WEATHER MONITORING AND REPORTING SYSTEM USING IOT

Abstract

The IOT-based Climate Forecasting and Reporting System concept is utilized to achieve real-time weather reporting. Temperature, humidity, moisture, and precipitation will all be measured. Consider the following scenario: An active volcano or a canopy of rain forests are two examples of an environment that researchers or nature observers want to keep an eye on as it evolves. They originate from many countries as well. Since the Text-based weather tracking system in this instance has many drawbacks, it only transmits SMS to a select set of contacts. Furthermore, because there are more mobile phone numbers, sending SMS takes longer. They must go to that precise spot to get the weather information for that location, which is available to everyone.

Keywords: Internet of things, Bluetooth, Humidity and Temperature sensor, soil senor, Rain sensor

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I. INTRODUCTION

Environmental monitoring and climate change have received a lot of attention recently. Man is curious about what has been the latest weather patterns in any location, including an educational institution or any other kind of specialized facility. Forecasting stations need to be set up since the world continues to shift so quickly. We provide a station for the weather that is incredibly helpful for any location in this article. IOT (internet of things) is used for powering this climate monitoring station. It has sensors for the environment which can track the surroundings anywhere and transmit information in real time to the cloud. The DHT11 soil humidity sensor, rain fall sensor, and the Arduino Uno were all utilized in conjunction with various sensors in the environment to accomplish it. The parameters related to the weather are used to provide real-time weather data after being sent to the cloud. This research focuses on the use of IOT in the gathering of environmental data and suggests an entirely novel approach for monitoring the environment in the future. The framework was designed to provide current weather information for any selected location, such as a workplace or room, with the goal of creating smart towns.

II. INTERNET OF THINGS

The Internet of Things (IoT) comprises an interconnected system of real-world objects, or "things," that have software, sensors, and other services built in. These "things" can connect to other gadgets and systems over the internet and exchange information with them. These gadgets include low-tech domestic items and sophisticated industrial machinery. Internet of Things devices are now connected in excess of 7 billion times, and predictions indicate that number will increase to ten billion by the year 2020 as well as 22 billion by the year 2025.

III. LITERATURE REVIEW

Many of the methods used today to detect pollution are based on various environmental factors. The design of an Internet of Things-based weather tracking and reporting system has been described. You can gather, process, analyze, and show your measured information on a web server using this system concept. Devices, routers and switches, gateways nodes, and management tracking centers make up the wireless sensor network's administration model. End devices collect information from wireless sensor networks and deliver it, whether directly or through a router, to the parent nodes for transfer to the gateway's node. The gateway node bundles the data from the sensor network's wireless connection once it has been analyzed, then sends it to the host in Ethernet format. Informally, a server is any machine that executes server software.

Network bandwidth management is the responsibility of servers. To increase the system's cognitive ability, adaptability, and effectiveness, Internet-based services and information are connected through LAN and made accessible to users via mobile phones, browsers for the internet, or other web browser devices. The server receives the analysed and Ethernet-formatted data that the gateway node acquired via the wireless sensor network. In a less precise sense, server hardware can also be any device that executes server software. Network resource management is the responsibility of servers. Mobile phones with web browsers, and other devices with internet connectivity allow users to

utilize Internet-based resources and data, enhancing the system's cognitive ability, adaptability, and effectiveness.

The writer of this essay discusses how the weather forecasting system is increasingly a serious issue in every weather severe occurrence that has an adverse effect on individuals and assets. The accuracy of meteorological data is therefore one of the key issues in developing the capacity for weather prediction and strengthening resilience to the effects of unfavourable weather report conditions. The author describes how Uganda along with other nations that are developing have struggled to get timely and accurate meteorological information because of the low amount of weather observation. The lack of weather monitoring makes it more expensive to generate independent climate data.

