IoT-Based Real-Time Weather Monitoring and Reporting System

Dipanjali D Raut[1], Sneha P Ubale[2], Prof. Kuldeep Deshmukh[3]
[1]Student. Electronic and Telecommunications, Shri shivaji polytechnic institute Parbhani
[2]Student, Electronic and Telecommunications, Shri shivaji polytechnic institute Parbhani
[3]Professor, Department of Electronic and Telecommunications, Shri shivaji polytechnic institute, Parbhani

***Abstract*—The system proposed in this paper is an advanced solution for monitoring the weather conditions at a particular place and making the information visible anywhere in the world. The technology behind this is the Internet of Things (IoT), which is an advanced and efficient solution for connecting things to the internet and connecting the entire world of things in a network. Here things might be whatever like electronic gadgets, sensors, and automotive electronic equipment. The system deals with monitoring and controlling the environmental conditions like temperature, relative humidity, and CO level with sensors and sends the information to the web page, and then plots the sensor data as graphical statistics. The data updated from the implemented system can be accessible in the internet from anywhere in the world.**

***Index Terms*—Internet of Things (IoT), Real-Time Monitoring, Weather Monitoring System, Environmental Monitoring, Temperature Sensor (DHT11/DHT22), Humidity Sensor, Air Quality Sensor (MQ135)**

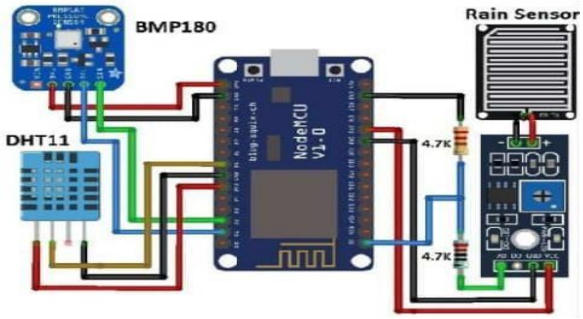
I. INTRODUCTION

Here we introduce a smart weather reporting system over the Internet. Our introduced system allows for weather parameter reporting over the Internet. It allows the people to directly check the weather states online without the need of a weather forecasting agency. System uses temperature, humidity as well as rain with humidity sensor to monitor weather and provide live reporting of the weather statistics. The system constantly monitors temperature using temperature sensor, humidity using humidity sensor and also for rain. Weather monitoring system deals with detecting and gathering various weather parameters at different locations which can be analysed or used for weather forecasting. The aim of this system is achieved by technologies such as Internet of Things (IOT) and Cloud. The idea of internet of things is to connect a device to the internet and to other required connected devices. Using Internet the information from the IOT device can easily be transferred to the cloud and then from the cloud to the end user. Weather Monitoring is an essential practical implementation of the concept of Internet of Things, it involves sensing and recording various weather parameters and using them for alerts, sending notifications, adjusting appliances accordingly and also for long term analysis. Also we will try to identify and display trends in parameters using graphical representation. The devices used for this purpose are used to collect, organize and display

Microcontroller (ATmega328 / ESP32 / Arduino)

- he microcontroller acts as the brain of the system.
- It receives voice commands and controls home appliances like lights, fans, etc.
- ATmega328: Used in Arduino Uno, suitable for basic automation.
- ESP32: Supports Wi-Fi & Bluetooth, ideal for smart and IoT-based home automation.
- Arduino: Provides an easy programming platform to control devices.

Working Principle



1. Data Collection

- Sensors: Temperature (DHT11/DHT22), humidity, barometric pressure (BMP180/BMP280), rainfall, soil moisture, etc.
- These sensors continuously measure environmental parameters.

2. Data Processing

- A microcontroller (commonly NodeMCU or Arduino with ESP8266 Wi-Fi module) receives sensor inputs.
- The microcontroller converts raw sensor signals into usable digital data.

3. Data Transmission

- The processed data is sent via Wi-Fi or GSM modules to a cloud server.
- Popular platforms: Arduino Cloud, ThingSpeak, AWS IoT, or Blynk.
- Uses client-server architecture where the device acts as a client sending data to the cloud server.

