

Raspberry Pi Based System for Weather Monitoring System Using MQTT Protocol

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Abstract: *In this paper, we have presented the weather condition based on raspberry pi using MQTT protocol. Weather condition is a fundamental of our daily life. We have to keep knowledge about weather in daily basis. collecting of data of the weather condition is now possible because of internet of things .the aim of this paper is a create a online weather station which enables a user for check real time weather condition anytime and anywhere in a few seconds. Collected data will stored in a cloud server and provide it to raspberry pi .then raspberry pi transmit the data using internet and data will display on the mail server*

Keywords: IOT, Raspberry Pi model, sensors, python programming, MQTT Protocol

1. Introduction

weather monitoring are not only important in human life but they have also a vital role in agriculture, cattle farming , forestry, hydro electric dam, wild fire monitoring ,disaster management and many other sections .in this project we monitor a weather parameter using sensors. Sensors are connected to the raspberry pi which is the base of this project .SPI communication is using to communicate between the sensors and modules in microcontrollers. different sensors like DHT11,soil moisture sensors is give a data to raspberry pi and in a cloud server will connect the data and sent it to a users using MQTT protocol

IOT is a platform of this project .IOT means of a internet of tings by the name we can understand that the things which we connect through the internet .IOT is widely used in a agriculture to detect a weather condition .IOT enables our device to connect authenticate and exchange message with IOT core using MQTT, HTTP, WEBSOCKETS protocols.IOT give with unique identifiers and ability to move data above a network without requiring human to human or human to computer.

SPI is a synchronous serial bus commonly used to send data between microcontrollers and a small peripheral such as shift register, sensors and SD cards. Electronics devices talk to each other by sending a bit through wires which physically connected between devices. the transmission of data in a bit form and bit of data can send by serial and parallel form in the parallel data send bit at a time in a separate wire and in serial data send one by one in a single wire. the data is transferred in each clock cycle to communicate between the devices .we have to do software setup with raspberry pi to enables the raspberry pi .we have to login to the console of the raspberry pi .when we open this page they gives us to a link. by the help of that they steer us to a SPI communication .open SPI commutation folder using instruction which is scripted in a python language then the raspberry pi is owed as a master SPI.

2. Problem Statement

In the age of technology we going through the problems of control of various agriculture parameter made it possible to increase the final yield but due to some external factors like uneven natural distribution of water, farmer needs to monitor and control equal distribution of water to all crops as per requirement .so green house technology maybe the best solution for this problem the irrigation of WSN in green house create to precision agriculture .AS we know that microprocessor is not good as microcontroller, but raspberry pi based processor took place of microcontroller based arduino board. raspberry pi is fully like computer with CPU, included GPU,RAM, network interface card, USB,GPIO controller for interfacing with electronics .raspberry pi is more faster than arduino ,with raspberry pi we can send mail ,listen music ,run internet etc .raspberry pi can be said as a mini computer which works with LINUX operating system and can deal with multiple programs running concurrently .pi is capable of doing at a time similar to computer .we can work with many language like c ,c++, java ,python etc. in the previous model of raspberry pi is that they not have a WI-FI in board but the revolution of raspberry pi they come with the 802.11 b/g WI-FI in board. We also overcome with the memory issue so we use a 1 GB memory in raspberry pi 3 model B. and today we dealing with the online work with that many consequences will come along with that so now we have to keep secure the data which we are dealing in the online work so we can secure data with the MQTT protocol in this project. if the system going to deals with a many of hardware then we can go with arduino board and when it will deal with software and protocol then can go with raspberry pi .

3. Methodology

This weather monitoring system represents the data of the environmental parameter. From the sensors which we take as per our requirement .so in this system raspberry pi, sensors and for interacting with internet to things IOT will take part.SPI is responsible for the communication between sensor to devices in ,microprocessor ,serial peripheral

interface is used to communicate for two-way communication. A SPI consists of four signals: master out slave in, master in slave out, clock signal, slave select. The working depends on master/slave architecture. In the single slave condition, there is no need of SS (select slave); in the multiple slave, we need to take the SS line to choose slave by master. In the SPI communication, master and slave are connected through a shift register; the output of a register is connected to the input of another register and vice versa. The master generates a clock signal. The buffer register is connected through the shift register. Most of the time, the shift register is not able to handle directly as we know that master can only generate the clock pulse when we need to write data from a slave device; then master generates a clock pulse. For reading data from a slave device, we need to send dummy data to slave device.

IOT is a concept of connectivity between device and internet. IOT has a giant network of connected things and people. IOT is not just a interconnected consumer devices, but it is technology which builds systems capable of autonomously sensing and responding to stimulus from the real world with human interference. IOT architecture includes four stages. IOT should be equipped with sensors and actuators which give the ability to release, accept, process. The data which we get from the actuators and sensors is in the form of analog form. So we need to convert data from analog to digital. In this, we can take help with data acquisition system. Then it becomes digitized. Before entering in a data center, we need to take this in edge systematic; data which needs more in-depth processing will send it to the physical data center and cloud-based system where data is stored for any further process.

