Air Pollution Detector

By

MANTHAN PATEL (12BCE066)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Ahmedabad-382481

Air Pollution Detector

Major Project

Submitted in fulfillment of the requirements

For the degree of

Bachelor of Technology in Computer Engineering

By

MANTHAN PATEL(12BCE066)

Guided By

Prof. Darshana Upadhyay
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Ahmedabad-382481

CERTIFICATE

This is to certify that the Seminar entitled "AIR POLLUTION DETECTOR" submitted by MANTHAN PATEL (12BCE066), towards the partial fulfillment of the requirements for the degree of Bachelor of Technology in Computer Engineering of Nirma University is the record of work carried out by him under my supervision and guidance. In my opinion, the submitted work has reached a level required for being accepted for examination.

Prof. Darshana Upadhyay
Assistant Professor,
Department of CSE,
Institute of Technology,
Nirma University,
Ahmedabad
Gujarat, India.

Dr. Sanjay Garg
Head of Department,
Department of CSE,
Institute of Technology,
Nirma University,
Ahmedabad
Gujarat, India.

ACKNOWLEDGEMENT

We would like to express my deepest appreciation to all those who provided me the possibility to complete this project. A special gratitude we give to my project guide Prof. Darshana Upadhyay whose contribution in stimulating suggestions and encouragement helped us to coordinate our project especially in designing. Her ideas, experience and advice led us to extract the optimal results of the project.

Furthermore, we would like to acknowledge with much appreciation the crucial role of Nirma University staff who gave us the permission to use the required equipment and materials to complete our tasks.

We would also like to appreciate the help of Prof Sharada Valiveti who provided us help during our review sessions and brought out the best in our Major Project**.**

ABSTRACT

Machines have become necessary part of every human life. Needs and habits demand the usage of different machines in direct or indirect manners. But as every coin has two sides, similarly usage of machines leads to different side effects the major of them being air pollution. Various machines emit different gasses in the process of production, running and even after disposal. But they are not harmful till the emission of gasses is kept below a standardized level.

One of the best methods is achieving awareness about pollution level by installing different sensors that will gives the amount of pollutants in a specific region or a region as whole, and provide necessary alerts if threshold levels are overpowered. This whole process of collecting readings to the mechanism for alerting can be done by using sensors along with a small module of raspberry pi.

This report is aimed at providing an insight of the design and implementation details of the module designed to provide an accurate detail of various pollutants present in the surrounding environment. The aspects regarding the hardware technicalities are also included to give a complete view of the module.

CONTENTS

Chapter 1

Introduction

1.1 The System

1.1.1 Definition of system

Pollution has always been an issue since the discovery of fire when the mankind started discovering and inventing through the power of his brain. But recently, the pollution levels have risen to harmful levels and the most widespread and fastest medium of pollution. This requires for a means to control its effects by effectively monitoring the pollutants produced by various industries and production units.

1.1.2 Purpose and Objective

Through the design and implementation of air pollution detection module, we are provided with a phenomenal way through which government as well as individual institutions can keep a tight check on the air pollution contents in the given region and take necessary steps to reduce and control the effects to a minimum.

1.1.3 Present systems

From the past few year, it has been noticed that the quality of air in world is consistently decreases and that harms to human health. Hence, having particular, constant data cannot just tell somebody with asthma ranges to maintain a strategic distance from on any given day, yet gives researchers a superior picture of where, when and why contamination is occurring, which is important to find a way to improve it. Some of the available systems are AirBot, WaterBot, Sensordrone, Lapka Environmental Monitor, Sensaris, Air Quality Egg, Electronic Nose Sensor. These devices are used for overall gases or water pollutants, and also gives only the live data. It did not save the data to database or did not show graphical representation.

1.1.4 Proposed system

The system will take readings from sensors and then it stores in file with date and time, which will be uploaded to the server and end user will able to see the data as well as the graphical representation. And also the device is small in size and portable. Hence it can be placed anywhere near to wifi connection so that it will take the data and send it to the server where the data will be processed and convert into required output.

