DESIGN OF WEATHER MONITORING STATION USING RASPBERRY PI

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Abstract:

Temperature has an impact on almost all the activities surrounding us. Here our main focus is to implement a prototype model for the weather monitoring system. We present the detection of real time temperature and relative humidity employing raspberry pi. This is a raspberry-pi based temperature and humidity logger that uses DHT11 sensor for measurement and it is unique as it not only reads temperature from sensor but also stores data to cloud and provide means to read that temperature data with any web enabled device (computer, phone)web browser. Python language is used. There are various techniques for observing weather like satellite, radar, microcontroller but Raspberry is latest and efficient technology.

Keywords: Raspberry-pi, Python.

I. INTRODUCTION

Internet of Things (IoT) has provided a promising opportunity to build powerful industrial systems and applications by leveraging the growing ubiquity of RFID, wireless, mobile and sensor devices. A wide range of industrial IoT applications have been developed and deployed in recent years. In an effort to understand the development of IoT in industries, this paper reviews the current research of IoT, key enabling technologies, major IoT applications in industries and identifies research trends and challenges. A main contribution of this review paper is that it summarizes the current state-of-the-art of IoT in industries systematically. The advancement of Automation technology, life is getting simpler and easier in all aspects. In today's world Automatic systems are being preferred over manual system. With the rapid increase in the number of users of internet over the past decade has made Internet a part and parcel of life, and IoT is the latest and emerging internet technology. Internet of things is a growing network of everyday object-from industrial machine to consumer goods that can share information and complete tasks while you are busy with other activities. This paper proposes that the industrial monitoring by using Temperature sensor, Humidity Sensor values to read the value and monitoring usingThingspeak system via Raspberry pi.

ThingSpeak is an application platform for the Internet of Things. ThingSpeak allows you to build an application around data collected by sensors. At the heart of ThingSpeak is a ThingSpeak Channel. A channel is where you send your data to be stored. Each channel includes 8 fields for any type of data, 3 location fields, and 1 status field. Once you have a ThingSpeak Channel you can publish data to the channel, have ThingSpeak process the data, and then have your application retrieve the data.

II. ABOUT RASPBERRY PI

The raspberry pi is a computer on a single board with credit card size that can be used for many tasks that computer does, like games, word processing, spread sheets and also to play HD video. It was established by the Raspberry Pi foundation from UK. It has been ready for public consumption since 2012 with the idea of making a low-cost educational microcomputer for students and children. The main purpose of designing the raspberry pi board is, to encourage learning, experimentation and innovation for school level students the raspberry pi board is portable and low cost. Maximum of the raspberry pi computers is used in mobiles. In the 21st century, the growth of mobile computing technologies is very high, a huge segment of this being driven by the mobile industries. The 98% of the mobile phones use ARM technology.

There are several models of raspberry pi and most for people Raspberry Pi 3 model B+ is the best one to choose.

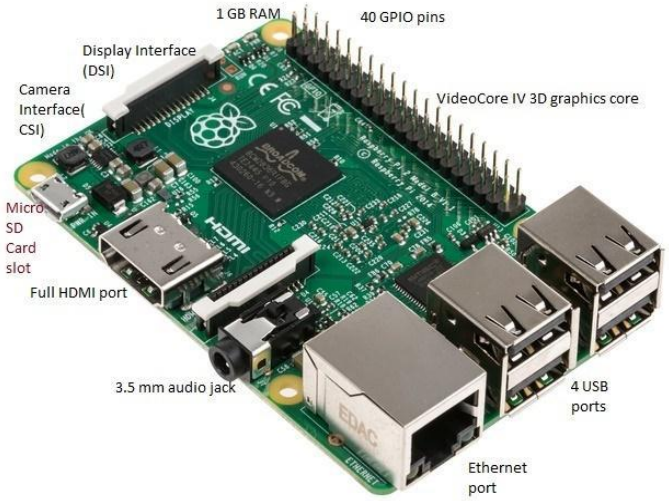

Figure 2.1: TOP VIEW OF RASPBERRY PI BOARD.

The Raspberry Pi Zero and Zero W are smaller and require less power, so they're useful for portable projects such as robots. It's generally easier to start a project with the Raspberry Pi 3, and to move to the Pi Zero when you have a working prototype that the smaller Pi would be useful for.

