Project Report

Course Code: CSE224
Title: Rain Alert System

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Rain Alert System

ABSTRACT:

A rain sensor is a switch-like device that gets activated by rainfall. It has two primary uses: one is for automatic irrigation systems, and the other is for the automatic operation of windshield wipers. This project aims to design a rain detection system that employs a rain sensor to sense rainfall. The rain sensor detects any rain falling on it, senses it, and performs the necessary actions. This system is managed through an Arduino. An Arduino UNO board is sufficient to control and interface with the rain sensor. The sensor's movement is controlled using a rain control module, which is managed by the Arduino Uno board acting as a microcontroller. The signal from the sensor is processed using the "Processing Development Environment Software," which provides the output.

Keywords—Rain Sensor Module, Arduino Uno, Rain Alert System

Introduction:

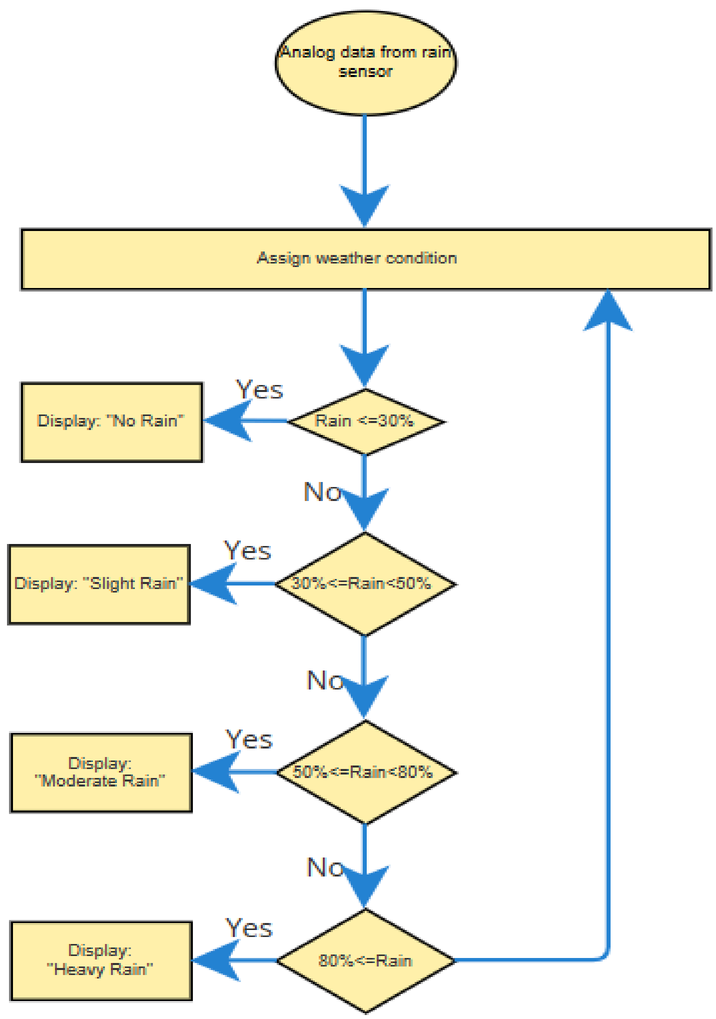
a. ***Problem Statement:*** In regions characterized by unpredictable weather conditions, the accurate monitoring of rainfall is crucial for applications such as agriculture, flood prediction, and water resource management. The existing rain sensors often lack the capability to measure rainfall intensity or level. Therefore, this project addresses the need for a cost-effective rain detector that not only identifies rain but also quantifies its intensity.

b. ***IoT Device:*** To achieve this goal, a rain detector circuit employing a raindrop sensor is designed. The project also implements a rain level measurement system using either an Arduino or Raspberry Pi and other essential components. Logic gates, including AND, OR, and NOT gates, are used to process the sensor data.

c. ***Implementation:*** The components used in the project include a raindrop sensor for detection, an Arduino or Raspberry Pi microcontroller, and an LCD display or IoT integration for real-time data visualization. Rain sensors are commonly used in automatic irrigation systems to prevent unnecessary watering when it's already raining. They are also used in weather stations for collecting precipitation data.

