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Solar Powered Efficient Weather Forecasting Using Iot Technology

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Abstract-

Using a wide variety of meteorological factors, weather forecasting attempts to predict the future of a certain area's air quality. The Internet of Things (IoT), Bluetooth, GSM, Zigbee, and radio frequency (RF) are some of the wireless technologies utilized in weather reporting and monitoring. The Internet of Things (IoT) enables a very effective system for environmental monitoring, including the recording and analysis of meteorological conditions. Rain, pressure, temperature, humidity, and the presence of various gases are just a few of the meteorological variables that the system utilizes the right sensors to track. A new power source, solar panels, have been included into this system. This article provides a synopsis of the Internet of Things (IoT) and its applications in the field of weather reporting and monitoring. We provide a state-of-the-art environmental monitoring system that utilizes IoT technology to effectively track and analyze weather conditions.

INTRODUCTION

We can't stress enough how important it is to keep an eye on the weather. Many industries, including farming, building, and many more, are severely impacted by environmental impacts. Current weather monitoring systems use a variety of detectors, including thermometers, barometers, wind vanes, rain gauges, and others, to track climatic changes. Nearly all of this machinery relies on basic analogue technology, which is then physically captured and stored in a database. Afterwards, news shows and radio stations use this data to report the weather prediction. In addition to the already exorbitant costs of installation and maintenance, the current systems' pricey equipmentThe area of real-time wireless communication is rapidly expanding and offers great opportunities for future study. Therefore, it is necessary to have an automated system in order to monitor things, react quickly to human input, or manage occurrences that are beyond its control. Environmental sensors are used in weather forecasting to get measurements from any given place. In order to forestall major natural catastrophes, the Automation of Meteorological Station System

tracks and analyzes meteorological factors using sensors, microcontrollers, and wireless technologies. This kind of weather station allows for the creation of weather forecast reports in addition to real-time weather and climate studies. Bluetooth is only one of several wireless communication technologies used by real-time weather monitoring systems. The area of real-time wireless communication is rapidly expanding, and there is a lot of room for further study in this exciting new area.

LITERATURE SURVEY !

A basic method for remote temperature tracking and recording is presented in this study by Senthilkumar et al. (2013). Using this method, the user may keep tabs on two separate room temperatures in real time while simultaneously keeping track of information in a database. Providing the user with access to database data allows them to calculate the average temperature of the area at any given time, which enhances the recommended strategy. This research details a

network that uses a temperature sensor and an ATmega 16 central processing unit. Data from the sensor is shown on an LCD screen in real-time. The data was communicated to the computer via the HC05 Bluetooth device, with the receiver end linked to the computer's USB port using the Bluetooth USB Dongle. The data that the computer has received is displayed via Hyper Terminal. A basic method for remote temperature tracking and recording is presented in this study by Senthilkumar et al. (2013). Using this method, the user may keep tabs on two separate room temperatures in real time while simultaneously keeping track of information in a database. Providing the user with access to database data allows them to calculate the average temperature of the area at any given time, which enhances the recommended strategy. This research details a network that uses a temperature sensor and an ATmega 16 central processing unit. Data from the sensor is shown on an LCD screen in real-time. Data was sent to the computer via the HC05 Bluetooth device, with the receiver end connected to the computer's USB port. The data that the computer has received is displayed via Hyper Terminal. A database management system called Microsoft Access stores the data, while Visual Basic is used as the front end to display it [1]. A database management system called Microsoft Access stores the data, while Visual Basic is used as the front end to display it [1]. A Bluetooth-based weather station is an accurate and dependable way to measure environmental data. The user may see specific variations in the amount of labor and also decrease it. A Bluetooth-based weather station is an accurate and dependable way to measure environmental data. The user may see specific variations in the amount of labor and also decrease it. By combining efficiency, portability, and affordability, Akhilesh Chawla et al. (2015) have developed a weather station. It provides useful data on humidity and temperature. A DHT11 sensor and an HC-05 Bluetooth module are included into the design of this station. Extremely precise temperature and humidity monitoring is the specialty of the DHT11 sensor. The HC-05 Bluetooth module allows for a greater data rate, greater range, and mobility, in addition to the other benefits [2]. By combining efficiency, portability, and affordability, Akhilesh Chawla et al. (2015) have developed a weather station. It provides useful data on humidity and temperature. A DHT11 sensor and an HC-05 Bluetooth module are included into the design of this station. Extremely precise temperature and humidity monitoring is the specialty of the DHT11 sensor. The HC-05 Bluetooth module allows for a greater data rate, greater range, and mobility, in addition to the

