

Real Time Weather Data Acquisition and Monitoring From a Remote Location Using ARM-11 Processor and IoT

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Abstract - Weather monitoring has become an important process for the human sustenance; therefore collection of information about the temporal dynamics of weather changes from a large number of locations has become inevitable. The fundamental aim of this paper is to develop an embedded system to design a real time remote weather monitoring system which enables the monitoring of important weather parameters. Such a system makes use of sensors like temperature, humidity, airflow, pressure, CO content in the air for the purpose of data generation. The data from the sensors are collected by the ARM processor, processed and also sent to intended location through the Ethernet. Some of these sensors produce the data in analog form, therefore we use internal ADC of ARM-11 to convert into digital format. The data is presented in a remotely located computer using Ethernet for further processing, usage and presentation in the desired format. It is also possible set threshold values for these parameters and generates warning in case of parameter crossing threshold value.

Keywords: Real time monitoring of weather parameters, Remote monitoring of weather, ARM-11 processor for data acquisition, sensors for weather monitoring, Ethernet, IOT

I. INTRODUCTION

Changes in the weather conditions are playing an important role in the human life. Most of the weather data collection is done by manually in India restricting the number of sites from which the weather is monitored. Data acquisition systems with remote accessibility are in great demand in industry and consumer applications as well. In some applications, manned locations have been replaced by unmanned devices that will acquire data and relay the data to the intended location. There are data-acquisition and control devices that will be a substitute for a supervisor in a multisite job operation. With the ability to access the application remotely, a service organization can eliminate the need to send a service person to the application and thus save the labour time and money. The implementation of chosen embedded networking is achieved by means of an embedded web server. A web server provides access to the end devices for the client by uploading web pages as per the client request. When the configured IP address is entered in the web browser, the predesigned HTML web pages gets displayed through which the client can remotely monitor the sensor data sequentially. The heart of communication is TCP/IP protocol. Network communication is performed by the IEEE802.3 Ethernet standard. ARM11 processor is as the brain of web server. ARM Processor has been chosen because of its high data processing capability. It also has features of multi parameter acquisition and multi-level monitoring and networking.

II. RELATED WORK

The data-acquisition systems are very useful in various applications in the industry, agriculture, defence and weather monitoring. Here in this paper, we are presenting a methodology to monitor weather from a remote area through Ethernet in real time. The main aim of the project is to monitor the weather parameters of a selected location from intended location. The parameters selected are the Ambient Temperature, Wind Speed, Humidity, Rainfall, Atmospheric Pressure and Air Pollution (CO).

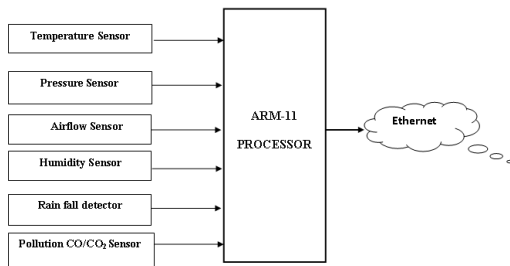
III. EXISTING SYSTEM

In most of the existing systems the weather data is acquired and updated to the base station using protocols such as UART.

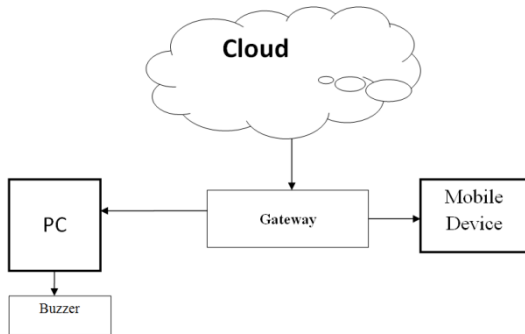
IV. PROPOSED SYSTEM

In this paper we have presented a data-acquisition system and built a prototype, by which we have acquired weather parameters, such as temperature using temperature LM35 sensor, Wind pressure by RPM sensor, Rainfall by level indicator, Humidity by DHT11 sensor, pollution of particular area using CO sensor MG811. As some of these sensors produce analog signal, we use internal ADC of ARM11 to convert into digital and then push the data to web using TCP/IP protocol. We have designed an HTML page to read and monitor the data, and to enable display of data in real time. We have also designed a driver, such that if the value of the data crosses the set threshold limit an alert is made using the buzzer.

BLOCK DIAGRAM: REMOTE LOCATION



BLOCK DIAGRAM: MONITORING SECTION



V. IMPLEMENTATION DETAILS

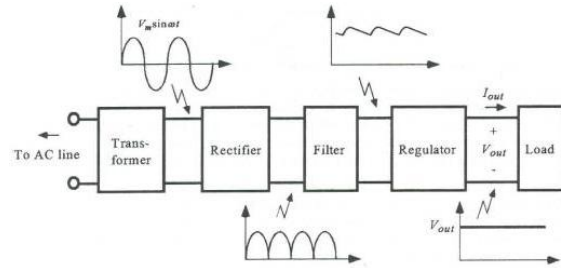
Circuit description

In this circuit diagram sensors are used to measure the weather parameters such as Temperature, Humidity, Rainfall detection, pollution (CO), and wind speed. The temperature values are read from temperature sensor (LM35 sensor), humidity values are read from humidity sensor (NPT 1210), rainfall values are measured from ultrasonic sensor, pollution of Carbon Monoxide values are read from MQ7 sensor, wind speed values are read from AWM 700 sensor. All the sensors are connected to ARM-11. Out of the above sensors Rain fall detector and Pollution detectors are in digital format and remaining sensors give output in the analog form.

