Smart Weather Station for Rural Farmers

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Abstract- Monitoring the weather is important for everyone. Especially for the first ones, this is a very necessary thing. They can act as soon as they know the weather forecast. Current weather monitoring reports come from the news agency. They received weather information from a central system. Individual weather monitoring systems can accurately predict the weather for a specific area. Here we offer a solution as an Android-based weather monitoring system that uses Bluetooth. Nowadays, the demand for portable weather monitoring devices that can be relied upon for real-time warning and notification of changing environmental conditions is becoming more and more necessary. To meet these requirements, we have created an efficient, compact, and cost-effective weather station that provides us with valuable information about temperature and humidity through the highly reliable DHT11 sensor and HC-05 Bluetooth module. The DHT11 sensor ensures high temperature and humidity measurement accuracy, while the HC-05 Bluetooth module enables high data transfer speed, better range, and portability. Also, it monitors and controls the moisture level of the soil and sends the collected data to the farmers through an Android application using a Bluetooth controller.

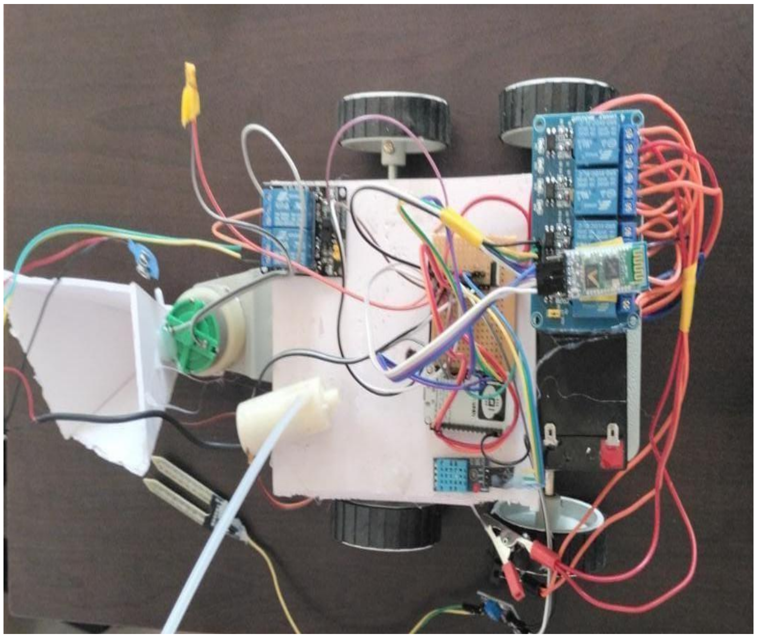
KEYWORDS: DHT11sensor, HC-05 Bluetooth module, Weather station, soil moisture sensor, and Android application

I. INTRODUCTION

The IoT applications help the farmer to reduce these problems and increase the efficiency of the standard and value of agricultural production. The Internet of Things (IoT) could be a technology where a mobile device is used to monitor the activity of the sensor. The perception of humidity and temperature has been important to humans for centuries. The basic concept of a weather station is to keep up with regular weather changes. Over the years, humanity has been affected by several major weather phenomena. Today, temperature and humidity are a major concern as global warming continues to threaten the environment. Conventional weather stations are large and consume more energy with limited reliability. In demanding situations, we need a weather station that is not only portable and compact to measure various environmental factors in remote areas, but also improves efficiency and reduces power consumption. The proposed device uses an ESP8266 node MCU microcontroller to manage and monitor the condition of the location status anytime, anywhere through an Android application. For these new needs, we designed and implemented a device that measures the temperature and humidity of a certain area with sensors (DHT11). The weather station's sensors measured and recorded data on temperature, humidity, and soil moisture. Collected data can be presented directly to the phone application as the data is regularly read and stored accordingly in a special database system. The Internet of Things (IoT) allows sensors to identify data from different sensors and connect them to exchange information on the Internet. It can be used to update the status of the device. This can be done by using a higher communication device such as a Wi-Fi module or Node MCU. In addition, it sends the data received by the sensors using a Bluetooth module (HC-05) to an Android application (BLUETOOTH CONTROLLER), which allows viewing the data in the form of relative temperature and humidity on a user's phone. The goal of this project is to design an easy-to-use portable weather station that meets the requirements of ease of use. The project emphasizes the use of the Node MCU board connected to a DHT11 sensor and a Bluetooth module. An Android application is required that allows the user to access all the measurements made in the weather station with one touch. It allows the user to regularly check the humidity and temperature details as set by the user.