4. Cloud Storage & Visualization

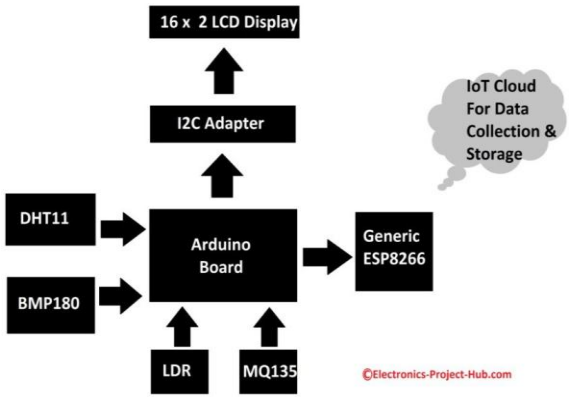
- Data is stored and displayed on a dashboard accessible through web or mobile apps.
- Users can view real-time weather updates and historical trends.

5. Remote Monitoring & Alerts

- Users can access weather data from anywhere in the world.
- Systems can be configured to send alerts/notifications (e.g., SMS, email) when thresholds are crossed (like heavy rainfall or extreme temperature).

Key components

➢ Arduino UNO
➢ ESP8266 WiFi Module
➢ DHT11
➢ BMP180
➢ Rain Sensor
➢ LCD Display



1. Sensing

Sensors like DHT11/DHT22 (temperature & humidity), BMP180/BMP280 (pressure), rain sensors, and wind sensors are deployed.

These sensors continuously measure environmental parameters.

2. Data Acquisition

The sensors send raw signals to a microcontroller (Arduino, NodeMCU, ESP8266, Raspberry Pi).

The microcontroller converts these signals into digital values.

3. Data Processing

The microcontroller organizes and processes the sensor data.

It may apply calibration or filtering to improve accuracy.

4. Connectivity

Using Wi-Fi, GSM, or LoRa modules, the processed data is transmitted to a cloud server.

The IoT device acts as a client in a client-server model.

5. Cloud Integration
Cloud platforms like ThingSpeak, AWS IoT, Blynk, or Arduino IoT Cloud receive the data.
Data is stored in databases for real-time and historical analysis.

6. Visualization
The cloud platform provides a dashboard or mobile/web app.
Users can view graphs, charts, and live weather updates.

7. Remote Monitoring
Users access the weather data from anywhere via the internet.
The system can send alerts/notifications (SMS, email, app alerts) when thresholds are exceeded (e.g., high rainfall, extreme temperature).

8. Decision Making
The collected data can be used for:
Agriculture (smart irrigation, crop planning)
Disaster management (flood or storm warnings)
Smart cities (environmental monitoring)

II. LIMITATIONS IDENTIFIED IN LITERATURE

I. Connectivity & Infrastructure
II. Sensor Accuracy & Calibration
III. Economic & Social Barriers
IV. Data Management & Scalability

III. FUTURE SCOPE

One can implement a few more sensors and connect it to the satellite as a global feature of this system. Adding more sensors to monitor other environmental parameters such as CO2, Pressure and Oxygen Sensor. In aircraft, navigation and the military there is a great scope of this real-time system. It can also be implemented in hospitals or medical institutes for theresearch & study in “Effect of Weather on Health and Diseases”, hence to provide better precaution alerts.

REFERENCE

[1] S. Acharekar et al., “IoT Based Weather Monitoring System,” International Journal of Computer Engineering Research Trends, 2020. Ijcert.org
[2] Kishan Shivhare et al., “IoT-Based Real-Time Weather Monitoring System,” RRJoSST Journal, 2025. STM Journals
[3] Sudipta Ghosh et al., “IoT-Based Smart Weather Monitoring System,” International Journal on Science and Technology, 2026. IJSAT
[4] Shuchita Mudgil, “IoT Based Smart Weather Monitoring System,” Engineering Science Journal, 2023. ResearchGate
[5] Simeon Ogunbunmi et al., “Internet of Things Weather Monitoring System,” World Journal of Advanced Research and Reviews, 2024. ResearchGate
[6] Girija C et al., “IoT Based Weather Monitoring System,” IJERT Conference Paper, 2018. IJERT
[7] Rasoul Ali Mahdi et al., “Review of Weather Monitoring Systems Based on IoT,” BIO Web of Conferences, 2024.