WEATHER MONITORING SYSTEM

A PROJECT REPORT

Submitted by

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DATA STRUCTURES AND ALGORITHMS (CSE 2003)

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CERTIFICATE

Certified that this project "**WEATHER MONITORING SYSTEM"** is the bonafide work of "**AMRUT PHADKE, JAIVARSAN B, YASWANT NARAYAN**" who carried out the project work under my supervision.

SIGNATURE

Abstract

Climate observing assumes a critical part in human life, so the gathering of data about the fleeting elements of climate changes is imperative. In any industry amid specific perils it is vital to screen climate. The key point of this paper is to build up an inserted framework to outline a climate checking framework which empowers the observing of climate parameters in an industry.

The estimations of temperature, climatic weight and relative dampness remotely by utilizing the suitable sensors is vital in natural or climate observing as well as vital for some mechanical procedures. A gadget for climate observing has been produced to screen and show the temperature, weight and relative stickiness utilizing Raspberry pi.

In this paper, different climate checking methods have been investigated. A WMS monitors temperature, stickiness, barometric weight. The framework shows these readings continuously on a show. It additionally monitors chronicled data on a hourly and everyday schedule .This authentic information can be pulled up on the show at the demand of the client. Different procedures are utilized to screen the climate like satellites, radars, microcontrollers and numerous other straightforward instruments. Climate can likewise be checked by utilizing remote sensors. Raspberry is the most recent remote climate checking strategy and henceforth we have actualized in our venture.

In this paper we will execute this WMS tech in making controlled condition for the development of products. The information is perused utilizing DHT11 sensor and BMP180 sensor, the qualities are put away in a database. which is gotten to by our site. The site would show the qualities. As per the qualities we will check the Normal range i.e. the ideal scope of temperature and humidity required for the development of the yield that we are developing and control these parameters.

TABLE OF CONTENTS :

1. Introduction

On the off chance that you oversee crops, regardless of whether in a little market plant, or a multi-area corporate homestead, or are included with turf support, you require precise climate information to help in your basic leadership on water system, nuisance and illness control and so forth. While there are many climate anticipating administrations accessible, they construct their conjectures in light of climate stations found a some separation from your own particular site, failing to assess neighborhood varieties in imperative perspectives, for example, wind speed and ice hollows. What's more, as we as a whole know, estimates are not generally solid.

Controlled-condition farming (CEA) is an innovation based approach toward sustenance creation. The point of CEA is to give insurance and keep up ideal developing conditions all through the improvement of the yield. Generation happens inside an encased developing structure, for example, a nursery or building. Plants are frequently developed utilizing hydroponic techniques so as to supply the correct measures of water and supplements to the root zone. CEA upgrades the utilization of assets, for example, water, vitality, space, capital and work. CEA innovations incorporate hydroponics, aquaculture, and aquaponics.[1]

Controllable factors:

- Temperature (air, supplement arrangement, root-zone)
- Humidity (%RH)

CEA offices can go from completely computerized glasshouses with PC controls for watering, lighting and ventilation, to low-tech arrangements, for example, cloches or plastic film on field developed harvests and plastic-secured tunnels.

CEA is utilized as a part of research so that a particular part of creation can be segregated while every single other variable continue as before. Tinted glass could be contrasted with plain glass along these lines amid an examination concerning

photosynthesis. Another probability would be an examination concerning the utilization of supplementary lighting for developing lettuce under a hydroponic system.

A February 2011 article in the magazine Science Illustrated states, "In business farming, CEA can build proficiency, diminish bugs and ailments, and spare assets. ... Reproducing an ordinary ranch with PCs and LED lights is costly yet demonstrates fetched effective over the long haul by creating up to 20 fold the amount of top of the line, sans pesticides deliver as a comparative size plot of soil. Fourteen thousand square feet of nearly observed plants deliver 15 million seedlings yearly at the sun based controlled plant. Such plants will be important to take care of urban China's rising demand for quality foods grown from the ground.

1.1 Raspberry Pi

Raspebrry Pi is a Linux powered computer and is a natural choice for IoT applications. The reason for raspberry pi being a preferred IoT device is because it runs a complete Linux Kernel and has direct interfaces such as Ethernet for wired internet as well as USB ports to connect to wifi. The operating system of raspberry Pi supports modern programming languages like python which makes IoT application development easier. Moreover, raspberry pi also has GPIOs so it can directly connect with devices, sensors and many real world devices. The Pi is so powerful that if the user plugs the Raspberry Pi into HDTV, people could watch Blue Ray quality video, using H.264 at 40MBits/s. Pi also has a 10/100 Ethernet port so the user can surf the web (or serve web pages) from wherever they are using the Pi. The system uses micro SD cards for saving data, so it is easier to organize and run many totally different operating systems on an equivalent hardware. Most Linux distributions for the Pi will happily live on a 4 GB micro SD card but larger cards are supported. Figure 1 shows the Raspberry Pi B+ Kit diagram

Figure 1: Raspberry Pi B+ model

2. Proposed system

Currently proposed system of weather monitoring system will monitor various weather parameters like temperature, atmospheric pressure and humidity for all these measurements various sensors are connected to the circuit. As project is based on raspberry pi ,it acts as a microcomputer and perform various functions efficiently, all the weather sensors are connected or interfaced with the raspberry. all the parameters collected by these sensors will send data to the raspberry module & store the data on Thinkspeak database.