1.2 Project Profile

1.2.1 Project title

The project is titled “Air Pollution Detector”.

1.2.2 Scope of project

The scope of the project is not so wide as of now because it has required some of the minor changes. But it can be used by any user to check the pollution in a place where the sensors are fixed. The user can get:

- Live pollution of that place.
- Previously saved data in the form of table with date-time and the values of sensors.
- The threshold value to a particular sensor and get the highlighted list of rows having values above threshold.
- Image or pdf of graph.

The dataset used is taken at given time.

1.2.3 Project team

The project has been performed by Manthan Patel under the supervision of Prof. Darshana Upadhyay.

1.2.4 Hardware-Software requirement

Hardware:

- Raspberry Pi
- CO Sensor
- Dust Sensor
- WiFi Adapter

Software:

- Python
- Putty
- Filezilla
- Vnc
- Wamp

Platform Required:

- Raspbian
- windows

Chapter 2

SYSTEM ANALYSIS

2.1 FEASIBILITY STUDY

A feasibility study is an evaluation and analysis of the potential of the proposed project which is based on extensive investigation and research to give full comfort to the decisions makers. It helps in deciding whether it is viable to go through the project or not. Feasibility study studies the system and tells the system whether to develop the system or not.

2.1.1 Operational feasibility

Operational Feasibility is a measure of how well a proposed system solves the problems, and how it satisfies the requirements of users. The operational feasibility assessment focuses on the degree to which the proposed development projects fits in with the existing business environment and objectives with regard to development schedule, delivery date, corporate culture, and existing business processes

The existing systems are able show the live data and alert according to that data. But this system is made by using raspberry pi which will take data from sensor, transfer it wirelessly to nearest wifi connection and that data will be store to server which helps for analysis of pollution for the particular area.

2.1.2 Technical feasibility

The Technical feasibility evaluation is centered around picking up a comprehension of the present technical assets of the association and their appropriateness to the normal needs of the proposed system. It is an assessment of the equipment and programming and how it addresses the issue of the proposed system.

The air pollution detector senses the pollution at raspberry pi and it transfer to the server and user is able to see only through website and it has been developed using HTML, PHP, JavaScript and CSS. Hence the system is technically feasible.

2.1.3 Financial and Economic Feasibility

The motivation behind the Financial and Economic achievability evaluation is to decide the positive financial advantages to the association that the proposed system will give. It incorporates measurement and recognizable proof of all the advantages anticipated. This appraisal commonly includes a cost/advantages examination. The expenses of various equipment/programming setup should be inspected. Shrouded costs, for example, client time for prerequisites procurement, testing and preparing ought not be discarded; the most as often as possible missed expense is the expense of keeping up the system once it is introduced. Set against the expenses ought to be a quantifiable appraisal of the normal advantages, for instance diminished work costs, and enhanced client administration for anticipated increment in requests. The advantages include how this anticipate will be gainful in fund to the association.

The estimated cost for purchasing the hardware is approximately 4500 Rupees. for the installer person and for end user the cost is a good internet connection only. Hence this project satisfies the above mentioned criteria for being feasible in the financial aspect.

2.2 REQUIRMENT ANALYSIS

2.2.1 Functional Requirements

- Starting client-server program: transfer reading from raspberry pi to server.

- Checking status: connection creating status as well as connecting to server status for data transfer.
- Getting reading from sensors: after successful connection, server receives data from raspberry pi.
- Sending - Receiving data to server and from Raspberry pi:
- Saving data to files:
- Converting data in appropriate form:
- Displaying in graph or table form:
- Taking image or pdf of graph:

2.2.2 Non-Functional Requirements

- **Accessibility**- Good internet connection is required for getting graph of live data and recorded data.
- **Capacity**- No need of permanent memory as the data is saved at server and every time the data will be transferred to the pc.
- **Efficiency**-The better the connection to the internet the better effiiency.
- **Effectiveness**-it has support for different network channel like 2g, 3g or Wi-Fi for end user that can access only website and only Wi-Fi for raspberry pi for sending data to server.
- **Extensibility**- Website can be accessed by any OS, while raspberry pi uses raspbian OS with python for sending data.
- **Response time**- it relies upon the type of web associativity for both end user and raspberry pi. It works smooth on good internet connection and bit slow in 2g network. Sometime it may possible of data loss from raspberry pi to server in bad internet connection.