The little financing is provided to the individual countries' national meteorological agencies. In this suggested system, the author first addresses the issues and then implements them. The author presented a wireless sensor network-based Automatic Weather Monitoring Station. The author intends to create three generations of Automatic weather stations, or AWS prototypes. In this study, the author reviews the first-generation AWS prototype in order to enhance the second generation based on the demand and generation. In order to have an Automatic Weather Station, the author suggests improving nonfunctional requirements such as power consumption, data accuracy, dependability, and data transfer. The non-functional need was eliminated through cost reduction in order to construct a strong and economical Automatic Weather Station (AWS). As a result, the suggested work, such as underdeveloped nations like Uganda, would be able to obtain the AWS in sufficient quantities. In order to enhance weather forecasting

The author [2] presents a system for tracking the weather which is Internet of Things based. Along with the LDR sensor, the author employs a secondary sensor to scale different metrics, including moisture, pressure, temperature, and rainfall value. The system also calculates the dew point value using the temperature prototype. An area, room, or other location's temperature can be ascertained using the temperature sensor. Using the LDR sensor, the brightness of the light can be used as desired. On the basis of information from sensors such as temperature, pressure, humidity, brightness of light, and rainfall value, the author included the capacity of tracking the weather as a text message notification system. An electronic mail and the social network post notification system is also included by the author. A node MCU is used by the author in this framework.

In the present research [3], the author illustrates one of the many fields where the Internet of Things, or IoT, has produced innovative things in the framework by using an inexpensive live weather tracking device that makes use of a display made of OLED. The author described a brand-new, cutting-edge system. This gauges the weather's condition right now. Everyone, from farmers to businesses to everyday workers to students, can greatly benefit from monitoring the weather. By creating an on-demand weather surveillance system, the author was able to reduce the degree of complexity for producers and company owners. In this study, the weather data were displayed on a display made of OLED by the author. The proposed concept, meanwhile, retrieves information from the cloud using an ESP8266-EX microcontroller-based WeMos D1 device working on Arduino. A wifi module called WeMos D1 is built around the ESP-8266EX CPU. It includes a 4MB memory card with flash. It is among the best because it is programmed

with the Arduino IDE and a node MCU. Wemos and OLED are the only two instruments the author uses in this study to measure the weather. After the connection has been established, data gathered will be kept in the cloud and used to display weather information on a Thingspeak webpage. Data is displayed on OLED, and system-based cloud communication is used. The author wants to show real-time data about the weather on an OLED screen.

The author [4] proposed a system that keeps track of and predicts weather patterns so that people can make plans for their daily life. The benefits of this activity spread to business and agriculture alike. In order to track and forecast weather data, the author uses two phases of the climate management framework. A real-time weather monitoring system was provided in stations and buses using data from detectors, bus mobility, and advanced learning technology. The friction-based model is employed in weather prediction. The method incorporates the effectiveness of area-specific processing that is based on sensing data from vehicles like buses. In stage I, weather monitoring, multilayered perception designs, and persistent memory are trained, according to the author, who then describes how it can be verified using information about the environment's temperature, moisture, and air pressure. In Stage II, the training technique is employed to learn the weather data time series. The author compared actual meteorological data with data gathered from the system to ascertain whether or not the information is accurate and to evaluate the system's performance. The author then addresses the trustworthy performance of the proposed system in weather monitoring. This model also provided a one-day forecast of the weather or predictions through the training framework. Lastly, the author demonstrates how this system provides real-time weather tracking and forecast using bus data management. Four essential elements are represented by the author. 1. Information management. 2- A bus station with interactive technology 3- Model for predictive machine learning 4- A website that provides weather data. An interactive graphic is used to display this data.

In this research paper, the author [5] describes how the weather can be monitored using Internet of Things (IoT) technology. The author constructs an IoT-based weather tracking system. and that provide details on climate change. With the help of this endeavour, people might become more aware of climate change. The output is accurate and effective, and the swarm approach is used to further increase the accuracy. So, the purpose of this project is for the author to use IoT to build a weather monitoring system. The project is straightforward to implement because it uses software as well as hardware. In the research, the writer uses a different sensor to collect and preserve climatic data. For this keeping, Internet of Things projects frequently turn to the website www.thingspeak.com. Additionally, it downloads all of the weather-related data stored in the cloud storage facility and publishes it via an Android app.

