NANDHA ENGINEERING COLLEGE

ERODE–638052 (Autonomous)

(Affiliated to Anna University, Chennai)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

22AIC14 – INTERNET OF THINGS AND ITS APPLICATIONS

MINI PROJECT REPORT ON

TOPIC – AUTOMATIC CLOTH COLLECTOR SYSTEM

Submitted by

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BONAFIDE CERTIFICATE

This is to certify that the project work entitled "AUTOMATIC CLOTH COLLECTOR SYSTEM" is the Bonafide work of BALAJI S(22AI003), NARESH KUMAR S (22AI027), and SRIJITH K(22AI051) who carried out the work under my supervision.

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Submitted for End semester PBL review held on _______________

AUTOMATIC CLOTH COLLECTOR SYSTEM

AIM:

To design a smart system that detects rainfall and automatically protects clothes by retracting a drying rack or deploying a cover using an ESP8266 microcontroller and servo motor. The system ensures convenience with remote monitoring via Wi-Fi and provides an energy-efficient solution for unpredictable weather.

SCOPE:

This project offers a cost-effective, energy-efficient solution for automating clothes protection during rainfall, reducing manual intervention. The system integrates an ESP8266 microcontroller, raindrop sensor, and servo motor to ensure quick response and reliability. The addition of Wi-Fi connectivity enhances user convenience, enabling remote monitoring and control. Its versatility makes it suitable for homes, dormitories, and other outdoor drying setups.

BRIEF HISTORY:

The concept of automating rain detection for protecting clothes emerged from the need to address the inconvenience of sudden rainfall, especially in regions with unpredictable weather. Early systems relied on basic mechanical setups, but advancements in microcontrollers and sensors enabled more precise and automated solutions. With the introduction of microcontrollers like the ESP8266 and the growing demand for smart home technology, this project evolved to include IoT features. These enhancements have made such systems more efficient, user-friendly, and accessible, combining rain detection with remote monitoring for greater convenience.

PROPOSED METHODOLOGY:

System Design and Component Selection:

- Choose essential components, including the ESP8266 microcontroller, raindrop sensor, servo motor, and necessary power modules.
- Design a physical structure to house the drying rack or retractable cover.

2. **Rain Detection**:
   - Use a raindrop sensor to detect rainfall and send signals to the ESP8266 for processing.

3. **Motorized Mechanism Control**:
    - Program the ESP8266 to activate the servo motor when rainfall is detected, retracting the drying rack or deploying a cover.
4. **Wi-Fi Integration for Remote Monitoring and Control**:
    - Utilize the Wi-Fi capability of the ESP8266 to enable remote operation and status monitoring through a smartphone or web interface.
5. **System Logic Implementation**:
    - Write code to ensure the rack returns to the drying position once the rain stops and incorporate delay mechanisms for stability.
6. **Testing and Optimization**:
    - Test the system under various conditions to ensure reliability and adjust sensor sensitivity and motor movements as needed.
7. **Deployment and Validation**:
    - Install the system in a real-world environment to validate its performance and user convenience.

COMPONENTS REQUIRED:

S. No	Component	Quantity
1.	ESP8266 Microcontroller	1
2.	Raindrop sensor	1
3.	Breadboard Power Supply	1
4.	Servo motor	1
5.	DC Power supply Adapter	1
6.	Jumper Wires	As required

DESCRIPTION:

1. ESP8266 Microcontroller

- The ESP8266 is a low-cost, Wi-Fi-enabled microcontroller that serves as the brain of the system.
- It processes data from the raindrop sensor and controls the servo motor based on programmed instructions.
- Its Wi-Fi capability allows remote monitoring and control of the system via smartphones or computers.

2. Raindrop Sensor

- A sensor designed to detect the presence and intensity of rain.
- It consists of a water-sensitive plate and a control module that outputs signals based on the amount of water on the plate.
- It sends a digital or analog signal to the ESP8266 when rain is detected.

3. Breadboard Power Supply

- A compact power supply module designed to fit on a breadboard.
- Provides stable and regulated 3.3V or 5V DC output to power the ESP8266 and other components.
- It ensures safe and reliable operation of the circuit components.

4. Servo Motor

- A rotary actuator that provides precise control of angular or linear position.
- In this project, it is used to move the drying rack or deploy a protective cover.
- Controlled via PWM signals from the ESP8266.