Chapter 3

SYSTEM DESIGN

3.1 System flow

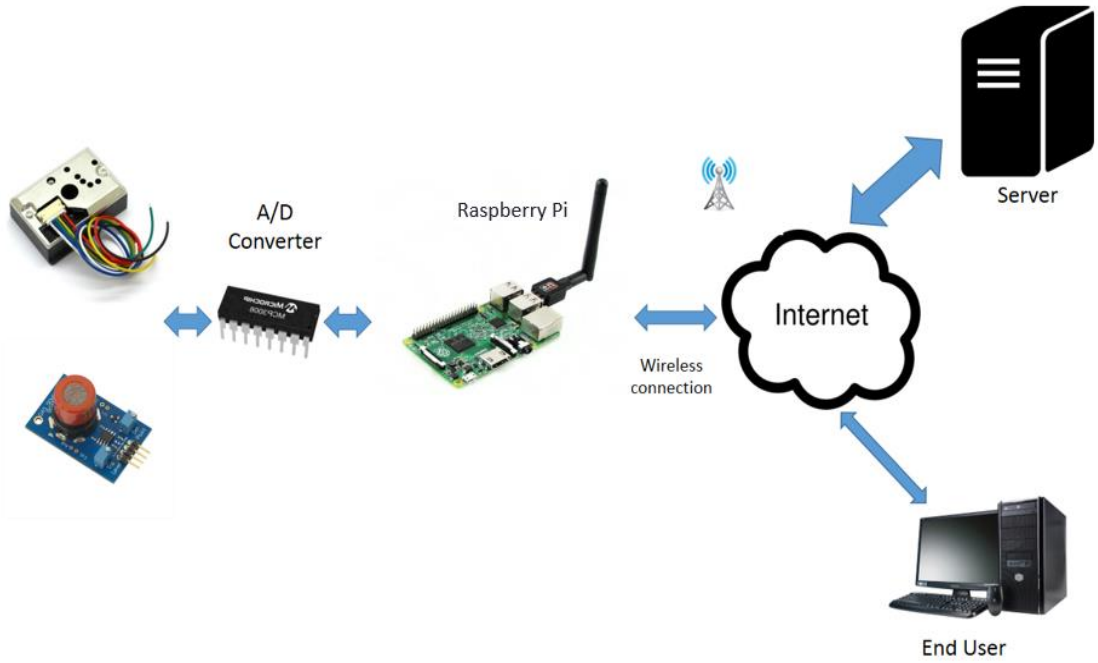

Figure 1

Figure 1 shows the flow of the system where the air pollution detector device will sense the particulate matters and density of carbon monoxide using dust and CO sensor. The sensors will give the analog values between 0 to 1023. But raspberry pi only takes digital values. Hence for the conversion of analog to digital values here MCP-3008 IC is used and it will provide digital values to raspberry pi. Using the python script pi will convert the values in appropriate form for representation and then via Wi-Fi connection to the modem, it will send data to server where the data will have saved in different .csv files where each file contains a fixed number of data with time and date. The name to file

will be given as the date so that end user can check the reading of sensors for the given named date. And also it is possible to assign the threshold value to a particular sensor so that system will highlight the row having the sensor value above the threshold value.
End user can also check the graph for live data. The graph provides graphical visualization which reduces the time by not seeing all the rows of particular time and also easy to find peak values by passing over the peak point from the graph. The page also provides some options like take an image or save as pdf or print the graph for displaying record.