IV. SYSTEM DESGIN

The temperature and humidity senses have always been important to humans. The weather station's main objective is to record the weather's cyclical variations. It was created a weather observatory that uses sensors (DHT11) to track temperature and humidity in a particular area. Additionally, it uses a module that supports Bluetooth (HC-05) to transmit information from the sensors to an Android app (SENA BTERM), which the user may access on their phone to view information such as comparative temperature and humidity.

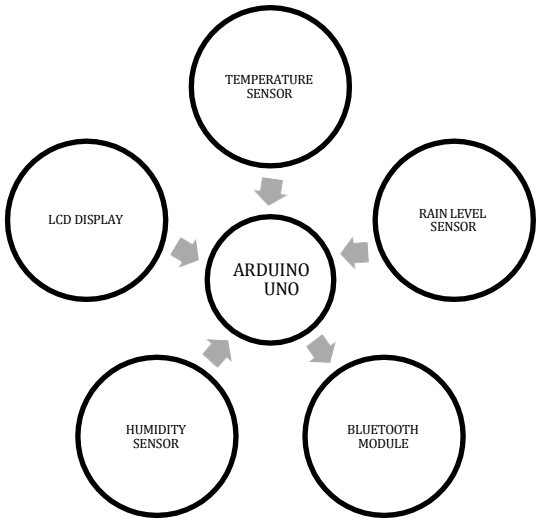

Figure.1: Block diagram

The Arduino Uno Board is used to implement the Bluetooth weather station. Connecting the Bluetooth-enabled HC-05 unit and the DHT11 sensor, the board acts as a bridge. Through serial connectivity, the Arduino receives information gathered by the sensors and transmits it to the computer for display. The SENA BTERM application installed on the Android mobile device displays the sensor data that was transmitted by the HC-05 Bluetooth module. It is easy to keep track of your local climate conditions in the present moment from wherever on the planet. In order to analyze fluctuations in the weather and discover how human caused change in the climate has impacted your local weather, it is important to save climatic and environmental information both temporarily and permanently. It is easy to set up the infrastructure for tracking regional atmospheric factors and environmental conditions for forecasting the weather and prediction. In order to increase crop output, farmers require to understand the relative humidity, temperature, soil moisture, amount of rain, and other elements. To gather this information, sensors such as the sensor for temperature, humidity/hygrometer detector, moisture content of the soil sensor, rainfall sensor, and others are employed.

In the IOT-enabled weather tracking project, the Arduino Uno detects four variables related to weather using four sensors. The combination of a temperature detector, a sensor for humidity, an illumination sensor, and a water level sensor makes up the total of four sensors. The aforementioned four sensors are connected directly to the Arduino Uno because it has an analog to digital converter. The weather tracking system offers excellent accuracy and dependability for meteorological tracking and climate change. It uses a green energy source, like a solar panel, to charge the connected battery. It can get online weather data and statistics in real time. This system has GPRS (general packet radio service) network communication capabilities. Less upkeep is necessary for end users. It has the capacity to store data and make it available to users as required.

V. THE ARDUINO UNO

The Arduino Uno, which is a microcontroller board s an electronics platform that is free and open-source and is mostly based upon the Atmega328 AVR chip. For connecting to external electrical circuits, the present Arduino Uno model offers an external USB interface, analog connection, and 14 digital I/O ports. Six of the 14 inputs and outputs allow for PWM output. Designers can use it to communicate with and perceive real external electronic devices. This board can be readily linked to a computer using a USB cable and has all the functions needed to operate the controller. Using IDE software, which was created specifically for programming Arduino boards, the program's code is transferred to the controller. C++ and other languages for programming are used in the IDE application. A microcontroller built around the ATmega328P platform powers the Arduino Uno board. This board features serial communication features for showing received data on a PC as well as an IDE (Integrated Development Environment) for fundamental programming.