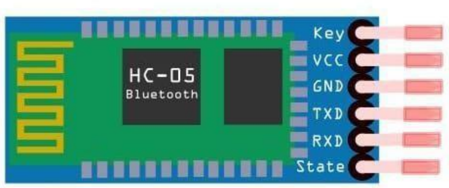
II. EXPERIMENTAL SETUP

The Bluetooth weather station is implemented using a microcontroller board. The board is used to connect the DHT11 sensor to the Bluetooth HC-05 module as shown in Figure 1. The microcontroller receives the data from the sensors and displays the output on the computer using serial communication. The HC-05 Bluetooth module is responsible for transmitting the data received from the sensors to the Android mobile phone, which is then displayed on the mobile phone using the BLUETOOTH CONTROLLER Android application.



The proposed structure of the weather and water level monitoring system is based on IoT. The proposed project includes a weather forecasting system that helps analyze data collected from various sensors. For an intelligent agricultural system, we used components like soil moisture, temperature, humidity sensor, relay & water pump. The soil moisture sensor is a connected microcontroller that when the humidity is above 10% (i.e. the soil is dry) those readings are returned. The microcontroller (Node MCU) instructs the relay to start the engine. Therefore, if the level of humidity is less than or equal to 10% it shows us that there is enough soil moisture and the engine remains off. The next half of the project based on a weather forecasting system. We use DHT11 (temperature and humidity sensor), The DHT11 helps to detect the temperature and humidity of the environment.

A. BLUETOOTH MODULE (HS-05)



The HC-05 shown in Figure is a Bluetooth module that works according to the SPP (Serial Port Protocol) principle. This module is specially designed for wireless serial communication. This module is equipped with Bluetooth V2.0 EDR (Enhanced Data Rate) 3 Mbps modulation with a full 2.4 GHz radio transmitter and base

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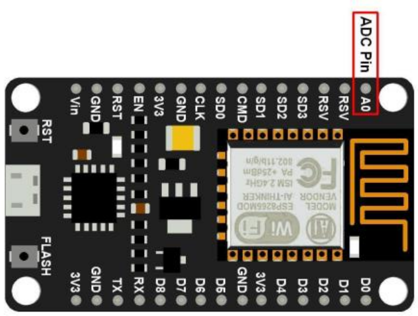
frequency. It uses CSR Bluecore 05 External single-chip Bluetooth system with CMOS technology and AFH (Adaptive Frequency Hopping Feature). The Bluetooth module is used because of its low cost, low energy consumption, and long-range, which allows the user to reach the weather station from a considerable distance. The sensitivity of the Bluetooth module is -80 DBm. It uses a UART interface whose baud rate can be programmed. A commonly used baud rate is 36800 and a data packet typically contains 8 bits of data, 1 stop, and no parity bits. These Bluetooth modules have two modes: master and slave. Even-numbered (HC-05) devices can be configured as master or slave after leaving the factory and cannot be changed to another mode. But for an odd device like HC-05, the user can set the mode to be superior or inferior using AT commands. The Bluetooth module used in the project is HC-05, which works in slave mode. HC-05 is a 6-pin IC where the TX and RX pins are connected to the RX and TX pins of the ESP8266 board. The potential divider circuit used reduces the 5V potential of the ESP8266 to 3.3V to ensure proper transmission and reception between the node MCU and the Bluetooth module. We need to make sure that the baud rate of the Bluetooth module is synchronized with the ESP8266 so that data is not lost and proper communication is achieved.