Chapter 4

USER MANUALS

4.1 SNAPSHOTS ALONG WITH DESCRIPTION

4.1.1 Website

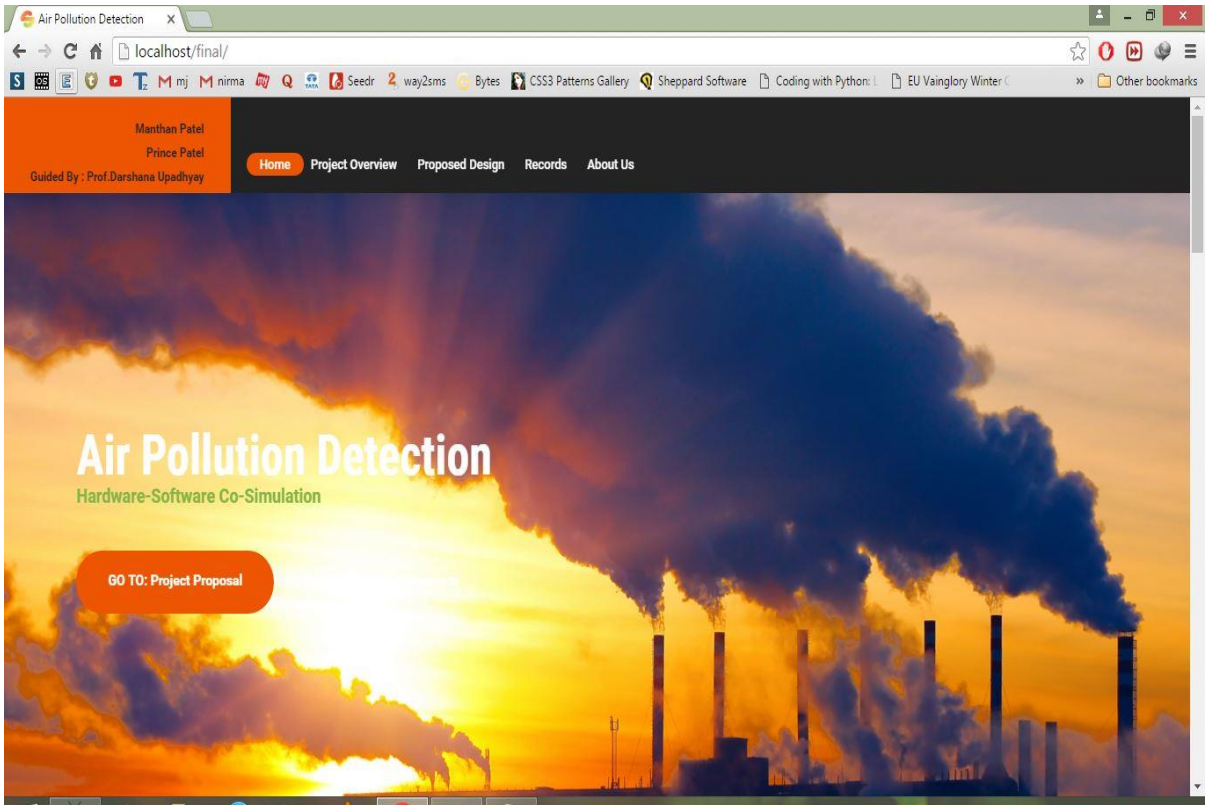

Figure 2

From Figure 2 to 8 shows the screen shots of the website which has different sections for project overview, proposed design, gallery, live as well as previously saved records' representation and about us. It redirects to the records page where different data sets of previously stored data have been uploaded and also displays the live data set's graph on another page.

