

Raspberry Pi Based Weather Monitoring System

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Abstract: Implementing a prototype model for the weather monitoring system is the main aim of the paper. Temperature, relative humidity and atmospheric pressure measurement by using the appropriate sensors is very beneficial for industrial, weather monitoring. A weather monitoring model or system has been developed as discussed in this paper to record and displaying of the weather parameters like temperature, humidity, wind direction speed, rain fall detection and atmospheric pressure. Various weather monitoring techniques have been reviewed in this paper. Recorded information is kept in the device for further use. User can find out the data saved by the system anytime as per the request. Among Various techniques radars, satellites, microcontrollers of weather monitoring systems raspberry pi is the latest & efficient wireless weather monitoring technique.

Keywords: Raspberry Pi, Cloud Server, Weather monitoring sensors, Python programming

I INTRODUCTION

Weather or Climate is important part of human life. Sensors are essential components not only applicable to the industries for process control but also in daily life for safety of building's and traffic flow measuring, environmental parameters measurement.

In weather monitoring, factors such as temperature, humidity and pressure are to be measured for this project, thus sensors have always been given the task for doing so. Main focus of project is to develop compact and powerful weather station. Data acquisition systems are very popular for consumer and industrial applications. The proposed system has three sensors that measures different parameters as stated above & for rain fall detection and wind direction speed measurement weather instrument is included.

Raspberry Pi, acting as data logger process the converted output of sensors from analog to digital. The logged data can then be transferred to a desktop or any other monitor has GUI for further analysis. So by using easily obtained components and less complicated circuitry powerful weather station can be build. Now a day's various weather factors like wind and many other cause great impact on humans day to day life.

In raspberry pi based weather monitoring system which depends on combination of several sensors to be integrated has been proposed. Raspberry Pi will receive readings from various sensors and then process the data and then data will be available on cloud server for viewing of user at remote location. Weather Monitoring can be done in either wireless or wired manner.

The Raspberry is cheap, small and rugged which make it perfect for real world projects? For agricultural development and industrial management, the proposed system is useful.

Raspberry pi is the latest wireless technology. Proposed System will visualize and store various weather parameters as given above with the help of sensors interfaced to Raspberry will get all data, SD card on Pi stores the collected data as like memory card. Then at the output side LCD is to be connected for showing the result and on off relays for server access. To know the current weather status at remote location, the user can log in on web browser by entering username and password given for particular server by the user. Web application opens after entering password and with the output graphical representation also obtain. Raspberry pi processed data will updated continuously on cloud server & user will get to know the stored data on hourly and daily basis.

The System Circuit

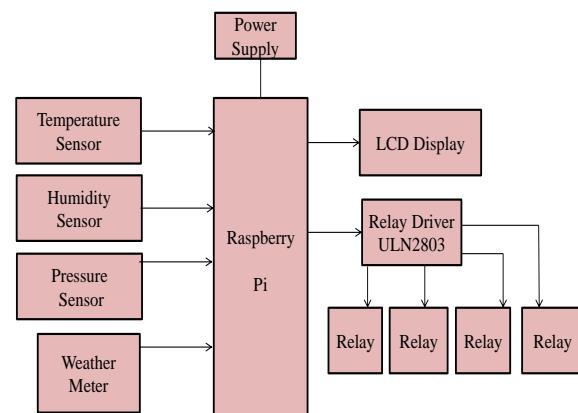


Figure 1 : Block diagram of Weather Monitoring

Fig2 shows the block diagram of weather parameters Monitoring Project mainly divided into two sections. First Section includes 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, a widely used digital pressure sensor.I2C interface is available on BMP180 sensor. Second sensor, One Wire Digital Temperature Sensor DS18B20,with a simple 1-Wire interface it measures the temperature in a wet environment also. The DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor provides digital output but DHT11 is mainly used for the humidity measurement. Features of sensors includes high reliability and long term stability

Weather Meter is useful measurement of three main factors: wind speed, wind direction and rainfall. Breadboard friendly, compel and compact board based on the ATmega328 (Arduino Nano 3.x) orATmega168 (Arduino Nano 2.x commonly known as Arduino nano included in project. Analog values from weather meter converted to digital values by Arduino and given to raspberry pi, hence acts as standard ADC but we are using digitally inputted sensors in this project. Low cost weather station or system can be implemented with less complicated circuitry and easily obtained components.

III. IMPLEMENTATION

A. Component Description:

The proposed system includes following components.

