

Weather Parameters Monitoring by Raspberry Pi

¹ Meetal Rasal, ² J.G. Rana

¹ Department of Electronics and Telecommunication
Jawaharlal Nehru Engineering College, Aurangabad, India

² HOD ,Department of Electronics and Telecommunication
Jawaharlal Nehru Engineering College, Aurangabad, India

Abstract - The paper mainly focus to implement a prototype model for the weather monitoring system. Temperature, relative humidity and atmospheric pressure and many other environmental parameters measurement by using respective sensors is very important in weather monitoring and industrial development. A device for weather monitoring has been developed as described in this paper to monitor and display the temperature, pressure and relative humidity , wind speed and direction, altitude of the atmosphere ,rain fall detection using Raspberry pi. In this paper, various weather monitoring techniques have been reviewed. System stores the data and as per the request data will be provided to user. There are various techniques for observing weather like satellite, radar, microcontroller but Raspberry is latest and efficient technology.

Keywords - Raspberry Pi, Cloud, Weather Sensors, Python Programming.

1. Introduction

Today, the winds and other weather variables has great effect on our modern lifestyle. Weather affects a wide range of man's activities, including agriculture, transportation. Combination of various sensors forms one weather station. Weather Monitoring System can be either wireless or wired one. Raspberry Pi used for many projects because of its small, cheap and wide memory capacity features. The primary motivation behind taking up this project is the large utility of the wireless weather monitoring in varied areas ranging from agricultural growth and development to industrial development. Weather variables like temperature, atmospheric pressure ,humidity ,wind speed and wind direction ,rain fall are sensed by sensors and further processed by Pi.

1.1. Raspberry Pi

Raspebrry Pi is a computer based on Linux OS and is used for IoT applications. The reason for raspberry pi being a

preferred IoT device is because it runs a complete Linux Kernal 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 real world devices.

The credit-card sized laptop is capable of doing many things like using the spreadsheets, word-processing and playing games. It can run many versions of Linux operating system and the heart of the system that makes this computer so powerful and compact is that the Broadcom BCM2835, a System-on-Chip provided by Broadcom which has ARM11 series processor with floating unit ,it runs at 700MHz, and a Video core GPU .The system uses micro SD cards for saving data, so it is easier to organize and on equivalent hardware it can run many totally different operating systems. No Serial / USB connection with the board are required to install the operating system. Most Linux distributions for the Pi will live on a 4 GB micro SD card but larger cards are supported. Figure 1 shows the Raspberry Pi B+ Kit diagram.



Fig1: Raspberry Pi b+ Model

2. Proposed System

Raspberry pi is the latest wireless technology .Proposed system of weather monitoring system will monitor various weather parameters as discussed above using sensors connected to the circuit raspberry pi acts as a microcomputer and perform various functions, all the collected data through sensors will send data to the raspberry & store the data on SD card of Pi.LCD at the output side will show the results. To know the weather status at remote location, the operator has to log in on web browser by entering username and password given for particular server by the user. Once the password on the cloud server is entered, the web application opens which can also shows the graphical format of the collected data.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. Data will be updated continuously and can be viewed by user.

