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IoT Based Real-Time Weather Monitoring And Reporting System

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Abstract: *The system proposed in this paper is an advanced solution for monitoring the weather conditions at a particular place and making the information visible anywhere in the world. The technology behind this is the Internet of Things (IoT), which is an advanced and efficient solution for connecting things to the internet and connecting the entire world of things in a network. Here things might be whatever like electronic gadgets, sensors, and automotive electronic equipment.*
The system deals with monitoring and controlling the environmental conditions like temperature, relative humidity, and CO level with sensors and sends the information to the web page, and then plots the sensor data as graphical statistics. The data updated from the implemented system can be accessible in the internet from anywhere in the world.

Keywords: Internet of Things

I. INTRODUCTION

Here we introduce a smart weather reporting system over the Internet. Our introduced system allows for weather parameter reporting over the Internet. It allows the people to directly check the weather states online without the need of a weather forecasting agency. System uses temperature, humidity as well as rain with humidity sensor to monitor weather and provide live reporting of the weather statistics. The system constantly monitors temperature using temperature sensor, humidity using humidity sensor and also for rain. Weather monitoring system deals with detecting and gathering various weather parameters at different locations which can be analysed or used for weather forecasting. The aim of this system is achieved by technologies such as Internet of Things (IOT) and Cloud.

The idea of internet of things is to connect a device to the internet and to other required connected devices. Using Internet the information from the IOT device can easily be transferred to the cloud and then from the cloud to the end user. Weather Monitoring is an essential practical implementation of the concept of Internet of Things, it involves sensing and recording various weather parameters and using them for alerts, sending notifications, adjusting appliances accordingly and also for long term analysis. Also we will try to identify and display trends in parameters using graphical representation. The devices used for this purpose are used to collect, organize and display information. It is expected that the internet of things is going to transform the world by monitoring andcontrolling the phenomenon of environment by using sensors/devices which are able to capture, process and transmit weather parameters. Cloud is availability of computer system resources like data storage, computing power without direct active management of user. The data captured is transmitted to the cloud so that the data could be further displayed. Besides this, the system consists of components such as Arduino UNO board which is a microcontroller board consisting of 14 digital pins, a USB connection and everything used to support microcontroller; DHT11 is Temperature and humidity sensor which is used for detecting these mentioned parameters; WIFI module is used to convert the data collected from the sensors and then send it to the web server. So, in this way weather conditions of any location can be monitored from any remote location in the world. The system constantly transmits this data to the micro controller which now processes this data and keeps on transmitting it to the online web server over a wifi connection.

This data is live updated to be viewedon the online server system. Also system allows user to set alerts for particular instances. In today's world many pollution monitoring systems are designed by different environmental parameters. Existing system model is presented IOT based Weather monitoring and reporting system where you can collect,

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process, analyze, and present your measured data on web server. Wireless sensor network management model consists of end device, router, gateway node and management monitoring center. End device is responsible for collecting wireless sensor network data, and sending them to parent node, then data are sent to gateway node from parent node directly or by router. After receiving the data from wireless sensor network, gateway node extracts data after analyzing and packaging them into Ethernet format data, sends them to the server. Less formally, any device that runs server software.

1.1 MOTIVATION FOR THE PRESENT RESEARCH WORK

Assemble all system as per circuit diagram. Program the NodeMCU using Arduino IDE. You will get confirmation on your screen once The NodeMCU is a programable controller which has inbuilt wi-fi module

We connect three sensors 1) BMP180 2) DHT11 and 3) Rain Sensor to NodeMCU. By using these three sensors, we can collect the required weather data for monitoring purpose. This pooled data is stream over the Internet to display it or read it from anywhere. After the successfully programmed hardware, the NodeMCU get one IP address. We can browse this IP address from any of WEB browser like Chrome, Firefox, Internet Explorer etc.so we display the required live data which fetched by sensors in beautiful Graphical User Interface format. The weather parameters that we monitor are Temperature, Pressure, Humidity and Rain. Also, you can check whether data through anywhere using Internet as we hosted this server publicly. We developed an android application for easy access to our weather monitoring system.