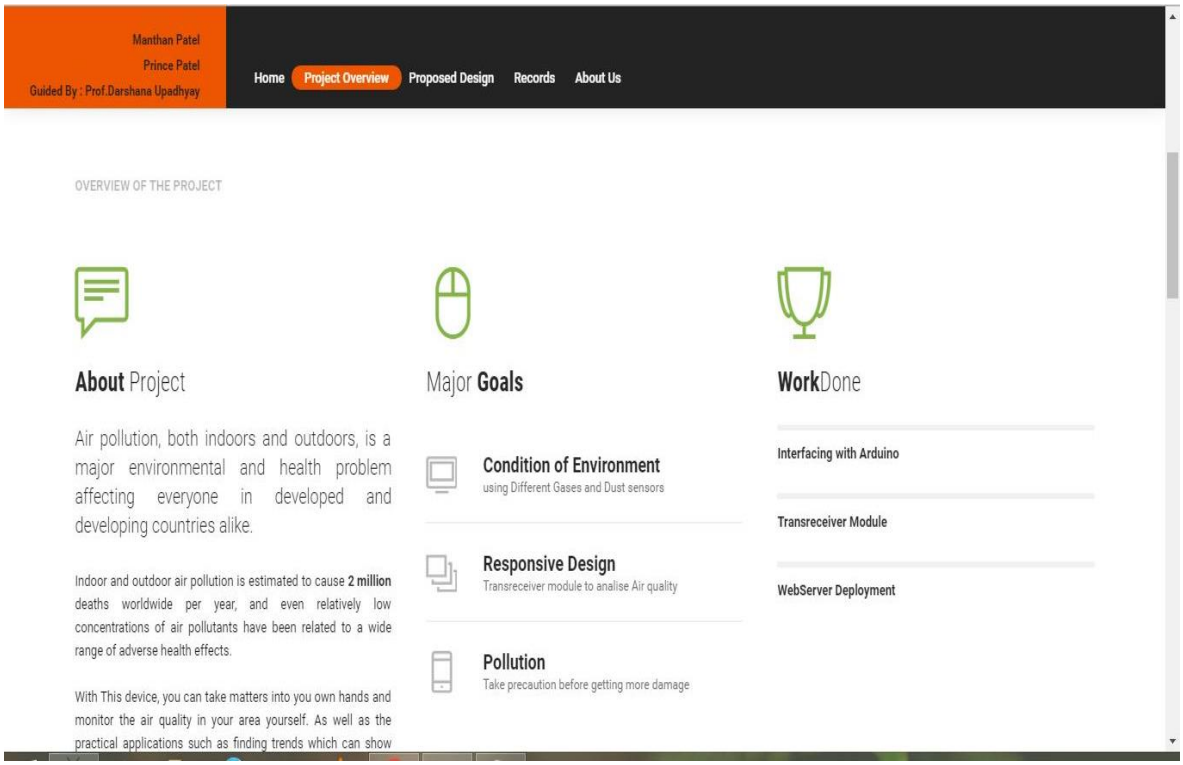

Figure 3

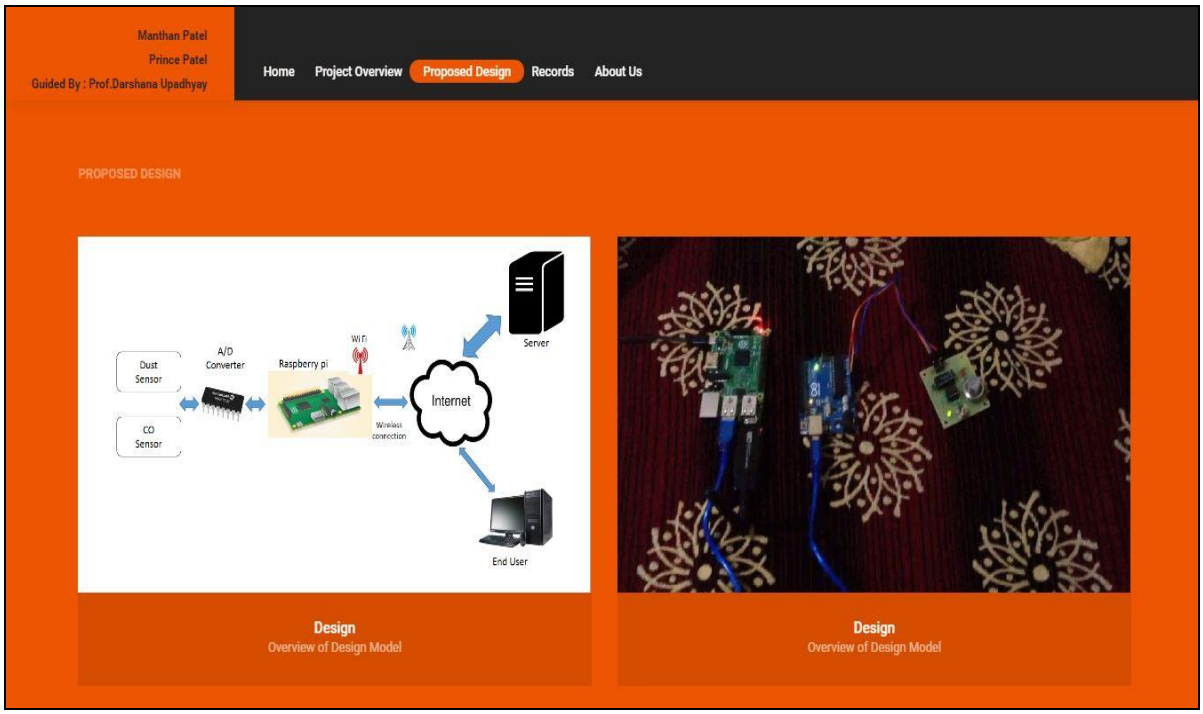