Circuit Diagram Description of Power Supply Unit

Power Supply

The input to the circuit is applied from the regulated power supply. The ac input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating dc voltage. So in order to get a pure dc voltage, the output voltage from the rectifier is fed to a filter to remove any ac components. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage. The block diagram of regulated power supply



Components of power supply

Transformer

Usually, DC voltages are required to operate various electronic equipment and these voltages are 5V, 9V or 12V. But these voltages cannot be obtained directly. Thus the a.c input available at the mains supply i.e., 230V is to be stepped down to the required voltage level. This is done by a transformer. Thus, a step down transformer is employed to decrease the voltage to a required level.

Rectifier

The output from the transformer is fed to the rectifier. It converts A.C. into pulsating D.C. The rectifier may be a half wave or a full wave rectifier. In this project, a bridge rectifier is used because of its merits like good stability and full wave rectification.

Filter

Capacitive filter is used in this project. It removes the ripples from the output of rectifier and smoothens the D.C. Output received from this filter is constant until the mains voltage and load is maintained constant. However, if either of the two is varied, D.C. voltage received at this point changes. Therefore a regulator is applied at the output stage.

Voltage regulator

As the name itself implies, it regulates the input applied to it. A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. In this project, power supply of 5V and 12V are required. In order to obtain these voltage levels, 7805 and 7812 voltage regulators are to be used. The first number 78 represents positive supply and the numbers 05, 12 represent the required output voltage levels.

VI. HARDWARE TOOLS

IOT Technology:

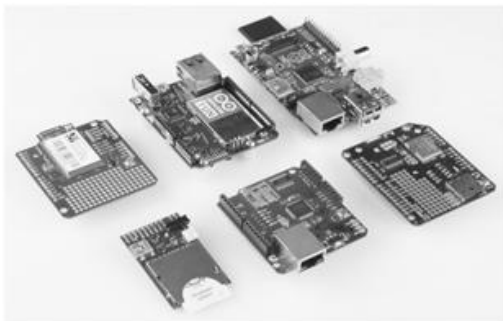
The “Internet of things” (IoT) is becoming an increasingly growing topic of conversation in every area of engineering. It’s a concept that not only has the potential to impact our lives but also the way we work. There are a lot of complexities around the “Internet of things” but we want to stick to the

basics. Lots of technical and policy related conversations are being had but many people are still just trying to grasp the foundation of what the heck these conversations are about. Broadband Internet is become more widely available; the internet costs are coming down. More devices are being created with Wifi capabilities and sensors built into them, technology costs are going down, and smart phone penetration is sky-rocketing. All of these things are creating a “perfect storm” for the IoT.

Sparkfun data cloud

SparkFun’s service helps us to easily push the data to the “cloud.” Whether we are posting weather readings, office environment conditions, or anything else, it can come in handy to have a central, online location to store those sensor readings. By sending a simple HTTP request to the Data. SparkFun.com server, project data is stored and displayed in a simple database where it can be retrieved or reviewed at your leisure.

Any electronics project that can be **Internet-connected** should be able to post data to the SparkFun data service. Luckily, these days – with Internet-of-Things applications taking off – there is no shortage of hardware gateways to the web. Basic Arduinos can rely on shields for WiFi or Ethernet access, while many advanced development platforms already have WiFi or Ethernet built-in.



An assortment of shields and development boards that can be used as your hardware’s Internet gateway for Data.SparkFun.com.

This tutorial is a grab bag of example sketches and scripts that show how you can publish anything to our data service using most of today’s popular hardware platforms. Each example has a section dedicated to the example hookup, code and setup:

Arduino & Ethernet Shield – The Ethernet Shield has been one of the Arduino’s longest lasting Network portals around. If you don’t mind a few wires hanging out of your project, this shield is one of the most reliable options around. This example also works with the PoEthernet Shield, or really any shield that uses the Ethernet library.

Arduino & CC3000 Shield – The CC3000 WiFi Shield is one of our newest offerings to the WiFi Shield market. Because it’s relatively low-cost and reliable, it’s a great choice if you’re short on RJ-45 ports or Cat5 cable.

Arduino & WiFly Shield – The WiFly Shield is another long-surviving shield that makes connecting your ‘duino to WiFi easy. Not as cheap as the CC3000, but a good option if you’ve already got a Shield lying around.

Arduino Yun – Internet-of-things applications like this are what the Arduino Yun was made for. With built in Ethernet, WiFi, and even Linux, not much stands in the way of your data on its way to the web.

Raspberry Pi (using Python) – With a full Linux kernel at its fingertips, the Raspberry Pi should have no problems posting an HTTP request.