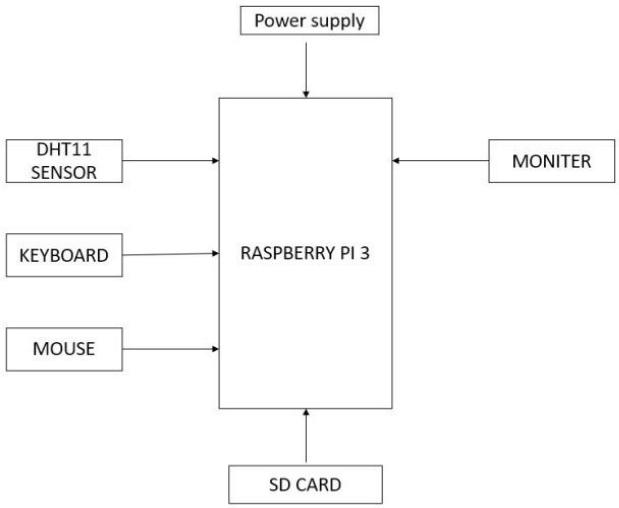

Figure 2.2: BLOCK DIAGRAM OF WEATHER MONITORING STATION.

To connect to a power socket, the Raspberry Pi has a micro USB port (the same found on many mobile phones).The power supply used is that voltage rating 5 volts and current rating is 2.5 Amperes. Your Raspberry Pi needs an SD card to store all its files and the Raspbian operating system. You will need a micro SD card with a capacity of at least 8 GB.Many sellers supply SD cards for Raspberry Pi that are already set up with Raspbian and ready to go.

Once you've set your Pi up, you can use a Bluetooth keyboard and mouse, but you'll need a USB keyboard and mouse for setting up. To view the Raspbian desktop environment, you will need a screen and a cable to link the screen and the Pi. The screen can be a TV or a computer monitor. If the screen has built-in speakers, the Pi will be able to use these to play sound. The Raspberry Pi has a HDMI output port that is compatible with the HDMI port of most modern TVs and computer monitors. Many computer monitors may also have DVI or VGA ports. You may want to put your Raspberry Pi in a case. This is not essential, but it will provide protection for your Pi. If you'd like, you can use the official case for the Raspberry pi 3 or pi Zero or Zero W.

The large Raspberry Pi models (not the Pi Zero/Zero W) have a standard audio port like the one on your smart phone or MP3 player. If you want to, you can connect your headphones or speakers so that the Pi can play sound. If the screen you're connecting your Pi to has built-in speakers, the Pi can play sound through these. The large Raspberry Pi models (not the Pi Zero/Zero W) have a standard Ethernet port to connect them to the internet. To

connect a Pi Zero to the internet, you need a USB-to-Ethernet adaptor. The Raspberry Pi 3 and Pi Zero W can also be wirelessly connected to the web.

III. DESCRIPTION OF GPIO PINS

It's important to be aware of which pin is which some people use pin labels (like the RasPioPortplusPCB, or the printable Raspberry Leaf).

A handy reference can be accessed on the raspberry pi by opening a terminal window and running the command pin out. This is provided by the GPIO Zerp Python library, which is installed on Raspbian desktop image, but not on Raspbian Lite.

It is possible to control GPIO pins using a number of programming languages and tools. There are 40 pins on the Raspberry Pi (26 pins on early models), and they provide various different functions. If you have a RasPiO pin label, it can help to identify what each pin is used for. Make sure your pin label is placed with the keying hole facing the USB ports, pointed outwards. If you don't have a pin label, then this guide can help you to identify the pin numbers: You'll see pins labeled as 3V3, 5V, GND and GP2, GP3, etc.

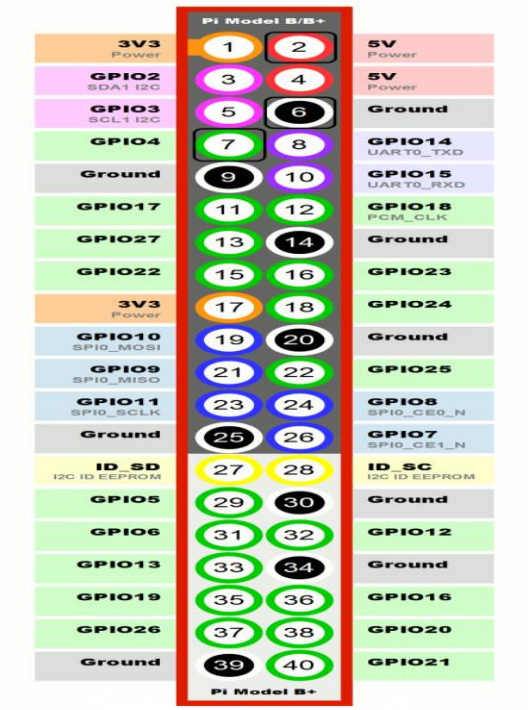

Figure 3.1: DESCRIPTION OF GPIO PINS

IV. DHT 11 HUMIDITY AND TEMPERATURE SENSOR

DHT11 Temperature & 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, and connects to a high- performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness allowed in the voltage and current waveforms on various types of systems.

