Obstacle Aware Servo Motor using PIR Sensor and Arduino

1. Aim of the Project

The aim of this project is to detect motion using a **PIR sensor** and rotate a **servo motor** to a specific angle based on motion detection using an **Arduino Uno**. The servo returns to its original position once no motion is detected. This is achieved by programming the Arduino and using the Tinkercad simulation platform for circuit design, testing, and validation.

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2. Purpose of the Project

This project demonstrates an obstacle-aware servo motor system using an Arduino Uno, a PIR (Passive Infrared) sensor, and a servo motor. The main purpose is to detect human motion through the PIR sensor and rotate the servo motor accordingly, simulating an automatic response system. When motion is detected, the servo rotates to a specified angle (90°), and when no motion is present, it returns to its initial position (0°). This helps beginners understand the basic concepts of sensor interfacing, servo control, and real-time response systems using Arduino. Such systems have practical applications in automatic door openers, smart surveillance systems, contactless dispensers, and energy-saving devices by detecting room occupancy. It provides a low-cost, simple automation prototype suitable for home and industrial uses.

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3. Application of the Project

- Automatic Door Opening System:
  The servo motor can simulate door movement based on detected human presence.
- Smart Surveillance Camera Rotation:
  A camera mounted on the servo can rotate toward motion for better monitoring.

- Contactless Hand Sanitizer Dispenser:
  Dispenses sanitizer automatically when motion is detected.
- Home Security Systems:
  Detects unauthorized movement and triggers actions like alarms or alerts.
- Energy-Efficient Lighting Systems:
  Turns lights or fans ON/OFF based on room occupancy detection.

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4. Components Required

S.NO.	Quantity	Component
1.	1	Arduino Uno
2.	1	PIR Sensor
3.	1	Servo Motor
4.	1	Breadboard
5.	multiple	Jumper Wires

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5. What is PIR Sensor? How is it used in Arduino

PIR (Passive Infrared) sensor is a motion detection device that detects the infrared radiation emitted by objects.

In Arduino, the digitalRead(pin) function reads the PIR sensor's output.
When motion is detected, the output pin goes HIGH.
When no motion is detected, the output stays LOW.

This allows Arduino to trigger actions such as rotating a servo motor.

6. Servo Motor

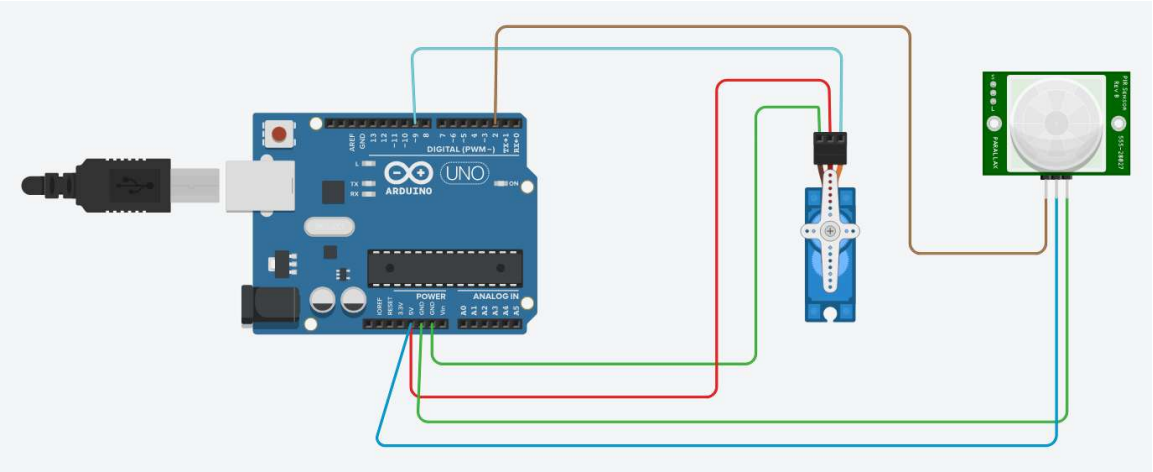
A **servo motor** is a type of actuator commonly used in automation and robotics to precisely control angular or linear position, velocity, and acceleration. It consists of a motor coupled with a sensor for position feedback and a control circuit.

In this project, the servo motor is used to rotate between 0° and 90° based on the motion detected by the PIR sensor. It is controlled by sending PWM (Pulse Width Modulation) signals from the Arduino, allowing accurate positioning. Due to its small size, reliability, and precise control.