2.1. System Development

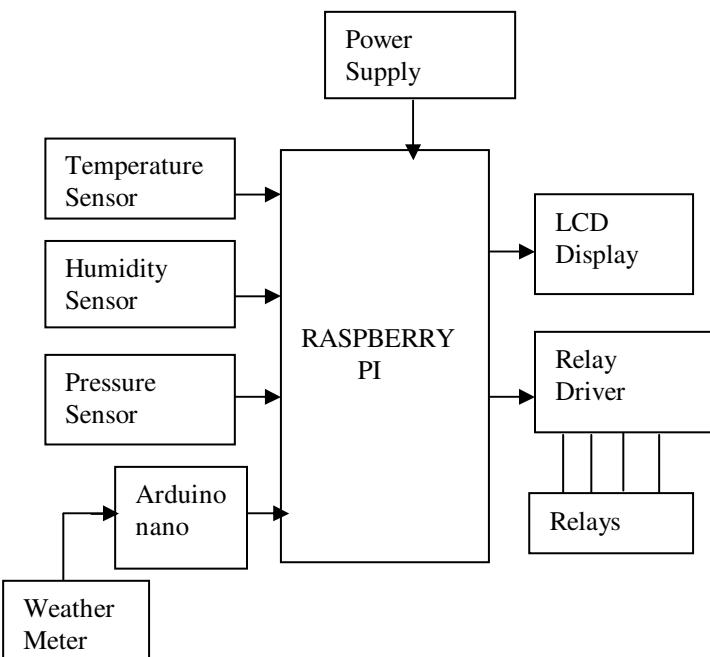


Fig.2: Block Diagram Of Weather Monitoring System

Fig 2 shows the block diagram of weather parameters monitoring .Basically there are two main sections .In first section various weather sensors are interfaced with the raspberry pi and at output side indication units like LCD is placed ,also there are relays to on and off control. The BMP180 is a digital barometric pressure sensor. This is available on a small module which provides access to the

sensor via the I2C interface. This allows us to easily connect it to the Raspberry Pi with a minimum of wiring.

One Wire Digital Temperature Sensor DS18B20, this sealed digital temperature probe lets you precisely measure temperatures in wet environments with a simple 1-Wire interface. The DS18B20 provides 9 to 12-bit (configurable) temperature readings over a 1-Wire interface, so that only one wire (and ground) needs to be connected from a central microprocessor.

The DHT11Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component offering excellent quality, fast response, anti-interference ability and cost-effectiveness .Weather meter used for measurement of three weather variables: wind speed, wind direction and rainfall.The Arduino Nano is a minute, breadboard-friendly board based on the ATmega328 (ArduinoNano3.x)orATmega16 (Arduino Nano 2.x). It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. Arduino converts analog values from weather meter to digital values and given to raspberry pi, hence acts as standard ADC.

3. 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.. For embedded programming, 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 else. 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.

3.1 Python Programming

Python is considered to be the simplest of all programming languages. Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in languages such as C++ or Java. The language provides constructs intended to enable clear programs on both a small and large scale. Python supports multiple paradigms, including object-oriented, imperative and functional programming. Python interpreters are available for many operating systems, allowing Python code to run on a wide variety of systems. Using third-party tools, such as Py2exe or Pyinstaller, Python code can be packaged into stand-alone executable programs for some of the most popular operating systems, so Python-based software can be distributed to, and used on, those environments with no need to install a Python interpreter.

3.1.1 Adafruit IO

Adafruit IO is a cloud platform which used to display input device value information in different formats and also used to control output device through it. In this project sensors are used as an input device and relay as an output device, then we can display values using these sensors like temperature sensor value, humidity value, pressure and many more etc. in this project we can make relays on and off, through which we can access this server.

Feeds are the core of Adafruit IO system. The feed holds data and metadata about values that get pushed to Adafruit IO. Feeds also contain information whether the data is public or private. In this project various feeds like temperature, pressure, humidity, altitude, wind speed, wind direction, rainfall are included and it continuously shows the last recorded value.

Dashboards are also a most important part of Adafruit IO. Dashboards allow us to visualize and control Adafruit IO connected projects from any modern web browser. Fig shows the actual output of all parameters that are included in project.

