IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, April 2026
Impact Factor: 8.2

IoT Based Weather Monitoring with Cloud Integration

Satyam Tanaji Patil[1], Shreya Shrishail Dharne[2], Vaibhavi Babasaheb Bhosale[3], Vishwajeet Chandrakant Bhadekar[4], Prof. M. F. Solunke[5]
Students, Department of Computer Engineering[1-4]
Guide, Department of Computer Engineering[5]
Puranmal Lahoti Government Institute of Engineering & Technology, Latur, India

Abstract: *This paper presents the design and implementation of an IoT-based weather monitoring system with cloud integration for real-time environmental data collection and remote monitoring. The system is developed using a NodeMCU ESP8266 microcontroller, which enables wireless communication through built-in Wi-Fi connectivity. Various sensors such as the DHT11 sensor for temperature and humidity measurement, a rain sensor module for rainfall detection, a soil moisture sensor for monitoring soil conditions, and a barometric pressure sensor are used to collect atmospheric parameters.*

The collected sensor data is processed by the NodeMCU and displayed locally on a 16×2 LCD display for immediate observation. Simultaneously, the data is transmitted to a cloud platform via the internet, allowing users to monitor weather conditions remotely through web or mobile applications. The cloud integration enables real-time visualization, storage of historical data, and analysis for future reference.

This system provides a cost-effective, reliable, and efficient solution for continuous environmental monitoring. It is particularly useful in applications such as smart agriculture, environmental monitoring, disaster warning systems, and smart city infrastructure. The implementation demonstrates how IoT technology combined with cloud computing improves accessibility, accuracy, and efficiency in weather monitoring systems

Keywords: IoT, Weather Monitoring, Cloud Computing, ESP8266, Smart Agriculture

I. INTRODUCTION

Weather monitoring plays a vital role in various fields such as agriculture, environmental research, disaster management, and smart city development. Traditional weather monitoring systems are often expensive, complex, and limited in accessibility. With the advancement of the Internet of Things (IoT), it has become possible to develop low-cost, efficient, and real-time environmental monitoring systems that can transmit data remotely through cloud platforms.

This project focuses on the design and implementation of an IoT-based weather monitoring system using the NodeMCU ESP8266 as the main processing unit. The system integrates multiple environmental sensors including the DHT11 sensor for measuring temperature and humidity, a Rain sensor module for detecting rainfall conditions, a Soil moisture sensor for monitoring soil moisture levels, and a BMP180 sensor for atmospheric pressure measurement. The collected environmental data is displayed locally using a 16x2 LCD display and simultaneously transmitted to a cloud platform via Wi-Fi for remote monitoring and storage.

Cloud integration enables users to access real-time weather information from anywhere using smartphones or computers, improving decision-making in agriculture and environmental management. The system is designed to be cost-effective, easy to install, and energy efficient, making it suitable for both rural and urban applications. This project demonstrates how IoT technology can be effectively utilized to build an intelligent weather monitoring solution that enhances accuracy, accessibility, and automation in environmental observation.

DOI: 10.48175/IJARSCT-32634

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, April 2026
Impact Factor: 8.2

II. LITERATURE SURVEY

Weather monitoring systems have evolved significantly with the advancement of wireless communication and Internet of Things (IoT) technologies. Researchers have developed various intelligent monitoring solutions that enable real-time data acquisition, remote accessibility, and cloud-based storage for environmental analysis.

In earlier studies, traditional weather monitoring systems relied on wired sensor networks and standalone data loggers that lacked remote monitoring capability and real-time accessibility. These systems were expensive and required manual supervision, limiting their practical applications in agriculture and environmental monitoring.

With the introduction of IoT technology, several researchers proposed smart weather monitoring systems using microcontrollers and wireless communication modules. Systems based on Wi-Fi-enabled controllers such as the NodeMCU ESP8266 demonstrated efficient real-time transmission of environmental parameters to cloud platforms. These systems improved accessibility and reduced implementation costs compared to conventional monitoring methods.

