# IOT BASED WEATHER MONITORING SYSTEM

## A Project Work Synopsis

*Submitted in the partial fulfillment for the award of the degree of*

## BACHELOR OF ENGINEERING

**COMPUTER SCIENCE**

**IN**

### INTERNET OF THINGS

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**Introduction**

The Internet of Physical Things is a network where all physical objects connect to the Internet via network equipment and exchange data. The Internet of Things can be managed remotely via an existing network infrastructure. IoT is a good, highly intelligent technology that reduces human effort and allows easy access to physical devices. This method also has a special control function, which allows you to control devices without any interaction with people. The "Internet of Things" is a work of art that became clear in 2009. The Internet of Things is actually changing our world. It helps to renew our life and society as a whole, creating different things that make our lives run smoothly. By 2020, an estimated 50 billion devices will be connected to the Internet and networks and the market will be $14 trillion. The Internet of Things is a growing theme of certain things, social and monetary, linked to gigantic dimensions. Customer items, different types of goods, cars and trucks, modern and modern spare parts, sensors and other conventional products are combined with the Internet and the exceptional data search capabilities that promise to change the way we work, live and play. The impact of the Internet of Things on the Internet of Things and the economy is significant: according to some estimates, the number of IoT devices will reach $100 billion by 2025 and total revenues will exceed $11 trillion. By 2013, the Internet of Things has evolved into a variety of systems that use different technologies, from wired Internet networks to wireless communications, from microelectromechanical systems to integrated systems. Traditional areas of automation, such as building automation, wireless networks, GPS, various operating systems and much more, support the Internet of Things. Internet of Things, consisting of several on/off devices connected to the Internet. This includes almost everything you can think of, from mobile phones to building maintenance and jet engines. Medical devices such as a heart rate monitor or farm animals can send data over the network and are members of the Internet of Things. They also assist in environmental matters and in the department of agriculture.

**Problem Statement**

The Problem found in most weather Stations recently all the weather Stations Consists of their Own Data Centre to Access and send the information to Display devices. Each and every data centre needs Crores to build their own data centre in the particular place. IoT Based Weather System acts as Weather Station and it update the Data Centre in Cloud. So, by using IoT Based Weather monitoring System we can solve the cost of equipment problem and also, we can also access the information remotely through internet Devices and Websites.

The weather monitoring system provides only the present condition of a particular field which will not provide the exact condition of thea particular city or particular place. The main problems in ordinary method were that devices are very much expensive and don’t have that much data measuring accuracy. In case of any divergent there is no such device to give the alert signal about current situation hence it’s very hard to control that kind of abnormality.

The existing weather monitoring systems normally use weather stations that use various kind of instruments such as thermometers, barometers, wind vanes, gauge etc. to measure weather and climate changes. Most of these used instruments use simple analog technology which is later physically recorded and stored in a data base. This information is later forward to news reporting stations and various stations where the weather report is given.

Limitations of the existing Weather Monitoring System

a.) Existing weather monitoring systems that are used generally consist of unconventional and heavy machinery that consists of number of moving parts that require constant maintenance and need to be monitored and changed frequently.

b.) Power requirements are one of many major constraints as these instruments are generally sited far from main power supply. This made instruments costly.

c.) Thermometers to measure external Temperature; But accurate is still not updated and continuously needs to be checked regularly for any change in temperature. d). Data collected by the instruments needs to be manually transferred from the system to a Laptop or computer via a cable.

**OBJECTIVE**

The main objective of this project is to originate electronic device or network that can capture and restore temperature and humidity and after that send data to the cloud or website for its analysis.

Here we can use the Arduino Unoas a microcontroller for the simple brain of the system. When we use the Arduino as a microcontroller, we need a Wi-Fi module to establish your Internet connection. And the DHT sensor, which (digital humidity sensor) can detect differences in temperature, humidity and humidity at a certain location, must be integrated into the system. The sensor continuously monitors temperature changes and sends data to the microcontroller. The microcontroller transfer the data for its storage and visualization to cloud.

We can also use IOT platforms such as ThinkSpeak IoT to collect data into the cloud for analysis. This system can then be customized to create good animations such as tweets or phone calls, or turn on a device when the temperature/humidity or other parameters are below a certain threshold.