In this research, the environmental parameter can be retrieved through sensors. The author uses a different sensor to scale the various parameter like humidity, temperature, pressure, rain value & the LDR sensor is used. The system also calculates the dew point value from the temperature prototype. The temperature sensor can be used to measure the value of the particular area, room, or any place. With the help of the LDR sensor, the light intensity can be used as described by the author. The author in this used an additional functionality of the weather monitoring as SMS alert system based on the exceed the value of the sensing parameters as temperature, humidity, pressure, light intensity, and rain value. The author also adds an email and tweet post alerting system.

II. LITERATURE REVIEW

In this paper, the author elaborates how the weather prediction system is becoming a crucial challenge in every Weather extreme event that causes an adverse effect of the system on lives and property as well. Hence the accuracy of weather data is being one of the critical challenges to enhance the weather prediction skills and build up the resilience to effect of detrimental weather report condition. The author describes that Uganda and various other developing countries have looked challenges in developing timely & accurate weather data due to scarce weathers observation. The scarce weather monitoring is a part of the high cost of developing automatic weather situations. The restricted funding is available to national meteorological services of the respective countries. In this proposed system the author firstly takes care of the problems and then applies them.

The author proposed an Automatic weather monitoring Station based on a wireless sensor network. The planning of the author is to develop three generations of Automatic weather stations or AWS prototypes. In this research, the author evaluates the 1st-generation AWS prototype to improve the 2nd generation depending upon the need and generation. The author provides a suggestion to improve the nonfunctional requirement sucha power consumption, data accuracy, reliability, and data transmission in order to have an Automatic Weather Station. The non-functional requirement collapsed with cost reduction in order to produce a robust and affordable Automatic Weather Station (AWS) Therefore the proposed work, like developing countries like Uganda will be able to acquire the AWS in suitable quantities. So that it can improve the weather forecasting The author in [2], presents an IoT-based weather monitoring system.

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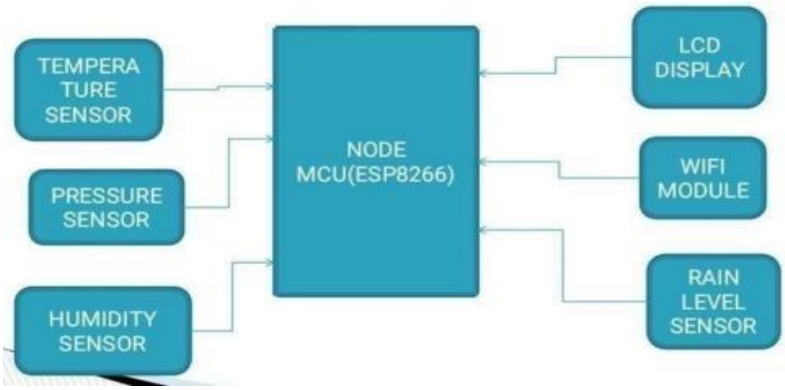
III. DESIGN METHODOLOGY AND IMPLETATION

3.1 DESIGN METHODOLOGY

3.1.1 INTRODUCTION

As temperature increases the temperature sensor will detect and it will trigger the buzzer and buzzer will blow. The water pump is connected to relay. A flame is detected, controller activated the water pump. The sprinklers connected to the pump. The sprinklers connected to the pump will sprinkle the water throughout the fire affected area. In the proposed method we used fire sensor and gas sensor to detect the fire in homes, industries etc. if fire sensor detects the fire the dc pumping motor is ON and it pumps the water to stop the fire. Here we are using Arduino as main controller, for it we are interfacing the sensor.

3.1.2 BLOCK DIAGRAM



3.1.2 ALGORITHM

Step-1: Take input from sensors and send to controller
Step-2: check the sensor value
Step-3: show sensor values on LCD display
Step-4: send the value to server