For software setup, we need to go with the language. So here we use python language. We use python on a server to create web application; we can use python to handle big data and perform complex mathematics. Python works on a different operating system like windows, MAC, LINUX, Raspberry pi etc. Python has a simple format similar to English language. Python can be worked in technical way, and object-oriented way or functional way.

MQTT is a machine-to-machine and internet of things connectivity protocol. It is designed as an extremely lightweight, publish/subscribe message transport. MQTT enables resource-constrained IOT devices to send or publish information about a given topic to a server that functions as an MQTT broker. The MQTT protocol is a good choice for wireless network that experiences unstable level of latency due to occasional bandwidth controlled or unreliable connections. Mosquitto is an open-source message broker that executes MQTT, provides a telemetry transport protocol. MQTT provides a lightweight way of carrying out messaging using a publish or subscribe model. Other transfer protocols under contemplation for IOT devices with constrained resources include the guarded application which uses a request/response communication pattern and the advanced message queuing protocol which like MQTT uses a publish/subscribe communication pattern.

As per the above, now we know that the main elements of this project is Raspberry pi board in which we are going to connect devices and IOT platform which is going through to

help us to create a connectivity between things to internet. Sensors and python language MQTT protocol from the very first we need to install a Raspbian software in a SD card then put it into a Raspberry pi board and give a connection from laptop or any other resources of current. Then after installing Raspbian in Raspberry pi board, internet will provide an IP address of that and by putting an IP address in Raspberry pi, it will allow to connect the laptop and internet in the Raspberry pi. There are 40 GPIO pins which we are going to use in the connection of sensors to device. In python commands shell, we write our coding to connect things to internet and device. We are using a MQTT protocol for communication between things to internet. In MQTT protocol, Mosquitto is a broker which can send or receive a request between publisher and subscribers. Topic is our main content for which we are trying on this. Brokers of all the information IP address, User Name, Password, Port No. so that is able to send and receive from publisher and subscriber. After establishing a connection between device to internet, the receiver can receive the data in the mail dashboard.

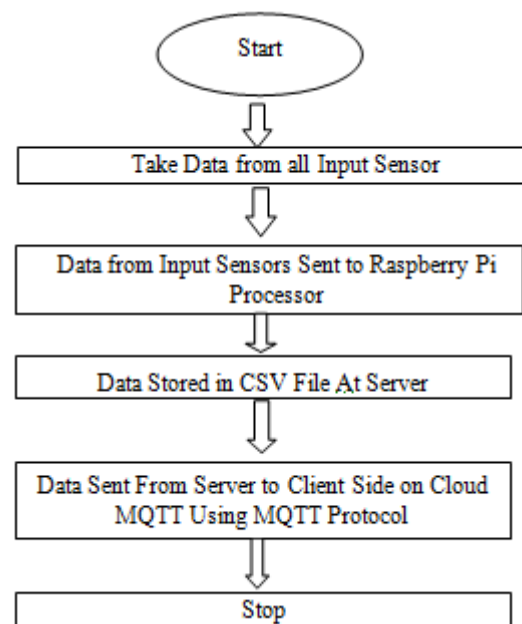


Figure: Flowchart of Weather Monitoring System

4. Literature Survey

Mrs.T.Vineela, J.NagaHarini, Ch.Kiranmai, G.Harshita, B.Adilakshmi, et.al titled [2] "IoT Based Agriculture Monitoring and Smart Irrigation System Using Raspberry Pi" International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 01 JAN-2018, this project works for the Irrigation system to get a data from sensors using HTTP protocol.

Prachi H.Kulkarni, Pratik D.Kute, et.al titled [3] "Internet of Things Based System for Remote Monitoring of Weather Parameter and Application" International journal of advances in Electronics and Computer science, ISSN- 2393-2835 VOL 3, Issue-2, Feb-2016. Describe a method of only logging of data so that the Device will interact with server. It is work on a Arduino Board.

Bulipe Srinivas Rao, Prof. Dr. K. Srinivas Rao, Mr. N. Ome, Et.al titled [4] "Internet of Thing (IOT) Based Weather

Monitoring System”, International Journal of Advanced Research in Computer Engineering (IJARCCE) 10.17148/IJARCCE.2016.5966. This project works on a arduino Board to get data, can be used in cities and industry pollution.

Alpana Kushwaha, Dr. Bharthi MalakReddy, et.al titled [5] “IOT Based Low-Cost Weather Monitoring System” International Journal of Science Research and Engineering Trends VOL 4, Issue 2, Mar-Apr-2018.this system is for weather monitoring in Arduino board using HTTP protocol in c language and the output Will b e show in E-Bulletin Board.

Ravi kiran verma, P I N Raju, M Priyanka, et.al titled [1] “An IOT Application for Environmental Monitoring and Control Using Raspberry- Pi”, International Journal of Engineering and Technology (IJET), Vol 9 No 3S July 2017 Provide method of weather parameter for farming using MQTT Protocol.