other benefits [2]. Using the Bluetooth communication technology, a portable weather model was developed, as described by Edgar Manuel et al. (2015). This model monitors relative humidity, temperature, and pressure. The weather model's embedded system uses the PIC32 microcontroller to generate multimedia applications. The SPIES methodology for embedded system development was used in its development. Edgar Manuel et al. (2015) detail the creation of a handheld weather model that monitors RH, temperature, and pressure via the use of the Bluetooth communication technology, which demonstrates how the weather may be linked to a computer. The weather model's embedded system uses the PIC32 microcontroller to generate multimedia applications. The SPIES methodology for embedded system development was used in its development. A computer can display and preserve the weather data thanks to the weather's Bluetooth connection. Environmental management decision-making is the intended use of the system, which aims to complement other subsystems. The elimination of the requirement to deploy a server makes this sort of solution both simple to use and rapid to implement [3]. keeps the information. Environmental management decision-making is the intended use of the system, which aims to complement other subsystems. The elimination of the requirement to deploy a server makes this sort of solution both simple to use and rapid to implement [3]. Radio frequency wireless connections were detailed by Iswanto et al. (2012) as a means of distant weather monitoring in real-time. Iswanto et al. (2012) detailed a way for remote, real-time weather monitoring using radio frequency wireless connections; the system takes into account the intensity of solar radiation, wind speed, and heat. Weather parameters are determined by considering heat, wind speed, and solar radiation intensity. The system's construction included the use of optocoupler speeds, an LM35 temperature sensor, and an LDR sunlight sensor. The sensor signal is first analyzed before being transferred to the ATmega8535 microcontroller processor board. In order to transfer information from the main board to the client PC, the KYL 1020 U acts as a go-between [4]. carefully considered. The system's construction included the use of optocoupler speeds, an LM35 temperature sensor, and an LDR sunlight sensor. The sensor signal is first analyzed before being transferred to the ATmega8535 microcontroller processor board. The KYL 1020 U acts as a bridge to transfer data from the processor board to the client computer [4]. An on-the-go weather monitoring system based on radio frequency wireless networking is described in detail

by Dushyant and Sanjeev Gaba. Light, temperature, and humidity are just a few of the many atmospheric variables that are detected and sent to a computer via radio waves. The system is composed of two parts. The transmitter module and the receiver module are two separate components. A microprocessor and other sensors allow the system to operate in real-time. The acquired data is shown on the PC and the transmitting terminal's LCD using a bespoke Visual Basic program [5]. deployment of a weather monitoring system that is portable and relies on radio frequency wireless networking. Light, temperature, and humidity are just a few of the many atmospheric variables that are detected and sent to a computer via radio waves. The system is composed of two parts. The transmitter module and the receiver module are two separate components. A microprocessor and other sensors allow the system to operate in real-time. The acquired data is shown on the PC and the transmitting terminal's LCD using a bespoke Visual Basic program [5]. In their 2013 study, Setu Garg et al. analyze a range of weather monitoring techniques. In addition to many other metrics, a WMS records data on humidity, pressure, wind speed and direction, and temperature. These readings are shown on a screen in real time by the technology. On a daily or hourly basis, it also remembers previous data. Whenever the user requests it, the display may reveal previous data. Satellites, radars, microcontrollers, and many other tiny gadgets keep tabs on the weather. Using distant wireless sensors, one may also track the weather. One of the more modern methods of wireless weather monitoring that is covered here is ZigBee [6]. In their 2013 study, Setu Garg et al. analyze a range of weather monitoring techniques. In addition to many other metrics, a WMS records data on humidity, pressure, wind speed and direction, and temperature. These readings are shown on a screen in real time by the technology. On a daily or hourly basis, it also remembers previous data. Whenever the user requests it, the display may reveal previous data. Satellites, radars, microcontrollers, and many other tiny gadgets keep tabs on the weather. Using distant wireless sensors, one may also track the weather. A relatively new method of wireless weather monitoring is ZigBee, which is covered in this article [6]. An automated sensor network and a platform for monitoring weather stations were created by Sreeja (2017) using wireless ZigBee technology. By implementing more exact parameter calculations and control over a wider region, this project aims to make the weather monitoring system more reliable. The measuring modules based on microcontrollers in the smart weather station collect data on humidity using the HSM-20g sensor. The data is compiled and

