "v40.33", "h142" ] ],
```

```
[ "led2:A", "ultrasonic1:VCC", "red", [ "v46.33", "h-161.33" ] ],
    [ "led1:C", "esp:D33", "green", [ "v56.33", "h225.37", "v94" ] ],
    [ "led2:C", "esp:D25", "green", [ "v56.33", "h-87.3", "v102" ] ]
],
    "dependencies": {}
```

### **5. SAMPLE OUTPUT SCREENSHOTS:**

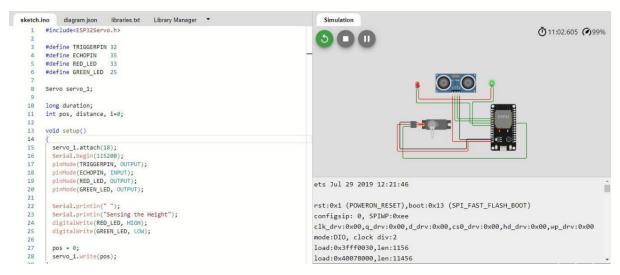


Fig:5.1

```
sketch.ino diagram.json
                        libraries.txt Library Manager ▼
                                                                                    Simulation
                                                                                                                                                00:51.436 (
       Servo servo_1;
       long duration;
  10
       int pos, distance, i=0;
  11
  12
       void setup()
  14
  15
         servo_1.attach(18);
        Serial.begin(115200);
pinMode(TRIGGERPIN, OUTPUT);
  16
  17
                                                                                 Sensing the Height
        pinMode(ECHOPIN, INPUT);
pinMode(RED_LED, OUTPUT);
  18
  19
                                                                                 Free Level: 140 Position: 180
  20
         pinMode(GREEN_LED, OUTPUT);
                                                                                 Free Level: 140 Position: 180
         Serial.println(" ");
Serial.println("Sensing the Height");
                                                                                 Free Level: 140 Position: 180
  23
                                                                                 Free Level: 140 Position: 180
  24
         digitalWrite(RED_LED, HIGH);
                                                                                 Free Level: 140 Position: 180
         digitalWrite(GREEN_LED, LOW);
  25
                                                                                 Free Level: 140 Position: 180
  26
  27
         pos = 0;
                                                                                 Free Level: 140 Position: 180
        servo_1.write(pos);
  28
                                                                                 Free Level: 140 Position: 180
                                                                                 Free Level: 140 Position: 180
  30
                                                                                 Free Level: 140 Position: 180
  31
       void loop()
  32
                                                                                 Free Level: 140 Position: 180
         digitalWrite(TRIGGERPIN, LOW);
  33
                                                                                 Free Level: 140 Position: 180
  34
         delayMicroseconds(3);
  35
         digitalWrite(TRIGGERPIN, HIGH);
                                                                                                                                                      ∠ ▶
```

Fig:5.2

```
sketch.ino diagram json libraries.txt Library Manager ▼
                                                                                                                                    Simulation
              #include<ESP32Servo.h>
                                                                                                                                                                                                                                ( 01:05.152 ( 999%
                                                                                                                                   500
              #define TRIGGERPIN 32
#define ECHOPIN 35
#define RED_LED 33
#define GREEN_LED 25
              long duration;
              int pos, distance, i=0;
                 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, LON);
       23
24
25
26
27
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29
30
                 pos = 0;
servo_1.write(pos);
                                                                                                                               Free Level : 124 Position : 180
                                                                                                                                Free Level : 124 Position : 180
```

Fig:5.3

```
sketch.ino diagram.json libraries.txt Library Manager *
                                                                                                             Simulation
                                                                                                                                    Position : 180
                                                                                                         Free Level : 140
Free Level : 140
                                                                                                                                                                                         Ō 05:07.258 (*)99%
             "editor": "wokwi",
                                                                                                                                    Position : 180
                 "type": "wokwi-esp32-devkit-v1", "id": "esp", "top": 57.34, "left": 242,
                                                                                                                                    Position: 180
                                                                                                         Free Level : 140
                                                                                                                                    Position: 180
                 "type": "wokwi-hc-sr04",
"id": "ultrasonic1",
"top": -69.03,
"left": 9.5,
"attrs": { "distance": "139" }
                                                                                                          Free Level : 140
                                                                                                                                    Position: 180
                                                                                                          Free Level : 140
                                                                                                                                    Position: 180
    10
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32
                                                                                                          Free Level : 140
                                                                                                                                     Position : 180
                                                                                                         Free Level : 140
                                                                                                                                    Position : 180
                ree Level : 140; "type": "wokwi-servo", "id": "servo1", "top": 84.81, "left": -96.4, "attr
Free Level : 140; "top": 84.81, "left": -96.4, "attr
                                                                                                                                    Position: 180
                                                                                                                                    Position: 180
                 "type": "wokwi-led",
"id": "led1",
"top": -44.13,
"left": -86.2,
"attrs": { "color": "red" }
                                                                                                       Free Level : 140
                                                                                                                                    Position : 180
                                                                                                         Free Level : 140
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                                                                                                                                    Position : 180
                                                                                                         Free Level : 140
                                                                                                                                    Position: 180
                                                                                                         Free Level : 140
                                                                                                                                    Position: 180
                                                                                                         Free Level : 140
                                                                                                                                    Position: 180
                 "type": "wokwi-led",
"id": "led2",
"top": -48.8,
"left": 227.13,
"attrs": { "color": "limegreen", "flip": "1" }
                                                                                                         Free Level : 140
                                                                                                                                    Position : 180
                                                                                                         Free Level : 140
                                                                                                                                    Position : 180
                                                                                                         Free Level : 140
                                                                                                                                    Position : 180
                                                                                                         Free Level : 140
                                                                                                                                    Position: 180
            "connections": [
[ "esp:TX0", "$serialMonitor:TX", "", [] ],
[ "esp:RX0", "$serialMonitor:TX", "", [] ],
                                                                                                         Free Level : 140
                                                                                                                                    Position: 180
                                                                                                         Free Level : 140
                                                                                                                                    Position: 180
                                                                                                         Free Level : 140
                                                                                                                                    Position : 180
                                                                                                         Free Level : 140 Position : 180
```

Fig:5.4

