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IoT: Based Weather Monitoring System

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Abstract: ***The Weather Monitoring System using the IoT is one such application of IoT that has paved the way for organizations to create new and efficient solutions. Because of the rapidly changing climate, the weather forecast is uncertain and inaccurate these days. The IoT based Weather Monitoring system features to monitor temperature and humidity level, Barometric pressure, light intensity, air quality and rainfall. The required hardware includes Raspberry Pi, Arduino Mega, DHT11, Light intensity sensor BH1750, MQ-135, BME-280, and raindrop sensor.. All the above sensors are used to measure the given parameters. Arduino IDE and Node-RED software is used for programming and connecting hardware devices and online services. All sensors and hardware components are connected and built with Raspberry pi and Arduino. The arduino board is programmed with necessary code through Arduino IDE. The output of the arduino is stored in the local database using the influxdb. A Web Application dashboard is developed using HTML, CSS and JavaScript. The web application collects data from the Node-RED and the dashboard visualizes all the sensor data like temperature, humidity, barometric pressure, light intensity, air quality and rainfall. The paper gives a description of using IoT to help the user to identify and monitor the temperature, humidity, barometric pressure, air quality, light intensity and rainfall in the environment. This dashboard will update real time values of the above parameters to helpmonitor, control and maintain a particular environment.***

Keywords: IoT, Node-RED

I. INTRODUCTION

Recent years have seen a lot of interest in environmental monitoring and climatic change. Man wants to be aware of the most recent weather conditions in any location, such as a college campus or any other specific facility. There should be weather stations because the climate is changing so quickly. Here, we offer a weather station that is beneficial for all locations. Based on IOT, this weather station (internet of things). It has environmental sensors that can be utilised to report measurements from a particular location. The Weather Monitoring Systems in global Market is projected to grow from 20 thousand crores in 2021 to 26 thousand crores by 2026, at an annual growth of 5.1% in terms of value during the forecasted period. The motivation of this project is to create an ideal environment and keep a track of the internal and external surrounding weather of the aquaponics unit. The term "Internet of Things" (IoT) refers to networks of physical objects (things) that are equipped with sensors, software, and other technologies to connect to other devices and systems online and exchange data with them. It is a broad field that offers a place to build a variety of prototypes, from simple domestic devices to sophisticated industrial devices. The paper gives a description of using IoT to help the admin to identify and monitor the temperature, humidity, barometric pressure, air quality, light intensity and rainfall in the environment. This dashboard will update real time values of the above parameters to help monitor, control and maintain a particular environment.

The purpose of this paper is to understand how IoT can be used to build a personalized weather monitoring system which can help users to visualize the real time data of various weather conditions in a dashboard.

II. LITERATURE SURVEY

K. S. Nikhilesh, Y. H. Raaghavendra, P. J. Madhu Soothanan and R. Resmi, "Low-cost IoT based weather monitoring system for smart community,"

This real-time weather monitoring system is built for a smart home that displays weather parameters such as the intensity of rainfall, temperature, wind speed and light intensity from the sensors to the cloud by injecting message queuing telemetry transport protocol. The proposed system is portable, affordable and the data can be accessed at any instant

R. K. M. Math and N. V. Dharwadkar, "IoT Based Low-cost Weather Station and Monitoring System for Precision Agriculture in India,"

This paper proposes a IoT based real-time local weather station for PA, that would give farmers a means of automizing their agricultural practices (irrigation, fertilization, harvesting) at the right time. This system would also aid the farmers to do agricultural tasks on real-time bases, which in turn helps them to use the agricultural resources in sufficient way and at the time when needed by the crops. This proposed weather system is a new way towards the building of PA system considering the Indian scenarios.

N. Kumari, Sakshi, S. Gosavi and S. S. Nagre, "Real- Time Cloud based Weather Monitoring System,"
This is an IoT based framework to gather the constant climate boundaries and store the information to the cloud stage. The gathered information is shown through the website page. The put away information is of extraordinary benefit where weather conditions guaging is required. The climate boundary incorporates temperature, stickiness, dew point, light power, pneumatic stress, precipitation, and smoke rate. The NodeMCU is utilized as a MQTT client to move the detected information to the Thingspeak cloud stage.