Then after that at the output will be displayed on our website. To see the results at remote location, the operator has to open a web browser and enter the IP address of the site. Once the IP address of the site is entered, the web application opens. Once he starts, there will be a number of sensors from which the raspberry pi will accept digital inputs and will simultaneously post it on to the web server. This data will be continuously updated in real time.

2.1 Block Diagram

The system consists of

- Raspberry Pi model B+
- 32 gb SD card
- DHT11 sensor
- BMP180

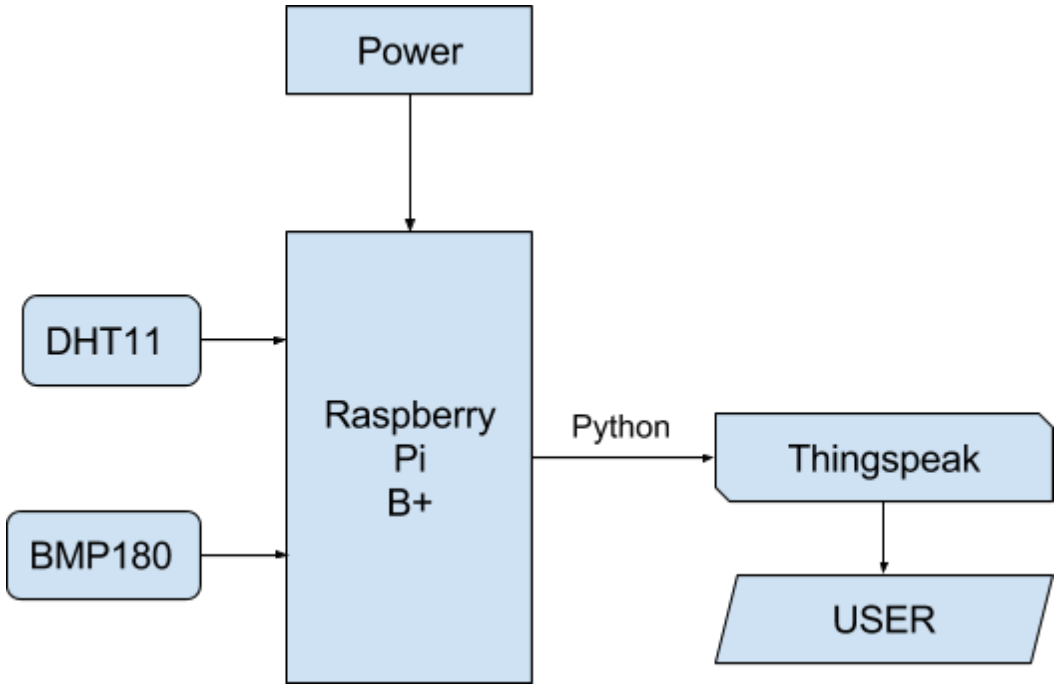
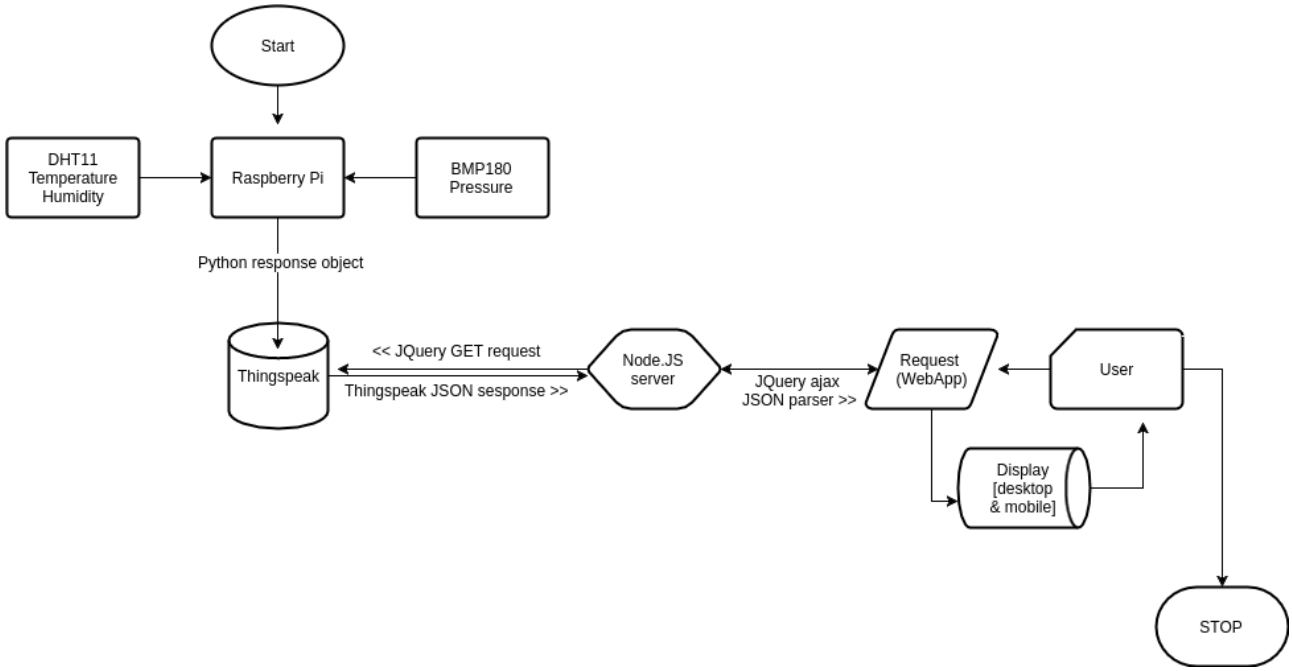