Figure 4

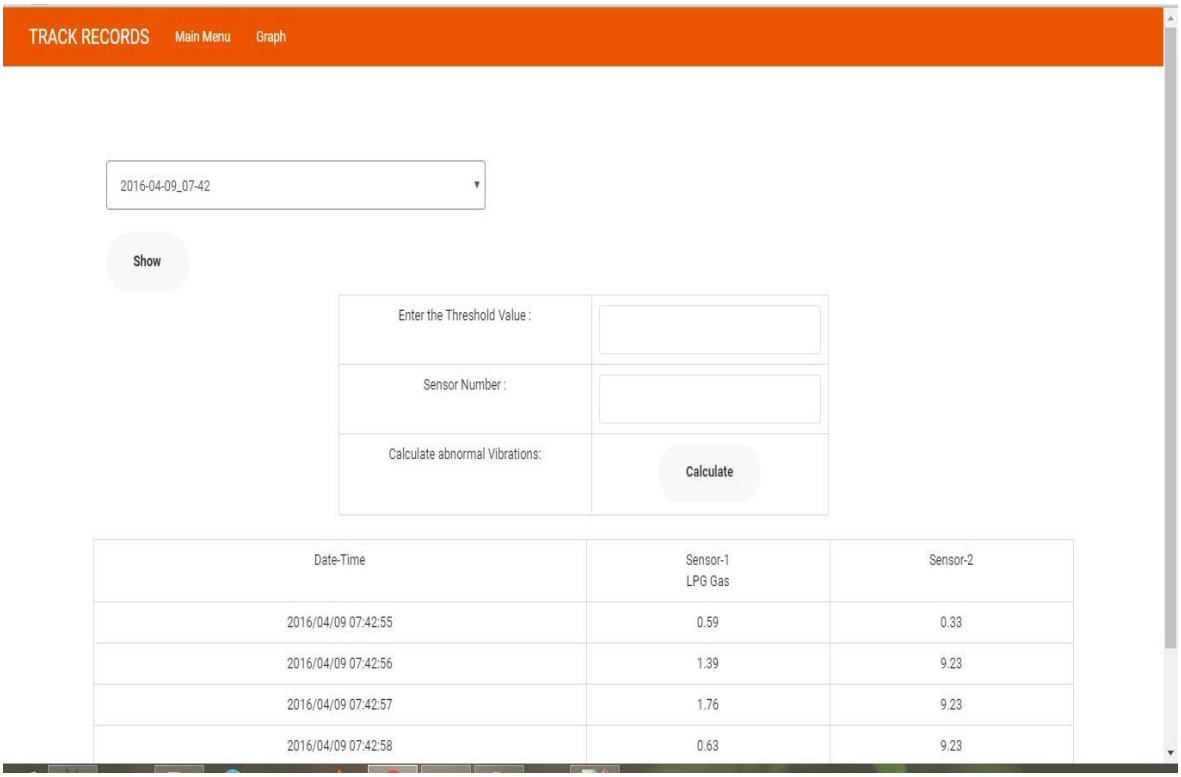

Figure 5