- [1] Raspberry Pi Board
- [2] LAN Cable
- [3] HDMI Display
- [4]Atmospheric pressure sensor
- [5] Humidity sensor
- [6] Temperature sensor
- [7] Weather Meter
- [8] Keyboard and mouse
- [9] Relay Board

1. Raspberry Pi

The **Raspberry Pi** Foundation implement and developed a Computer in UK of size just like ATM card or a credit card called **Raspberry Pi**.Linux OS is used on Raspberry Pi and for IoT applications it is used frequently and it can be connected directly to the internet as well as USB ports to connect to wifi. Raspberry Pi's Operating system supports programming languages like python. For direct connection with the sensors and many other devices Raspberry Pi has 40 GPIO's. The credit-card sized laptop can do all the functions like word processing and playing games many more. The **Broadcom BCM2835** system based Raspberry Pi consist ofARM1176JZF-S runs on 700 MHz processor, and primarily works on 256 megabytes of RAM, later upgraded (models Band B+) to 512 MB. This 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. The Raspberry Pi featuring of a 40-Pin GPIO header, 4 x USB ports, 1x LAN port, also 1x CSI and 1x Touch Screen interface, 1x hdmi port, also 1x integrated audio and video output port. So there is no need to have large SD card. Figure 1 shows the Raspberry Pi B+ Model.



Figure2: Raspberry Pi b+ Model

[ii] **LAN Cable (Local Area Network):** To access the internet in Raspberry Pi we need LAN connection, with the help of which we can access the real time results of parameters at remote location. The LAN connected devices has much more faster speed than the wireless connection.

[3] **HDMI Display:** To see the current status of the weather as well as the sensors (humidity, pressure, temperature) and also we will able to check the updates regarding Raspberry Pi.

[4]The **DHT11** is a basic, ultra low-cost digital temperature and humidity sensor. It uses a resistive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin Full range temperature compensated. Relative humidity and temperature measurement. Good for 20-80% of humidity measurement and 0-50°C of temperature measurement

[5]The BMP180 is the function compatible successor of the BMP085, a new generation of high precision digital pressure sensors for consumer applications. The ultra-low power, low voltage electronics of the BMP180 is optimized for use in mobile phones, PDAs, GPS navigation devices and outdoor equipment. Pressure range: 300 ... 1100hPa (+9000m .500m relating to sea level).

[6]The DS18B20 Digital Thermometer provides 9 to 12-bit (configurable) temperature readings which indicate the temperature of the device. Information is sent to/from the DS18B20 over a 1-Wire interface, so that only one wire (and ground) needs to be connected from a central microprocessor to a DS18B20.Temperatutre Measurement range from -55°C to +125°C.

[7]**Weather Sensor Assembly:** This kit includes a wind vane, cup anemometer, and tipping bucket rain gauge, with associated mounting hardware. These sensors contain no active electronics, instead using sealed magnetic reed switches and magnets to take measurements. A voltage must be supplied to each instrument to produce an output.

[viii] **Relay Board:** Relay is an electromechanical switch which is used in industrial controls, automobiles and home

appliances, because of their relative simplicity, long life, and proven high reliability. In the proposed system we are using 8-channel relay for switching and controlling the devices, having 8 independently controlled relays. The Control signals use +5V logic levels and is of TTL compatible



Figure 3: Interfacing Device with Raspberry Pi

controlled and monitored from any web browser, is the motive of Dashboards. We can add Blocks to our Dashboard. Blocks can be input blocks and some blocks can act as output blocks. Fig shows the actual output of all parameters that are included in project

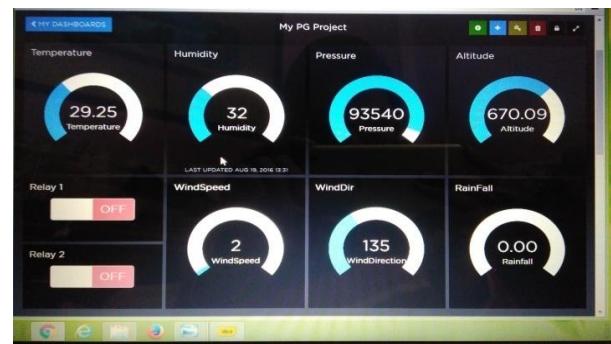


Figure 4: Result displayed on Screen at Remote Location

IV. RESULTS AND CONCLUSION

B. Software Requirement

Programming on Raspberry pi can be done in many ways. RPI can run all those programming languages which a Linux computer can run. The GCC compiler suite is preloaded with raspberry Pi's operating system raspbian. Raspberry pi directly run C programs without any other installation.

Python

Recommended language mainly for Raspberry Pi is Python, while Raspberry works on Linux Operating system. Python interpreters allowing Python code to run on a wide variety of systems. Py2exe or PY installer, Python code packaged into stand-alone executable programs for some of the most popular operating systems, so without installing python interpreter these codes can be used easily. Thegitbuh.com consist of variety of user libraries for working on raspberry using python efficiently. Python is designed to be highly readable Python is a simplest, dynamic, interpreted, object oriented language.

