**Automatic Hand Sanitizer**

**Mini project**

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Course Code : ECA1487

Course Name : Embedded System For IOT Application

**Aim:**

To develop an automatic hand sanitizer dispenser using an ultrasonic sensor and a servo motor that detects hands within a specific range and dispenses sanitizer without physical contact.

**Apparatus Required:**

1. **Arduino Board** (e.g., Uno, Nano, etc.).
2. **Ultrasonic Sensor (HC-SR04)**: For hand detection by measuring distance.
3. **Servo Motor**: To press or operate the sanitizer pump.
4. **Sanitizer Bottle**: With a pump mechanism that the servo motor will activate.
5. **Connecting Wires**: For electrical connections.
6. **Breadboard**: For prototyping the circuit.
7. **Power Supply**: USB or external 5V source for the Arduino.

**Principle:**

1. **Ultrasonic Sensor (HC-SR04)**:
   * Emits ultrasonic pulses via the **trig pin** and listens for the reflected pulse via the **echo pin**.
   * Measures the time taken for the pulse to return and calculates the distance using the formula: Distance=Duration (in µs)58.2\text{Distance} = \frac{\text{Duration (in µs)}}{58.2}Distance=58.2Duration (in µs)​
2. **Servo Motor**:
   * Rotates to predefined angles to press the pump of the sanitizer bottle when a hand is detected within a specific range.

**Procedure:**

1. **Hardware Setup**:
   * Connect the **trig pin** of HC-SR04 to Arduino pin 10.
   * Connect the **echo pin** of HC-SR04 to Arduino pin 9.
   * Connect the servo motor signal pin to Arduino pin 3.
   * Provide 5V power and GND connections to all components.
   * Fix the servo motor to the sanitizer bottle to push the pump effectively.
2. **Software Setup**:
   * Write and upload the given Arduino code.
   * Open the serial monitor to debug distance measurements.
3. **Testing**:
   * Place your hand in front of the ultrasonic sensor.
   * Verify the servo motor's activation and sanitizer dispensing.

**Working:**

1. The ultrasonic sensor continuously transmits ultrasonic waves and listens for reflected signals.
2. The Arduino calculates the distance to any object (e.g., a hand) within its range.
3. If a hand is detected within **15 cm**, the servo motor rotates to press the sanitizer pump and then resets to its initial position.
4. The system waits before the next detection to avoid repeated triggering.

**Library Used:**

* **Servo.h**:
  + Simplifies control of servo motors, enabling easy rotation using functions like attach() and write().

**Code:**

#include <Servo.h>

// Define pins for ultrasonic sensor

Servo Myservo;

#define trigPin 10 // Trig Pin Of HC-SR04

#define echoPin 9 // Echo Pin Of HC-SR04

long duration, distance;

void setup() {

Myservo.attach(3); // Attach servo motor to pin 3

Serial.begin(9600); // Initialize serial communication

pinMode(trigPin, OUTPUT); // Trig pin as output

pinMode(echoPin, INPUT); // Echo pin as input

}

void loop() {

// Emit ultrasonic pulse

digitalWrite(trigPin, LOW);

delayMicroseconds(2);

digitalWrite(trigPin, HIGH); // Transmit waves for 10µs

delayMicroseconds(10);

digitalWrite(trigPin, LOW);

// Measure duration of echo pulse

duration = pulseIn(echoPin, HIGH);

// Calculate distance in cm

distance = duration / 58.2;

Serial.println(distance);

// If hand is detected within 15 cm

if (distance < 15 && distance > 0) {

Myservo.write(160); // Rotate servo to press the pump

delay(1500); // Hold for 1.5 seconds

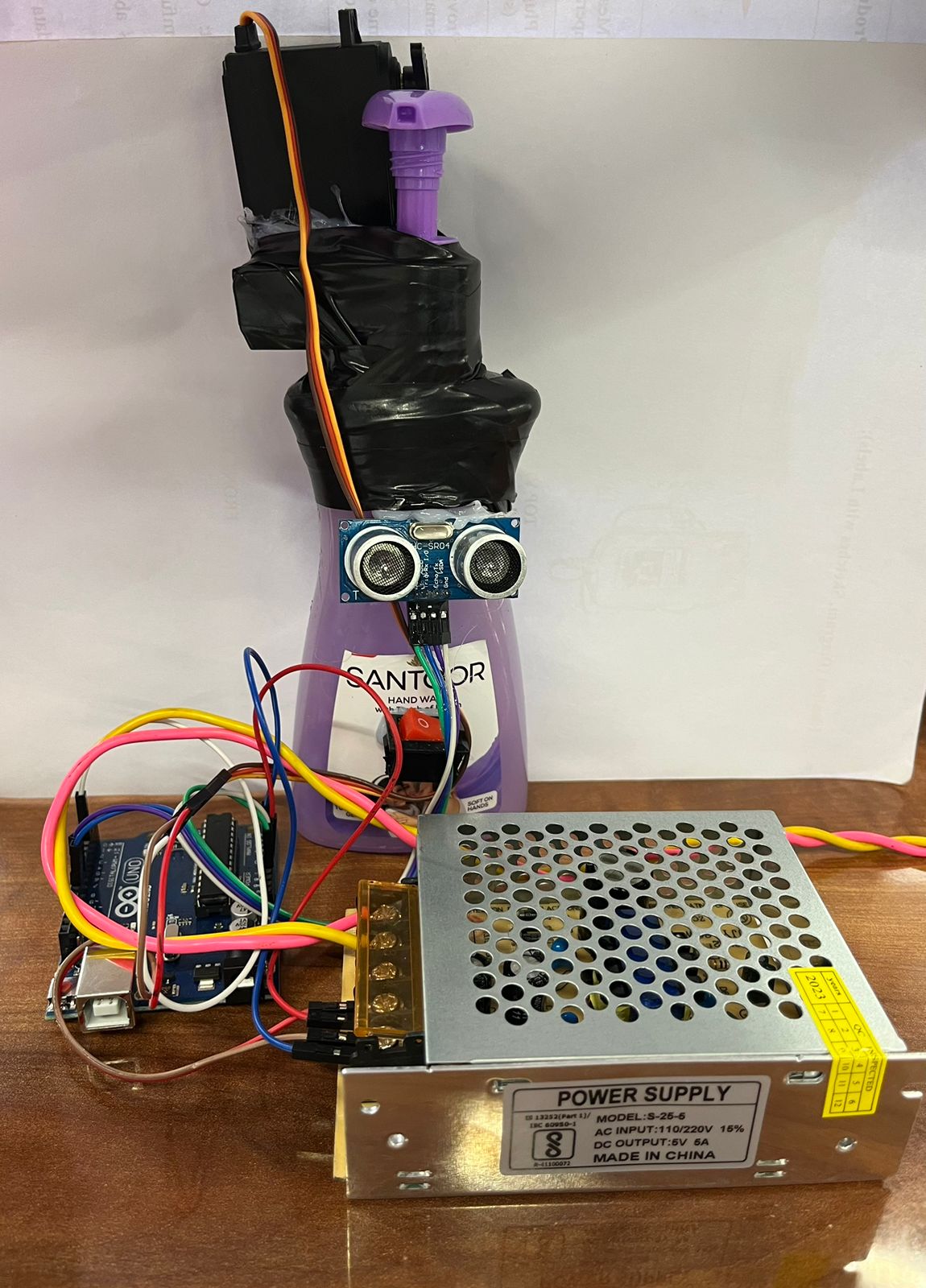
Myservo.write(90); // Reset servo position

delay(1500); // Delay before next detection

}

}

**Output:**

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