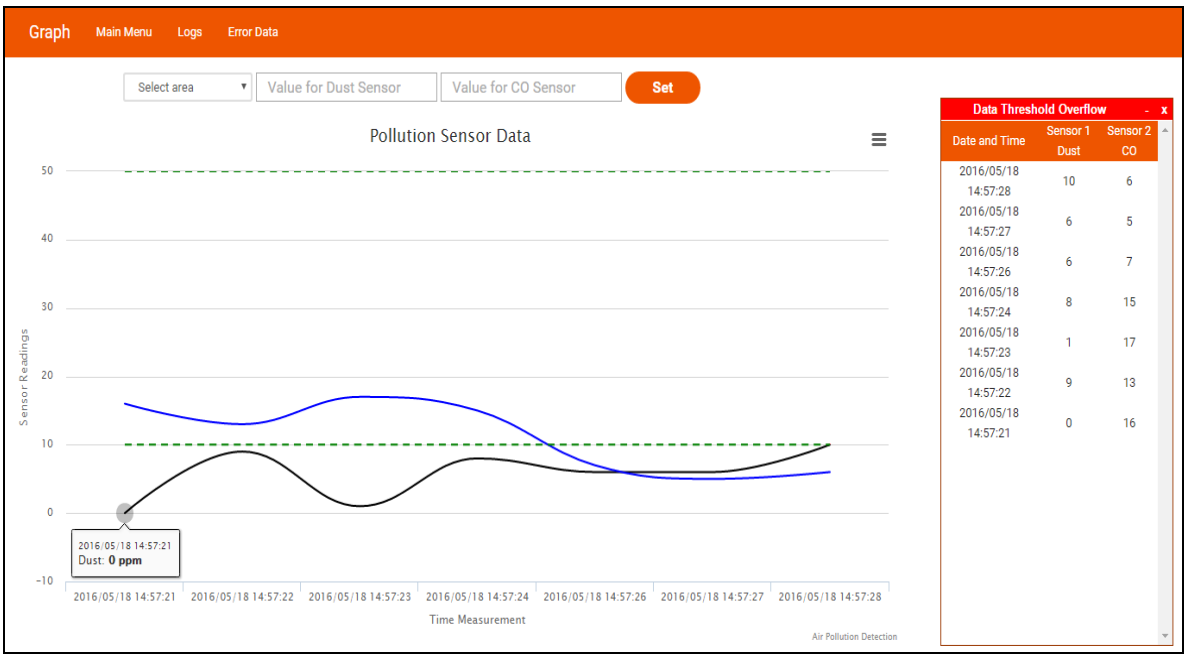

Figure 6

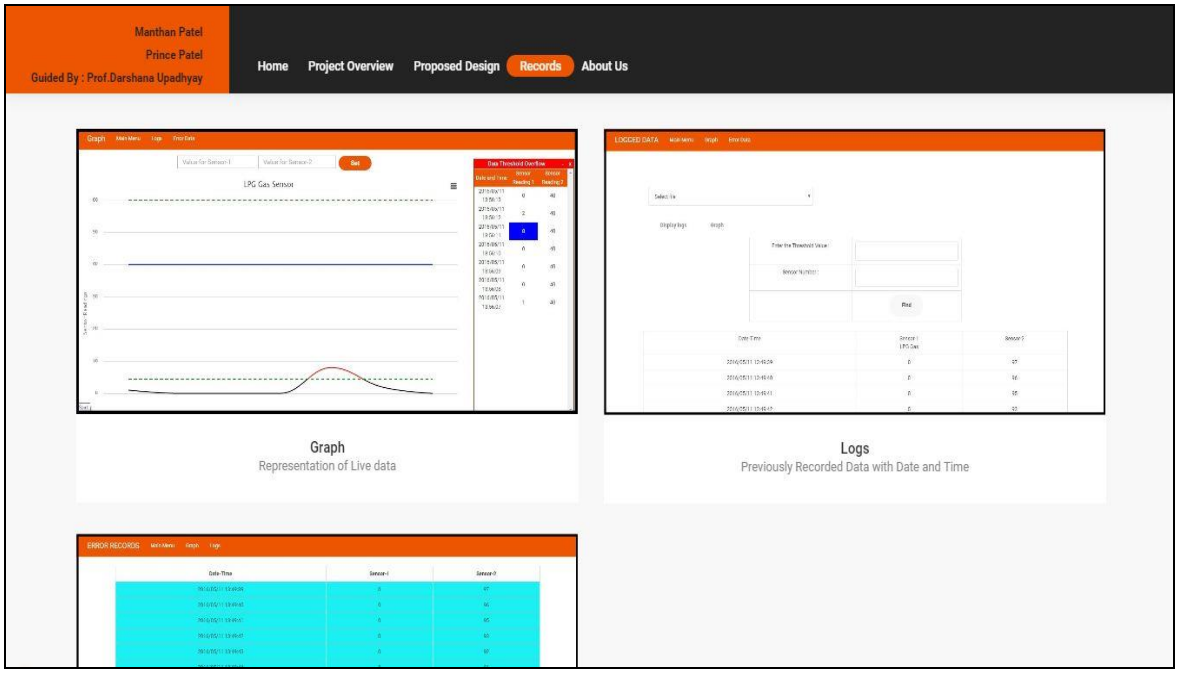

Figure 7