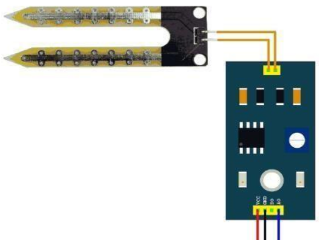
B. ESP8266 BOARD



A low-cost System-on-a-Chip (SoC) called the ESP8266 serves as the foundation of the open-source Node MCU (Node Microcontroller Unit). The Espressif Systems-designed and produced ESP8266 has all the essential components of a computer, including CPU, RAM, networking (Wi-Fi), and even a contemporary operating system and SDK. This makes it a fantastic option for all types of Internet of Things (IoT) projects The ESP8266 is difficult to access and use as a chip, though. For the simplest operations, like turning it on or sending a keystroke to the "computer" on the chip, you must solder wires with the necessary analog voltage to its pins. Additionally, you must program it using low-level machine instructions that the device can understand The Processor is an L106 32-bit RISC microprocessor core based on the Tensilica Diamond Standard, Memory is about 32 KiB instruction RAM, 32 KiB instruction cache RAM, 80 BiB user-data RAM, 16 KiB ETS system - data RAM, Integrated TR switch, 17 GPIO pins, Serial

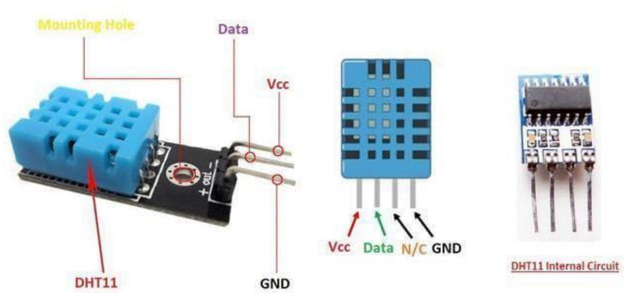
Peripheral Interface BUS (SPI).

C. SOIL MOISTURE SENSOR



Soil moisture sensors measure the volumetric water content in the soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners. Soil moisture sensors typically refer to sensors that estimate volumetric water content. Another class of sensors measure another property of moisture in soils called water potential; these sensors are usually referred to as soil water potential sensors and include tensiometers and gypsum blocks Measuring soil moisture is important for agricultural applications to help farmers manage their irrigation systems more efficiently.

D. TEMPERATURE AND HUMIDITY SENSOR



DHT11 is a temperature and humidity device. The sensor comes with an

NTC sensor to measure temperature and an 8-bit microcontroller to output temperature and humidity values as serial data. The sensor is also factory calibrated so it is easy to interact with other microcontrollers. The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with accuracy of ±1°C and ±1%. Therefore, if you want to measure within range, this sensor will be a good choice for you.

III. HARDWARE DESIGN

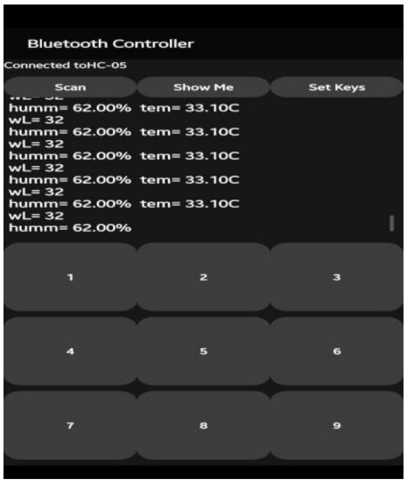
The proposed structure of the weather forecasting system based on IoT is divided into two parts. The first half of the proposed project includes a smart farming system built using new Internet of Things technologies. The second half is a weather forecasting system that helps analyze data collected from various sensors for an intelligent agricultural system we, used components like soil, temperature, humidity sensor, relay, and water pump. The soil moisture sensor is a connected microcontroller that when the humidity is above 10% (ie the soil is dry) those readings are returned. The microcontroller instructs the relay to start the engine. Therefore, if the level of humidity is less than or equal to 10% it shows us that there is enough soil moisture and the engine remains off. The next half of the project based on a weather forecasting system. We use DHT11 (temperature and humidity sensor), The DHT11 helps to detect the temperature and humidity of the environment. It includes Bluetooth (HC-05) module, which is connected to the esp8266 board. DHT11 connected to node MCU digital pins to read Atmospheric temperature and humidity. Here DTH11 reads the respective parameters of the atmosphere and also measures the soil moisture level. Bluetooth sends all this data to the Android mobile application. This Android Application is customized and displayed all sensor data.