5. Conclusion

COMPARISON DATA TABLE OF UNIVERSITY DATA & EXPERIMENT DATA												
Properties	Temperature T (°C)				Humidity (%)			Moisture (0 - Not Detected, 1 - Detected)				
	University Data			Experiment Data	Error (%)	University Data	Experiment Data	Error (%)	University Data	Experiment Data	Error (Y/N)	
DATE	Max.	Min.	Avg.									
10-Jul	31.5	25.4	28.45	30	5%	84	82	2%	1	1	N	
11-Jul	33	26.6	29.8	31.5	5%	80	78	3%	0	0	N	
12-Jul	32	26	29	31	3%	84	83	1%	0	1	Y	
13-Jul	34.8	26.5	30.65	32	8%	82	80	2%	1	1	N	
14-Jul	35.5	27.5	31.5	34	4%	77	75	3%	0	0	N	
15-Jul	36	26.5	31.25	32	11%	77	76	1%	1	1	N	
16-Jul	36	26.5	31.25	34	6%	78	75	4%	1	0	Y	
17-Jul	37.4	27	32.2	33	12%	78	76	3%	0	0	N	
18-Jul	37.6	26.4	32	34	10%	81	78	4%	0	1	Y	
19-Jul	36.5	25	30.75	33	10%	90	87	3%	1	1	N	
20-Jul	34.2	25.2	29.7	32	6%	90	88	2%	1	1	N	
21-Jul	32	27	29.5	30	6%	85	82	4%	1	1	N	
22-Jul	35	28	31.5	33	6%	83	80	4%	0	0	N	
23-Jul	36	26.6	31.3	34	6%	83	82	1%	1	0	Y	
24-Jul	35	26.4	30.7	33	6%	86	84	2%	0	1	N	
25-Jul	33	26.6	29.8	30	9%	83	82	1%	0	1	N	
26-Jul	32	24	28	32	0%	90	85	6%	1	1	N	
27-Jul	31	25	28	30	3%	92	89	3%	1	1	N	
28-Jul	27.8	24.8	26.3	26	6%	87	85	2%	1	1	N	
29-Jul	31	25.2	28.1	30	3%	92	87	5%	0	0	N	
30-Jul	27.6	23.5	25.55	27	2%	86	85	1%	0	0	N	
31-Jul	26.2	23.4	24.8	26	1%	91	88	3%	1	0	Y	

Figure: Comparison data sheet of university and experiment

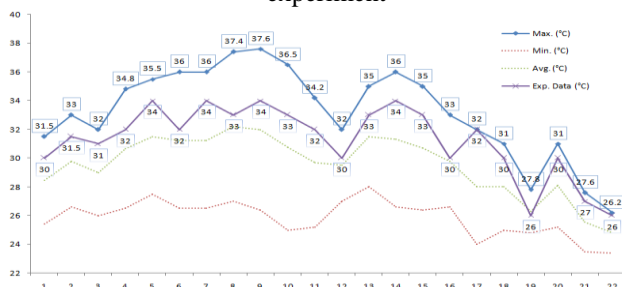


Figure: Comparison chart of Temperature humidity

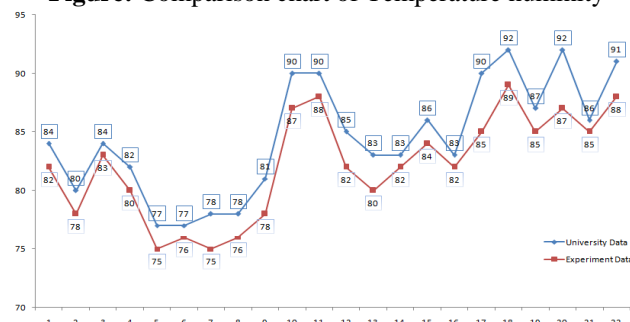


Figure: Comparison chart of Humanity

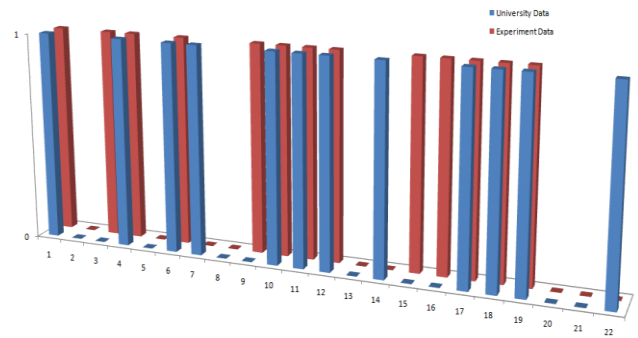


Figure: Comparison chart of Moisture

6. Applications

This work has the following applications:

- The use of this kit is in green house farming
- This can be use in vertical farming.

7. Future Scope

- This kit extent by adding an irrigation system.
- This model can be modifying with the auto refresh system.

8. Acknowledgement

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