Weather monitoring system using internet of things

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Abstract: The technology used is an innovative way for tracking and analyzing local weather patterns and makes the data accessible from anywhere across the globe. This has been carried out easily using Internet of Things (IoT) technology, which is an effective way to link objects to the internet and connect essential information to globe together in a chain. The system includes sensors used to monitor environmental factors such as temperature, relative humidity, atmospheric pressure and air quality. It then transfers the data to a web page where the collected data is plotted. The updated information from the system in place can be viewed online from anywhere in the world. This work uses a sensor or a parameter to track the required weather data in real time and displays it on a web server. Keywords — Arduino Software, ESP8266, Internet of Things (IoT) Embedded Computing System, Sensors.

1.INTRODUCTION

A weather monitoring system is a device which provides live weather data such as temperature, humidity and air quality. This device plays a crucial role in many situations such as agriculture, meteorology and many more. Internet users can access weather data form anywhere in the world that too at any time. The weather data is now displayed and announced on television and the radio, but only at specific times and with reduced efficiency. Nowadays, technology plays a very crucial role in helping people with their daily lives. Therefore, this project uses technology to enable individuals to know the weather at a specific location with just their fingertips. With the help of this monitoring system many upcoming natural disasters can be detected and actions can be taken to save agricultural destruction and even lives. Installation of this system in rural areas can be beneficial, as due to lack of facility rural area people already face many problems.

Recently, the Internet of things (IOT) technology has developed it has led us to the creation of IoT based weather monitoring systems. These systems use sensors to monitor and control environmental conditions such as temperature, atmospheric pressure, air quality, etc. All the real time information that is collected from these sensors are sent to a website and are plotted as graphical statistics which can be accessed easily by anybody at any time. The system is implemented using smart phones and Wi-Fi protocols for intelligent monitoring. The measured data is displayed using the web-based system.

2. Methodology

2.1 Hardware Requirements

MQ-135 (Air quality sensor): MQ-135 sensor is used for air quality monitoring. It detects gases such as carbon dioxide, ammonia, methane, and more. It is commonly employed in applications like air purifiers and environmental monitoring to ensure safe indoor and outdoor air quality.

DHT 11 (Temperature and humidity sensor): The DHT11 sensor is a low-cost digital sensor which checks temperature and humidity and provides accurate information about the temperature and humidity in its surroundings. Measurement Range: Temperature: 0°C to 50°C Humidity: 20% to 80% relative humidity It typically operates at 3.3V or 5V

Node MCU ESP8266MOD: The Node MCU ESP8266MOD is a versatile Wi-Fi module operates at 3.3V, integrates a microcontroller. It has 4MB flash memory. It's highly programmable with various programming languages Wi-Fi standards makes it suitable for wireless communication.

MB-102(Breadboard Power supply): The MB-102 is a commonly used breadboard power supply module. This module typically accepts input voltages ranging from 6.5V to 12V and outputs two regulated voltage rails: +5V and +3.3V The MB-102 is commonly used for prototyping and testing circuits

Arduino UNO: The Arduino Uno is a popular microcontroller ATmega328P microcontroller, 32KB flash memory, 2KB SRAM, 1KB EPROM, and 14 digital I/O pins (6 PWM outputs). It offers 6 analog inputs, a USB connection for programming, a power jack, and an ICSP header. The Uno operates board with a 16MHz at 5V, making it suitable for interfacing with various sensors and actuator

Breadboard: breadboard is a tool used in electronics. It is a simple board which has a grid of holes which helps us connect other electronic together for testing.

Pins: basically, pins are electric connectors, used to connect components in a circuit.

