IOT based Home Automation System using Real Time Weather

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Abstract*— Everyone benefits from the rising use of automation in every industry in the modern world, which lowers costs, improves safety, shortens lead times, and boosts production, profitability, and efficiency. Similarly, the increasing demand for smart home technology has led to improvements in automation systems based on the Internet of Things (IoT). In the past, every system in the house relied on human observation and reaction, which made it a cumbersome procedure. Our proposed system demonstrates the design and deployment of an Internet of Things (IoT)-based home automation system that incorporates a number of sensors for real-time environmental control and monitoring. Several sensors make up the integrated system, including an LDR sensor .to measure light intensity, a DHT11 sensor to measure temperature and humidity, and a MQ135 sensor to measure air quality. Custom thresholds are applied to all of the sensor data in order to enable automated reactions to changes in the surrounding environment. For instance, the LDR measurements can be used to set the light control to turn on. All of the information gathered by these different sensors is sent to Adafruit.io, a cloud-based platform, for analysis and visualization. By providing us with information on the environment's repeating nature, all of those sensor data enable users to make accurate decisions and conduct long-term follow-ups. This study shows how IoT technology may be used practically to create affordable and successful home automation systems that improve convenience, energy efficiency, and environmental consciousness. Future improvements will involve adding more sensors for more utility and incorporating machine learning for predictive analytics.

Keywords: Weather Monitoring, IoT (Internet of Things), Adaptive Home Systems, Real-time Data, Automation and Security, Smart Home Automation System

I. INTRODUCTION

For the diverse weather conditions of India, where the conditions vary from time to time, the use of home automation makes the daily tasks quite convenient. The extreme and unpredictable conditions of the weather present many challenges leading to discomfort and increased bills. The lack of proper automation system leads to stress and time consumption to home owners. Use of IOT has been widely popularized in simple home applications and regular tasks. The deployment of automation resolves the task of energy saving and maintaining a level of comfort [1]. By equipping the technologies like LTE, 4G, 5G, or Wi-Fi and IOT engagement even the older homes can be developed into smart homes with minimal investments [2]. In IOT pattern a ‘smart home’ terminology aims at integrating various devices for home automation. One out of many advantages of home automation system is its ability to control the automation using different devices, particularly including a smartphone etc. [3]. The data collected from the IOT devices is quite vulnerable while talking about the security. Key challenges in the current smart home landscape include concerns related to automation and security.

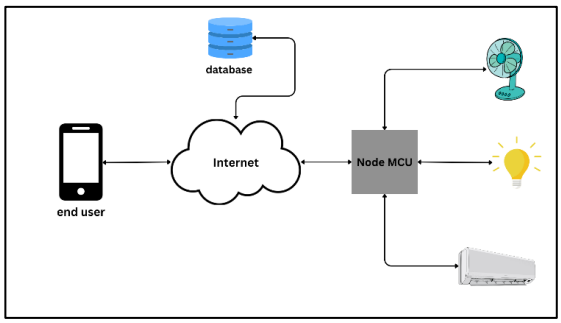

Fig.1 Work Diagram of the System

II. LITERATURE REVIEW

[1] This paper presents a Home Automation System that combines user-friendly automation with real-time weather monitoring for optimal comfort regardless of weather changes. It offers remote control via an Android app, voice recognition for accessibility, and a secure door entry system with password protection. This paper presents a Home Automation System that combines user-friendly automation with real-time weather monitoring for optimal comfort regardless of weather changes. It offers remote control via an Android app, voice recognition for accessibility, and a secure door entry system with password protection. It

is affordable and adaptable, supporting a range of devices for smooth operation and improving convenience and comfort in the home.[2] The management of comfortable living spaces in homes using automation and monitoring technology is covered in this document. Thermal (temperature and humidity), visual (colors and lighting), and sanitary (air quality) attributes are all considered essential comfort parameters. These measurements are regularly monitored by monitoring systems to make sure they stay within predetermined bounds. [3] In order to improve daily living, this study investigates how the Internet of Things (IoT) can be integrated to connect individuals with connected gadgets. IoT has shifted its focus to enabling "thing to thing" (direct) communication between devices. IoT technology is used in the smart home idea to improve convenience and comfort. [4] This paper describes an Internet of Things (IoT) based home automation weather monitoring system that can remotely operate domestic appliances and track weather conditions. It consists of a DHT11 temperature and humidity sensor, a relay module, and a network gateway interfaced with an ESP32 microprocessor with Wi-Fi.[5] The suggested system presents an IoT-driven solution for weather monitoring, providing instant access to real-time data across a broad spectrum. It tracks diverse weather metrics, including temperature, humidity, wind speed, moisture, light intensity, UV radiation, and carbon monoxide levels, utilizing a variety of sensors. The collected data then reaches a particular webpage where it is analyzed and subsequently displayed in graphs. [6]. The collection of real-time environmental data has always been associated with numerous challenges in modern times. The suggested method focuses on the Gorakhpur Region, which tracks real-time meteorological conditions. It uses a two-tier approach with a client-server architecture and the Internet of Things.