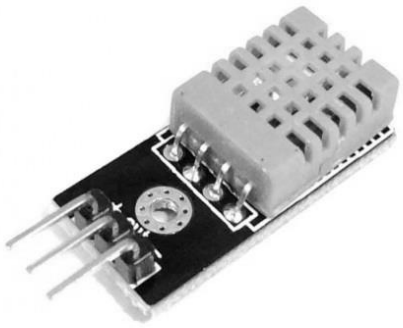

Figure 4.1**:** DHT 11 SENSOR

Each DHT11 element is strictly calibrated in the laboratory that is extremely accurate on humidity calibration. The calibration coefficients are stored as program in the OTP memory, which are used by the sensor's internal signal detecting process. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20-meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package. It is convenient to connect and special packages can be provided according to users' request. When the connecting cable is shorter than 20 meters, a 5K pull-up resistor is recommended; when the connecting cable is longer than 20 meters, choose an appropriate pull-up resistor as needed. DHT11's power supply is 3-5.5V DC. When power is supplied to the sensor, do not send any instruction to the sensor in within one second in order to pass the unstable status. One capacitor valued 100nF can be added between VDD and GND for power filtering.

V. INSTALLING THE RASPIBIAN IN RASPBERRY PI 3

5.1 Introduction

Installing Raspbian on the Raspberry Pi is pretty straight forward. We'll be downloading Raspbian and writing the disc image to a microSD card, then booting the Raspberry Pi to that microSD card. For this project, you'll need a microSD card (go with at least 8 GB), a computer with a slot for it, and, of course, a Raspberry Pi and basic peripherals (a mouse, keyboard, screen, and power source). This isn't the only method for installing Raspbian (more on that in a moment), but it's a useful technique to learn because it can also be used to install so many other operating systems on the Raspberry Pi. Once you know how to write a disc image to a microSD card, you open up a lot of options for fun Raspberry Pi projects.

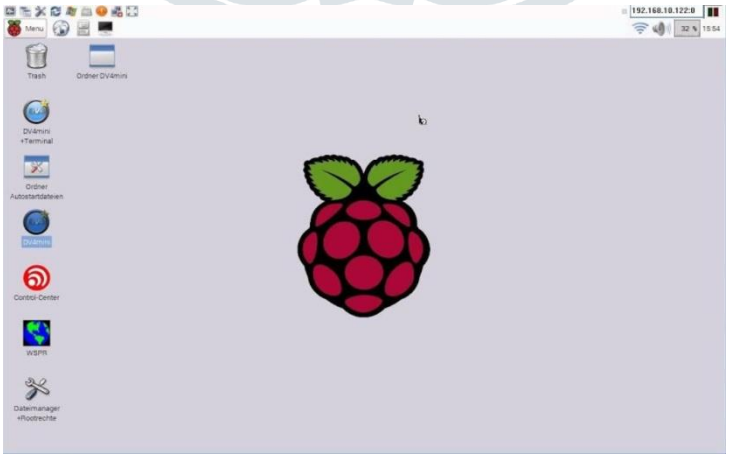

Figure 5.1**:** DESKTOP IMAGE OF INSTALLED RASPBIAN ON RASPBERRY PI 3

The following are the steps to install the Raspbian operating system

Step 1: Download Raspbian

I promised to show you how to install Raspbian on the Raspberry Pi, so it's about time that we got started. First things first: hop onto your computer (Mac and PC are both fine) and download the Raspbian disc image. You can find the

latest version of Raspbian on the Raspberry Pi Foundation's website here. Give yourself some time for this, especially if you plan to use the traditional download option rather than the torrent. It can easily take a half hour or more to download.

Step 2: Unzip the file

The Raspbian disc image is compressed, so you'll need to unzip it. The file uses the ZIP64 format, so depending on how current your built-in utilities are, you need to use certain programs to unzip it. If you have any trouble, try these programs recommended by the Raspberry Pi Foundation:

- Windows users, you'll want 7-Zip.
- Mac users, The Unarchiver is your best bet.
- Linux users will use the appropriately named Unzip.