**Hardware Specification**

Bmp-180 Sensor

DHT-11 Sensor

Rain Drop Sensor

ESP-8266 NODE-MCU

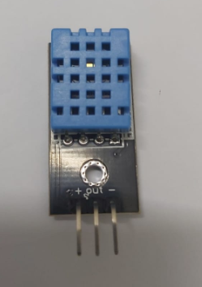
Bmp-180 Sensor =>

This precision *sensor* is the best low-cost *sensing* solution for measuring barometric pressure and temperature



DHT-11 Sensor =>

The *DHT11* is a commonly used Temperature and humidity *sensor*. The *sensor* comes with a dedicated NTC to measure temperature



Rain drop Sensor=>

Rain Sensor module allows to measure moisture via analog output pins and it provides a digital output when a threshold of moisture exceeds.



ESP-8266 NODE-MCU=>

*Esp8266* cp2102 *nodemcu* lua esp-12e wifi serial wireless module · Built-in micro-usb, with flash and reset switches, easy to program



**Software Specification**

ThingSpeak

Arduino IDE

**Literature Survey**

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, 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 could be considered a server as well. Servers are used to manage network resources. The services or information provided through the Internet that are connected through LAN and made available for users via smart phones, web browser or other web browser devices to make the system more intelligent, adaptable and efficient.

Through the meteorological system, we can collect data on humidity and Temperature, as well as data on pollution and, taking into account current and previous data, we can graphically modify the results in any system. After reviewing many articles, there are currently far fewer articles that mention monitoring the combination of temperature, lighting and humidity in a small integrated system and have actuators to change these settings. There is a research paper that discussed the monitoring of these three environmental conditions; however, there was no mention of having actuators to modify. Thus, the main idea was to create a system that could detect the main components that make up the climate and be able to predict time without human error. Existing weather forecasting methods were generally based on observed patterns of events, and can be called pattern recognition. For example, one could observe that if the sunset was red and normal, the next day often brought a very nice weather. This experience gathers more than and generations to produce the tradition of the time. However, not all of these predictions are reliable and since then many of them have not been able to withstand rigorous statistical testing. The simplest way to predict time, persistence, depends on today's conditions to predict tomorrow's conditions. This can be a good way to predict weather when it is in a stationary state, such as during the summer in the tropics. This method of forecasting depends on the presence of a stationary weather pattern. It can be useful for both short- and long-range weather forecasts. Pressure measurements and pressure variations over time have been used in forecasts since the 19th century

**PROPOSED SYSTEM**

Many high-end systems are now available for 24-hour weather observation. But these systems are being plotted on a Large scale to monitor real-time Weather in a state or an entire state. The implementation of such a system for a small area is not possible because they are not set for it and the effort for the maintenance of such systems for a small area is very high. The new system uses 3 sensors to measure atmospheric and environmental factors such as temperature, humidity, light intensity, dew point and thermal index. The values read by the sensors are processed by the Arduino microcontroller and stored in a text file that can be processed for analysis. The readings are also displayed on an integrated LCD screen for quick viewing. All these measurements can be analyzed to determine the weather characteristics of a particular region and record the weather profile. These saved settings are essential and vary from place to place. All these requirements are entered into the database and these values are essential and are recorded over time. With these input values, we can draw a weather map for a particular region in time.

**Feature and advantages of the proposed system**

1.Our proposed ‘Smart weather monitoring system’ unlike conventional weather monitoring instruments is very small and compact allowing it to be installed easily on rooftops.

2. It is light and portable; this advantage allows us to easily carry it to remote location for installation. Due to its design it can be easily be carried by a weather balloon to measure atmospheric changes at high altitudes

3. The power requirements for our system (sensors and boards) is much less compared to the existing instruments in the market hence enabling us to use solar cells as power supply. This not only cuts down on cost but allows us to leave the monitoring system in remote, areas where power is not easily available, for long periods of time. Addition of solar panels also helps our design be eco-friendly.

4. The sensors used in our product are much cheaper compared to the ones that are used in the existing weather monitoring systems making our design more cost effective.