Methodology:

1. ***Working Flowchart:*** The rain detector system begins with the deployment of a raindrop sensor to detect rain. The data is then processed using logic gates. The microcontroller facilitates communication between these components, and the results are displayed on an LCD screen or transmitted to the cloud for IoT integration.



Description of Each Steps:

i. ***Raindrop Sensor Placement:*** Position the raindrop sensor outdoors to detect rain by generating a signal upon contact with raindrops.

ii. ***Microcontroller Interface:*** Use an Arduino to collect data from the raindrop sensor .

iii. ***Data Visualization:*** Display real-time rain status and rainfall level on an LCD screen, and optionally, transmit data to the cloud for remote monitoring.

iv. ***IoT Integration (Optional):*** Utilize IoT services to send rainfall data to the cloud for remote monitoring and analysis.

Circuit Diagram:

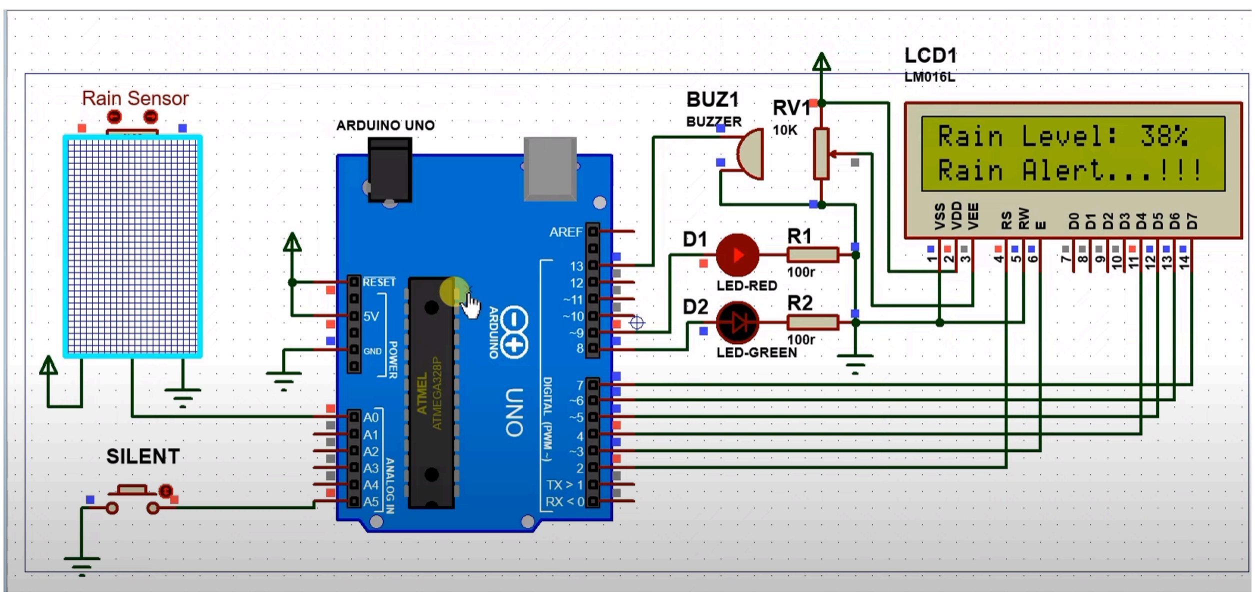


Fig 01 : Circuit Diagram

Description of Equipments: The equipment used includes a raindrop sensor, Arduino UNO microcontroller, jumper cable, LED, Buzzer, Battery (12V), BreadBoard, and an 16X2 LCD display.

1. Arduino Uno R3:

The Arduino UNO is an open-source, programmable microcontroller board that is versatile, and simple to use. It is used in a wide range of electronic projects. Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.