IV. SOFTWARE DESIGN

Embedded systems programming is different from developing applications on a desktop computer. Key characteristics of an embedded system, when compared to PCs, are as follows. Embedded devices have resource constraints(limited ROM, limited RAM, limited stack space, less processing power) Components used in embedded systems and PCs are different; embedded systems typically use smaller, less power-consuming components. Embedded systems are more tied to the hardware. Two salient features of Embedded Programming are code speed and code size. Code speed is governed by processing power, and timing constraints, whereas code size is governed by available program memory and the use of programming language. The goal of embedded system programming is to get maximum features in minimum space and minimum time.

V. RESULT

All the data related to the sensors are uploaded to the Bluetooth controller application server by specifying the write interface key of the weather forecasting application based on the IoT of a specific channel. The channel monitors and displays information such as temperature, humidity, and water level in the soil by the android application in Fig. It also shows the water level in the soil, the pump will turn on when the water level is low.



VI. CONCLUSION

We are developing a market-based system that helps automate the monitoring system by analyzing soil moisture and continuously monitoring weather conditions. An intelligent irrigation system proves to be a useful system because it automates and regulates irrigation without manual intervention and prevents soil flooding. The main applications of this project are for farmers, greenhouses, and gardeners who want to closely monitor soil water levels. Here, different types of sensors are used for different purposes to detect the observed parameters. The sensors cover several parameters and these sensors send alerts to the microcontroller, which in turn informs the system administrator through a mobile application installed on the smartphone. Our further work on this system depends on the customer's requirements, which helps to develop the system in a mature state.

VII. FUTURE SCOPE

In addition, the project can be modified and scaled according to customer requirements, and depending on the size of the field, the number of sensors can be multiplied and upgraded to obtain accurate readings throughout the field. The system can also be adapted to a GSM-based standalone embedded system that can monitor and control such sensors regardless of distance limitations.

VIII. REFERENCES

[1] Akhilesh Chawla, Tejas Bangera, Chinmay Kolwalkar, Mahalaxmi Bhat, Electronics and Telecommunication EngineeringUniversity Of
Mumbai, '*Bluetooth Based Weather Station'* International Journal of
Engineering Trends and Technology (IJETT) 2015

[2]Huang, H., Wang, H., Chen, Y., & Zou, X. (2021). A Review of Smart Agriculture Technologies and Applications. Agricultural Water Management, 255, 107063.

[3]Singh, R. K., Mohapatra, P., & Kumar, P. (2020). Smart Agriculture: A Comprehensive Review. Journal of Cleaner Production, 257,120524.

[4]Martínez-Carrasco, F., Skliros, D., Pérez-Navarro, A., & Mesas-Carrascosa, F. J. (2021). Smart Agriculture: A Review of Technology, Applications and Future Trends. Agricultural Water Management, 249, 106792.

[5] Kumar, V., & Singh, M. K. (2021). IoT-based smart agriculture: a comprehensive review. Journal of Ambient Intelligence and Humanized Computing, 12(1), 123-143.

[6] Jangir, P., & Khandelwal, P. (2021). IoT-based smart agriculture: A comprehensive review of architectures, challenges, and solutions.
Computer Networks, 191, 108000.

[7]Singh, P., Singh, P., & Bhatia, R. (2021). IoT-based smart agriculture: A review of enabling technologies and applications. Journal of King Saud University-Computer and Information Sciences, 33(3), 324-336.

[8]Kumar, V., & Singh, M. K. (2021). A review on IoT-based smart agriculture using machine learning techniques. Journal of Intelligent and Fuzzy Systems, 41(1), 697-714.

[9]Sultana, I., Islam, M. R., Uddin, M. J., & Hossain, M. S. (2021). IoT-based smart agriculture: A review on technology, architecture, applications, and challenges. IEEE Access, 9, 11629-11647.

[10]Bao, H., Wang, X., Li, Y., & Wang, B. (2021). IoT-based smart agriculture: A review of research progress and development prospects. IEEE Access, 9, 22511-22529.

[11]Singh, A., Singh, K., &Pateriya, P. (2021). IoT-based smart agriculture: A review of enabling technologies and applications. Journal of Ambient Intelligence and Humanized Computing, 12(5), 5015-5030.