5. These sensors send the data to a web page and the sensor data is plotted as graphical statistics. The data uploaded to the web page can easily be accessible from anywhere in the world. The data gathered in these web pages can also be used for future references. Unlike the existing system where data has to be physically transferred.6. Due to the presence of fewer moving parts less amount of maintenance will be needed cutting down on maintenance charges.

**PROBLEM FORMULATION:**

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Own Data Centre to Access and send the information to Display devices. Each and every data

centre needs Crores to build their own data centre in the particular place. IoT Based Weather

System acts as Weather Station and it update the Data Centre in Cloud. So, by using IoT Based

Weather monitoring System we can solve the cost of equipment problem and also, we can also

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will not provide the exact condition of thea particular city or particular place. The main problems

in ordinary method were that devices are very much expensive and don’t have that much data

measuring accuracy. In case of any divergent there is no such device to give the alert signal

about current situation hence it’s very hard to control that kind of abnormality.

The existing weather monitoring systems normally use weather stations that use various kind of

instruments such as thermometers, barometers, wind vanes, gauge etc. to measure weather and

climate changes. Most of these used instruments use simple analog technology which is later

physically recorded and stored in a data base. This information is later forward to news reporting

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location, must be integrated into the system. The sensor continuously monitors

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for analysis. This system can then be customized to create good animations such as

tweets or phone calls, or turn on a device when the temperature/humidity or other

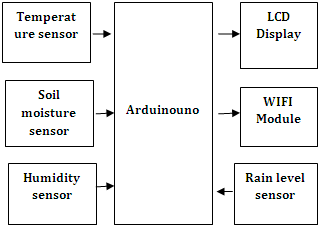
parameters are below a certain threshold.

**METHODOLOGY**

**Step 1: Block Diagram**

The most basic step for the formation of the monitoring system is to deduce a block diagram for

the system on which all further actions are performed.



**Step 2: Circuit Diagram**

The Block diagram is followed by the construction of the circuit diagram in which all the

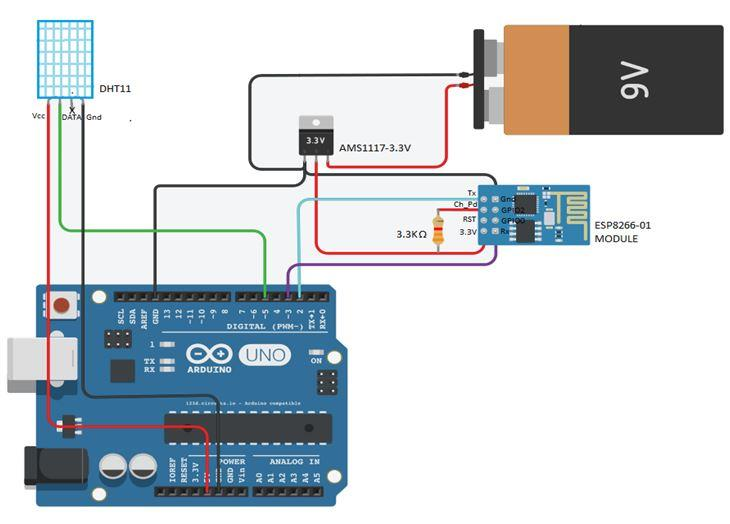
components i.e., different sensors, Wi-Fi module etc. are mounted over the microcontroller

and the breadboard.

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and the breadboard.



**Step 3:Temperature and Humidity sensor**

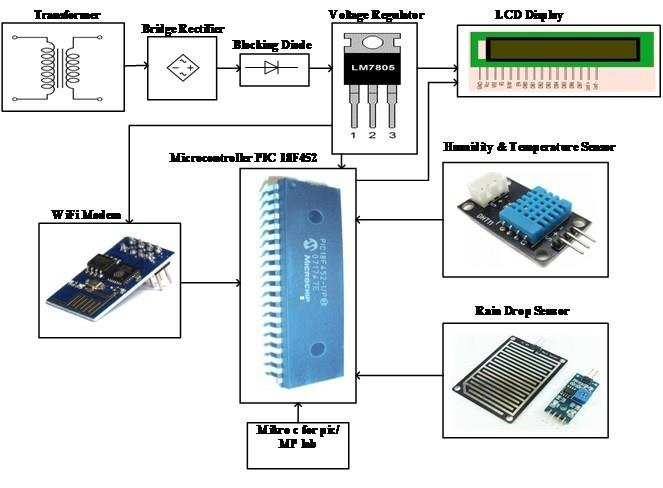
DHT11 temperature and humidity sensor will be used which is best model for measurement.