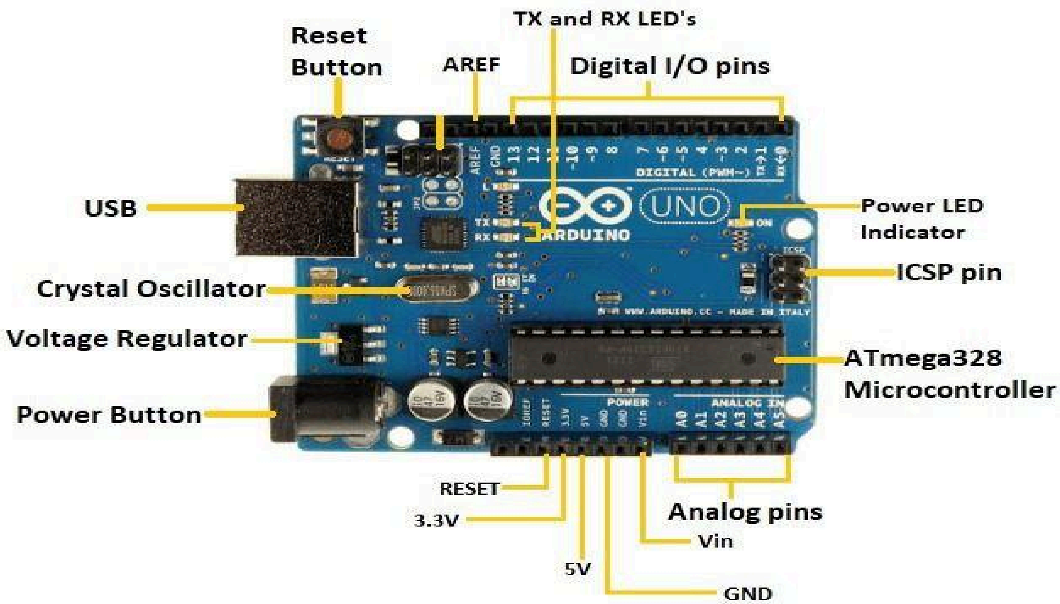


Fig 02 : Arduino Uno R3

The components of Arduino Uno R3:

- ***ATmega328:*** This is the brain of the board in which the program is stored.
- ***Ground Pin:*** There are several ground pins incorporated on the board.
- ***PWM:*** The board contains 6 PWM pins. PWM stands for Pulse Width Modulation, using this process we can control the speed of the servo motor, DC motor, and brightness of the LED.
- ***Digital I/O Pins:*** There are 14 digital (0-13) I/O pins available on the board that can be connected with external electronic components.
- ***Analogue Pins:*** There are 6 analogue pins integrated on the board. These pins can read the analogue sensor and can convert it into a digital signal.
- ***AREF:*** It is an Analog Reference Pin used to set an external reference voltage.

- ***Reset Button:*** This button will reset the code loaded into the board. This button is useful when the board hangs up, pressing this button will take the entire board into an initial state.
- ***USB Interface:*** This interface is used to connect the board with the computer and to upload the Arduino sketches (Arduino Program is called a Sketch)
- ***DC Power Jack:*** This is used to power up the board with a power supply.
- ***Power LED:*** This is a power LED that lights up when the board is connected with the power source.
- ***3.3V:*** This pin is used to supply 3.3V power to the breadboard/project.
- ***5V:*** This pin is used to supply 5V power to the breadboard/projects.
- ***Vin:*** It is the input voltage applied to the UNO board.
- ***Voltage Regulator:*** The voltage regulator controls the voltage that goes into the board.

2. LCD(16X2):

LCD is an abbreviation for liquid crystal display. This particular type of electronic display module is utilized in a wide range of circuits and gadgets, computers, calculators, cell phones, and more. The primary advantages of utilizing this module are its low cost, easy programming, animations, and limitless display options for unique characters, special effects, among other things.