Sriyanka and S. R. Patil, "Smart Environmental Monitoring through Internet of Things (IoT) using RaspberryPi 3,"
This paper examines an observing framework which gives data about natural circumstances and momentarily contacts the mechanical progressions in checking the climate and drawing out the new degree in checking the ongoing climate issues. The framework is created utilizing Arduino, Raspberry Pi 3, Zigbee and Adafruit IO which ends up being financially savvy and having low power utilization. The sensors will assemble the information of different natural boundaries and give that information to Raspberry Pi through Zigbee from the Arduino. The Raspberry Pi 3 will then transfer the handled information on to the web through python programming and involving Adafruit IO as an IoT stage. Trial results exhibited that the framework can precisely gauge the convergences of the carbon monoxide, carbon dioxide, flammable gases, smoke and air quality

J. Shah and B. Mishra, "IoT enabled environmental monitoring system for smart cities,"
A smart city needs to make resources more efficiently and provide its residents with services of higher caliber. The fundamental variables for providing services like managing air quality, tracking the weather, and automating homes and buildings in a smart city are temperature, humidity, and CO2. In order to check temperature, humidity, and CO2, this study provides a customised design for an IoT-enabled environment monitoring system. Data is transmitted from the transmitter node to the receiver node in an established system. Through a Graphical User Interface (GUI) created in LabVIEW, the data got at the receiver node is tracked and recorded in an excel sheet on a personal computer (PC)

III. SUMMARY OF LITERATURE REVIEW

A real-time weather monitoring system for a smart home and data is sent to cloud and data using telemetry transport protocol
There are many local weather stations around the globe, which can be collected from the authorities and this data can be visualized for the farmers to view real-time weather data. Cloud services can be used to store sensor data and later the information can be shown on website. Modules like NodeMCU and MQTT client can used. Microcontroller like Arduino and low-cost computers like Raspberry Pi can be used to build weather stations. This helps developers to build their own gadgets. Front-end technologies can be used to visualize sensor data and information in various formats and dashboard.

IV. EXISTING SYSTEM

In existing system, the weather stations are built in very small scale with on few sensors which display locally. A very few parameters are considered like temperature, humidity, and barometric pressure. The data collected is not stored in database for future references which becomes really for users to view historical data of the parameters. Data is visualized in an external platform or locally and not a determined platform

A. Disadvantages

1) Very few parameters are considered.
2) Data is not stored for future references.
3) A dedicated platform for the personalized weather station is not built.

V. PROPOSED SYSTEM

This weather monitoring system features to use various sensors like dht11 sensor, MQ135 sensor, light intensity(BH1750) sensor, raindrop module sensor and BME280 sensor are embedded with arduino mega to read temperature, humidity, air quality, light intensity, rainfall and barometric pressure. Serial communication is used between arduino and raspberry pi to connect each other using USB. The Arduino IDE is used to write and upload the code for reading data from sensors and sending it to Raspberry Pi, and it is written in C++. This program imports dht11, light intensity, mq135 and rain drop module libraries from adafruit and other distributors.

Node-RED is a visual tool for non-programmers to work with the Internet of Things, it can be used to build applications for IoT products. Node-RED can be used to easily interface hardware devices, APIs, and other online services together in new and interesting ways. Node-RED is an open source IoT tool. Node-RED uses a module-based approach, in which predefined modules are graphically connected to perform the sequence of operations on Node_RED. It directly reads data from microcontroller boards such as Arduino and Raspberry Pi using the predetermined pin number. Node-RED helps connect the arduino and functions are written to format the data received from the arduino. Further the functions are wired with Influx Db to store all sensor data.
Node-RED is used to create a basic dashboard for all the parameters.
Influx Db is used for storing all the sensor data in a current timestamps and retrieve it to the node-red.
The Visual Studio Code is used for development of a application for the weather monitoring system. The basic Node-RED dashboard is accessed here and retrieved. The entire system is written in HTML, CSS and JavaScript, Node.js and React.

