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Rain Detector and Automatic Cloth Collector (Iot Based)

Miss. Aditi. D. Patil[1], Akanksha Londhe[2], Tulsi Bhadane[3], Shaila Chikhale[4], Akshara Dive[5], Pratiksha Gaikwad[6]

[1]*HOD/Guide, Electronics and Communication Engineering, Y. B. Patil Polytechnic, Akurdi, Pune, India*

[2,3,4,5,6]*Students, Electronics and Communication Engineering, Y. B. Patil Polytechnic, Akurdi, Pune, India*

***Abstract*—The Rain Detector Based Automatic Cloth Collector System using NodeMCU (ESP8266) is a smart home automation project designed to protect clothes from unexpected rainfall. The system uses a rain sensor to detect rain and automatically activates a motor to collect clothes without human intervention.**

The NodeMCU enables Wi-Fi connectivity, allowing the system to send real-time notifications to the user's mobile phone and also provides remote control through a mobile application. This makes the system more efficient and user-friendly.

The project is especially useful in rural and coastal areas where clothes are dried in open spaces and are highly exposed to sudden weather changes. It reduces human effort, saves time, and prevents clothes from getting wet.

***Index Terms*—Rain Sensor, NodeMCU ESP8266, IoT, Home Automation, Automatic Cloth Collector, Mobile Notification.**

I. INTRODUCTION

1. Problem Context (Rural Area Focus)

In many rural areas, especially in regions like the Konkan belt, people commonly dry their clothes in open outdoor spaces such as courtyards, terraces, or open fields. These areas are highly exposed to environmental conditions, particularly sudden rainfall. Unlike urban areas, rural households often lack advanced infrastructure such as covered balconies, automated drying systems, or indoor drying facilities. As a result, clothes are more vulnerable to getting wet during unexpected rain.

2. Need of the Project in Rural Areas

This project is specifically designed keeping in mind the challenges faced by people in villages and coastal regions.

Key reasons:
Sudden and unpredictable rainfall in Kokan region
Clothes are dried in open spaces
No immediate human intervention available
Lack of automation facilities
The system helps in automatically collecting clothes when rain is detected, thus reducing dependency on human presence.

3. Comparison with Urban Areas

In urban cities:
- People mostly live in apartments or societies
- Clothes are dried in balconies or indoor areas
- Covered spaces protect clothes from rain

Therefore, the problem of clothes getting wet is comparatively less in urban environments.
In contrast, rural areas do not have such facilities, making this system more useful and necessary.

4. Purpose of the Project

The main purpose of this project is to:
Provide a low-cost and practical solution for rural households
Reduce manual effort in collecting clothes
Protect clothes from sudden rainfall
Introduce basic automation in villages

5. Social Impact of the Project

This project contributes to society by:
Improving daily life convenience in rural areas
Saving time and effort
Preventing repeated washing of clothes
Promoting the use of technology in villages

6. Conclusion of Justification

This project is not just a technical solution but also a socially relevant innovation aimed at improving the lifestyle of people in rural and coastal regions where such automation systems are not commonly available.

II. METHODOLOGY

The rain detector and automatic clothes collector system consists of the following key components:

- Rain Sensor Module: Used to detect the presence of rainwater on its surface.
- ESP8266 NodeMCU: Acts as the main controller with inbuilt Wi-Fi for IoT communication.
- Servo Motor (SG90): Used to precisely control the movement of the clothesline by rotating to a specific angle for automatic collection of clothes when rain is detected.
- Mobile Application (Blynk): Offers remote control and monitoring capabilities through a mobile interface.
- Notification System: Sends alerts to the user when rain is detected.
- Jumper Wires: Used to make electrical connections between different components in the circuit for proper signal and power transmission.
- Power Supply Unit: Provides required power to all components.

The rain sensor is placed in an open area where it can directly detect rainfall. When raindrops fall on the sensor, it changes its electrical conductivity, generating a signal. This signal is sent to the ESP8266 NodeMCU.

The ESP8266 processes the signal and determines whether rain is present or not. Since it has built-in Wi-Fi capability, it connects to the internet and communicates with a mobile application (such as Blynk).

When rain is detected, the system automatically activates the motor through a motor driver or relay module. The motor then rotates in such a way that it pulls the clothesline inside, protecting clothes from getting wet. At the same time, a notification is sent to the user's smartphone indicating that rain has been detected and clothes are being collected.

The user can also manually control the system using the mobile application, allowing them to open or close the clothesline remotely.

III. DETAILED WORKING OF EACH COMPONENT

Fig 1: Shows the rain sensor module with detection plate, control board, and connecting wires.