Fig 03 : LCD (16X2)

The components of LCD(16X2):

- ***Ground/Source Pin(Pin1):*** This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- ***VCC/Source Pin(Pin2):*** This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- ***V0/VEE/Control Pin(Pin3):*** This pin controls the display's difference and is used to connect a variable POT that can supply voltages between 0 and 5 volts.
- ***Register Select/Control Pin(Pin4):*** This pin connects to a microcontroller unit pin and toggles between the command and data registers, obtaining a value of 0 or 1(0 = data mode, and 1 = command mode).
- ***Read/Write/Control Pin(Pin5):*** This pin, which is connected to a microcontroller unit pin to receive either 0 or 1, toggles the display between the read and write modes (0 = Write Operation, and 1 = Read Operation).
- ***Enable/Control Pin(Pin6):*** This pin should be held high to execute the Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- ***Data Pins(Pins 7-14):*** Data is sent to the display using these pins. Two-wire modes such as 4-wire mode and 8-wire mode are used to connect these pins. Only four pins, such as 0 to 3, are connected to the microcontroller unit in 4-wire mode; in contrast, eight pins, such as 0 to 7, are connected to the microcontroller unit in 8-wire mode.
- ***6+ve pin of the LED(Pin15):*** This pin is connected to +5V
- ***-ve pin of the LED(Pin16):*** This pin is connected to GND.

3. Rain Sensor Module:

The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. When raindrops fall on the sensor surface, they cause changes in the electrical conductivity of the material. This change is then detected by the sensor. Then it produces an output signal that correlates with the presence or intensity of rainfall. This signal can be analog or digital, depending on the sensor's design.

Fig 04 : Rain Detector Sensor Module

4. <u>**Breadboard:**</u>

A breadboard is a sort of prototype platform used for temporarily testing and evaluating the circuit designs of electronics projects. It is made up of a plastic board with a number of linked metal clips that allow electrical components to be readily inserted and attached.

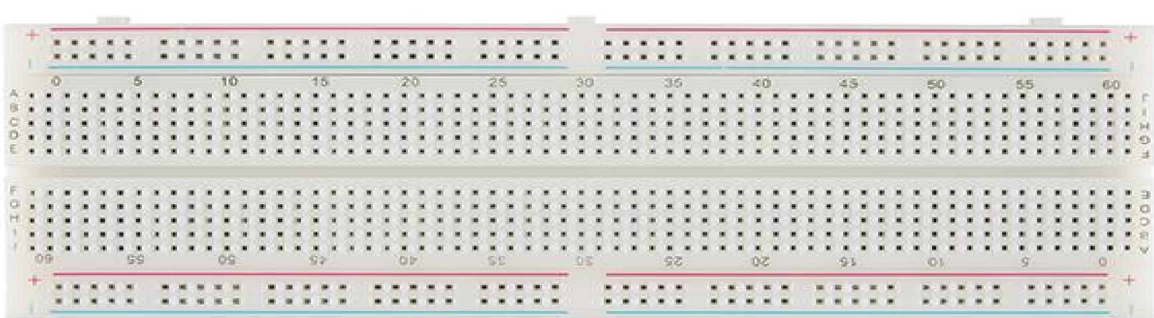


Fig 05 : Breadboard

5. <u>**Jumper Wires:**</u>

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboard and other prototyping tools in order to make it easy to change a circuit as needed.