Many research works utilized sensors such as the DHT11 sensor for temperature and humidity monitoring due to its simplicity and low power consumption. Similarly, rainfall detection using the Rain sensor module enabled early identification of precipitation conditions, which is useful in agriculture and flood monitoring systems. Soil condition monitoring using the Soil moisture sensor has also been widely implemented in smart irrigation systems to optimize water usage and improve crop productivity.

System Architecture

The system consists of sensors, NodeMCU ESP8266, LCD display, and cloud platform. Sensors collect environmental data, which is processed by NodeMCU and transmitted to cloud servers.

System Diagrams

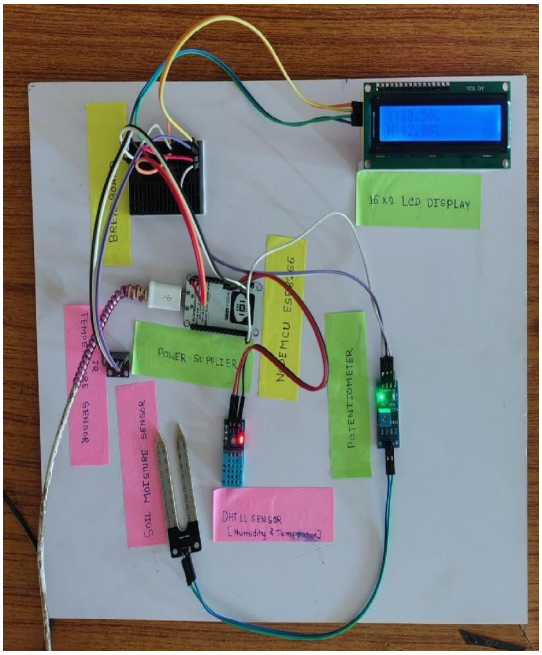


Figure: Actual Hardware

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, April 2026
Impact Factor: 8.2

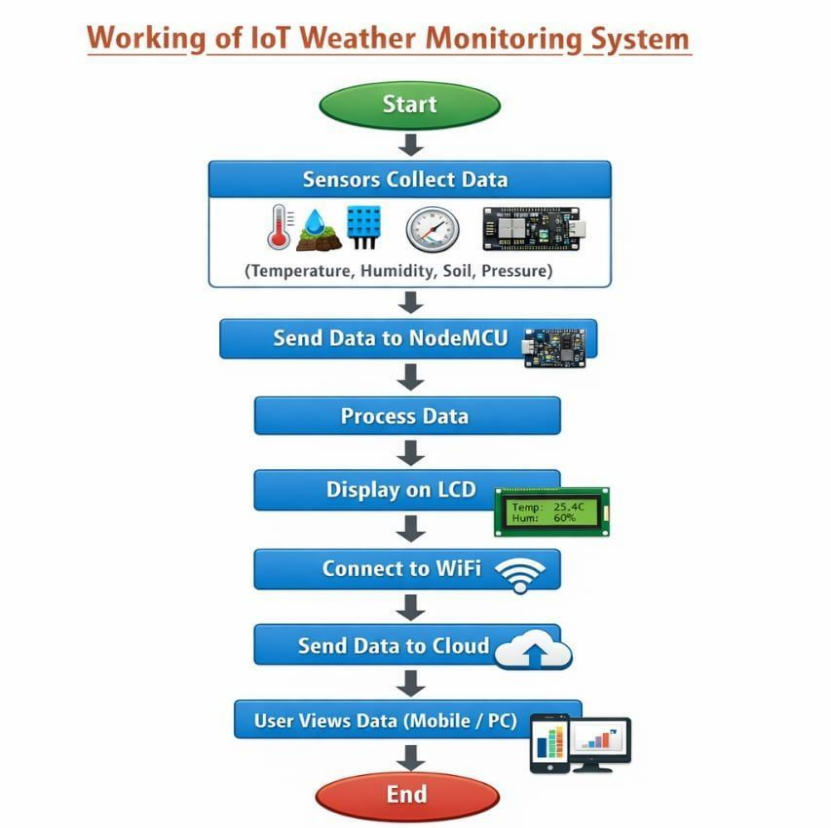


Figure 2: Working

Implementation

The system is implemented using NodeMCU ESP8266 with multiple sensors. Data is collected and transmitted via Wi-Fi to cloud platforms such as ThingSpeak for monitoring.