Adafruit IO

Cloud server hosting is a type of hosting in which customers or users can use hosting services through internet. Adafruit IO is one of the most popular cloud platforms which used to indicate values of devices at the input and controls output device through it. This project mainly includes sensors which are used as input devices and corresponding values of temperature, atmospheric pressure and humidity will be reflected on output side, also relays are used for on and off control which access the server. Adafruit IO system consist of very important part called feeds Data get held by feeds which is then pushed to Adafruit IO. For each unique public or private data there will be one feed. In this project there is a one feed is allowed for every parameter that are included and shows the updated information. Dashboards plays an important role in Adafruit IO. Adafruit IO connected projects can be

Thus, we can conclude that the Raspberry Pi efficiently does the work of weather station because of it's a compact yet very powerful device. RPI GPIO library is needed which gives access to raspberry PI's GPIO's is get accessed by RPI GPIO library which additionally needed by for final Programming. and the HTTPLIB which can access internet connection of raspberry and over internet data pushed on the server.

Data available on cloud server will be vanished automatically after several interval of time if we want. Comparison shown below satisfies how the discussed system is preferable in terms of cost & memory capacity etc& all the models on +5 supplies. Processor for Model B and B+ is single core while Quad core processor used for Model 2 and Model3.

Different Models of Raspberry Pi

Table 1: Raspberry Pi Models Comparison

Parameter	Model B+	Model 2	Model 3
Zx			
GPIO Ports	40	40	40
Processing Speed	700 MHZ	900 MHZ	1.2ghz
RAM	512MB	1GB	1GB
Bluetooth& Wifi	No	No	Yes
USB ports	4 USB	4USB	4*USB2 ports

V. FUTURE SCOPE

The future of this system is very wide. Internet of Things is just opening its arms, Same system can be applicable to the variety of applications like Data monitoring ,sending and controlling of data at remote location.

In this project I have used sensors with digital input but with suitable A-D convertor we can easily use sensors with analog input. As applications are literally limitless we can send SMS or E-mail through Raspberry Pi.

Thus, such a system can be readily implemented using a low cost computer like Raspberry Pi which can function like a complete computer.

Using moisture sensor Automatic irrigation control can be done in order to get information about field and accordingly water pump will turn on. Data can be monitored using infrared sensors and pressure sensors in Surveillance system

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REFERENCES

- [1] International Journal of Engineering Trends and Technology (IJETT) – Volume 33 - March 2016 ‘An Automated ThingSpeak Weather Monitoring System using Raspberry PI’ M. Ramesh1, Dr. S.A.K. Jilani2, Mr.S.Arun3 Department of Electronics &Communication Engineering, MITS, Madanapalle, India
- [2] International Journal of Engineering Research & Technology (IJERT)ISSN: 2278-018IJERTV3IS090619 Vol. 3 Issue 9, September- 2014 ‘Modular Weather and Environment Monitoring Systems using Raspberry Pi’ Kuruvadi Praveen ,AnkhitBala Venkata Department of Telecommunications BMS College of Engineering Bangalore, India
- [3] The International Journal of Engineering and Science (IIES) Volume 4 2015 ISSN (e): 2319 – 1813 ‘Zigbee based weather monitoring system’
- [4] Low-Cost controller-based Weather MonitoringSystem-CMAJournal (2006)
- [5] International Journal of Computer technology July 2014 Design and Implementation of Weather Monitoring and Controlling Systems.
- [6] Article Publishedon Wireless Remote sensing Weather Monitoring Based on MEMS .
- [7] Synopsis for ‘SMS based Weather reportinformation system’
- [8] International Journal of Computer Science, Vol. (1) , ‘Design of ARM based Embedded Web Server for Agricultural Application’
- [9] DeHennis, A. D., and K. D. Wise.A wirelessmicrosystem for the sensing of temperature, and relative humidity. Journal Micro electro mechanical Systems 14(1):ISO7730. 1984, Geneva, Switzerland.
- [10] Moghavvemi, M., K., C. Y. Soo, and S. Y. Tan.2005.’A reliable and feasible remote sensing system for temperature and humidity measurement.’ Sensors and Actuators A 117: 181–185.
- [11] Ong, K. G., , C. L. Robbins, and R. S. Singh. 2001.Design of a wireless, passive, resonant-circuit. environmental monitoring sensors. Sensors and Actuators A 93: 33–43.
- [12] Documentation for the Python programming language :<http://www.python.org>.

BIOGRAPHIES



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