Figure 2: Block diagram

Figure shows the block diagram of weather monitoring system by Raspbery Pi. Block diagram is divided into parts of input and output. .At input side various sensors are interfaced with the raspberry pi and after that result will be uploaded in thingspeak database.

2.3 Flowchart



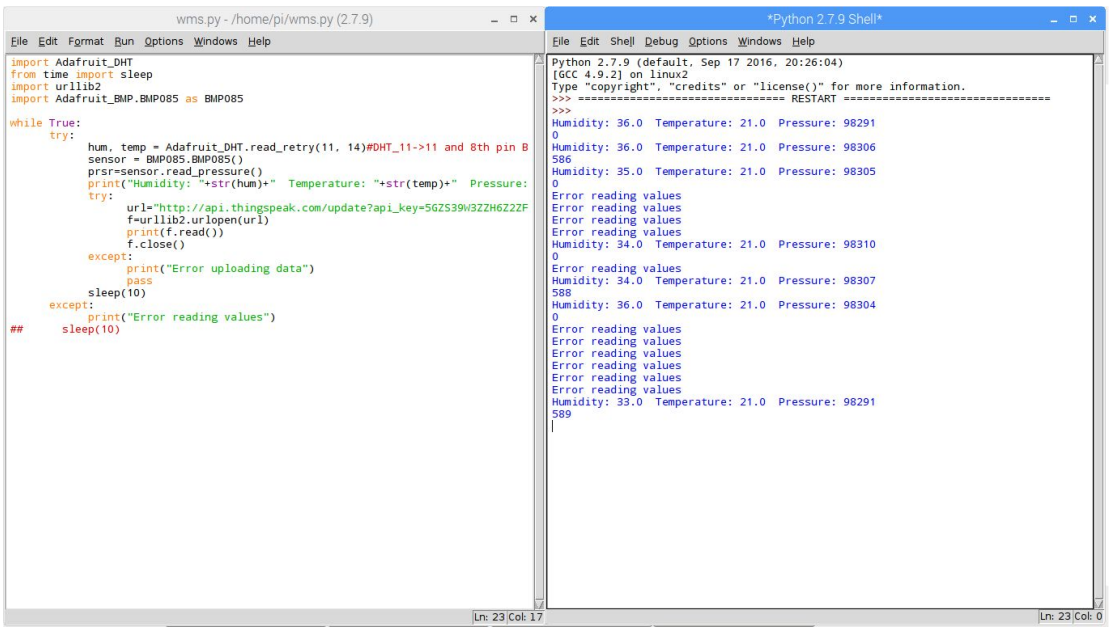
2.2 Software requirement

Programming on Raspberry pi can be done in many ways. RPI is a complete Linux based computer hence it can run all those programming languages which a Linux computer can run. Starting from the most basic C programming to advanced coding like Java or even Qt for GUI development, it runs many different programming languages. For Weather Meter, Temperature Sensor, Humidity Sensor Power Supply Pressure Sensor, thought, we need to install supporting libraries according to the programming language we are using. The raspberry pi's raspbian operating system is preloaded with the GCC compiler suite. This GCC compiler is not needed to be installed separately and hence raspberry pi directly run C programs without installing anything extra. But the embedded coding requires access to the Raspberry Pi GPIO's and for that sake, it's a must to install additional libraries. In the short time that the Raspberry Pi has been around, a number of programming languages have been adapted for the Raspberry Pi, either by the creator of the language, who wanted to support the Pi by porting their creation, or by enthusiastic users who wanted to see their language of choice available on their platform of choice. The Raspberry Pi