Step 3: Write the disc image to your microSD card

Next, pop your microSD card into your computer and write the disc image to it. You'll need a specific program to do this:

- Windows users, your answer are Win32 Disk Imager.
- Mac users, you can use the disk utility that's already on your machine.
- A Linux person, Etcher , which also works on Mac and Windows is what the Raspberry Pi Foundation recommends.

The process of actually writing the image will be slightly different across these programs, but it's pretty self-explanatory no matter what you're using. Each of these programs will have you select the destination (make sure you've picked your microSD card and the disc image (the unzipped Raspbian file). Choose, double-check, and then hit the button to write.

Step 4: Put the microSD card in your Pi and boot up

Once the disc image has been written to the microSD card, you're ready to go! Put that sucker into your Rasberry Pi, plug in the peripherals and power source, and enjoy. The current edition to Raspbian will boot directly to the desktop.

5.2 Description of application program interface

ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to execute MATLAB code in ThingSpeak you can perform online analysis and processing of the data as it comes in. ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics.

There are sensors all around in our homes, smart phones, automobiles, city infrastructure, and industrial equipment. Sensors detect and measure information on all sorts of things like temperature, humidity, and pressure. And they communicate that data in some form, such as a numerical value or electrical signal.

Sensors, or things, sense data and typically act locally. ThingSpeak enables sensors, instruments, and websites to send data to the cloud where it is stored in either a private or a public channel. ThingSpeak stores data in private channels by default, but public channels can be used to share data with others. Once data is in a ThingSpeakchannel, you, you can analyze and visualize it, calculate new data, or interact with social media, web services, and other devices.

Figure 5.2: G-MAIL NOTIFICATION INDICATING WEATHER REPORT.

5.3 Python code

Python is an interpreted, high, general-purpose programming language. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales. Van Rossum led the language community until July 2018.

Python is dynamically typed and garbage-collected. It supports multiple programming paradigms, including procedural, object-oriented, and functional programming. Python features a comprehensive standard library, and is referred to as "batteries included".

Python interpreters are available for many operating systems. CPython, the reference implementation of Python, is open-source software and has a community-based development model. Python and CPython are managed by the non-profit Python Software Foundation.

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.

VI. RESULTS

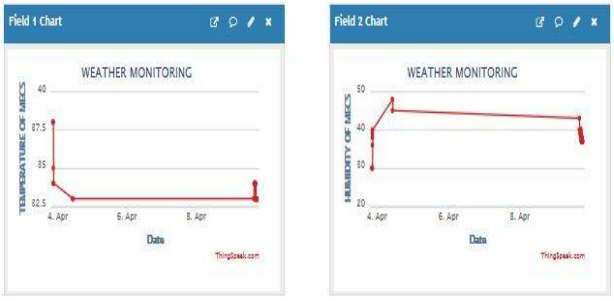

Figure 6.1: TEMPERATURE AND HUMIDITY MONITORING.

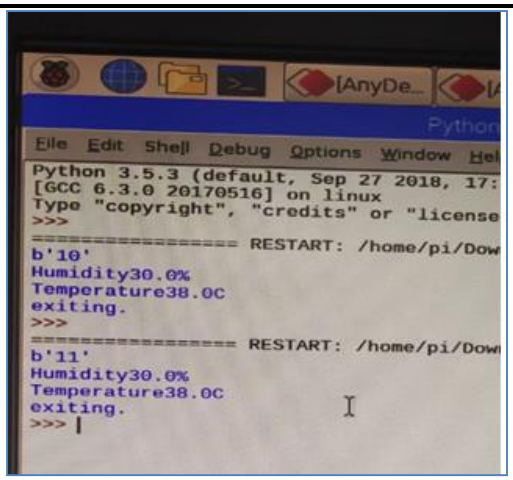

Figure 6.2: OUTPUT EXECUTED AFTER RUNNING THE CODE.

VII. CONCLUSIONS

This IoT based system gives real-time monitoring of environmental parameters. This system monitors temperature, humidity. Data can be seen from anywhere in the world. By using this system the client can continuously monitor different environmental parameters without any interaction with additional server. Raspberry Pi itself acts as a server. This is efficiently carried out by Raspbian operating system. This weather monitoring system is designed using Raspberry pi is having low cost, small size, low power consumption, fast data transfer, good performance and remote monitoring.

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