displayed on an LCD after these modules wirelessly send it to a base station. The addition of a few more stations and sensors is now within reach [7]. The goal of the micro weather station proposed and built by Parvez et al. (2016) is to collect data on several meteorological variables at a minimal cost. Both urban and rural locations may easily install the system, and it can resist certain bad weather conditions. Everyone can benefit from having a better grasp of the weather at the moment, but Parvez et al. (2016) want to build a micro weather station that can collect data on many meteorological factors at a minimal cost. Both urban and rural locations may easily install the system, and it can resist certain bad weather conditions. Everyone, but particularly farmers, may benefit from having a better understanding of the most recent weather patterns. Users will like using this system since it doesn't need any extra calibration after installation. Once the data has been uploaded to a web server, the user may be provided with access to it via a web page or message. The data transmission method of the GSM module allows users in faraway regions to access data [8]. farmers. Users will like using this system since it doesn't need any extra calibration after installation. Once the data has been uploaded to a web server, the user may be provided with access to it via a web page or message.

The data transmission method of the GSM module allows users in faraway regions to access data [8]. Automatic or notice-driven communication across several places is introduced by Sarmad Nozad (2018) in a new way. Connecting FOUR separate sites and regularly storing data from each was the suggested method of operation. It has been determined that the three most important weather station components—temperature, humidity, and wind speed—should be distributed across the four sites for optimal applicability. It is common practice to establish a reliable system of real-time weather stations to ascertain the local climate at the designated locations. Lastly, a new method for automated or notice-driven communication across different places is introduced by Sarmad Nozad (2018) of the system. Connecting FOUR separate sites and regularly storing data from each was the suggested method of operation. The decision has been made to disperse the three critical components of the weather station—wind speed, humidity, and temperature—among the four sites for better applicability. It is common practice to establish a reliable system of real-time weather stations to ascertain the local climate at the designated locations. Ultimately, a GSM shield communication module attached to an Arduino microcontroller was chosen as the system's power supply [9]. An Arduino

microcontroller paired with a GSM shield communication module was chosen as the power supply [9]. Using the Internet of Things and a client-server architecture approach, Puja Sharma and Shiva Prakash (2021) monitor real-time weather conditions. There are two levels to the system's configuration. Temperature, humidity, precipitation, and system pressure are all variables that will be monitored by a multitude of sensors in this system. The sensor data is received by the node's MCU controller. The data that has been detected may be uploaded using the Arduino IDE. As a link between the sensor and the cloud, the serial monitor has served its purpose. A serial monitor records an IP address in the data sent by the sensor. The content of the webserver may be accessed over the HTTP protocol. In this way, you may see up-to-the-minute weather data derived from ecological elements or sensors shown on the web site. Without the need for any specific app or website, anybody having access to a webserver may see the current weather conditions. Anyone may access the data [10]. Using the Internet of Things and a client-server architecture approach, Puja Sharma and Shiva Prakash (2021) monitor real-time weather conditions. There are two levels to the system's configuration. Temperature, humidity, precipitation, and system pressure are all variables that will be monitored by a multitude of sensors in this system. The sensor data is received by the node's MCU controller. The data that has been detected may be uploaded using the Arduino IDE. As a link between the sensor and the cloud, the serial monitor has served its purpose. A serial monitor records an IP address in the data sent by the sensor. The content of the webserver may be accessed over the HTTP protocol. In this way, you may see up-to-the-minute weather data derived from ecological elements or sensors shown on the web site. Without the need for any specific app or website, anybody having access to a webserver may see the current weather conditions. Everyone can see the data [10]. Using the Naive-Bayes and Chi-square classification algorithms, Veeresh et al. (2021) presented a method for weather prediction based on classification. To collect and analyze data for weather forecasting, sensing equipment is employed in the environment. After that, the user may access the collected data using Wi-Fi and assess the results. The data will be useful for studies in the future. Using the Naive-Bayes and Chi-square classification algorithms, Veeresh et al. (2021) presented a method for weather prediction based on classification. Environmental sensing equipment is essential for data collection and processing in weather forecasting. After that, the user may access the collected data using Wi-Fi and assess the results. The data will be useful for studies in the

future. Being a web-based program, this system boasts an attractive user interface [11]. a web-based application with a well-designed user interface [11].

PROPOSED METHODOLOGY

An integral part of our proposed system, the Arduino UNO R3 serves as its central processing unit. Figure 1 below shows the schematic of the suggested approach.