III. RESULTS AND DISCUSSION

The system successfully provides real-time monitoring. Data is visualized on cloud dashboards, showing trends in temperature, humidity, and rainfall

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, April 2026
Impact Factor: 8.2

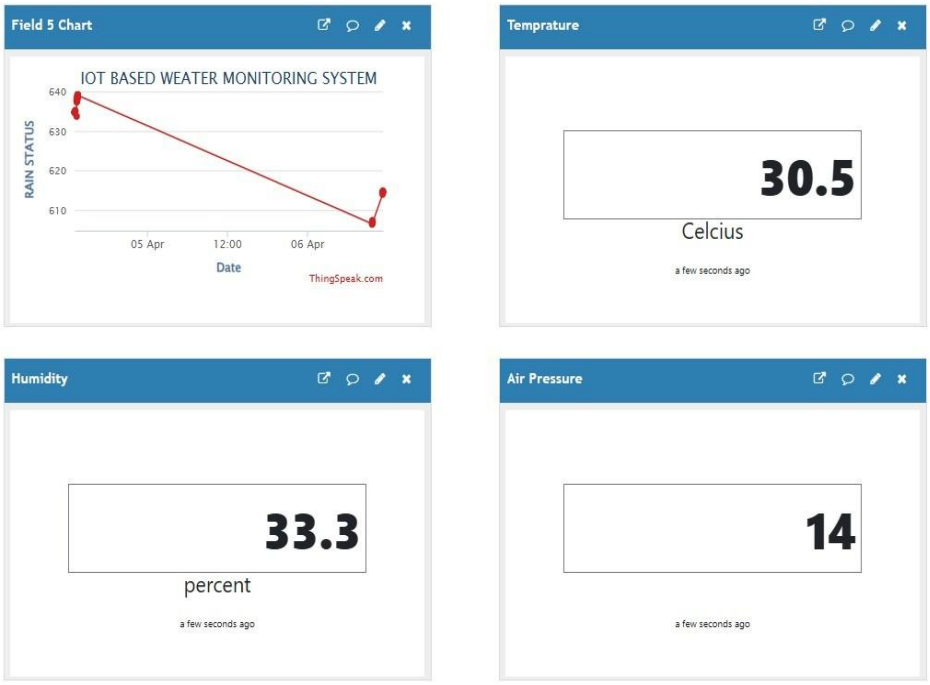
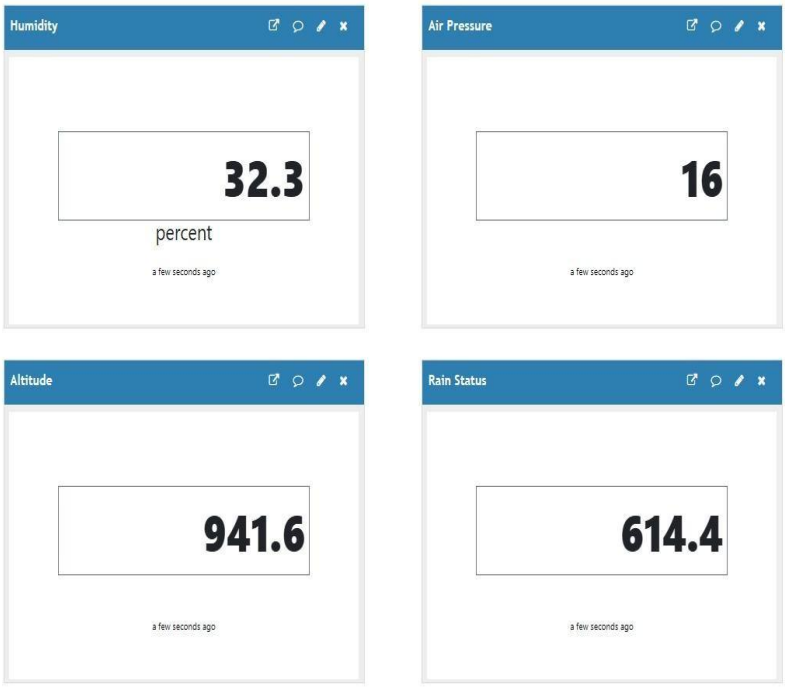


Figure 3:-Output



DOI: 10.48175/IJARSCT-32634

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, April 2026
Impact Factor: 8.2

IV. CONCLUSION

The IoT-based Weather Monitoring System with Cloud Integration is designed to measure weather conditions such as temperature, humidity, air pressure, rainfall, and soil moisture using different sensors connected to the NodeMCU (ESP8266). The system collects data from these sensors and sends it to the cloud through Wi-Fi so that users can check the weather information from anywhere.

