International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Conference Proceedings: Volume: 05 ACME – 2026 DOI: 10.55041/ISJEM.ACME151
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

Solar Powered Efficient Weather Forecasting using IOT Technology

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Abstract-The science of predicting the atmospheric conditions at a specific location based on numerous meteorological variables is known as weather forecasting. Several wireless technologies, including Bluetooth, RF, Zigbee, and IoT are used for weather monitoring and reporting. An efficient environmental monitoring system for tracking and analyzing weather conditions is provided using IoT technology. The system uses appropriate sensors to monitor a variety of climatic factors, including rain, pressure, temperature, humidity, and the presence of different gases. Solar panels have been added to this system as a power source. An overview of IoT wireless communication technology utilized in weather forecasting is given in this study. The device uses solar electricity, which is a very effective source of energy.

Keywords-Weather Monitoring,IoT, Sensors, Solar Power,Wireless Technology,Solar panels,Climatic Factors.

I.INTRODUCTION

Weather monitoring and forecasting play a crucial role in agriculture, disaster management, transportation and environmental protection. Environmental effects have huge negative impact on a number of businesses, including agriculture, construction, and many more. The weather forecast is then broadcast on news programmes and radio stations using the information. The existing systems are expensive equipment raise the already high installation and maintenance expenses. The proposed weather prediction system benefits from the Internet of Things(IoT). An Internet of Things system comprises of internet-connected smart devices that use an embedded CPU, sensors, and communication hardware to store, transfer and act on data. MQ136 for hydrogen sulphide, MQ7 for nitrogen monoxide sensor, MQ2 for carbon dioxide sensor are used. Other sensors include FC-37 for rain detection,DHT11 for temperature and humidity detection. IoT devices analyse the sensor data either locally or on the cloud . The components of this system can even be powered by solar panels. This study provides a thorough evaluation of the literature on several wireless techniques for gathering local meteorological data in real-time.

II. LITERATURE SURVEY

Solar Integrated Smart Weather Sensing and Forecasting system harnesses renewable energy to autonomously collect and transmit real-time meteorological data to cloud platforms for analysis. It improves forecasting efficiency.

A.Kumar and S.Kumar (2020)-developed a solar-powered IoT weather station using Arduino and Node MCU that measured core environmental parameters such as temperature, humidity, pressure, and rainfall with online data transmission to a cloud platform. The contribution was demonstrating a low-cost, IoT-based weather sensing system powered by solar energy, enabling remote real-time weather data collection. However, the system lacked advanced forecasting capability and had limited long-term power autonomy under low light conditions[1].

P.Sharma et al(2021)-implemented a solar energized IoT weather monitoring system integrating temperature, humidity, pressure, rain sensors powered via solar with real-time web interface using AJAX technology and Node MCU microcontroller. Major contributions included interactive real-time visualization and solar-powered

sustainability. Limitations included dependency on continuous solar irradiance and absence of predictive or analytical forecasting models[2].

Sugumaran Ganesan(2022)-developed a Self-Sustained Solar Powered IoT Based Weather Monitoring System measuring temperature, humidity, pressure, rainfall prediction using Node-MCU,DHT11,BMP180, and rain sensors with real-time transmission to Thing Speak and Blynk platforms. This work contributed a renewable energy-driven autonomous weather data acquisition prototype suitable for remote monitoring. Drawback included modest sensor accuracy and dependence on consistent solar irradiance for power, affecting continuous data capture under low sunlight conditions[3].

Parameswaran Ramesh et al(2023)-proposed a multi-parameter solar-powered IoT weather monitoring system integrated with cloud storage. Data was transmitted to cloud platforms for real monitoring and analysis. It increases hardware complexity, lack advanced predictive forecasting algorithms[4].

Ebehal Akeel Hamed et al(2024)-implemented a IoT-based weather forecasting model integrated with Artificial Intelligence techniques. The system applied machine learning algorithms for short-term weather prediction. Cloud computing was used for data storage and analysis. The contribution of this work was the integration of AI-based prediction with IoT data acquisition. However, the solar energy integration details are not clearly explained and model required high computational resources[5].

Hamed Mokhtarazadeh et al(2025)-developed a high-accuracy solar powered smart weather station using advanced IoT technology. The system measured multiple environmental parameters such as wind speed, solar radiation, humidity. Data collected from sensors was transmitted in real-time to a cloud platform for monitoring and analysis. The study focused on improving measurement precision and ensuring reliable operation through efficient solar energy utilization. However, the system mainly emphasized environmental monitoring rather than long-term predictive forecasting and involved relatively higher implementation and maintenance costs[6].

