Automatic Rain Sensing Window Using Arduino

Dr. Vijay B. Jadhav [1], Archana B. Pathare [2], Vikrant A. Mallav [3]
Student Aditya Vidaya [4], Anikat Jasud [5]
[1,2,3] Department of Mechanical / Electronics Engineering
S.P.I.T. Polytechnic, Maharashtra, India

Abstract

Automation in buildings and smart homes is increasing rapidly to improve comfort, safety, and energy efficiency. One common issue faced in homes and offices is leaving windows open during unexpected rainfall, which may lead to water entering rooms and damaging furniture, electronics, and documents. This paper presents the design and development of an Automatic Rain Sensing Window system that detects rain and automatically closes the window using a motorized mechanism. The system uses a rain sensor module, Arduino microcontroller, motor driver, and DC motor. When rainwater is detected by the sensor, a signal is sent to the controller which activates the motor to close the window automatically. The system is simple, cost-effective, and suitable for smart home applications. Experimental testing shows that the system responds quickly to rain detection and provides reliable protection against water entry.

Keywords: Rain Sensor, Arduino UNO, Smart Home Automation, DC Motor, Automatic Window Control

1. Introduction

Smart home technologies are becoming increasingly popular due to their ability to improve convenience, safety, and energy efficiency. Automation systems can perform tasks automatically without human intervention.

Rainfall is a natural phenomenon that can create problems if windows are left open. Water entering through open windows may damage furniture, electronic devices, documents, and interior structures. Therefore, an automatic system that detects rain and closes windows can provide significant protection.

The Automatic Rain Sensing Window system is designed to detect rainfall using a rain sensor and automatically close the window through a motorized mechanism controlled by an Arduino microcontroller. The proposed system provides a low-cost and reliable solution suitable for residential and commercial buildings.

2. Problem Statement

Many people forget to close windows when leaving their homes or offices. Sudden rainfall may cause water to enter the room which results in several problems:

- Damage to furniture and electronic equipment
- Water leakage inside buildings
- Electrical hazards
- Damage to important documents

Therefore, there is a need for an automatic system that detects rainfall and closes windows without human intervention.

3. Objectives

The main objectives of this project are:

1. To design an automatic rain detection system.
2. To automatically close windows when rain is detected.

3.   To protect indoor equipment from rainwater damage.
4.   To reduce human effort.
5.   To develop a low-cost smart home automation system.

4. Literature Review

Several researchers have worked on rain detection and automation systems. Previous studies mainly focused on automatic car wipers and smart building control systems.

Research by **Dr. Mohan Kumar (2023)** presented an automatic rain sensing window using advanced control circuits. However, the system was complex and expensive.

Another study published in **International Research Journal of Engineering and Technology** proposed an Arduino-based rain detection system. Although the system worked efficiently, sensor sensitivity issues sometimes caused false detection.

Recent studies suggest that using adjustable threshold rain sensors such as the FC-37 module improves detection accuracy and reliability.

The present study focuses on developing a simple, low-cost, and efficient automatic rain sensing window system.
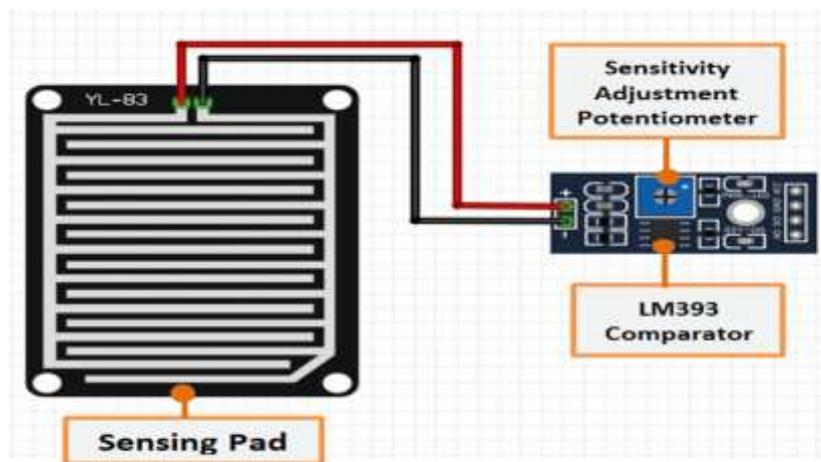
Methodology

Fig. 01 Process Diagram

The methodology followed in this project includes the following steps:

1.   Study of rain sensing technology
2.   Selection of electronic components
3.   Circuit design and development
4.   Programming of the microcontroller
5.   Installation of motor mechanism
6.   System testing and evaluation

The system uses the following main components:

- Rain Sensor (FC-37)
- Arduino UNO Microcontroller

- L298N Motor Driver
- DC Motor
- Power Supply

The rain sensor detects water droplets and sends signals to the Arduino microcontroller. The Arduino processes the signal and activates the motor through the motor driver to close the window.