Foundation recommends Python as a language for learners. Any language which will compile for ARMv6 can be used with the Raspberry Pi, though; so you are not limited to using Python. C, C++, Java, Scratch, and Ruby all come installed by default on the Raspberry Pi

2.3 Python

Python is considered to be the simplest of all programming languages. As python was being preferred by the raspberry pi foundation itself, later on, it happened so that many people who wanted to write device drivers, firmware and sample codes for various GPIO interfaces to raspberry pi, began naturally to write all these things in python only. This leads to a wave of programming stuffs and material being done in python. The gitbuh.com contains loads of different user contributed libraries to make working on raspberry pi using python a delight. Python is a much high-level, interactive, interpreted and object-oriented programming and scripting language.



The **urllib2** module defines functions and classes which help in opening URLs (mostly HTTP) in a complex world — basic and digest authentication, redirections, cookies and more.

urllib2.**urlopen**(*url[, data[, timeout[, cafile[, capath[, cadefault[, context]]]]]]*)

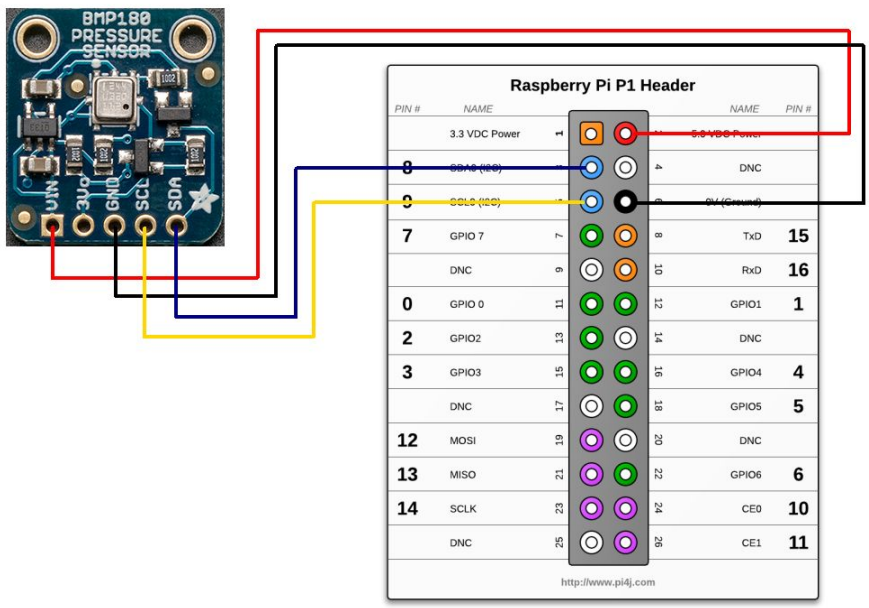
Open the URL *url*, which can be either a string or a **Request** object. *data* may be a string specifying additional data to send to the server, or None if no such data is needed. Currently HTTP requests are the only ones that use *data*; the HTTP request will be a POST instead of a GET when the *data* parameter is provided. *data* should be a buffer in the standard *application/x-www-form-urlencoded* format.

2.4 Sensors

The sensors used in this model are BMP180 sensor for pressure readings and DHT11 sensor for temperature and humidity.