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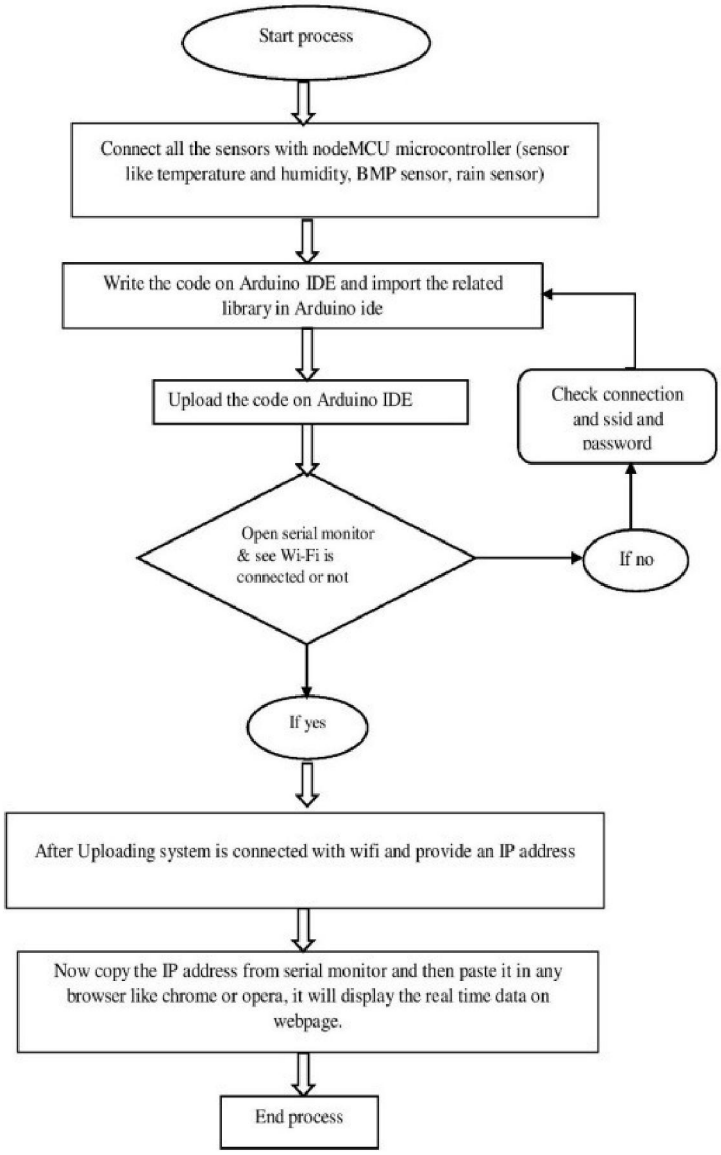
3.1.3 FLOW CHART



3.1.4 DESIGN IMPLEMENTATION

3.4.1.1. ESP8266 – Wi-Fi Module

The ESP8266 WiFi Module is a self-contained SOC with in an integrated TCP/IP protocolstack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device andget about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! TheESP8266 module is an extremely cost-effective board with a huge, ever -growing, community.

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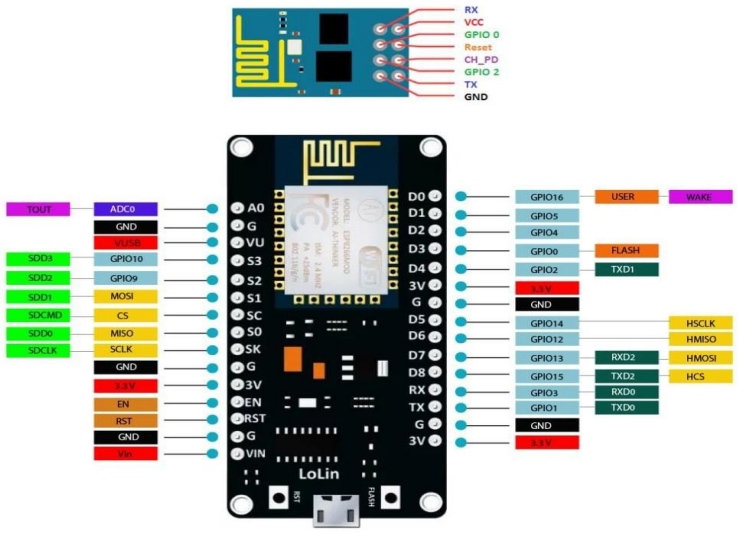

3.4.1.2. Some features of ESP8266

- Low cost, compact and powerful Wi-Fi Module
- Power Supply: +3.3V only
- Current Consumption: 100mA
- I/O Voltage: 3.6V (max)
- I/O source current: 12mA (max)
- Built-in low power 32-bit MCU @ 80MHz
- 512kB Flash Memory
- Can be used as Station or Access Point or both combined0
- Supports Deep sleep (<10uA)
- Supports serial communication hence compatible with many development platform likeArduino
- Can be programmed using Arduino IDE or AT-commands or Lua Script