Electric Imp – A prerequisite to using the Electric Imp is that it must be Internet-connected to download code. With its ability to work with web “agents”, the it’s easy to get the imp posting HTTP requests.

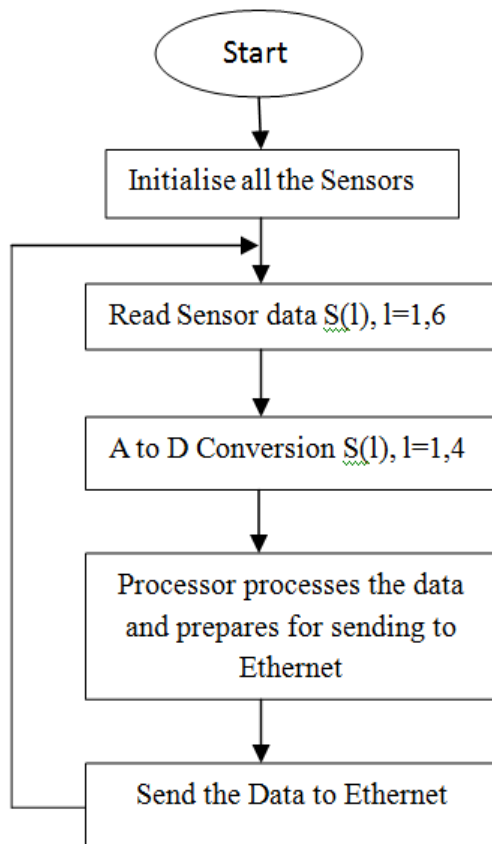


BROAD Come 2835

It consists of following components

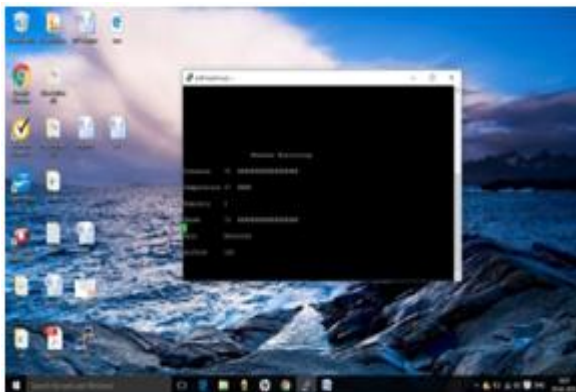
- 40GPIO pins
- Micro SD Card slot
- DSI Display Connector
- CSI Camera connector
- Ethernet Output to USB port
- Ethernet Controller
- 4 Squarely Placed mounting holes
- Switching Regulator for less power consumption
- 5V Power supply
- HDMI output port
- Output Jack

FLOW CHART FOR PROCESSING IN MICRO CONTROLLER



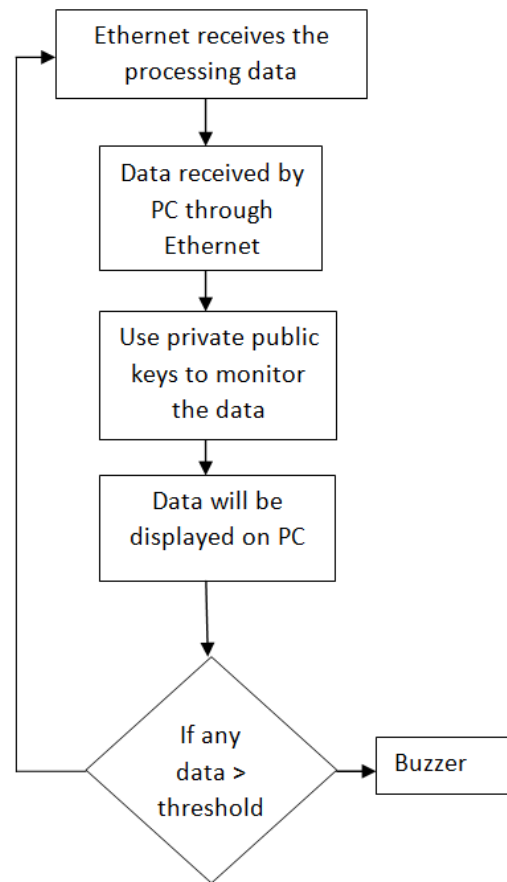
PROGRAMMING STEPS

- Step-1: Connect all the modules through Raspberry pi
- Step-2: Open the Putty software window and enter the login Id and password.
- Step-3: Open the programming file as SUDO python filename.py
- Step-4: Then all the parameter values are monitored and displayed on PC.
- Step-5: To exit from the window press ctrl+c.



Display of data on PC

FLOW CHART FOR MONITORING SECTION



VII. CONCLUSION

This paper deals with acquisition of the weather parameters such as Ambient Temperature, Wind speed, Humidity, rainfall, Atmospheric Pressure and CO Pollution by using the appropriate sensors and ARM 11 microprocessor in real time. All these sensors produce the analog data; therefore we use internal ADC of ARM11 to convert into digital format. The data is presented in a remotely located computer using Ethernet for further processing, usage and presentation in the desired format.

VIII. BIBLIOGRAPHY

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IX. AUTHOR'S PROFILE

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