The rain sensor consists of a sensing plate with conductive tracks designed to detect the presence of water droplets. When rainwater falls on the surface, the resistance between these conductive tracks decreases due to the conductive nature of water. This change in resistance is converted into an electrical signal. The generated signal is then sent to the NodeMCU for further processing. The rain sensor module can provide both analog and digital outputs, allowing flexibility in detecting different levels of rainfall intensity.

Fig 2: Shows the NodeMCU microcontroller board used for IoT applications and wireless communication.

The ESP8266 NodeMCU acts as the central controller of the entire system. It continuously reads the input signals from the rain sensor and processes the data to determine whether rain is present. Since it has built-in Wi-Fi capability, it connects to the internet and communicates with the mobile application. Based on the sensor input, the NodeMCU sends commands to control the motor and also triggers notifications. It plays a key role in enabling IoT-based monitoring and remote access.

Fig 3: Depicts the TowerPro SG90 Micro Servo used for precise angular position control in embedded systems.

A servo motor is a rotary actuator used for precise control of position and movement in automation systems. It works on the principle of Pulse Width Modulation (PWM), where the microcontroller sends signals to control the angle of the motor shaft, usually between 0° and 180°. It consists of a DC motor, gears, a position sensor, and a control circuit that ensures accurate movement. In this project, the servo motor is used to move the clothesline and automatically collect clothes when rain is detected.

Fig 4: Shows the Blynk platform integrated with NodeMCU ESP8266 for wireless IoT-based control using a mobile application.

The mobile application is used for real-time monitoring and control of the system. It displays the current status of the environment, such as whether rain is detected or not. The user can also manually control the motor using the app interface, allowing flexibility in operation. The application is connected to the NodeMCU via the internet, enabling remote access from anywhere. It also provides aeasy-to-use interface for better user interaction.

Fig 5: Shows jumper wires used for making connections between electronic components in a circuit.

Jumper wires are used to make electrical connections between different components in the circuit such as the ESP8266 NodeMCU, sensor module, motor driver, and other parts of the system. They help in transferring signals and power from one component to another without the need for permanent soldering. In this project, jumper wires ensure flexible and reliable connections during circuit assembly and testing, making it easy to modify or debug the system whenever required.

IV. OVERALL ARCHITECTURE OF THE SYSTEM

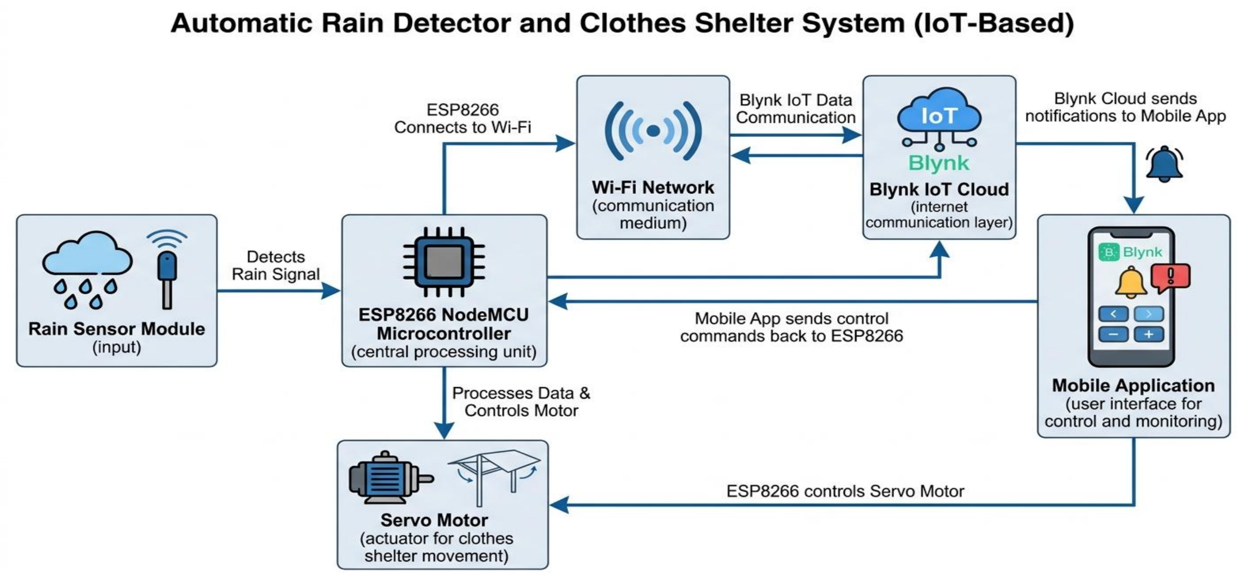

Fig 6: System architecture

The circuit diagram of the Rain Detector and Automatic Cloth Collector using IoT (ESP8266) represents the electrical connections between various components such as the power supply, rain sensor module, NodeMCU (ESP8266), servo/DC motor, and the communication interface. This diagram illustrates how all components are interconnected to achieve automatic as well as remote-controlled operation of the system.