A. Advantages

The advantages for the proposed system can be listed out as follows:

1) Open source
2) Easy to build and deploy
3) The dashboard is one place to visualize and the in one place
4) A dedicated user can register and login to the web application created using react

VI. ARCHITECTURE

Fig1 describes the development of an IoT-Based Weather Monitoring System in Aquaponics is one of a monitoring system with main focus on climate and weather monitoring. the sensors had to work without any connection to Raspberry Pi, since it will be mounted on the bread board and should be at rest at all times. The raspberry pi is then accessed from a desktop. Later the arduino code is run and the sensor output is retrieved. Finally the user can login to the web application and view the real time data from sensors. This is a general description of weather monitoring system architecture and it's working a detailed one involves a more in-depth knowledge.

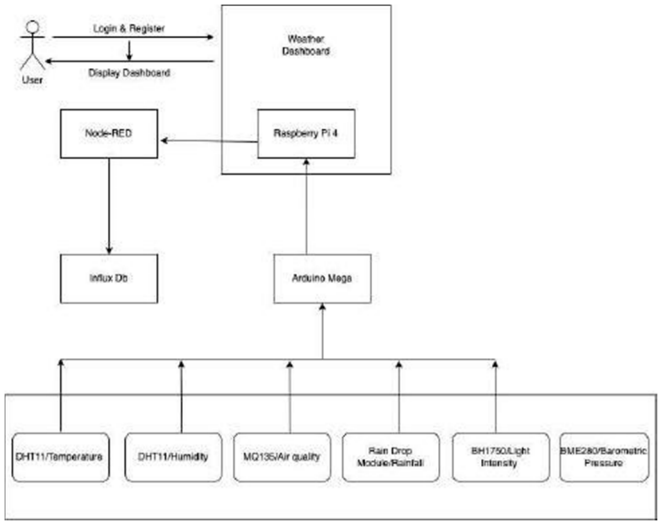

Fig. 1: Architecture of Weather Monitoring System

VII. SUSTAINABILITY AND SOCIAL CONCERNS

There are various ways in which society is becoming increasingly sensitive to weather and climate. At the same time, better understanding, observations, are leading to improvements in the accuracy of weather and climate information. Together, the increased sensitivity and the availability of more accurate information are creating more and new users of environmental information and are heightening the value of this information. The IoT device provides an essential component of a observing system that serves as a foundation for an Earth Information System, a comprehensive environmental database that will support a large variety of users for the benefit of society. A large community of users from various sectors can deploy and build their own weather monitoring system specific in agricultural domain.

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VIII. SYSTEM REQUIREMENTS

A. Hardware Requirements

1) Device : Raspberry Pi 4, Arduino Mega 2560
2) Storage: 2GB minimum (8 GB recommended)
3) RAM : 2GB
4) Core speed: 1.4 GHz or higher

B. Software Requirements

1) Operating System: Ubuntu/Raspbian
2) Front End: HTML, CSS, JavaScript, ReactJS, Node.JS
3) Database: Influx Db
4) Programming: C++ (Arduino IDE)
5) IDE: Arduino IDE, Node-RED

IX. RESULT AND DISCUSSION

There is a lot of variations continuous changes happening suddenly in the environment. So there is necessity of a system which constantly monitors the various parameters like temperature, humidity, rainfall, air quality, light intensity, barometric pressure. These are the basic weather parameters which needs to be monitored in any environment. These parameters will help judge users to take decisions in their sector if there are sudden changes in weather conditions. This dashboard developed using front end technologies help the users to monitor the weather conditions easily.

The below diagram displays the dashboard with various parameters which are monitored.

Fig. 2: Dashboard with various parameters

X. CONCLUSION

Establishing a monitoring station in the environment for monitoring purposes allows the environment to protect itself (i.e., create a smart environment). The environment's sensor devices must be used for data collection and processing in order to achieve this. We can make the environment more realistic by using sensor devices in it.In this study, an effective, low-cost embedded system that monitors the surroundings is provided. Additionally, it uploaded the sensor parameters to the database. This information can be easily shared with other users and will be useful for upcoming analyses. This model can be enhanced to monitor pollution in industrial areas and emerging cities. This concept offers a successful and affordable method for ongoingenvironmental monitoring.
To execute this need to send the sensor in the environment for gathering the information and examination. By deploying sensor in the environment, it will record constant real rime information. The user can now easily accessed the real time data from the web application dashboard. Weather is an air condition that lasts for a short period of time so constant monitoring is required in some sectors. In the proposed architecture purposes of different modules were discussed and how each module works are demonstrated.