5. DC Power Supply Adapter

- Supplies power to the entire system by converting AC mains electricity to a regulated DC voltage.
- Commonly used to provide the necessary 5V or 12V to power the breadboard power supply and servo motor.

6. Jumper Wires

- Flexible electrical wires with connectors at both ends, used to establish connections between the components on the breadboard.
- Available in male-to-male, female-to-female, or male-to-female configurations, they simplify the circuit setup.

These components collectively enable the detection of rain, automated movement of the drying rack, and remote control capabilities, forming a reliable and energy-efficient system.

PROTOCOLS

1. GPIO (General Purpose Input/Output):

The ESP8266 NodeMCU utilizes GPIO pins to interface with external components like the rain sensor and servo motor. The rain sensor is connected to a digital GPIO pin (e.g., D2), and its state (rain detected or not) is read as a HIGH or LOW signal. The servo motor is controlled via PWM (Pulse Width Modulation) using a GPIO pin (e.g., D1). The ESP8266 generates PWM signals to move the servo motor to a specific angle.

2. Pulse Width Modulation (PWM) for Servo Control:

Servo motors are controlled by sending a PWM signal that determines the angle of the motor. This protocol is used by the ESP8266 to control the servo motor's position. The PWM signal typically has a frequency of 50 Hz, with a duty cycle that controls the angle of the servo. A 1ms pulse corresponds to 0 degrees. A 2ms pulse corresponds to 180 degrees. This PWM signal is generated by using the Servo.h library in the Arduino IDE, which simplifies PWM generation for controlling the servo.

3. Digital I/O for Rain Sensor:

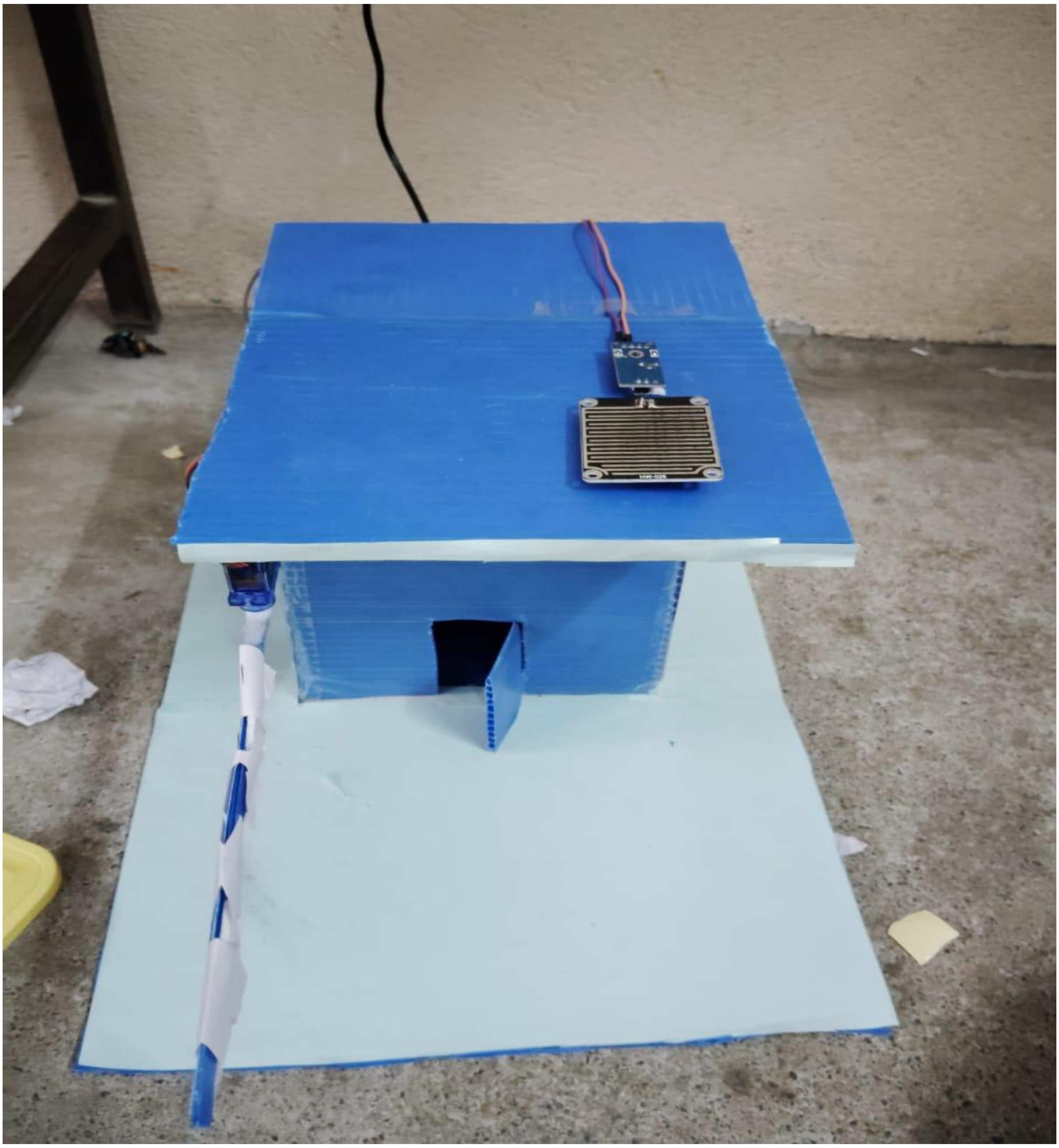
The rain sensor module typically has two outputs: Digital Output: This output sends a HIGH signal when rain is detected (when the sensor's surface is wet) and a LOW signal when there is no rain. The ESP8266 reads the digital input from the sensor and takes action based on the rain detection.