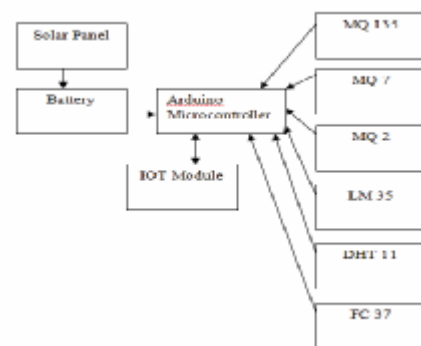


fig 1: Proposed System Block Diagram

Connected to the microcontroller are sensors that monitor things like hydrogen sulfide (MQ 135), carbon monoxide (MQ 7), carbon dioxide (MQ 2), temperature (LM 35), humidity (DHT), and pressure (BMP 180). Connected to the gadget is the ESP 8266, an IoT module that facilitates the retrieval of sensor data from the Arduino and its subsequent upload to a cloud server. A solar panel powers the whole apparatus. The gadget is powered by the energy collected by the solar panel, which is stored in a battery.

ARDUINO IDE PLATFORM

The Arduino is a community of users and a business that uses open-source software and hardware to build microcontrollers for single-board computers. It is possible to transform input data from sensing devices into a desired output by instructing the board's microcontroller. An application created in the Arduino programming language, the integrated development environment (IDE) is made accessible by the Arduino proposal. It is multi-platform. The

amount of inputs and outputs that each kind of Arduino can receive and send, as well as the attached modules, are what differentiate them. The Smart Shopping Cart was built using an Arduino, specifically an Arduino Uno, a general kind of single-board microcontroller that makes use of open-source software and hardware. It is possible to transform input data from sensing devices into a desired output by instructing the board's microcontroller. The Arduino IDE, a cross-platform software based in the Arduino programming language, is made accessible as part of the Arduino proposal. The amount of inputs and outputs that each kind of Arduino can receive and send, as well as the attached modules, are what differentiate them. The Smart Shopping Cart was built using a general form of Arduino called the Arduino Uno.

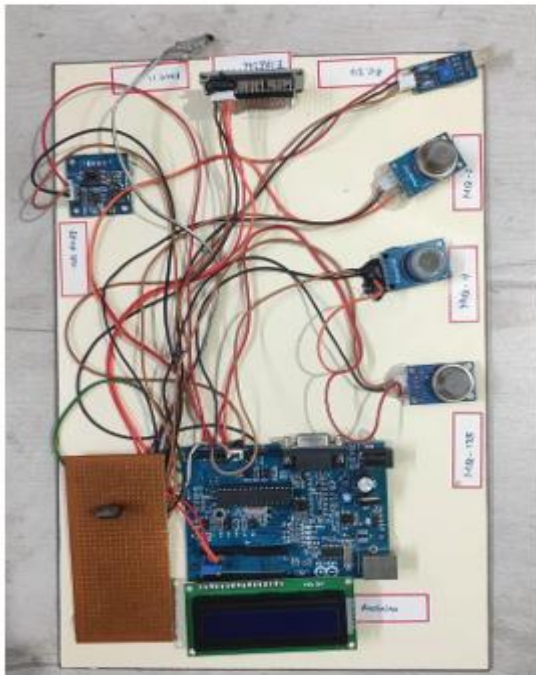


fig 2: Working Proposed System
 Proposed System



Fig 3:H2S No2 and CO Gas Level
 and CO Gas Level



Fig 4: Temperature, Humidity and Pressure Level
Level Fig 4: Temperature, Humidity and Pressure Level

The findings show that all sensor readings are updated in real-time on the Thingspeak cloud server, along with the precise date and time. This means that every location may have a weather forecast system built and monitored in real-time. Solar electricity is both environmentally benign and easy to utilize because of its utilization.

CONCLUSION

The proposed system will be used to create an intuitive weather monitoring system that tracks various environmental variables using IoT technologies. Because it is cost-effective and uses less power, the system's design is more environmentally friendly with the addition of solar panels. Precipitation, air pressure, temperature, humidity, and gas concentrations (H₂S, N₂, and CO) are only a few of the crucial elements that this system measures, calculates, and broadcasts. By

analyzing the efficiency of modern wireless technologies, this research aims to prove that the proposed system is cost-effective, has sufficient power supply, and can measure sensors well.

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