III. METHODOLOGY

1. Installation of Weather Sensors:

LDRs are strategically positioned, active indoor and active outdoor DHT11 (temp-humidity sensor), AQI, and Raindrop Sensors. Complete capture of weather information.

Proper installation and calibration for accurate readings.

Sensors:

For the first design stage, sensors were selected for the measurement of temperature and humidity. DHT11 was chosen to sense temperature, and humidity was detected by it. These were the preferred options because other similar ones, like DHT22 were larger and more expensive.DHT11 is linearly correlated with the output voltage with respect to the temperature measured in degrees Celsius. The output voltage from the sensor is linked to the analog input of the microcontroller. A direct correlation exists between the output voltage and the real humidity levels in the atmosphere. The information is obtained from the sensor's datasheet. To gauge room brightness, we employ a Light Dependent Resistor (LDR), favored over alternatives such as the photodiode due to its compact size and cost-effectiveness. In the figure above, the output voltage is acquired via voltage division and subsequently converted directly into lux.

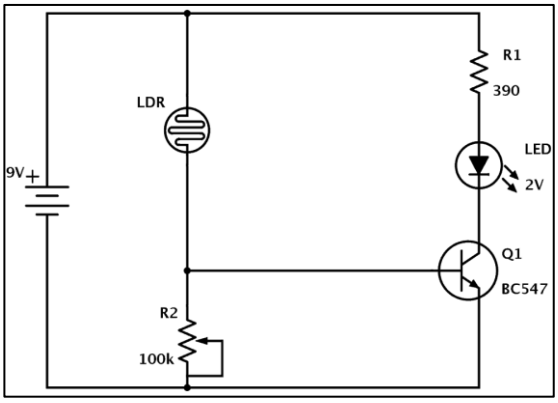

Fig.2 Working of LDR Sensor

The connection between the resistance of the LDR and the output voltage is expressed by the equation provided below:

$$V_o = V_s\left(\frac{R}{R_{LDR}+R}\right)$$

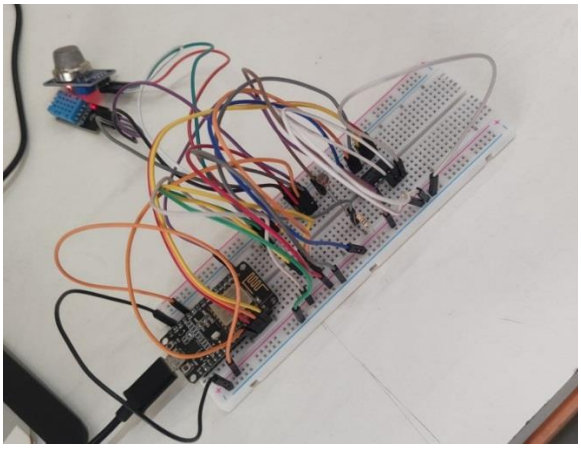

Fig.3 Above connections show the sensors integrated with NodeMCU

2.Development Automation Logic: Write algorithms and logic that will interpret the weather data recorded by the sensors into action creation rules based on

specified conditions, under which some actions will be executed within the home automation system.

Examples in Automations

- Fans or air conditioners are turned on if recorded temperature exceeds a certainness.
If it goes down below a certain value, heating systems are triggered. If there is any chance of rain that day, activate the sprinklers.

3. Control Mechanism Construction: On the control measure establishment, the last component to installing an automation system responsible for handling devices and appliances around the house is actuators, motors, relays, etc. The efficient operation between sensor control actuator durability.

4. Validation and Testing: The system shall be tested comprehensively under a variety of ambient conditions to ascertain its viability, accuracy of sensor reading, and responsiveness of logic automation. The system is intended for testing under different scenarios to ensure functionality.

5. User Interface Development: An intuitive manner by which end users navigate and review the weather history and have overridden automation will be found in a website, an appropriate mobile application, or a specialized control panel interface. Thus, a user-friendly interface will retain real-time updates and easy controls.