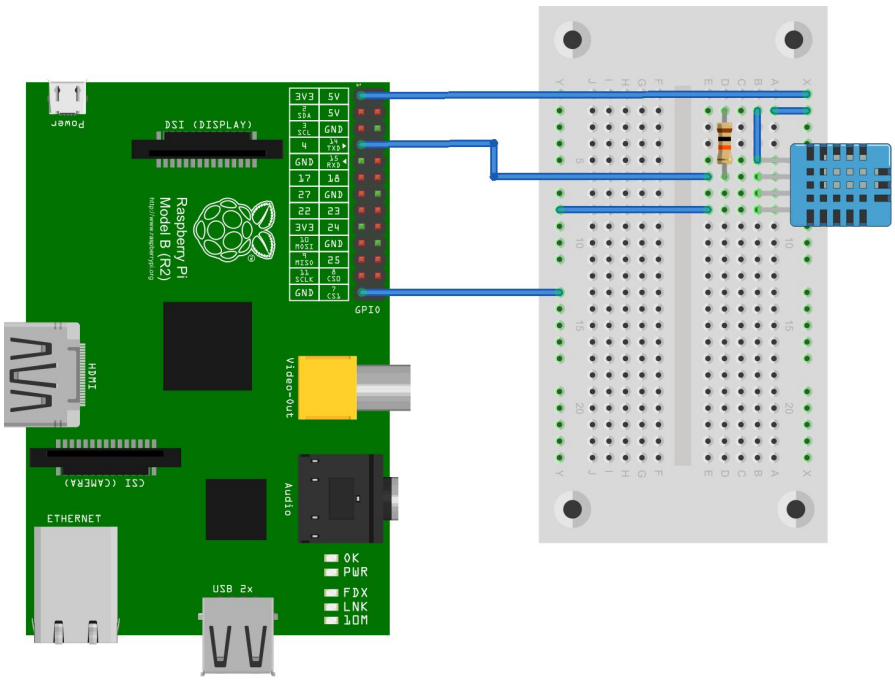
2.4.1 BMP180 specification

- Working voltage: 3.3v
- Pressure range: 300 - 1100 hPa (+9000m ~ -500m relating to sea level)
- Low power control mode: 12C (address 0x77)
- Operating temperature: -40 ~ +85 ℃
- Dimensions: 25.43mm x 20.35mm



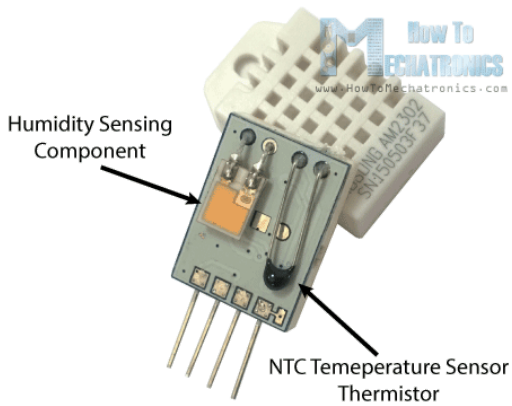
2.4.2 DHT11 specifications

- Supply voltage: +5v
- Temperature range: 0-50 ℃ error of ± 2 ℃
- Humidity: 20 - 90% RH ± 5% RH error
- Interface: Digital

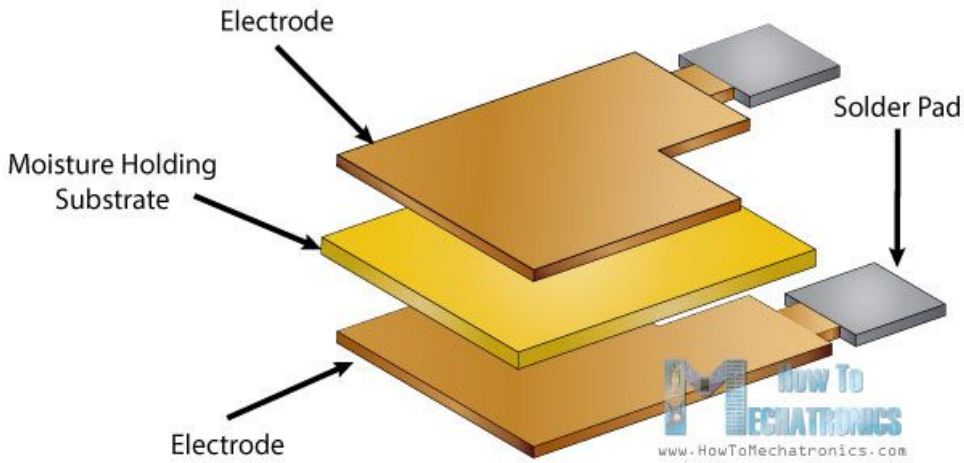


DHT11 Working Principle

They consist of a humidity sensing component, a NTC temperature sensor (or thermistor) and an IC on the back side of the sensor.



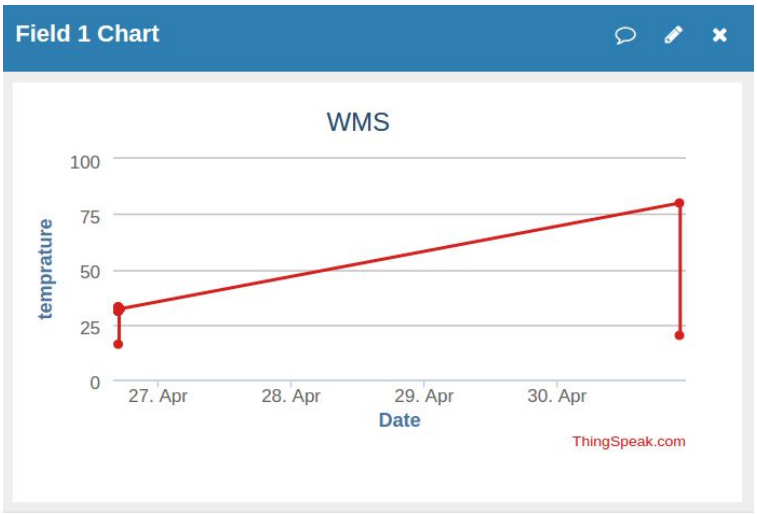
For measuring humidity they use the humidity sensing component which has two electrodes with moisture holding substrate between them. So as the humidity changes, the conductivity of the substrate changes or the resistance between these electrodes changes. This change in resistance is measured and processed by the IC which makes it ready to be read by a microcontroller.