5. Circuit Diagram

The circuit consists of:

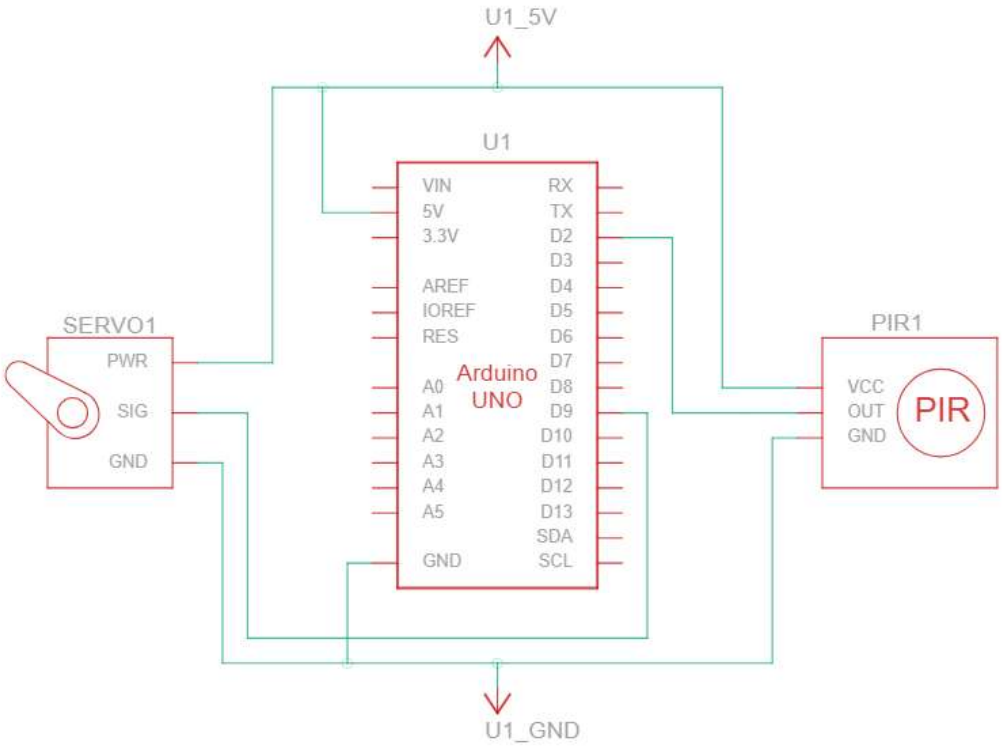
- Arduino Uno connected to PIR sensor output pin and servo motor signal pin.
- PIR sensor's VCC and GND connected to Arduino's 5V and GND respectively.
- Servo's control wire connected to PWM pin (D9), VCC and GND also to Arduino.



6. Layout (Tinkercad Simulation)

In the Tinkercad simulation:

- Mount PIR sensor and servo motor.
- Connect PIR OUT to digital pin (e.g., D2) of Arduino.
- Connect servo signal to pin (e.g., D9).



7. Code with Explanation

Let's break down and justify each part of your Arduino program step by step, based on what it's trying to achieve — likely to control a servo motor using PIR sensor detection.

Code Analysis

```
#include <Servo.h>

Servo myServo;

int pirPin = 2;      // PIR sensor output pin

int servoPin = 9;    // Servo motor control pin

int pirValue = 0;    // Variable to store PIR status

void setup() {

pinMode(pirPin, INPUT);

myServo.attach(servoPin);

myServo.write(0);   // Initial position

Serial.begin(9600);

}

void loop() {  pirValue = digitalRead(pirPin);

if (pirValue == HIGH) {

Serial.println("Motion Detected : ");

myServo.write(90);    // Rotate to 90°

delay(500);        // Wait for 1 sec

} else {

Serial.println("No Motion");

myServo.write(0);    // Return to 0°  }


delay(50); // Short delay to avoid flickering

}
```

✅ Justification:

- Pins are declared and configured for PIR and Servo.
- Servo moves to 90° when motion is detected.
- Servo resets to 0° otherwise.
- Short delay prevents noise.

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8. Conclusion

In conclusion, this project successfully demonstrates a simple yet effective obstacle-aware system using a PIR sensor and a servo motor controlled by an Arduino Uno. It highlights how motion detection can be used to automate tasks such as opening doors, activating devices, or triggering security responses. Through this project, we gained hands-on experience in sensor interfacing, servo motor control, and basic Arduino programming. The system is cost-effective, reliable, and easily scalable, making it a practical solution for real-life applications in home automation, security, and energy-efficient systems.