Mini Project Report: Rain Detector Sensor with Servo Motor

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Introduction

Rainwater can damage outdoor electronics, open windows, or delicate equipment when not promptly covered. To address this issue, a rain detection system can automatically sense rainfall and take an action such as closing a window or covering an object. This project uses a rain sensor to detect rain and a servo motor to move a flap or cover automatically. The system can be implemented in homes, greenhouses, or vehicles to prevent damage. The objective is to create a cost-effective, automatic, and reliable rain protection mechanism.

Literature Review / Background Study

Existing systems use various sensors like capacitive or resistive rain sensors, and actuators such as motors or hydraulic arms. Traditional systems either rely on manual control or are expensive. Arduino-based projects provide a low-cost alternative using a simple sensor that detects the presence of water droplets through changes in conductivity. Gaps found in earlier designs include slow response time and lack of integration with additional environmental sensors (like humidity or temperature).

Problem Statement

In many cases, equipment or openings are left exposed during rainfall, causing inconvenience and potential damage. Manual operation is not always possible. The challenge is to design an automatic rain-sensing system that detects rain and triggers a servo motor to perform protective movement quickly and efficiently.

Objectives

- To design and develop a rain detection circuit using an Arduino and rain sensor.
- To control a servo motor that automatically reacts to rainfall.
- To display the system's status (Rain Detected / No Rain) via LED or Serial Monitor.
- To create a compact and energy-efficient prototype suitable for practical applications.

Design and Implementation

Hardware Components:

- Arduino Uno
- Rain Sensor Module
- Servo Motor
- Jumper Wires and Resistors
- Power Supply

Working Principle:

When the rain sensor detects water droplets, its output changes from HIGH to LOW. The Arduino processes this signal and sends a control command to the servo motor. The servo then moves to a pre-defined position (e.g., closing a lid or window). When no rain is detected, it returns to its original position.

System Flow:

Rain Sensor → Arduino Input → Servo Motor Control Signal → Movement Action

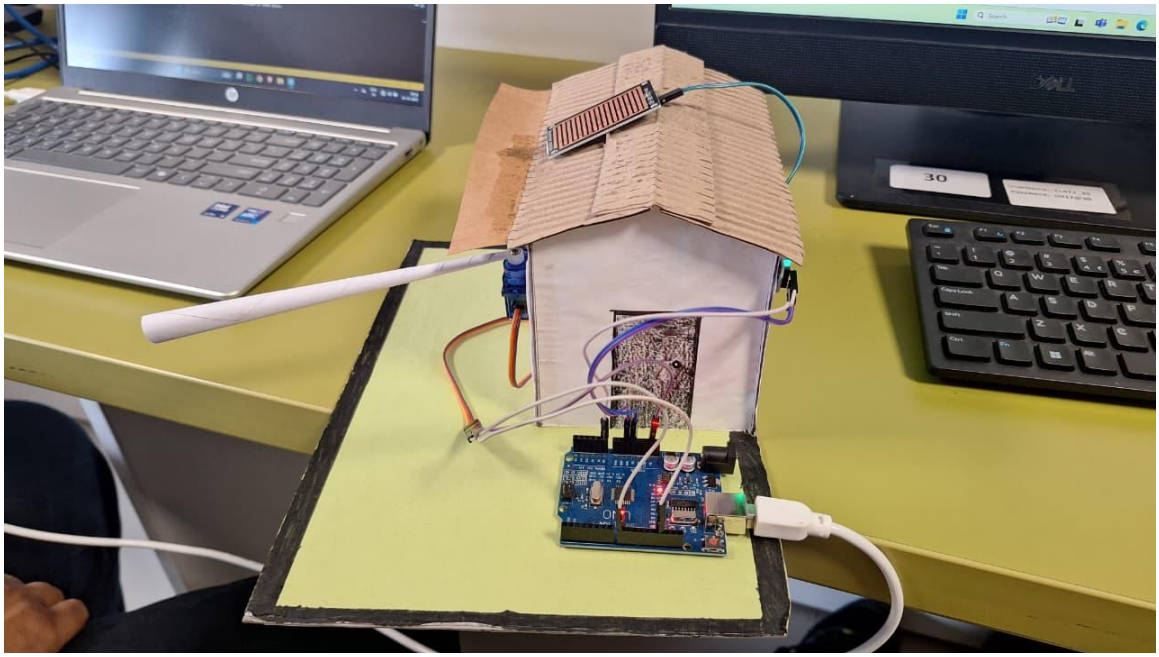
Code Snippet:

```
#include <Servo.h>

const int RAIN_SENSOR_PIN = A0;
const int SERVO_PIN = 8;

const int CLOSE_WINDOW_THRESHOLD = 680;
const int OPEN_WINDOW_THRESHOLD  = 720;

const int WINDOW_CLOSED_ANGLE = 0;
const int WINDOW_OPEN_ANGLE = 90;

enum WindowState {
 CLOSED,
 OPEN
};

WindowState currentWindowState = CLOSED;

Servo myServo;

void setup() {
 Serial.begin(9600);

 pinMode(RAIN_SENSOR_PIN, INPUT);

 myServo.attach(SERVO_PIN);
```

```
  myServo.write(WINDOW_CLOSED_ANGLE);
  currentWindowState = CLOSED;
  Serial.println("System initialized. Window is closed.");
}

void loop() {
  int sensorValue = analogRead(RAIN_SENSOR_PIN);
  Serial.print("Sensor Value: ");
  Serial.println(sensorValue);

  if (sensorValue < CLOSE_WINDOW_THRESHOLD && currentWindowState == OPEN) {
    Serial.println("Rain detected! Closing the window.");
    moveServoSmoothly(myServo.read(), WINDOW_CLOSED_ANGLE);
    currentWindowState = CLOSED;
  }
  else if (sensorValue > OPEN_WINDOW_THRESHOLD && currentWindowState == CLOSED) {
    Serial.println("It's clear. Opening the window.");
    moveServoSmoothly(myServo.read(), WINDOW_OPEN_ANGLE);
    currentWindowState = OPEN;
  }

  delay(500);
}

void moveServoSmoothly(int startPos, int endPos) {
  if (startPos < endPos) {
    for (int pos = startPos; pos <= endPos; pos++) {
      myServo.write(pos);
      delay(15);
```

```
  }
 }
 else {
  for (int pos = startPos; pos >= endPos; pos--) {
   myServo.write(pos);
   delay(15);
  }
 }
}
```

PROJECT IMAGE



Results and Discussion

The prototype successfully detected rain and activated the servo motor within seconds. The system responded consistently to moisture on the sensor plate. When dry, the servo motor returned to its original position. The test confirmed accurate detection and reliable movement. The performance can vary slightly depending on droplet size and ambient humidity.

Conclusion

The Rain Detector Sensor with Servo Motor effectively automates a simple but important environmental response. It helps protect items from rain exposure without manual intervention. The project demonstrates the potential of low-cost automation using Arduino.

Future Scope

- Integration with IoT for remote monitoring via Wi-Fi.
- Addition of temperature or humidity sensors for better weather prediction.
- Use of waterproof servo enclosures for outdoor durability.
- Implementation in smart home systems or automatic window shutters.

References

1. Arduino Documentation – https://www.arduino.cc
2. Datasheet of Rain Sensor Module (YL-83 / FC-37)
3. Servo Motor Control with Arduino Tutorials – various online resources.