The power supply unit is responsible for providing the required electrical energy to the entire system. The NodeMCU operates on a regulated voltage (typically 3.3V/5V), while the motor may require a higher voltage supply. A stable power source ensures proper functioning of all components without interruption.

The rain sensor module is connected to the input pins of the NodeMCU. It continuously detects the presence of rainwater on its sensing plate. When water droplets fall on the sensor, it produces a signal (analog or digital), which is transmitted to the NodeMCU. This signal acts as the input for further processing.

The NodeMCU (ESP8266) is the central processing unit of the circuit. It receives input from the rain sensor through its GPIO pins and processes the data according to the programmed logic. Based on this input, the NodeMCU decides whether to activate or deactivate the motor. It also handles communication with the mobile application using its built-in Wi-Fi module.

The Wi-Fi connectivity of the ESP8266 enables the system to connect to the internet. Through this connection, data is exchanged between the hardware system and the Blynk IoT platform. This allows real-time monitoring, control of the system using a smartphone.

The Blynk application acts as the user interface. It receives notifications when rain is detected and displays system status. Additionally, it provides manual control options, allowing the user to operate the motor remotely if required.

The servo motor or DC motor is connected to the output pins of the NodeMCU (directly or through a driver circuit). It acts as the actuator of the system. When triggered, the motor rotates and drives the clothesline mechanism, pulling the clothes to a safe indoor or covered area.

All components in the circuit are interconnected through proper wiring, ensuring smooth signal transmission and power distribution. The correct connection of input, output, and communication lines is essential for the efficient working of the system.

Overall, the circuit diagram demonstrates how sensing, processing, communication, and actuation are integrated into a single system. This design ensures automatic detection of rain, timely action through motor operation, and real-time user interaction via IoT, making the system reliable, efficient, and user-friendly.

V. REAL LIFE IMPLEMENTATION

A. Rural & Coastal Household Clothes Protection System

Use Case: Protecting Clothes from Sudden Rainfall

In rural and coastal areas (such as Konkan), clothes are usually dried in open spaces like courtyards or terraces. Sudden rainfall can wet the clothes, causing inconvenience and repeated washing.

Implementation:

- A rain sensor is installed in an open area to detect rainfall.
- The ESP8266 NodeMCU processes the signal from the sensor.
- A servo/DC motor is connected to the clothesline mechanism.
- When rain is detected, the motor automatically pulls the clothes into a safe, covered area.
- The system is connected to Wi-Fi and Blynk IoT platform.
- A notification is sent to the user's mobile phone when rain is detected.
- The user can also control the system remotely through the mobile app.

Impact:

- Prevents clothes from getting wet because of unexpected rain.
- Reduces manual effort and saves time.
- Minimizes repeated washing → saves water and energy.
- Provides a smart and affordable solution for rural households.

B. Smart Home Automation for Urban Users

Use Case: Remote Monitoring and Control of Clothesline

In modern homes, users may not always be present to monitor weather conditions and protect clothes.

Implementation:

- The system uses ESP8266 with Wi-Fi connectivity to connect with mobile applications.
- The Blynk app provides real-time updates about weather conditions.
- Users receive instant alerts when rain is detected.
- The clothesline mechanism can be controlled manually from anywhere using the mobile app.

Impact:

- Enhances convenience and user control.
- Enables remote access and monitoring.
- Supports smart home ecosystem integration.

C. Hostel / Apartment Shared Drying Areas

Use Case: Managing Clothes in Shared Drying Spaces

In hostels or apartments, clothes are dried in common areas where users cannot always monitor them.

Implementation:

- A centralized system is installed in the drying area.
- The rain sensor detects rain and triggers automatic collection.
- The system sends notifications to multiple users via IoT platform.
- Clothes are moved to a protected area using motor mechanism.

Impact:

- Prevents damage to clothes in shared spaces.
- Reduces dependency on individuals.
- Improves efficiency in shared environments.

D. Smart Laundry / Small Scale Commercial Use

Use Case: Protecting Clothes in Laundry Services

Small laundry businesses often dry clothes outdoors, making them vulnerable to sudden rain.

Implementation:

- The system is installed in outdoor drying areas.
- Rain detection triggers automatic collection of clothes.
- Notifications are sent to the laundry operator.
- The system ensures continuous monitoring without manual supervision.