CODING:

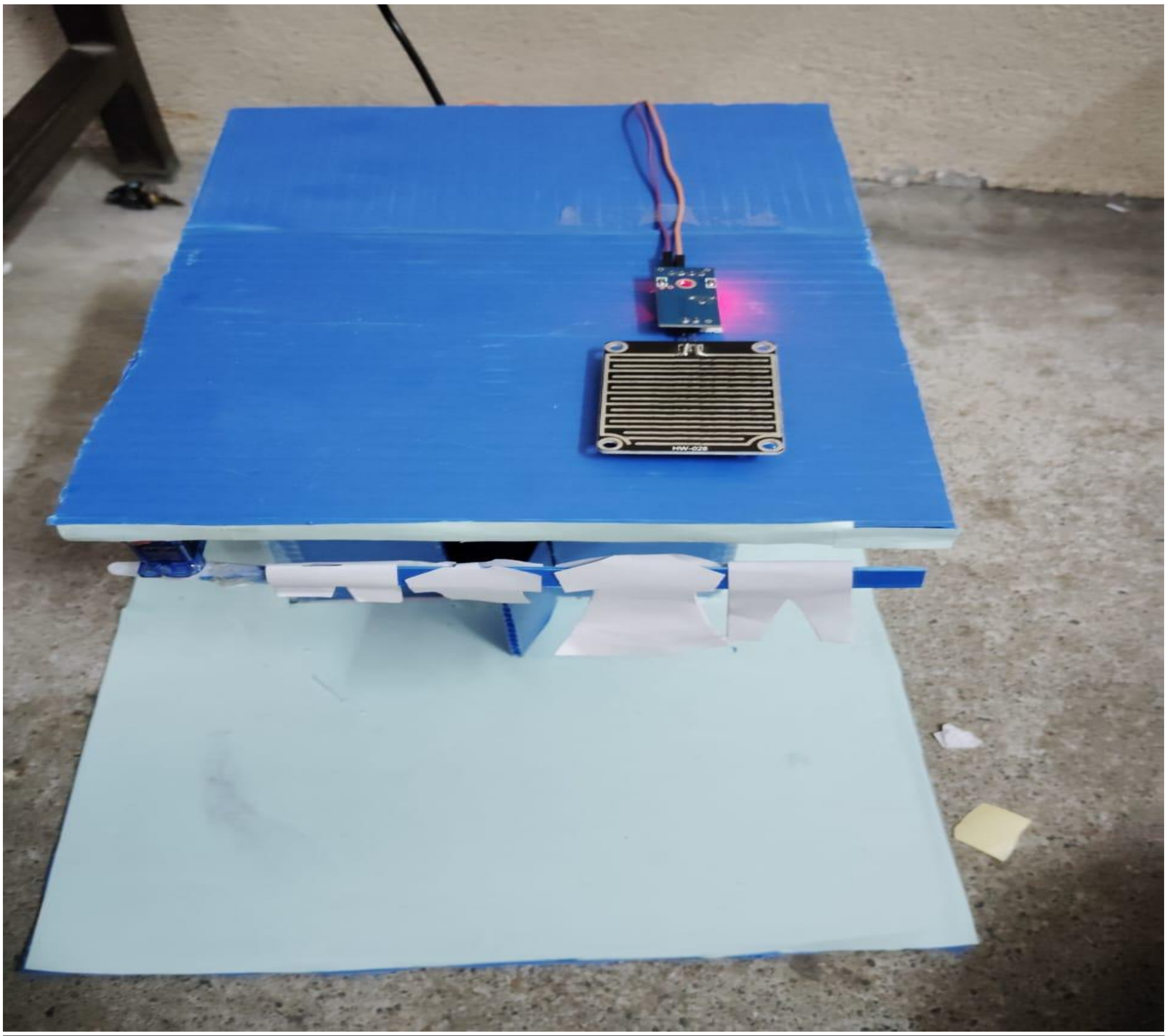
```
#include <ESP8266Servo.h> // Include the ServoESP8266 library


// Define pins

#define RAIN_SENSOR_PIN D1 // GPIO5 for the rain sensor

#define SERVO_PIN D2       // GPIO4 for the servo motor


Servo myServo; // Create a servo object


void setup() {
```

```
  // Set rain sensor pin as input
  pinMode(RAIN_SENSOR_PIN, INPUT);

  // Attach the servo to the specified pin
  myServo.attach(SERVO_PIN);

  // Initialize the servo at 0 degrees
  myServo.write(0);

  // Start the Serial Monitor
  Serial.begin(115200);
  Serial.println("Rain Detection System Initialized");
}

void loop() {
  // Read the rain sensor's digital signal
  int rainDetected = digitalRead(RAIN_SENSOR_PIN);

  if (rainDetected == LOW) { // Assuming LOW means rain detected
    Serial.println("Rain detected! Moving servo to 90 degrees.");
    myServo.write(90); // Move the servo to 90 degrees
    delay(2000); // Stabilize for 2 seconds
  } else {
    Serial.println("No rain detected. Resetting servo to 0 degrees.");
    myServo.write(0); // Reset the servo to 0 degrees
  }

  delay(500); // Small delay to debounce
}
```