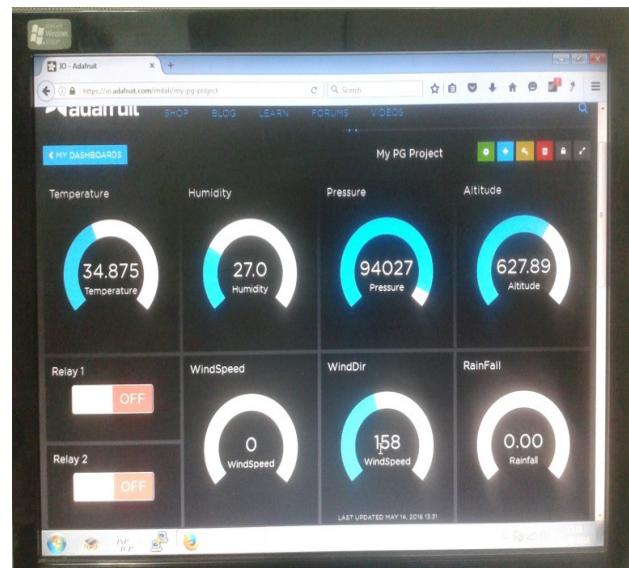


Fig3: Output of weather parameters

4. Results and Conclusion

For final programming, additional libraries used like 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 server present on the internet. The data posting through the python programming can be timed at suitable intervals so as to not to clutter the sever with incoming streams of data continuously. The proposed system is an enormous improvement over existing commercial methods in terms of cost, portability, memory capacity. The project deals with designing a simple and low cost weather monitoring system using different weather sensors, LCD, relay and raspberry pi, to monitor weather parameters.

Table 1: Comparison Of Raspberry Models

Parameters	Model B	Model B+	Model 2	Model 3
GPIO's	26	40	40	40
Speed	700 Mhz	700 Mhz	900 Mhz	1.2 Ghz
R RAM	256 MB	512 MB	1 GB	1 GB
P Processor	Single core	Single core	Quad core	Quad core
USB Ports	2	4	4	4*USB 2 ports
B Bluetooth & wi fi	No	No	No	Yes

5. Future Scope

Though the sensors that were used in this system were all digital inputs, we can make use of sensors with analog inputs by using a suitable A-D Converter. SMS and E-mail sending is also possible easily on raspberry pi to the requested user. The applications are limitless. Thus, such a system can be readily implemented using a low cost computer like Raspberry Pi which can function like a complete computer.

Automatic irrigation control can also be implemented using moisture sensor to fetch data regarding water presence in the farm and do turn on or turn off water pump accordingly. In Surveillance system,infrared sensors and pressure sensors are used for data monitoring. The said system can run continuously for satisfying the most demanding application also.

Acknowledgment

I express my sense of gratitude and sincere regards to my guide Prof J. G. Rana He inspired and guided me at all stages of this project work.I would like to thank all the staff members of Electronics and Telecommunication Department.

References

- [1] Low-Cost Microcontroller-based Weather Monitoring System- CMU. Journal (2006) Vol. 5(1)
- [2] International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 5, May 2013“THE ROLE OF ZIGBEE TECHNOLOGY IN WEATHER MONITORING SYSTEM”
- [3] KESHAV KUMAR SINGH ,Department of Electronics and Communication Engineering National Institute of Technology “DESIGN OF WIRELESS WEATHER MONITORING SYSTEM ”
- [4] International Journal of Embedded Systems and Applications (IJS) Vol.2, No.3, September 2012 DOI : 10.5121/ijesa.2012.2311 “WEATHER MONITORING STATION WITH REMOTERADIO FREQUENCY WIRELESS COMMUNICATIONS”
- [5] International Journal of Computational Science, Mathematics and Engineering, Volume 2, Issue 2, February 2015 “Weather Monitoring Systems in Hazardous Zones Survey”
- [6] Adafruitraspberrypi:tutorials:https://learn.adafruit.com/category/raspberry_pi

Authors Profile

Ms Meetal V. Rasal is PG student, pursuing M.E in Electronics and Telecommunication from JNEC, Aurangabad.

Mr.J.G.Rana is a M.E in Electronics & Telecommunication, working as a HOD and professor in JNEC, Aurangabad with 27 years of teaching experience .He has been guided many UG and PG student, ,around 25 papers has been published by him at national and international level.