VI. RAIN LEVEL SENSOR

A simple rain detecting device is the rain sensor module. It is possible to use a raindrop that passes through a wet board as an indicator and to gauge the force of the rain. The analog output is employed to track variations in rainfall volume. If the device's DO output is high enough that there are no droplets on the induction circuit board and the device is linked to a 5V power source, the LED will light up. Due to the low DO output, even a small amount of water spilled will cause the switch's indication to turn on. High levels of output are produced when the area is returned to its original state following the water drops have been eliminated. The term "rain sensor" refers to a switching device that detects rainfall.

Figure.2: Rain sensor with Bluetooth module

VII. TEMPERATURE AND HUMIDITY SENSOR

Digital signal output is included with the DHT11 humidity and temperature Sensor. A high-performance 8-bit CPU is part of it. High dependability and exceptional long-term stability are guaranteed by its technology. It performs brilliantly, is of great quality, reacts quickly, and is interference resistant. Each DHT11 sensor comes with a humidity calibration chamber that is incredibly accurate. Signals captured by the internal detectors and stored in the OTP programming memory are known as calibration coefficients. It is incorporated to

speed up and simplify the use of single-wire serial interface technology. It may be used for most challenging situations thanks to its tiny dimensions, low power consumption, and ability to transmit signals ranges of as much as 20 meters. The 4-pin single row connection arrangement makes up the product. Users can join whenever they want and order certain bundles.

VIII. HC-BLUETOOTH MODULE

The Bluetooth module for the HC-05 makes use of the Serial Port Protocol (SPP) theory. The main purpose of this module's design was wireless serial communication. This module features Bluetooth V2.0+EDR (Enhanced Transfer Rate) modulation at 3Mbps in addition to a full 2.4GHz radio transceivers and baseband. It makes use of the CMOS and AFH (Adaptive Frequency Hopping Feature) technologies of the CSR Blue core 04-External single device Bluetooth connectivity system. The Bluetooth module makes it possible to access the weather station remotely due to its inexpensive cost, low power requirement, and high range. The sensitivity of the Bluetooth module is -80dBm. It uses a UART interface with a baud rate that is programmable. The typical data packet possesses eight bits of data, one stop, and one start, and the common baud rate is 36800.

The project employs the HC-05 Bluetooth module, which operates in slave mode. The HC-05 is a six-pin integrated circuit (IC) with the TX and RX pins linked to the Arduino board's RX and TX pins. The potential divider circuit reduces the Arduino's 5V potential to 3.3V to guarantee optimal transmission and reception between the Arduino and the Bluetooth Module. It is critical to synchronise the baud rates of the Arduino and the Bluetooth module to avoid data loss and ensure proper connectivity.

IX. RESULTS

The sensor collected temperature and humidity data in the lab, which was shown on the Arduino serial monitor screen. The data is also shown on the Android smartphone utilising the SENA BTERM application through a Bluetooth module named the HC-05, as seen in Figure;

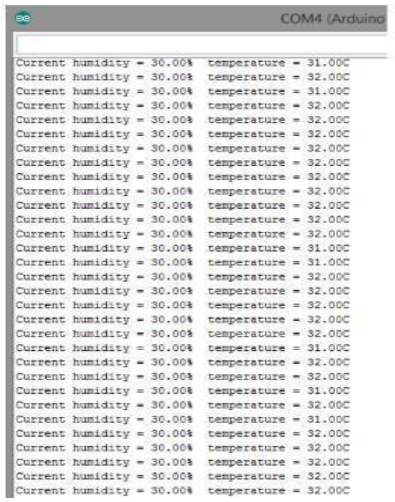

Figure.3: Output data

X. CONCLUSION

A Bluetooth-based weather station is a trustworthy and practical device for exact monitoring of environmental factors such as temperature and humidity. Users may view specific changes in human power as well as reduced human power. The scope of this project may be expanded to incorporate light intensity measurement using an LDR (Light Dependent Resistor). Furthermore, we may include IOT (Internet of Things) into the same project and display the results on a server, therefore building a modest data gathering system.

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