6. System Architecture

The system architecture consists of the following blocks:

- Rain Sensor
- Arduino Microcontroller
- Motor Driver
- DC Motor
- Window Mechanism
- Power Supply

Working Process:

1. Rain sensor detects water droplets.
2. Sensor sends signal to Arduino.
3. Arduino processes the signal.
4. Motor driver activates the DC motor.
5. Motor rotates and closes the window.

7. Components Used

Rain Sensor

The rain sensor detects the presence of water droplets on its conductive surface. When water falls on the sensor plate, electrical conductivity increases and a signal is generated.

Arduino UNO

The Arduino UNO is a microcontroller board based on the ATmega328P. It processes signals from the sensor and controls the motor driver.

Motor Driver (L298N)

The L298N motor driver module controls the direction and speed of the DC motor.

DC Motor

The DC motor provides the mechanical motion required to close the window.

8. Working Principle

The rain sensor continuously monitors the presence of water droplets. When rain falls on the sensor surface, the electrical resistance decreases and a signal is sent to the Arduino microcontroller.

The Arduino processes the signal and sends a command to the motor driver. The motor driver activates the DC motor which rotates and closes the window through a mechanical linkage system.

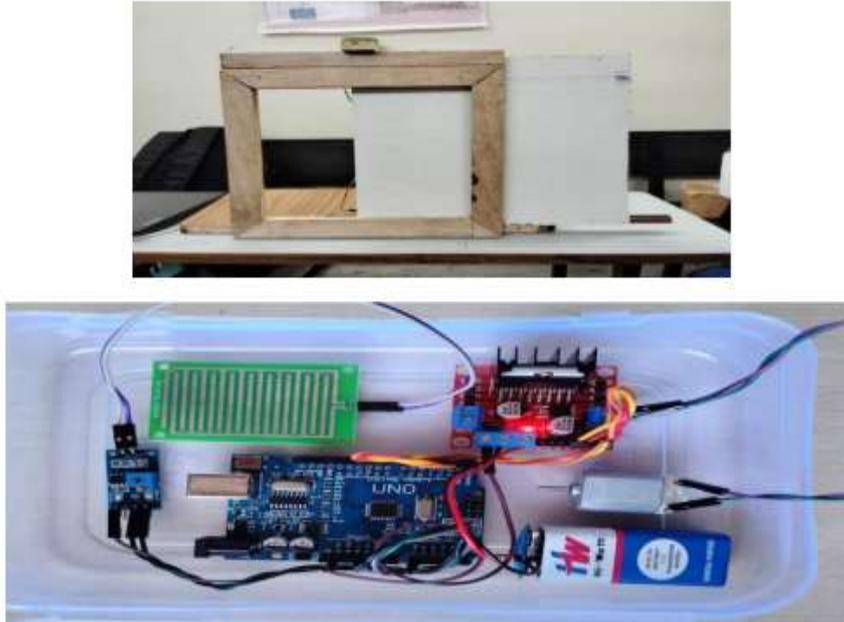Once the rain stops, the window can be reopened manually or automatically.

Fig.02 Project Working

9. Design Considerations

The motor torque required for the window mechanism can be calculated using:

[Torque = Force \times Distance]

Proper motor selection ensures smooth window movement and reliable operation.

Gear mechanisms such as rack-and-pinion or lead screw systems can be used to convert rotational motion into linear motion.

10. Results and Testing

The system was tested by spraying water on the rain sensor.

Observations:

- Rain sensor detected water successfully
- Arduino processed the signal correctly
- Motor activated automatically
- Window closed within a few seconds

The system demonstrated reliable operation and effectively prevented rainwater from entering the room.

11. Advantages

- Automatic window control
- Prevents rainwater damage
- Reduces human effort
- Low-cost system
- Suitable for smart homes

12. Applications

- Smart homes
- Office buildings
- Greenhouses
- Automated ventilation systems
- Smart agriculture

13. Future Scope

Future improvements may include:

- IoT-based monitoring system
- Mobile app control
- Solar-powered system
- Integration with smart home automation

14. Conclusion

The Automatic Rain Sensing Window system successfully detects rainfall and automatically closes the window using a motorized mechanism. The system is simple, cost-effective, and reliable. Experimental results demonstrate that the system responds quickly and effectively protects indoor environments from rainwater damage. The proposed design can be easily implemented in residential and commercial buildings and can be further enhanced with IoT-based technologies.

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