In this Temperature will display in Celsius.

Humidity(H) will display in %

The sensor tells 20 % - 80% readings which is 5% accurate and -40 - 80-degree Celsius

temperature that is +-0.5 accurate, it can be decrease or increase.



**Block Diagram**

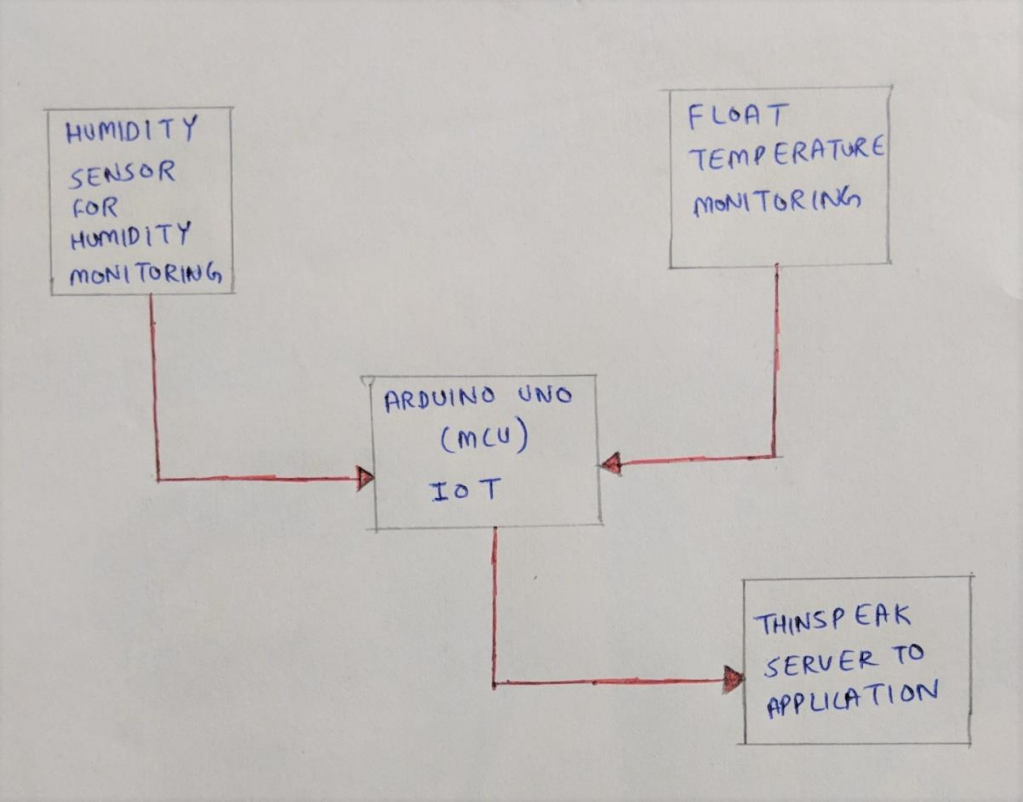
(DHT 11) Sensor senses for the surroundings Temperature and Humidity and send the

information to the Arduino uno microcontroller device.

The Arduino UNO further uploads this information of the recorded parameters to the thingspeak

cloud using the ESP8266 wifi module.

User uses this Thingspeak server and it acts as an front end of the whole system.



**Project Code (python)**

#include <ESP8266WiFi.h>

#include <ESP8266WiFiMulti.h>

#include "ThingSpeak.h"

#include <Wire.h>

#include <Adafruit\_Sensor.h>

#include <Adafruit\_BMP085\_U.h>

#include <DHT.h>

#include <ArduinoOTA.h>

ESP8266WiFiMulti wifiMulti; // Instancia de WifiMulti para gestionar múltiples SSIDs.