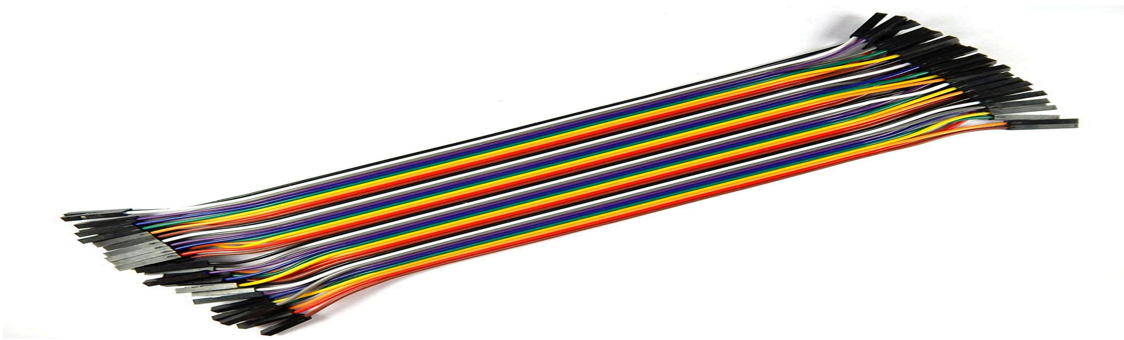


Fig 06 : Jumper Cable / Wire

*6. <u>**DC Motor Driver:**</u>*

A motor driver is an electronic device or circuit that controls the movement and direction of an electric motor. It is commonly used to interface motors with microcontrollers, such as Arduino or Raspberry Pi, to control the speed and direction of the motor. Motor drivers are essential for robotics, automation, and various electromechanical applications. Here we use L298N Dual H-Bridge Motor Driver. This is a popular motor driver for controlling DC motors. It allows bidirectional control (forward and reverse) and speed control. It's suitable for low- to medium-power applications.

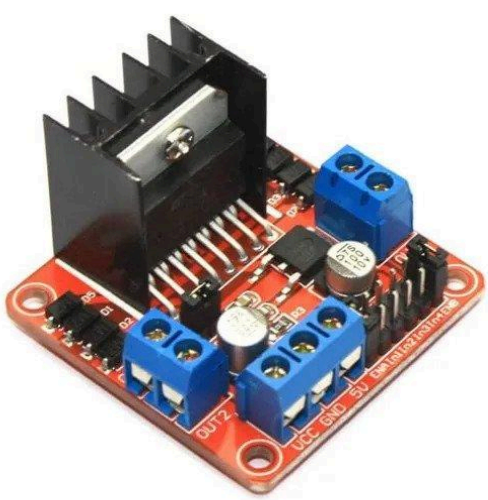


Fig 07 : L298N Dual H-Bridge Motor Driver

7. __DC Motor:__

DC (Direct Current) motors are devices that convert electrical energy into mechanical energy. They operate on the principle of electromagnetic induction, where a current-carrying conductor in a magnetic field experiences a force. DC motors are widely used in various applications due to their simplicity, ease of control, and reliability.

Fig 08 : DC Motor (100 RPM)

8. __Buzzer:__

The buzzer active 5v module is an active piezo buzzer module useful for creating sound and alerting the falling of rain water on the sensor module.

Fig 09 : Buzzer(5v)

Effect on Society and Environment:

Accurate rainfall data is vital for applications such as agriculture and flood prediction. This project contributes to societal well-being by providing a cost-effective solution for reliable rain detection and measurement. Additionally, the project emphasizes environmental sustainability by promoting efficient water resource management.

Discussion:

The project successfully combines the simplicity of raindrop sensors with the precision of tipping bucket rain gauges, providing a comprehensive rain detection and measurement system. Real-time data display and optional IoT integration enhance the project's utility for various applications. A summary of project procedures is presented along with a photograph showcasing the completed rain detector system.

1. First of all, we connect our 16X2 LCD Display with Arduino. To do that we use Arduino pin 2, 3, 4, 5, 6, 7.
2. Now we connect the Rain Sensor Module with Arduino and the source.
3. We also connect a potentiometer to control the contrast of the Display, Green LED, Red LED to understand the rain level, and a Buzzer for alarm, and a push button to stop the buzzer.
4. Additionally we connect a motor driver with our Arduino UNO to control two DC motors which will provide us an automatic shelter service while rainfall.
5. Now after all connection, to combine and maintain all the stuffs using Arduino, we wrote a code in C via Arduino IDE and upload it to the Arduino Server.
6. After uploading the code in Arduino we check our project using some artificial rainfall.
7. When the rain level is above 30% the red LED will get power and buzzer will give us alert. At the same time the DC motor will give a shelter over our yard

automatically and if the rain stops the DC motors will spin reversely to remove the shelter over the yard.

