Weather Monitoring System Using Internet of Things

[1]M. Anantha Lakshmi, [2]P. Rambabu, [3] Dr. M V S S Nagendranath,,
Sasi Institute of Technology & Engineering, Andhra Pradesh, India
[1]rambabupasumarthy@sasi.ac.in, [2]nagendranath@sasi.ac.in, [3]anantha.cse@sasi.ac.in

Abstract

In this paper, we've proposed an IOT and cloud primarily based totally Weather Monitoring System. The purpose of climate tracking gadget is to detect, document and show diverse climate parameters along with temperature, humidity. This gadget uses sensors for detecting and tracking climate parameters and then this accrued fact is dispatched to the cloud which may be accessed the usage of the internet. The information displayed as an output may be discovered. The gadget engages an Arduino UNO board, sensors, WIFI Module which sends information to cloud computing services. A internet web page is likewise created which reveals the information and shows it to users. An Arduino UNO board, sensors, and a WIFI module are used in the system, which delivers cloud computing services with data. In addition, a web page is constructed that shows the data to users.

Keywords: *IOT, cloud, WIFI, Ardunio UNO, sensors.*

1. Introduction

The purpose internet of Things (IOT) and cloud technologies area unit accustomed fulfil the system's goal. The idea behind the net of things is to link a tool to the net in addition as alternative connected devices. info from IoT devices is also promptly sent to the cloud so from the cloud to the top user via the net. It entails sensing and collection various weather factors and mistreatment them for alarms, causing notifications, sterilization appliances PRN, and semipermanent analysis. We'll additionally attempt to spot and exhibit patterns in graphics. info is collected, organized, and displayed mistreatment the devices used for this purpose. the net of things is foreseen to revolutionize the globe by observance and dominant environmental phenomena through sensors/devices that may capture, process, and send meteoric parameters. like data storage and computing power while not the user's direct active management. the knowledge gathered is distributed to the cloud, wherever it may be analyzed more. temperature and wetness device, that is employed to observe the said parameters; and also the DHT11 temperature and wetness The local area network module converts the info from the sensors before causing it to the net server. As a result, climatic conditions at any space may be tracked from anyplace on the earth. an online page is made with access to the cloud and also the ability to indicate and organize the desired output.

2. Literature Survey

The purpose of the literature review is to have a clear comprehension to current problem in the topic under discussion. Clearly understanding all the previous development and their works will provide the best way to obtain the perfect problem statement existing in the present condition.

The following section summarizes the history of those works which are done previously, highlighting the strengths and weaknesses of each method. Various Weather monitoring system methods were proposed and reviewed here.

- Weather monitoring system based on machine learning methods
- Weather monitoring system based on Internet of Things

A. Weather monitoring system based on machine learning methods

Spinney *et al*. (2011) [9] come up with the data utilized in his experiment came corpus was compiled from the Sohu news site and was manually sorted and classified before being saved. The experiment is written in the C++ programming language. original corpus, we tend to completed loads of pre-processing work, like word segmentation, deleting stop words and single words, computing word frequency in documents, and computing word frequency in classes. Finance, health, sports, tourism, education, accomplishment, culture, and therefore the military square measure among the eight classes within which the check are going to be conducted.

Ghalot *et al*.(2015) [25] The journal Zigbee based mostly Weather watching System printed analysis within the agricultural field, light the truth of agriculture's falling yields and revealing the necessity for technology to help farmers within the method of planting and

harvest soil product. The implementation of a wireless weather watching system that needs no human effort in its functioning is pictured during this publication. it's geared toward up the reliableness of pollution watching systems by utilizing wireless sensing element networks to discover rain, temperature, wind, humidity, daylight intensity, and humidness over a bigger space than a manual meteorological observation post might, and so displaying the results on associate liquid crystal display screen in real time on associate hourly basis.