Adafruit\_BMP085\_Unified bmp = Adafruit\_BMP085\_Unified(10085);

#define DHTPIN 2

DHT dht(DHTPIN, DHT11, 15); // Definido DHT11. Pasar a 22 en un futuro?

unsigned long myChannelNumber = 1547157;

const char \* myWriteAPIKey = "CX0XERZFN106YTGS";

const char\* server = "api.thingspeak.com";

WiFiClient client;

void setup() {

wifiMulti.addAP("Vadlamudi", "Vadlamudi@1942"); // Listado de SSIDs

wifiMulti.addAP("XXX", "XXX");

Serial.begin(115200);

Serial.println("Connecting ...");

int i = 0;

while (wifiMulti.run() != WL\_CONNECTED) { // Wait for the Wi-Fi to connect: scan for Wi-Fi networks, and connect to the strongest of the networks above

delay(1000);

Serial.print('.');

}

Serial.println('\n');

Serial.print("SSID:\t\t");

Serial.println(WiFi.SSID()); // SSID al que se ha conectado.

Serial.print("IP address:\t");

Serial.println(WiFi.localIP()); // IP del ESP8266.

dht.begin();

ThingSpeak.begin(client);

ArduinoOTA.begin();

}

void loop() {

ArduinoOTA.handle();

delay(1500);

float dht\_h = dht.readHumidity();

float dht\_t = dht.readTemperature();

double gamma = log(dht\_h / 100) + ((17.62 \* dht\_t) / (243.5 + dht\_t));

double dp = 243.5 \* gamma / (17.62 - gamma);

float dew\_point = dp;

if (isnan(dht\_h) || isnan(dht\_t)) {

Serial.println("Failed to read from DHT11");

delay(1000);

return;

}

if (!bmp.begin()) {

Serial.print("Failed to connect to BMP sensor");

while (1);

}

sensors\_event\_t event;

bmp.getEvent(&event);

Serial.print("Pressure:\t");

Serial.print(event.pressure);

Serial.print(" hPa\n");

float seaLevelPressure = 1015;

Serial.print("Altitude:\t");

Serial.print(bmp.pressureToAltitude(seaLevelPressure, event.pressure));

Serial.println(" m");

float temperature;

bmp.getTemperature(&temperature);

Serial.print("Temperature:\t");

Serial.print(temperature);

Serial.print(" ºC \n");

if (client.connect(server, 80)) {

ThingSpeak.setField(1, event.pressure);

ThingSpeak.setField(2, temperature);

ThingSpeak.setField(3, dht\_h);

ThingSpeak.setField(4, bmp.pressureToAltitude(seaLevelPressure, event.pressure));

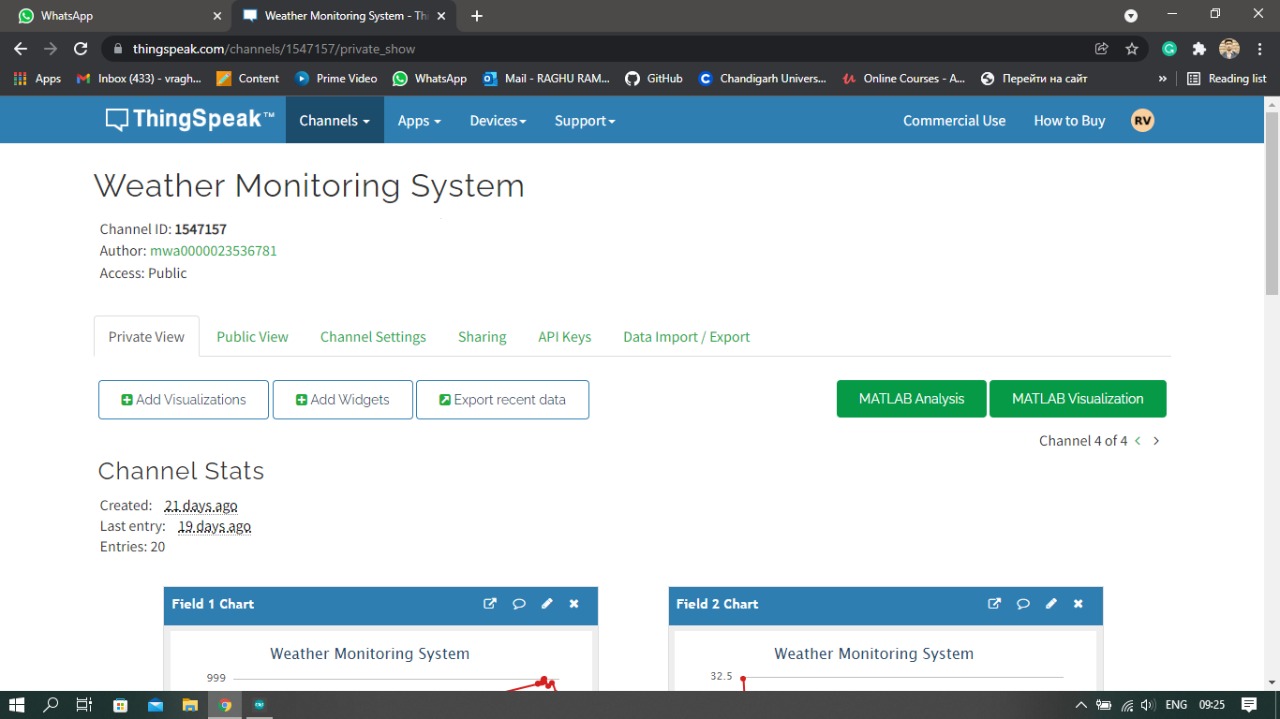
ThingSpeak.setField(5, dew\_point);