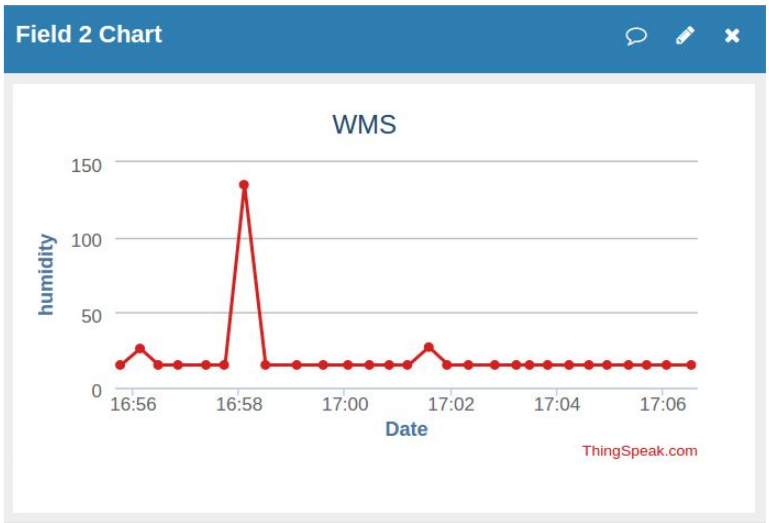


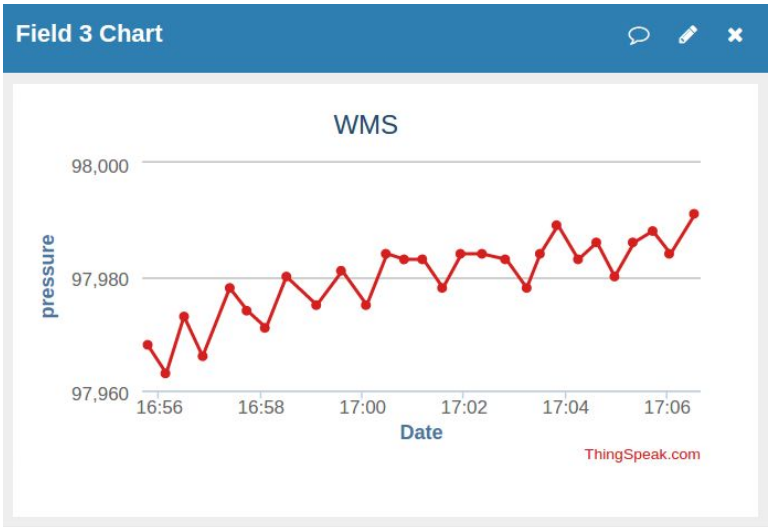
On the other hand, for measuring temperature these sensors use a NTC temperature sensor or a thermistor. A thermistor is actually a variable resistor that changes its resistance with change of the temperature. These sensors are made by sintering of semiconductive materials such as ceramics or polymers in order to provide larger changes in the resistance with just small changes in temperature. The term "NTC" means "Negative Temperature Coefficient", which means that the resistance decreases with increase of the temperature.

2.5 Thingspeak Database

ThingSpeak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates. ThingSpeak has integrated support from the numerical computing software MATLAB from MathWorks. Allowing ThingSpeak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from Mathworks.


Field 1 Chart
WMS
100
75
50
25
0
temprature
27. Apr
28. Apr
29. Apr
30. Apr
Date
ThingSpeak.com


Field 2 Chart
WMS
150
100
50
0
humidity
16:56
16:58
17:00
17:02
17:04
17:06
Date
ThingSpeak.com


Field 3 Chart
WMS
98,000
97,980
97,960
pressure
16:56
16:58
17:00
17:02
17:04
17:06
Date
ThingSpeak.com

3 Results and conclusion

For Final programming, we need to use some additional libraries for using with python basic programming software. These additional libraries are RPI GPIO library which gives access to raspberry PI's GPIO's and the HTTPLIB which can access the working internet connection of raspberry pi through programming and post the data to the thinkspeak database. The data posting through the python programming can be timed at suitable intervals so as to not to clot the sever with incoming streams of data continuously. Proposed system is of better choice in terms of cost, portability, memory capacity The project deals with designing a simple and low cost weather monitoring system using different weather sensors, and raspberry pi, to monitor the weather conditions of the desired location and transmit the data to thingspeak cloud storage and display the results in a web page. The complete project is made open source in github.