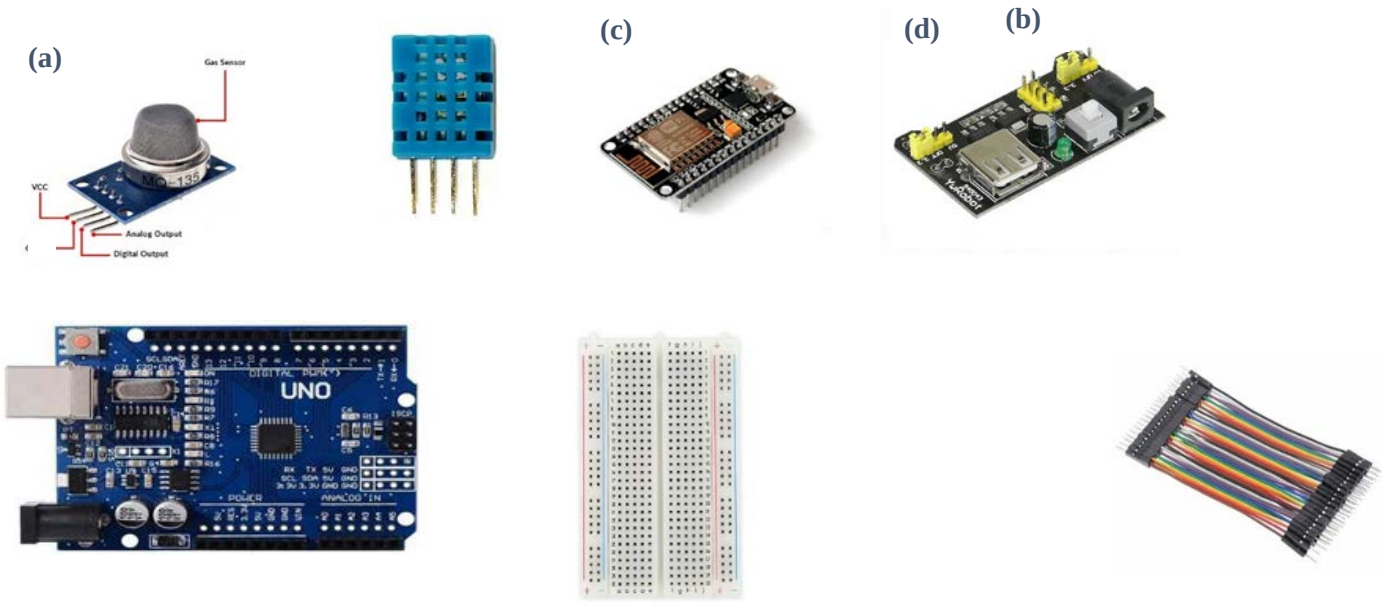

Figure 1. (a) MQ-135 (B) DHT-11 (c) Node MCU ESP8266MOD (d) MB-102 (e) Arduino UNO (f) Breadboard (g) Pins

(f) **(g)**

2.2 Software Requirements

Arduino: Arduino will be programmed to collect all the data from the sensors. It will also show this data on the I2C LCD Display. The Arduino will send this data to Node MCU ESP8266MOD to transfer the information to IoT Cloud for Data Collection and Storage.

Node MCU ESP8266MOD: This will be programmed to send this data to ThingSpeak. It is an IOT analytics platform which gives us the access to visualize and observe real time data. We can transfer data to ThingSpeak from our devices and display live data.

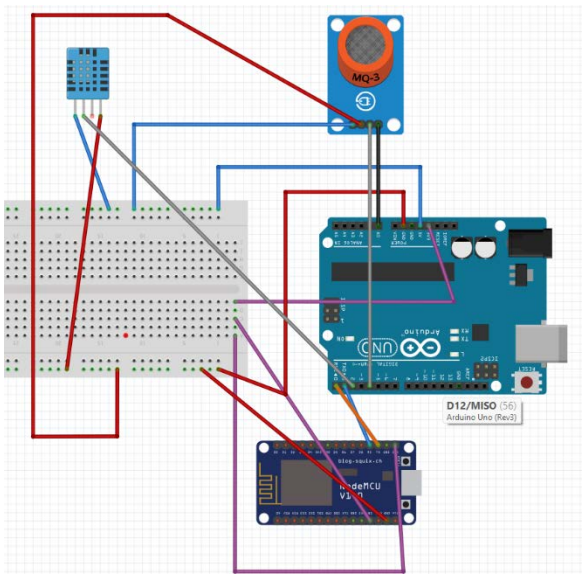

Figure 2. Circuit diagram of the system

3. Results and Discussions

The result of our project shows the data collected by the sensors on the ThingSpeak platform. The data of temperature, Humidity and Air quality is graphed over a period of time. The change in data is visible after a short period of time. The DHT11 data change more frequently compared to MQ-135 data. MQ-135 data has only air quality index which doesn't change very frequently. One of the limitations of the system is that changing the Wi-Fi connection is not very easy. You have to change the code of NodeMCU every time.

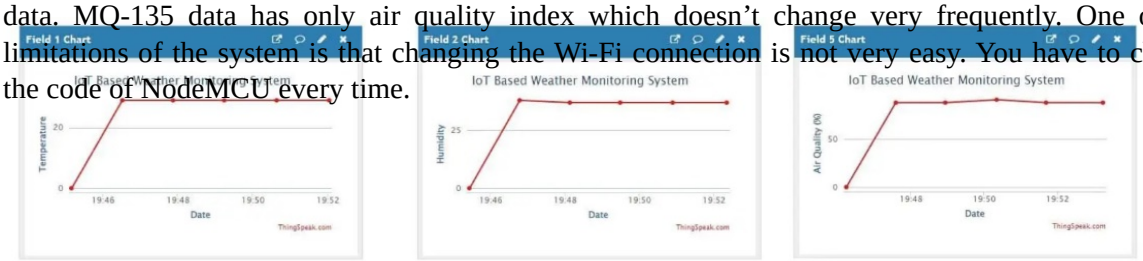

Figure 3. Result Graphs of Temperature, Humidity and Air Quality on ThingSpea]k

4. Future Scope

In Healthcare: Weather monitoring system can be used in hospitals and medical colleges for research and to study about the weather effects on health and diseases, to provide awareness.

Agriculture in remote areas: In remote areas weather data is either not there or is not accurate. With the use of our weather monitoring system a farmer will get an idea of the weather and help him plan accordingly.

Climate change monitoring: with the help of weather monitoring system, we can keep track of the impacts of climate change in a better way. In order to reduce the effects of climate change, there will always be a greater focus on enhancing tools and software to evaluate long term climate trends.

Early warning systems: By weather monitoring system we can get timely as well as long term climate change warnings helping the society to adapt and mitigate the effects of a changing climate.

5. Conclusion

Advancements in modern weather prediction technologies, including our weather monitoring system project, have substantially improved accuracy and reliability. Utilizing tools like remote sensing instruments and advanced computer models, our project contributes to enhanced global weather forecasting. These improvements have practical implications, from optimizing agricultural practices and improving transportation planning to proactive disaster management and environmental conservation. Looking ahead, continuous innovation in weather prediction remains crucial for building a resilient and adaptive society amidst evolving environmental conditions.

While there are still many limitations to these devices, like the sensors are not 100 percent accurate. With time these technologies are sure to be improved upon. Adding new sensors and new use cases.

6. Acknowledgment

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7. References

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