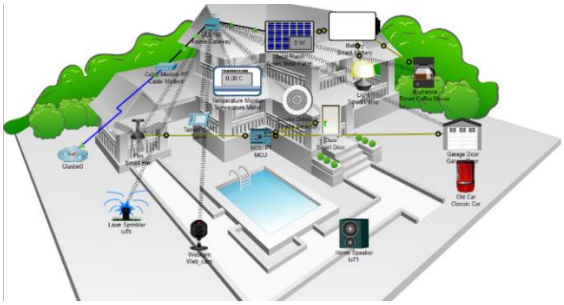

Fig.4 User Interface developed on Cisco Packet Tracer

6. Deployment: After testing and validation are complete, the functional weather-based home automation system will be installed inside the house. For the component elements to function harmoniously, proper installation and setup are required.

7. Monitoring and Maintenance: Routine maintenance tasks like software updates, hardware inspections, and sensor calibrations are performed in addition to regular system-wide monitoring. To guarantee that they can continue to operate dependably and continuously, other issues must be fixed as soon as possible.

8. Optimization and Expansion:
For example, in case of incorporating more devices, adding more sensors, or introducing cutting-edge technologies like machine learning algorithms for predictive control to increase the ability of the system, and Continuous improvement of the automation logic according to performance analysis and user input to improve efficacies. Regularly update the system to incorporate latest advancements in technology and improve overall performance. Update the system frequently to take advantage of new technological developments and enhance overall functionality.

IV. RESULT AND DISCUSSION

The evolution of automation logic has been targeted towards formulating algorithms and decision-making rules to trigger certain actions in the home automation system based on climatic data. It seeks to control different appliances and home gadgets in conjunction with actuators connected to the home automation system. It is important to properly test and validate the complete system under a variety of weather conditions, including examining sensor data and the automation logic's responsiveness. A user-friendly interface has also been designed, allowing users to check the weather from a dedicated control panel, mobile apps, or the internet, and handle all manual overrides of automatically configured processes. And that is the story of an important report having the home automation system based on the climatic environment in the house already set up using detailed testing and validation, which should make sure that every part is well installed and configured. In this regard, it reports the periodic monitoring-cum-maintenance practices such as sensor calibration, software update, and inspection of hardware components for the continuous and reliable performance of the system. It has stressed the continuous improvement of the automation logic on the basis of user feedback and performance analysis and also exploring ways to expand the capabilities of the system.

V. CONCLUSION

In order to address all weather-related issues for Indian households, the project intends to construct a home automation system that offers a real-time weather monitor. Through remote control and adjustment of appliances, systems, and other items, it aims to improve the comfort of the home environment while

also boosting the effectiveness and inclusivity of controlling domestic surroundings. The project mainly focuses on better energy consumption while efficiently fulfilling the guidelines of adaptive climate control which can intelligently respond to weather changes. The overall system architecture is composed of types of software and hardware such as Arduino IDE, DHT11 Sensor, LDR Sensor, AQI Sensor, Raindrop Sensor, LCD Display, Arduino UNO, NodeMCU, Cisco Packet Tracer. In order to collect comprehensive weather data, the project involves installing and calibrating weather sensors both inside and outside the house, including the Light Dependent Resistor (LDR), DHT11, AQI sensor, and raindrop sensor. The process of developing the system include creating logic and algorithms to decipher the weather information gathered by the sensors and creating rules for making decisions based on the weather that will cause the home automation system to do particular actions. In order to control different appliances and household gadgets, it also entails integrating actuators with the automation system, such as relays, motors, and switches. To make sure the system works properly in a variety of weather scenarios, as well as to confirm the precision of sensor readings and the automation logic's response, extensive testing and validation are carried out. The user-friendly interface, which can be accessed by a dedicated control panel, mobile app, or web, enables users to manually override automation settings as necessary and monitor weather conditions. The weather-based home automation system is installed in a home environment after thorough testing and validation, guaranteeing that every component is correctly installed and set up for seamless operation. To guarantee the system runs consistently and dependably, ongoing monitoring and maintenance are carried out, including hardware inspections, software upgrades, and sensor calibration. In order to improve efficiency and effectiveness, the project will continuously improve the automation logic based on user feedback and performance analysis. It will also look into ways to add more sensors and integrate more devices to increase the system's capability. The project's goals include increasing energy efficiency, maximizing household comfort, achieving cost savings, and implementing a reliable safety measure system

VI. REFERENCES

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