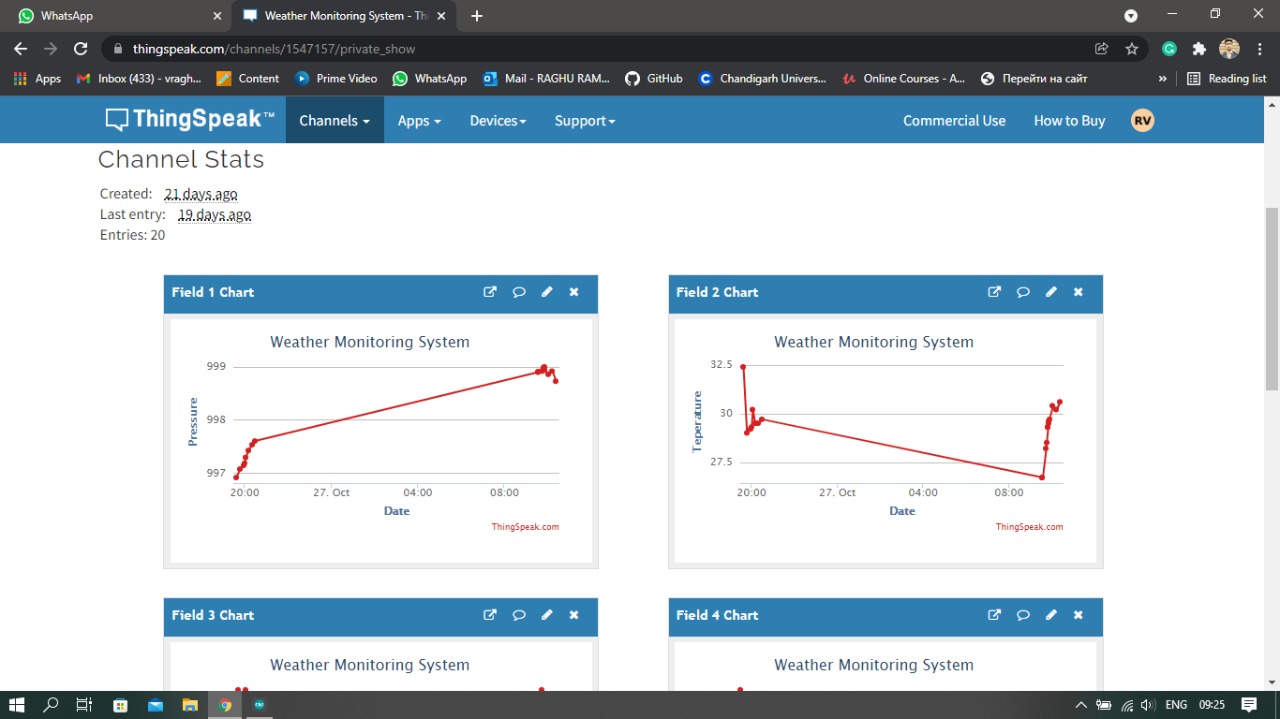
ThingSpeak.writeFields(myChannelNumber, myWriteAPIKey);