3.1 Future scope

The future of this system is very wide open. Though the sensors that were used in this system were all digital inputs, we can use also sensors with analog inputs by using a suitable A-D Converter. E-mail sending is also possible easily on raspberry pi using the smtplib function present already. The applications are literally limitless. Wherever, data monitoring, remote sensing and remote controlling is required, the same system is applicable directly with minute modifications.Thus, such a system can be readily implemented using a low cost computer like Raspberry Pi which can function like a complete computer. The said system can run for 24 hours a day 7 days continuously for satisfying the most demanding application also.

3.2. Product images

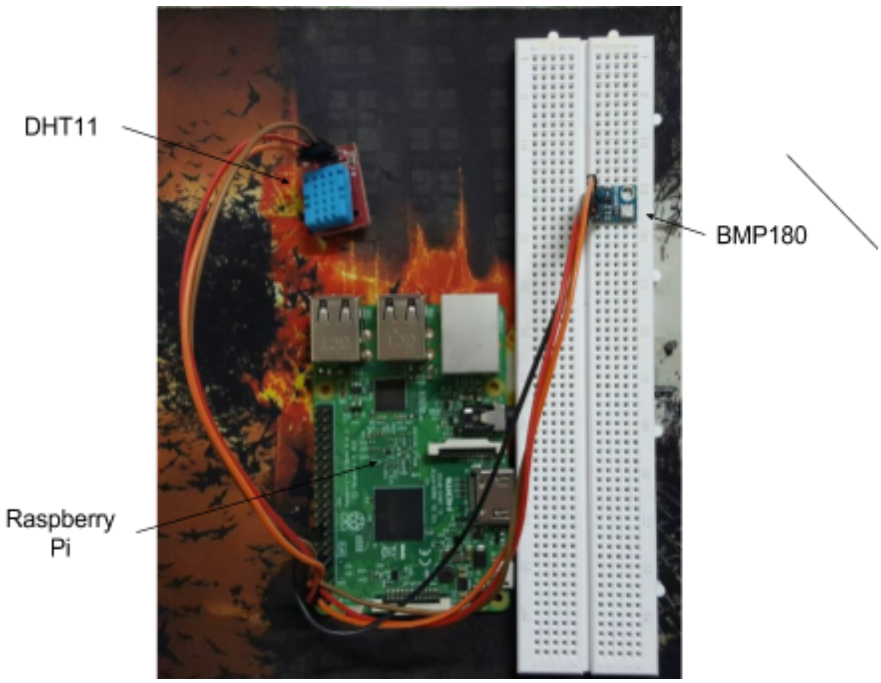
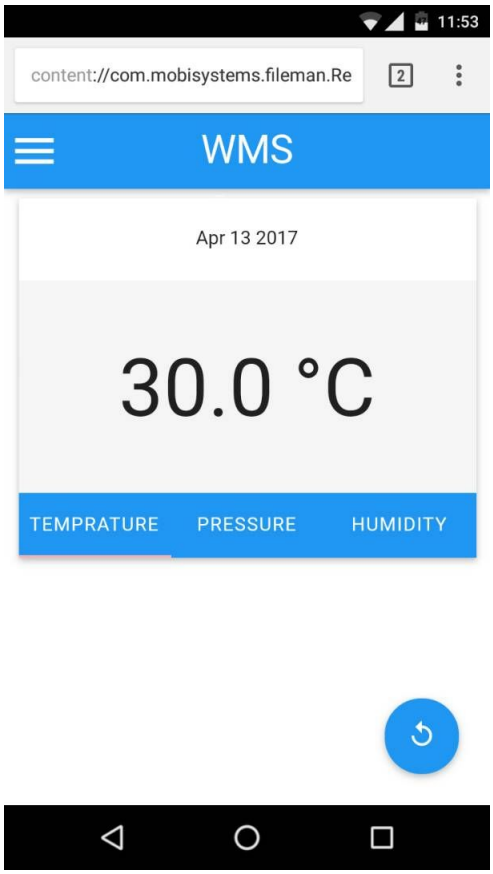