B. Weather monitoring system based on internet of things methods

Pujari *et al*. (2016) [21] Weather uncertainty can be disastrous organizing human activity. Weather reporting necessitates a thorough examination of various climatic conditions, in order create findings. The building of a weather monitoring station is a solution to this problem, but the cost of construction must be taken into account. They are ineffective if they require active human involvement to operate and generate results simply by monitoring a single weather variable, such as rain. The weather monitoring system can detect a variety of weather situations. And allows the user to get weather information by SMS, allowing the user to have partial control over the device without having to be physically present with it. The weather monitoring system, on the other hand, will forecast the weather over a smaller area, providing more accurate findings than a weather forecast. The sensors are connected to an ARM-7 microprocessor, which reads digital data from the ADC (Analog-to-digital Converter). The microcontroller analyses and processes the data before displaying it on the LCD (Liquid Crystal Display) screen. The microcontroller also saves data that is sent to the GSM module and received via a serial interface by the PC (Personal Computer). The PC is linked to a database that contains the maximum and minimum values for the meteorological parameters that the sensors are monitoring.

(2006) [2] Weather station aims to monitor temperature, relative humidity and pressure with the respective sensors for applications in industry agriculture and weather monitoring in our daily life, according to another paper. It's designed to be inexpensive, portable, and tiny, with huge storage capacity. The components are divided into four circuits: a sensor circuit with sensors, a data-logging circuit with the microcontroller, a time-keeping circuit, and a USB interfacing circuit that connects the station to the PC. The LM35, HSP15A, and MPX4115A sensors were utilized for temperature, relative humidity, and pressure, respectively. The ADC on the microcontroller, PIC16F877A, converts analog data from the sensors into digital signals, which is then processed and analyzed before being sent to the PC through a USB (Universal Serial Bus) interface.

3. Proposed Methodology

IOT has become an excellent space of interests for institutes, big technical school corporations and users or customers conjointly. Many IOT primarily based ideas have gained such a lot attention like sensible wearable devices, smart home, smart town etc. Almost all the applications supported web of things embrace devices like transducers and sensors hooked up to the microcontroller with a wireless/wired flow of information to a remote cloud service or an area knowledge storage that converts the data to a major data which can be additionally utilized in several areas.

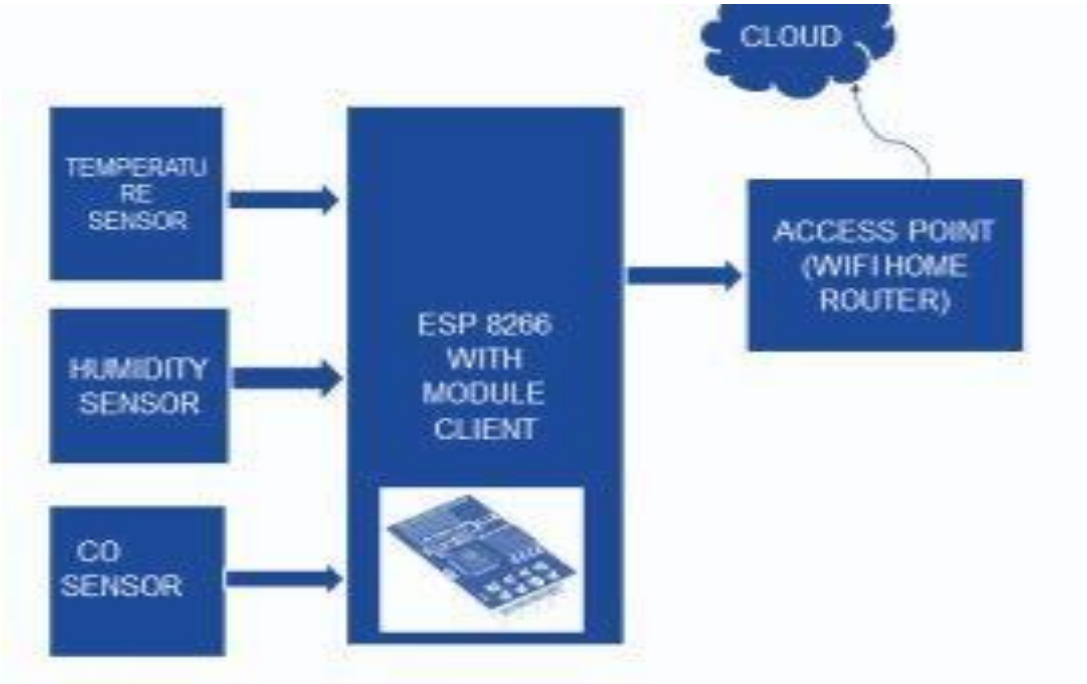

Fig. 1 Proposed Architecture

A. Steps in the proposed system

The proposed work has three sensors which are temperature sensor, humidity sensor, CO sensor implementing of the weather monitoring system, displaying temperature, humidity, CO values and the graph is plotted. The sensors are given below:

- Temperature and Humidity sensor
- CO sensor
- Wifi module
- Lcd display
- Arduino IDE

A. Temperature and Humidity sensor:

It comes with an 8-bit microprocessor with high overall performance. Its production offers extreme dependability and top-notch long-term stability. It offers excellent quality, a quick response time, anti-interference cap capability, and exceptional overall performance. The single-cord serial interface device is built-in to make it quick and simple. Small size, low power, sign transmission distance up to twenty meters, enabling for a wide range of programmes or perhaps the most rigorous requirements. A four-pin divorced row pin housing could be the product.

As a result of the distinctive digital signal and information reality- primarily based Temperature or wetness police investigation module, the device is deemed trustworthy and stable. The resistive part of the DHT device measures wetness, whereas the negative temperature constant NTC part measures temperature. The device is predicated on associate 8-bit microchip that demonstrates responsibility, sensitivity, stability, high response, no interference, and most significantly, low value [4]. The used Temperature / wetness device

(DHT) has 3 pins: VCC (connected to 5V from Arduino), GND (connected to Arduino GND) and information (connected to Arduino digital pin).

B. CO sensor:

The MQ2 has AN chemistry sensing element that alters resistance in response to varied gas concentrations. it's cheap and may be used for a spread of functions. The sensing element detects flammable gas and smoke. The MQ2 gas sensing element is one in every of the foremost wide used of the MQ sensing element series. Gas concentrations may be detected employing a straightforward network of voltage dividers. The MQ2 gas sensing element operates on 5V DC and consumes more or less 800mW. it's a detection vary of two hundred to ten,000 ppm for LPG, smoke, alcohol, propane, hydrogen, gas and CO. like LPG, propane, methane, hydrogen, alcohol, smoke, and CO within the atmosphere. resistance is another term for MQ2 gas sensing element. once it comes into bit with gas, the resistance of the sensing material changes. The detection of gas is completed by mensuration the amendment in resistance price.

Sensors are technological gadgets that allow you to interact with the outside world. Sensors that detect light, noise, smoke, proximity, and other variables are available. These are now available in both analogue and digital formats, thanks to technological advancement. Sensors are an important aspect of safety systems since they allow for communication with the outside world. Humidity sensors are used to manipulate humidity withinside the unit for the easy operation of manage structures and touchy electronics.

Six connecting legs are coupled to the device. The detector device element is heated by 2 leads, whereas the opposite four are used for output signals. once a sensing element material is heated to a warmth within the air, gas is adsorbable on the surface. once reducing gases are gift, these gas atoms react with the reducing gases, lowering the adsorbable oxygen's surface density. The concentration of those voltage values is decided by mensuration them.

C. Wifi module:

The Arduino Uno wireless local area network may be a model of the Arduino Uno with a integrated wi-fi module. The board is made across the ATmega328P associate degreed consists of an ESP8266 wireless local area network Module. The ESP8266 wireless local area network Module may be a self-contained SoC with a integrated TCP/IP protocol stack will which may which might} connect together with your wireless local area network community (or the tool can act as associate degree get right of entry to point). Support for OTA (over-the-air) programming, whether or not or not for Arduino sketches or wireless local area network code, may be a accessible characteristic of the Uno wireless local area network. The Arduino Uno wireless local area network is associate degree Arduino Uno with associate degree incorporated wireless local area network module. The board is wholly} totally at the ATmega328P with associate degree ESP8266 wireless local area network Module incorporated. One helpful characteristic of Uno wireless local area network is assist for OTA (over-the-air) programming, each for switch of Arduino sketches or wireless local area network code wireless local area network Module: The ESP8266 wireless local area network Module may be a self-contained SOC with associate degree inbuilt TCP/IP protocol stack which may provide get right of entry to on your wireless local area network community to any

microcontroller. The ESP8266 may also in addition each host associate degree software system or offload all wireless local area network networking capability to a separate software system processor. every ESP8266 module comes pre-programmed with AT command set code, in order that you'll merely plug it into your Arduino and obtain just about as tons wireless local area network capability as a wireless local area network protect. The ESP8266 module may be a low-price board with an oversized, and hurriedly increasing, community. This module has sufficient process and garage electricity on board to allow it to be incorporated with sensors and totally different software-unique devices.