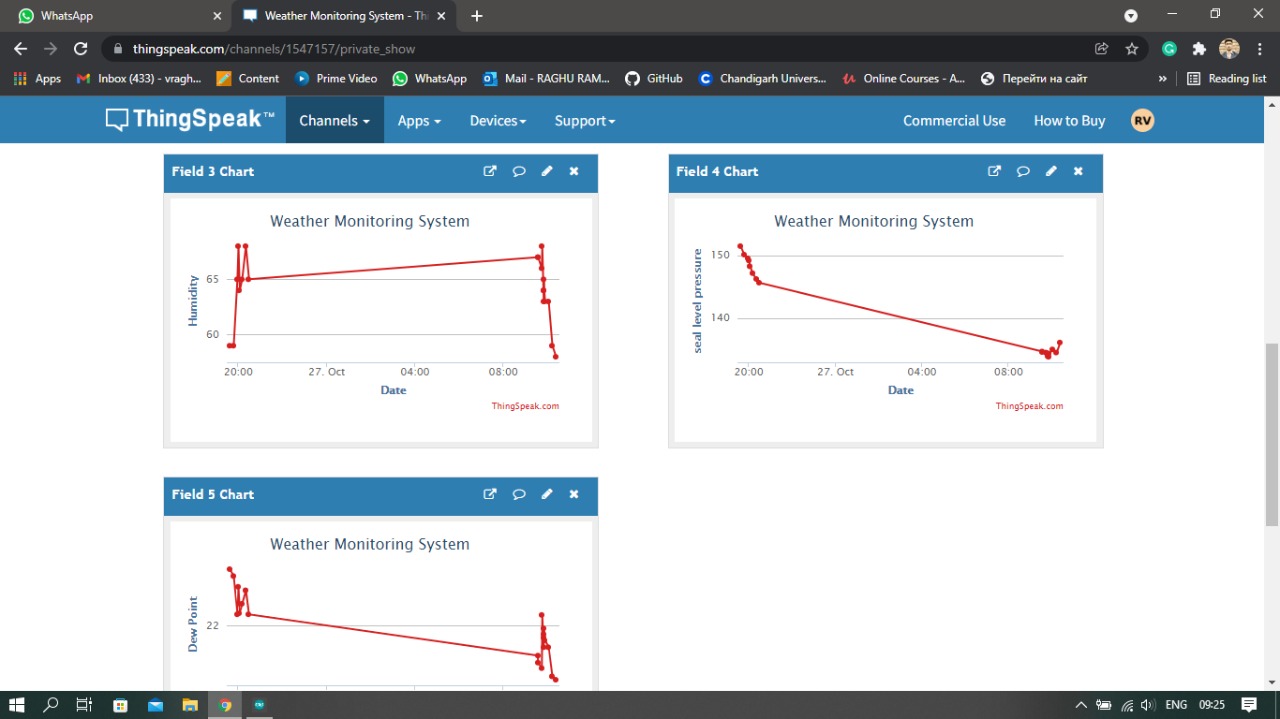
delay(600000);

}

}

**OUTPUT:  
**

****

****

**CONCLUSION:**

By keeping the weather station in the environment for monitoring enables self protection (i.e., smart environment) to the environment. To implement this need to use the sensor devices in the environment for collecting the data and analysis. By using sensor devices in the environment, we can bring the environment into real life. Then the collected data and analysis results will be available to the user through the Wi-Fi. The smart way to monitor environment an efficient, low cost embedded system is presented in this paper. It also sent the sensor parameters to the cloud. This data will be helpful for future analysis and it can be easily shared to other users also. This model can be expanded to monitor the developing cities and industrial zones for pollution monitoring. To protect the public health from pollution, this model provides an efficient and low cost solution for continuous monitoring of environment.

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* Arduino Based Weather Monitoring System .AUTHOR : Karthik Krishnamurthi,

Suraj Thapa, Lokesh Kothari, Arun Prakash.

* GOOGLE,YOUTUBE,INSTRUCTABLES.