III. PROPOSED METHODOLOGY

In proposed system Arduino UNO R3 plays a vital role which act as the brain of the system. The following Fig 1 represents the block diagram of proposed methodology.

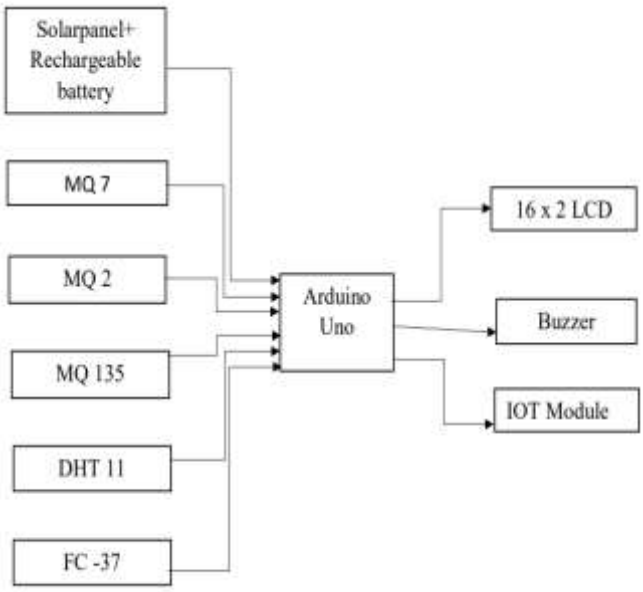


Fig 1:Proposed System Block Diagram

The sensors such as MQ135 which measures hydrogen sulphide, MQ7 which measures Carbon monoxide, MQ2 which measures Carbon dioxide, DHT 11 which measures temperature and humidity is connected to microcontroller. ESP8266 which is the IOT module is connected to the device which helps in fetching the sensor data from the Arduino and upload it to the cloud server. The entire system is powered by solar panel. The power produced from the solar panel is saved in a battery and from battery power goes to the entire device.

The collected data is processed by the Arduino Uno and transmitted to the internet using the ESP8266 Wi-Fi Module. This allows real-time monitoring and storage of weather data on a cloud platform. Users can view the weather conditions remotely through IoT applications or web dashboards.The entire system is powered by a solar panel with battery backup, ensuring continuous operation even in remote or off-grid locations. When sensor values exceed predefined thresholds, the system activates a buzzer to provide alerts for abnormal environmental conditions.This integration of solar energy, sensors, and IoT communication enables efficient and real-time weather monitoring and forecasting.

Operational Flow:

Power Generation:Solar panel converts sunlight into electrical energy. The energy is stored in a rechargeable battery to provide continuous power.

System Initialization:When the system starts, the Arduino Uno initializes all sensors and communication modules.

Data Collection:Sensors measure environmental parameters such as temperature, humidity, rainfall, and air quality.

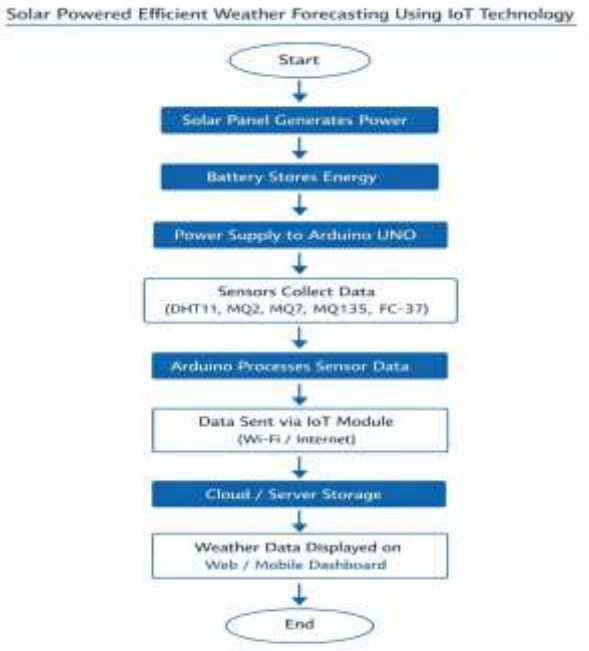
Data Processing:The Arduino processes the sensor data and checks for predefined threshold values.

Data Transmission:The processed data is transmitted through the ESP8266 Wi-Fi module to an IoT cloud platform.

Data Monitoring:Users can monitor weather data remotely through a mobile app or web dashboard.