D. Lcd display

A liquid show (LCD), frequently said as a liquid show, may be a reasonably show that creates use of liquid technology. we wish a medium/tool to reveal output values and messages while we have a tendency to assemble real life/real-global digital-primarily primarily based all comes. seven phase shows are the utmost basic reasonably digital show to be had, however they need got their personal set of limitations. The 162 digital display Module, that might show thirty two code characters in lines, is that the most usually used of all of the LCD modules to be had at the market. Display devices serve a considerable component in organizing suitable verbal exchange among the human and gadget worlds. As a result, they play a important position in embedded systems. The major characteristic of the proposed LCD show is to reveal the facts stated with the aid of using the hired sensors as numerous attributes for you to make clear the scenario of the device periodically.

The same basic premise applies to any or all show units, in spite of however huge or little they're. apart from difficult show units like graphic displays and 3D displays, easy displays like 16x1 and 16x2 units should be understood. The 16x2 digital display can have a complete of thirty two characters, sixteen on the primary line and sixteen on the second. the pliability is provided by the presence of 2 management pins. This sets the digital display to the best distinction and browse mode attainable. All we've to try to to now could be management the alter and RS pins to speak characters and information. The 16x2 show uses a parallel port, which implies the microcontroller should management several interface pins at identical time to work the digital display. The RS (Register Select) pin, Read/Write pin, Enable pin, information pins from D0 to D7, show distinction pin, junction rectifier backlight pins, and power provide pins square measure all a part of the interface.

E. Arduino IDE:

Arduino IDE is the primary software program device we used to programme our microcontroller board. It comes with a built-in library with a variety of output and entry techniques. It's also a free and open-source software package. To flash the human code to arduino codes, it uses AVRDUDE as the default importing device. Sketches are the packages that can be written in the Arduino IDE environment. This IDE aids the C and C++ languages through the use of a few specific policies for code organization.

4. Results and Discussion

This section discusses the evaluation results and experimental details of the proposed model. This model uses After the sensor measurements are uploaded to the cloud, the values are analyzed after which it's miles changed every time any of the parameter's the precise fee is out of its everyday range. Also a graph is plotted to reveal the trends.

S.No	Temperature	Humidity	MQ2	Date
1	34	75	109	2022-03-31 11:01:57
2	34	82	165	2022-03-31 11:00:47
3	32	66	80	2022-03-25 14:52:54
4	33	66	86	2022-03-25 13:05:59
5	32	69	105	2022-03-25 13:04:49
6	32	69	150	2022-03-25 13:03:39
7	34	40	69	2022-03-16 20:31:58
8	35	80	70	2022-03-16 20:30:49
9	33	26	159	2022-03-16 20:29:39
10	32	28	59	2022-03-16 20:28:28
11	32	22	52	2022-03-16 19:48:51
12	32	22	70	2022-03-16 19:47:41
13	32	22	55	2022-03-16 19:46:31
14	33	76	44	2022-03-16 16:00:33
15	32	21	45	2022-03-16 15:59:23
16	32	21	45	2022-03-16 15:58:14