The 16×2 LCD display shows the weather data directly near the system, and the cloud platform stores the data for future use and analysis. This system is useful for agriculture, environmental monitoring, research work, and smart weather observation. The project is low-cost, easy to use, and helps in real-time monitoring of weather conditions. In the future, the system can be improved by adding more sensors, mobile app support, and solar power supply.

Overall, this project shows how IoT technology can be used to monitor weather conditions easily and effectively from remote locations.

V. ACKNOWLEDGMENT

It is our privilege to express our sincere regards to our project guide, **Mr. M. F. Solunke** for her valauable inputs, able guidance, encouragement, whole- hearted cooperation and constructive criticism throughout the duration of our project. We deeply express our sincere thanks to our Head of Department **Mr. N. D. Agawane** for encouraging and allowing us to present the project on the topic **-IOT Based Weather Monitoring System with Cloud Integration** at our department premises for the partial fulfillment of the requirements leading to the award of Diploma in Computer Engineering.

We take this opportunity to thank all our lecturers who have directly or indirectly helped us for our project. We pay our respect and love to our parents and all other family members and friends for their love and encouragement throughout our career. Last but not the least we express our thanks to our friends for their cooperation and support**.**

REFERENCES

[1]. Mary Nsabagwaa, Maximus Byamukamab, Emmanuel Kondelaa, "Towards a robust and affordable Automatic Weather Station ", journal homepage: www.elsevier.com/locate/deveng.

[2]. Ravi Kishore Kodali and Snehashish Mandal "IoT Based Weather Station" 2016 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT) 978-1-5090- 5240-0/16/$31.00, IEEE, (2016).

[3]. Ravi Kishore Kodali and Archana Sahu "An IoT based Weather Information Prototype Using WeMos" 2016 2nd International Conference on Contemporary Computing and Informatics (ic3i), 978-1-5090-5256- 1/16/$31.00, IEEE, (2016)

[4]. Zi-Qi Huang, Ying-Chih Chen and Chih-Yu Wen, "Real-Time Weather Monitoring and Prediction Using City Buses and Machine Learning", Vols. 3 to 21 Published 10 September (2020)

[5]. Kavya Ladi, A V S N Manoj, G V N Deepak, "IOT Based Weather Reporting System to Find Dynamic Climatic Parameters", International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS-2017)

[6]. P. Susmitha, G. Sowmyabala "Design and Implementation of Weather Monitoring and Controlling System", International Journal of Computer Applications (0975 – 8887) Volume 97– No.3, (July 2014)

[7]. Tanmay Parashar1, Shobhit Gahlot2, Akash Godbole3, Y.B. Thakare4 "Weather Monitoring System Using Wi-Fi", (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2015): 78.96, 2015

[8]. Nutant Sabharwal, Rajesh Kumar, Abhishek Thakur, Jitender Sharma "A LOW-COST ZIGBEE BASED AUTOMATIC WIRELESS WEATHER STATION WITH GUI AND WEB HOSTING FACILITY" e-ISSN: 1694-2310 | p-ISSN: 1694-2426, Vol. 1, Spl. Issue 2 (May 2014)

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, April 2026
Impact Factor: 8.2

[9]. M. Prasanna, M. Iyapparaja, M. Vinothkumar, B Ramamurthy, S.S. Manivannan," An Intelligent Weather Monitoring System using Internet of Things", International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue4, November (2019)

[10]. Mircea Popa and Catalin Iapa "Embedded Weather Station with Remote Wireless Control", 19th Telecommunications forum TELFOR 2011 Serbia, Belgrade, November 22 24, 2011, 978-1-4577-1500- 6/11/$26.00, IEEE, 2011 43