Impact:

- Prevents financial loss due to wet clothes.
- Improves service reliability.
- Reduces manual labor and supervision.

VI. ADVANTAGES OF SMART DRAINAGE MONITORING SYSTEM

- Automatic Protection of Clothes

The system continuously monitors weather conditions using a rain sensor and automatically collects clothes when rainfall is detected. This helps prevent damage, wetting, and repeated washing of clothes.

- IoT-Based Remote Monitoring and Control

With the help of ESP8266 NodeMCU, the system is connected to Wi-Fi and can be monitored or controlled through a mobile application. Users can operate the system from anywhere, even when they are not at home.

- Real-Time Notification System

The system sends instant alerts to the user's smartphone when rain is detected. This ensures quick awareness and allows users to verify system activity in real time.

- Reduces Manual Effort and Human Intervention

The automatic operation eliminates the need for continuous weather monitoring or manual collection of clothes. This is especially useful when users are away or busy.

- Time Saving and Efficient Operation

Since the system responds immediately to rain detection, it reduces delay compared to manual actions. This improves efficiency and ensures timely protection of clothes.

- Low Cost and Easy to Implement

The system is built using simple and widely available components such as a rain sensor, NodeMCU, and motor driver. This makes it affordable and suitable for domestic use and student projects.

- Energy Efficient System

The system operates only when rain is detected, which reduces unnecessary power consumption and improves overall efficiency.

- Suitable for Smart Home Automation

It can be easily integrated into smart home systems, making daily household tasks more automated and convenient.

- Simple Maintenance and Reliable Operation

The use of fewer mechanical parts and sensor-based control makes the system easy to maintain and reliable over long-term use.

- Expandable and Upgradeable System

The project can be further enhanced by adding features like humidity sensing, weather forecasting, solar power supply, or AI-based prediction systems for smarter automation.

VII. FUTURE SCOPE

- Weather Prediction Integration

The system can be improved by adding weather forecasting APIs so that it can predict rain in advance and act proactively before rainfall actually starts.

- Advanced IoT Cloud Monitoring

Instead of only mobile app control, the system can be connected to cloud platforms for storing data, analyzing patterns, and monitoring performance over time.

- AI-Based Smart Decision System

Artificial Intelligence can be used to analyze weather trends, humidity, and past data to make smarter and more accurate decisions about clothes protection.

- Humidity and Temperature Sensors Integration

Adding sensors like humidity and temperature sensors will help the system better understand environmental conditions and improve decision accuracy.

- Solar Power Integration

The system can be made more energy efficient by using solar panels, making it suitable for outdoor installations and reducing electricity dependency.

- Advanced Mobile Application Features

The mobile app can be upgraded with features like manual override, live system status, history logs, and voice control integration.

- Full Smart Home Integration

The system can be integrated with other smart home devices like smart lighting, doors, and security systems for a complete home automation setup.

- Camera and Security Monitoring

A camera module can be added to monitor clothes area for safety, theft detection, or real-time visual confirmation of system operation.

- Improved Mechanical Design

More advanced mechanical structures like retractable robotic clotheslines or automated folding systems can be implemented for higher efficiency.

- Large Scale Deployment

The system can be expanded for use in apartments, hostels, hotels, and industrial laundry systems where automation is required on a larger scale.

VIII. CONCLUSION

This study's Drainage Monitoring System provides a creative, economical, and effective way to monitor drainage networks in real time. This system efficiently detects obstructions, abnormal flow rates, and temperature changes in pipes by combining flow sensor, a capacitive water level sensor, a temperature sensor, a GSM module, and a 16x2 LCD display with an Arduino Uno. By ensuring that maintenance personnel receive timely information, a GSM-based alarm mechanism lowers the risk of flooding, contaminated water, and infrastructure damage.

This system's adaptability and scalability are demonstrated by its real-world application in sewage treatment plants, industrial wastewater management, urban drainage networks, and agricultural irrigation systems. It is a cost-effective and environmentally friendly substitute for conventional drainage monitoring techniques due to its low power consumption. Additionally, the technology lowers operating costs and minimizes environmental hazards by enabling preventive maintenance.

To further increase precision and effectiveness, future developments may incorporate machine learning algorithms, AI-driven predictive maintenance, and IoT-based cloud monitoring. The system's viability in remote areas can also be increased by including solar power.

To sum up, this Drainage Monitoring System is a smart, scalable, and dependable method of managing drainage in the current world. It improves environmental safety, public health, and infrastructure longevity, making it a crucial instrument for sustainable water management in cities and industries.

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