SCREENSHOTS:



OUTPUT:



LIMITATIONS:

1. **Dependence on Power Supply**:
   - The system requires a consistent power supply. Power outages or fluctuations can disrupt its operation.
2. **Limited Coverage Area**:
   - The system may be designed for a specific size of drying rack or cover. Larger setups may require additional motors or sensors, increasing complexity.
3. **Sensor Sensitivity Issues**:
   - The raindrop sensor may produce false positives due to high humidity, dew, or splashes, triggering unnecessary actions.
4. **Mechanical Wear and Tear**:
   - Frequent movement of the rack or cover can cause wear on the motor and structural components over time, requiring regular maintenance.
5. **Wi-Fi Dependency for Remote Monitoring**:

- While the system can operate locally, its remote monitoring and control features rely on a stable Wi-Fi connection. Poor connectivity can limit usability.

FUTURE ENHANCEMENTS:

1. **Advanced Sensor Integration:**

   Use more robust sensors like capacitive or optical rain sensors to minimize false positives caused by humidity or splashes. Add wind sensors to retract the rack during high wind conditions, preventing damage.

2. **Energy Optimization:**

   Incorporate solar panels with rechargeable batteries to make the system energy-efficient and sustainable. Use low-power microcontrollers to reduce overall power consumption**.**

3. **Weather Forecast Integration:**

   Integrate APIs to access real-time weather data, allowing the system to act proactively based on rain forecasts**.**

4. **Improved Mechanical Design:**

   Use durable materials and weather-resistant components to increase the lifespan of the rack and motor mechanism. Design a modular setup to accommodate different drying rack sizes and configurations**.**

5. **Enhanced Wi-Fi Features:**

   Add support for mobile apps or web dashboards to provide real-time system monitoring and customization of settings like sensitivity or delay. Introduce local storage or cloud integration for logging operational data.

CONCLUSION:

The Raindrop Sense and Cloth Collector System provides an easy and efficient way to protect clothes from unexpected rain. Using an ESP8266 microcontroller, raindrop sensor, and servo motor, it automates the process and adds convenience with Wi-Fi control. This project is a practical, cost-effective solution for households, ensuring reliability and ease of use in managing clothes drying during unpredictable weather.