Figure : Raspberry Pi with BMP180 and DHT11 sensor



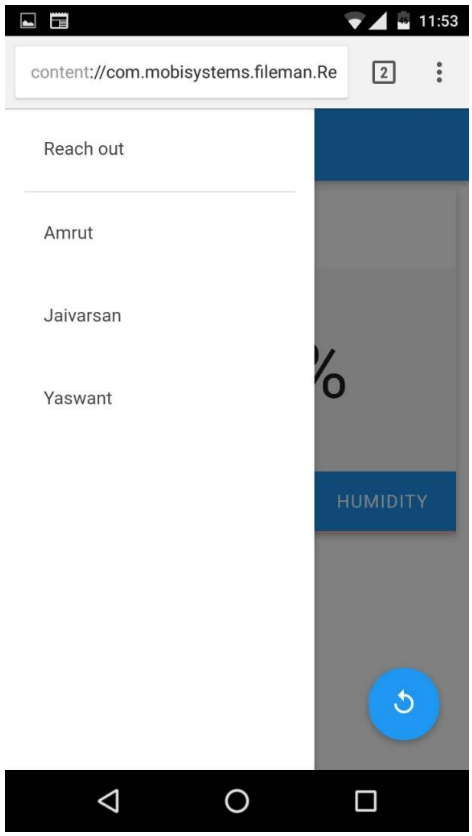


Figure : Mobile web app screenshots

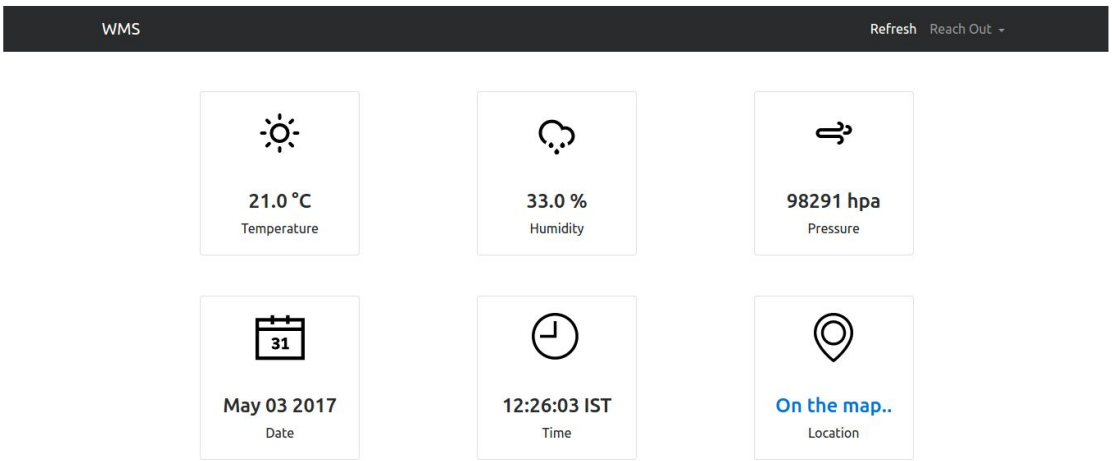


Figure : Desktop site screenshot

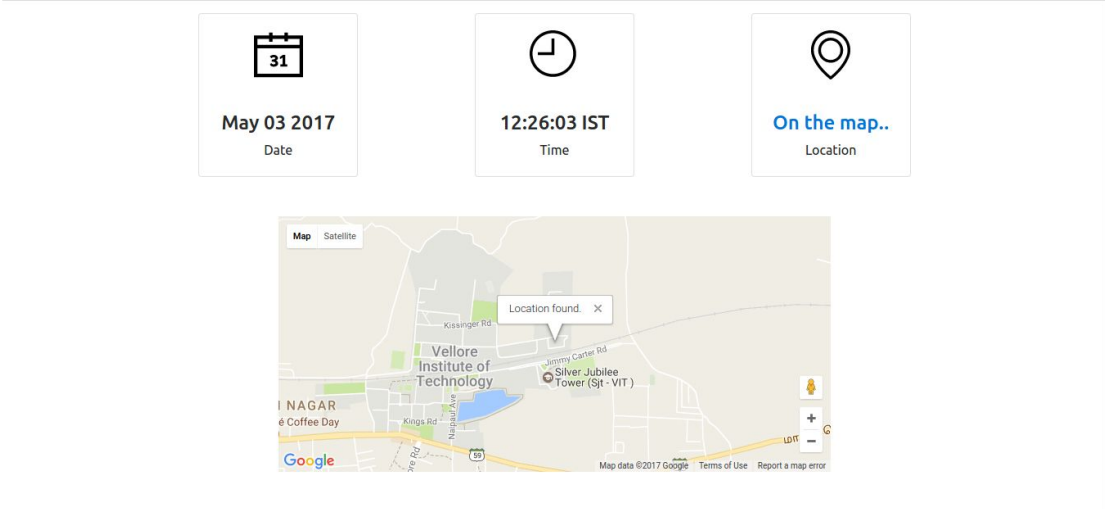


Figure : Desktop site google map integration

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5. References:

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