Fig. 2: Output of the developed weather monitoring system

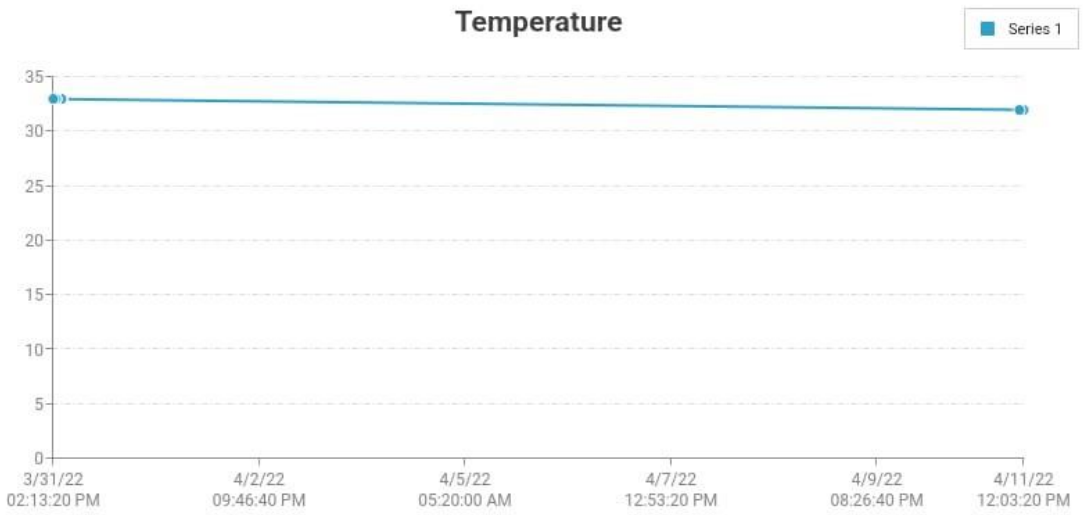

Fig.3 Temperature Graph

In the above fig.3 graph x-axis illustrates date and time and the y-axis temperature in degrees. The graph above the line represents temperature.

Fig.4 Humidity Graph

In the above fig.4 x-axis represents the date and time, while the y-axis humidity degrees. The graph above the line represents humidity.

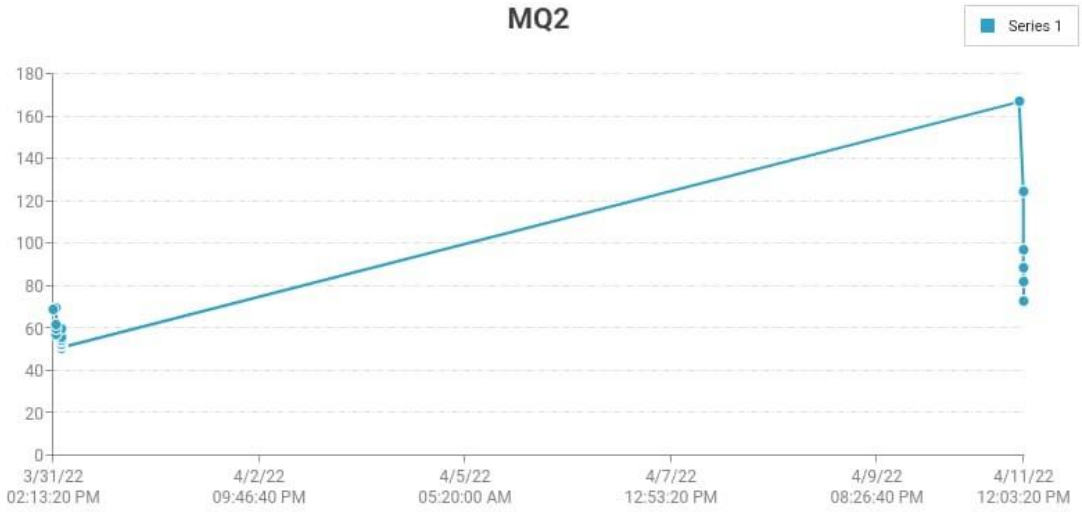

Fig.5 Mq2 Graph

In the above fig.5, x-axis shows the date and time, and the y-axis mq2 level ppm. The graph above line represents the mq2 level.

5. Conclusion and Future Enhancement

This project Weather Monitoring System the usage of Internet of Things is value-effective, eco-friendly, sensible and the most secure manner to display climate through the usage of sensors accurately. By retaining the gadgets withinside the surroundings for tracking allows self -protection to the surroundings. To place into impact this need to set up the sensor devices withinside the environment for collecting the facts and evaluation. it may interact with exclusive gadgets thru the network accumulated information evaluation outcomes had to give

up person thru the Wi-Fi. The clever manner to display surroundings and an efficient, low-value embedded machine is provided with exclusive sensors.

This challenge specifically makes a specialty of tracking the actual time climate the use of its sensors and pics improves the accuracy. The ultra-modern stepped forward techniques are getting used to expand the accuracy rate. In the destiny paintings of this research, greater green techniques may be used and upload in greater capabilities to destiny beautify the machine in tracking the actual time climate that might be utilized by public.

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