XI. ACKNOWLEDGMENT

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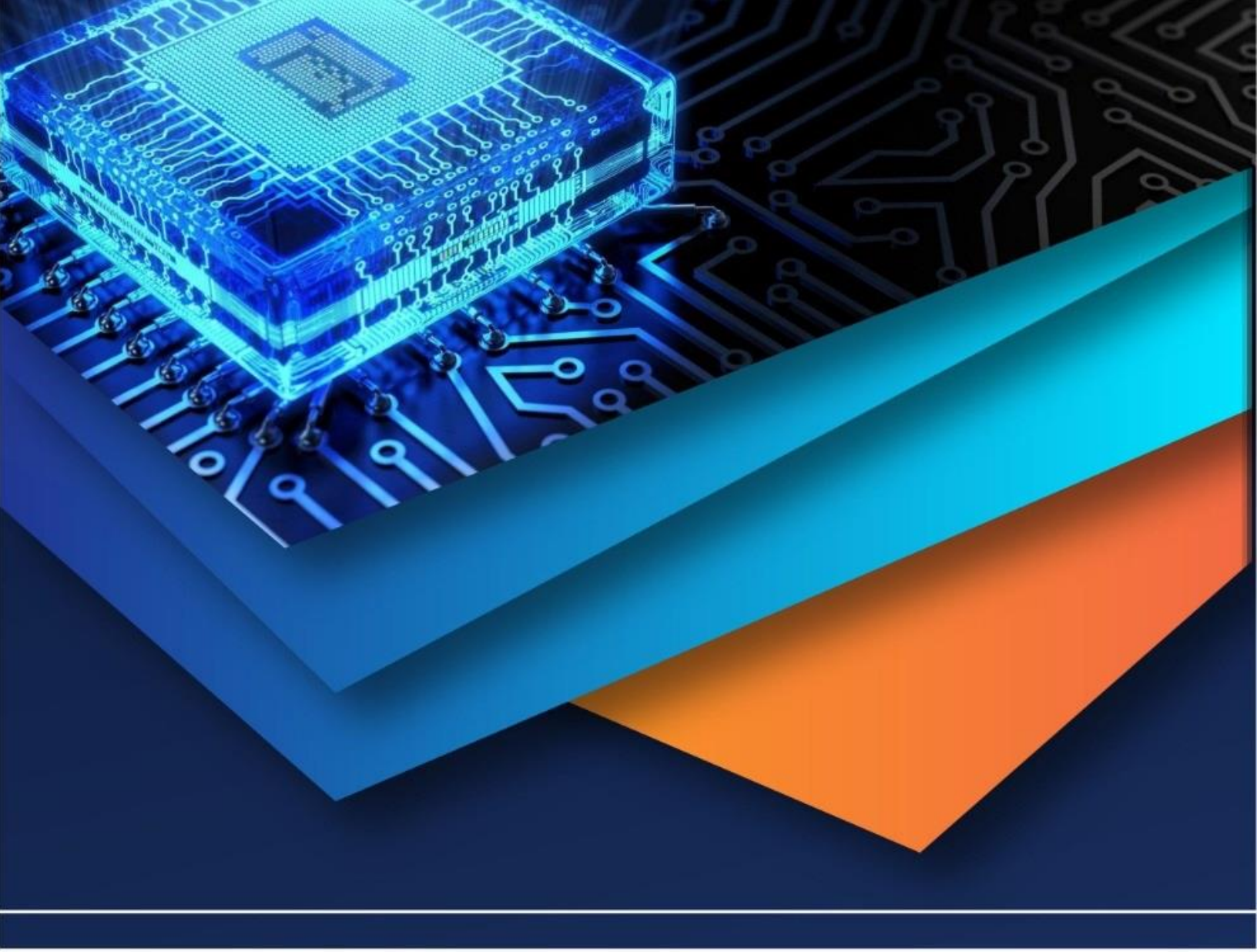

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