3.4.2. DHT11(Temperature & Humidity sensor)

The DHT-11 Digital Temperature and Humidity Sensor is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins)

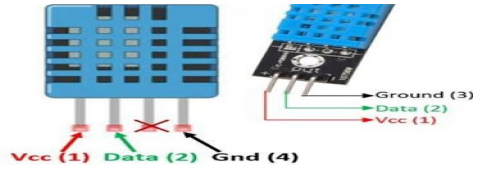

Fig – 7 DHT11(Temperature & Humidity Sensor)

3.4.3 BMP180 (Pressure Sensor)

BMP180 is one of sensor of BMP180 series. They are all designed to measure Barometric Pressure **or** Atmospheric pressure. BMP180 is a high precision sensor designed for consumer applications. Barometric Pressure is nothing but weight of air applied on everything. The air has weight and

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wherever there is air its pressure is felt. BMP180 sensor senses that pressure and provides that information in digital output. Also, the temperature affects the pressure andso we need temperature compensated pressure reading. To compensate, the BM180 also has good temperature sensor.

Fig – 8 BMP180

3.4.4.Rain Sensor

A rain sensor is one kind of switching device which is used to detect the rainfall. It workslike a switch and the working principle of this sensor is, whenever there is rain, the switchwill be normally closed.

Fig – 9 Rain Sensor with Module

Rain Sensor Module

The rain sensor module/board is shown below. Basically, this board includes nickel coated lines and it works on the resistance principle. This sensor module permits to gauge moisture through analog output pins & it gives a digital output while moisture threshold surpasses.

This module is similar to the LM393 IC because it includes the electronic module as well as a PCB. Here PCB is used to collect the raindrops. When the rain falls on the board, then it creates a parallel resistance path to calculate through the operational amplifier.

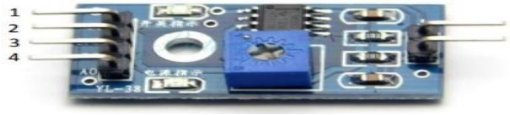

Fig – 10 Rain Module

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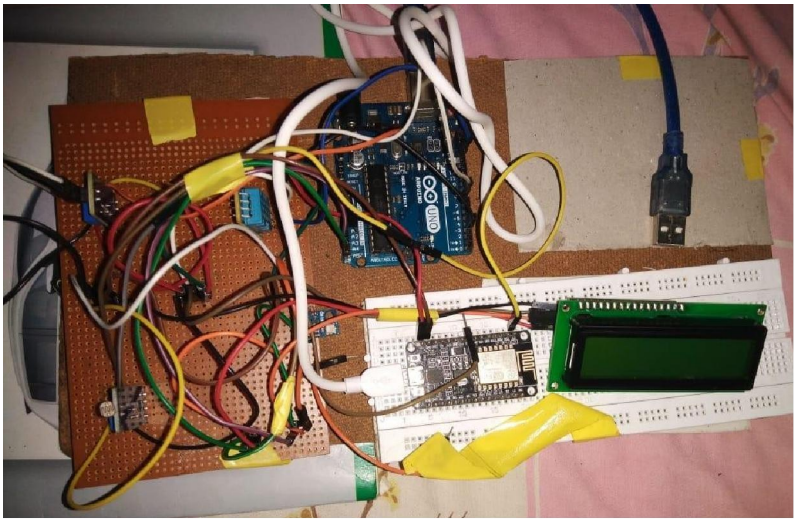
IV. PROTOTYPE



Ease of monitoring your local weather conditions in real time from anywhere in the world. For storing weather and environment data for short and long term for studying weather pattern changes and to understand how human induced climate change affected your local weather. Easy deployment of the setup for monitoring local atmospheric conditions and microclimates for weather forecasting and prediction. Farmers need to know the temperature, relative humidity, soil moisture, rain fall etc. to enhance their crop production and the following type of sensors are utilized to obtain the data: Temperature sensor. Humidity / hygrometer sensor. Soil moisture sensor. Rain sensor etc. For an airplane pilot he/she needs to know wind speed, wind direction, atmospheric pressure, precipitation, visibility etc. before they takeoff and they use the following sensors: Barometric sensor – for measuring atmospheric pressure

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