Alert Generation:If any parameter exceeds the set threshold (e.g., heavy rain or high gas levels), the system activates a buzzer to alert users.

Continuous Operation:The system continuously monitors environmental conditions and updates the cloud in real time.



IV. ARDUINO IDE PLATFORM

Arduino is a company and user community that designs,produces single-board microcontrollers using open-source computer hardware and software. Input data from sensing devices can be used to send instructions to the board's microcontroller, which can then be processed into a specific output. The Arduino proposal makes available the Arduino integrated development environment(IDE), a multi-platform app written in the Arduino programming language.The Arduino used in the construction of the Smart Shopping Cart is a generic type known as the Arduino Uno.

V. RESULTS AND DISCUSSION

As per the block diagram connections are given and all the sensors are connected to the arduino microcontroller and solar power is used for the device. The following Fig 2 represents the entire working model of the proposed system. The results are updated to cloud using ThinkSpeak application.

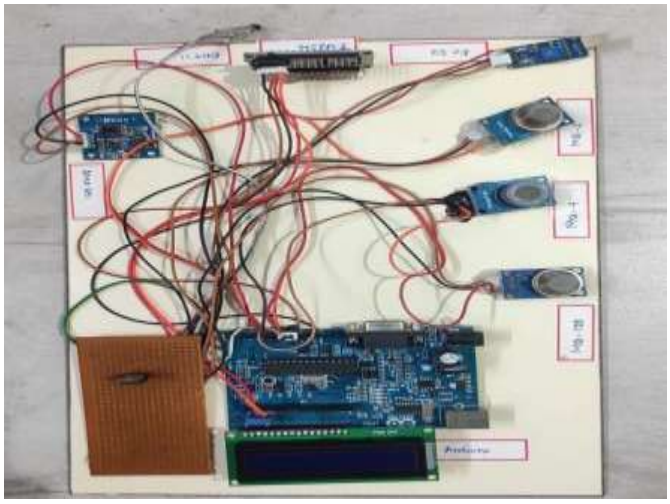


Fig 2: Working Proposed System

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Fig 3: H2S,NO2 and CO Gas Level

Fig 4:Temperature, Humidity Level

From the above results obtained we can see the live updation of all sensor values clearly updated in Thinkspeak cloud server with exact date and time. So this type of device can be installed in any place to do a live monitoring of weather prediction. Since solar is used it act as a green energy and user friendly power system.

VI.CONCLUSION

With the use of IoT technologies, the suggested system will be used to develop a user-friendly weather monitoring system that would track different climatic conditions. The added solar panels make the system's design more eco-friendly. Numerous important factors, including precipitation, air pressure, temperature, humidity, and gas concentration like H2S, NO2, and CO are measured, computed, and broadcast by this system. In order to demonstrate the effectiveness of the suggested system in terms of measuring sensors, power supply, and affordability, the performance of contemporary wireless technologies is investigated in this study.

VII.DISADVANTAGE

The system provides limited accuracy as it depends on sensor data. Performance can be effected by sensor errors.

VIII.FUTURESCOPE

The future scope of project includes integrating AI and machine learning to improve prediction accuracy. It can be expanded with multiple sensor nodes for cloud-based analytics for better real-time monitoring

IX.REFERENCES

[1]A.Kumar and S.Kumar,"Design and Implementation of Solar Powered IoT Based Weather Monitoring System,"International Journal of Engineering Research & Technology(IJERT) vol.9,no.5,2020.

[2]P. Sharma, R. Gupta, N. Verma,"Low-Cost IoT Based Weather Monitoring System with Remote Access."International Journal of Innovative Technology and Exploring Engineering(IJITEE) vol.10,no.3,2021.

[3]Sugumaran Ganesan,"Self-Sustained Solar Power IoT Based Weather Monitoring System," International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering(IJAREEIE)vol.11,no.6,2022.

[4]Parameswaran Ramesh, S.Kumar and R.K.Sharma,"Multi-Parameter Solar Powered IoT-Based Weather Monitoring System with Cloud Storage,"International Journal of Advanced Research in Computer and Communication engineering (IJARCCE)vol. 12,no.4,2023

[5]E.A.Hamed, M.Y.Ali and S.H.Kareem,"IoT and AI-Based Weather Forecasting Model Using Machine Learning Techniques." International Journal of Intelligent Systems and Applications in Engineering(IJISAE) vol.13,no.2,2024.

[6]H.Mokhtarazadeh,A.Rahmani,T.Hosseini,"High Accuracy Solar-Powered Smart Weather Station Using IoT Technology," IEEE Access vol.13, 2025.