```
diagram.json libraries.txt Library Manager ▼
                                                                             Simulation
                                                                           Free Level : 140
                                                                                               Position : 180
                                                                                                                                      Ō 07:04.081 (*)106%
20
          "attrs": { "color": "red" }
                                                                                               Position : 180
                                                                                               Position: 180
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37
38
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41
          "type": "wokwi-led",
"id": "led2",
"top": -48.8,
"left": 227.13,
                                                                           Free Level : 140
                                                                                               Position: 180
                                                                           Free Level: 140
                                                                                              Position: 180
                                                                           Free Level : 140
                                                                                              Position: 180
                                                                                               Position : 180
                                                                           Free Level : 140
          "attrs": { "color": "limegreen", "flip": "1" }
    Free Level : 140
                                                                                               Position : 180
                                                                                              Position : 180
                                                                                              Position: 180
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                                                                                              Position: 180
                                                                           Free Level : 140
                                                                                              Position: 180
```

Fig:5.5

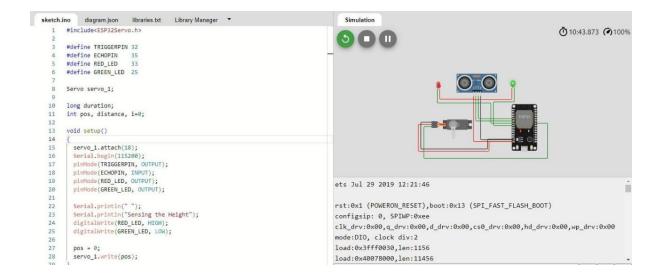


Fig:5.6

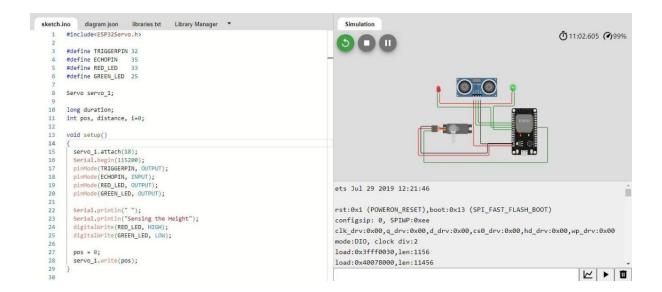


Fig:5.7

```
sketch.ino diagram.json libraries.txt Library Manager *
                                                                                                                 Simulation
                                                                                                              12:21:46
                                                                                                                                                                                               ( 12:02.135 ( 999%
             #define TRIGGERPIN 32
            #define ECHOPIN 35
#define RED_LED 33
#define GREEN_LED 25
                                                                                                             rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
                                                                                                              configsip: 0, SPIWP:0xee
                                                                                                              clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
                                                                                                              mode:DIO, clock div:2
            Servo servo 1;
                                                                                                              load:0x3fff0030,len:1156
      10
            long duration;
int pos, distance, i=0;
                                                                                                              load:0x40078000,len:11456
                                                                                                              ho 0 tail 12 room 4
                                                                                                              load:0x40080400,len:2972
             void setup()
                                                                                                              entry 0x400805dc
               servo_1.attach(18);
              Serval.attacn(18);
Serial.begin(115200);
pinMode(TRIGGERPIN, OUTPUT);
pinMode(ECHOPIN, INPUT);
pinMode(RED_LED, OUTPUT);
pinMode(GREEN_LED, OUTPUT);
      16
17
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27
                                                                                                              Sensing the Height
                                                                                                              Free Level: 140 Position: 180
                                                                                                              Free Level : 140
                                                                                                                                         Position : 180
                                                                                                              Free Level : 140
                                                                                                                                         Position : 180
              Serial.println(" ");
Serial.println("Sensing the Height");
digitalWrite(RED_LED, HIGH);
digitalWrite(GREEN_LED, LOW);
                                                                                                              Free Level : 140
                                                                                                                                         Position : 180
                                                                                                              Free Level : 140
                                                                                                                                         Position: 180
                                                                                                             Free Level : 140 Position : 180
Free Level : 140 Position : 180
Free Level : 140 Position : 180
              pos = 0;
servo_1.write(pos);
                                                                                                             Free Level : 140 Position : 180
```

Fig:5.8