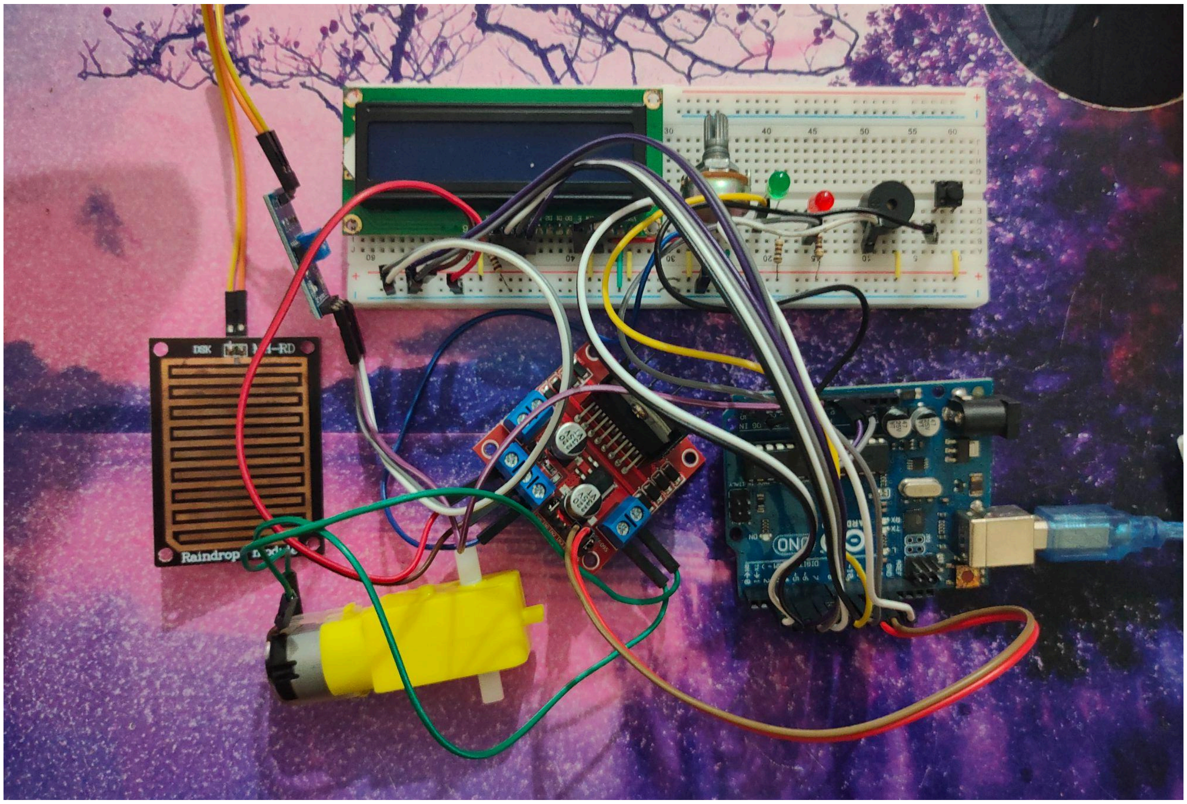


Fig 09 : Project Prototype

Conclusion:

In conclusion, the rain detector system developed in this project effectively addresses the need for accurate rainfall data. The integration of raindrop sensors and tipping bucket rain gauges, coupled with IoT capabilities, ensures real-time monitoring and analysis. This project holds promise for applications in agriculture, flood prediction, and water resource management, contributing to both societal benefit and environmental sustainability.

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