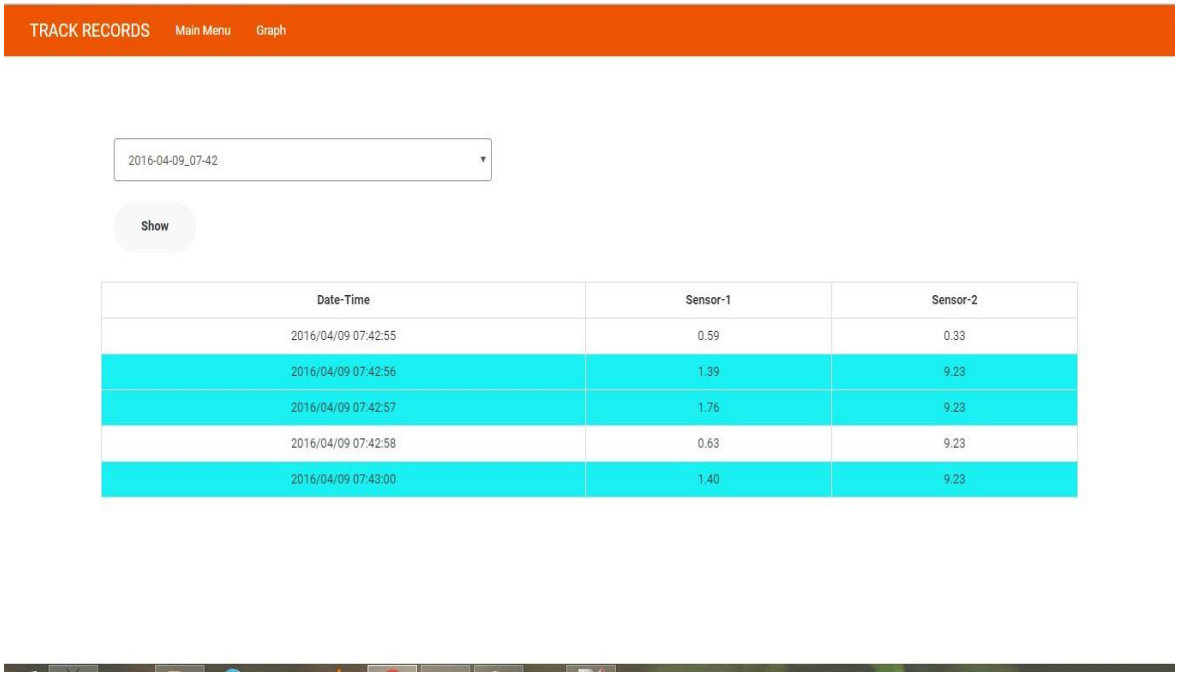

Figure 8

4.1.2 Python Script at Server

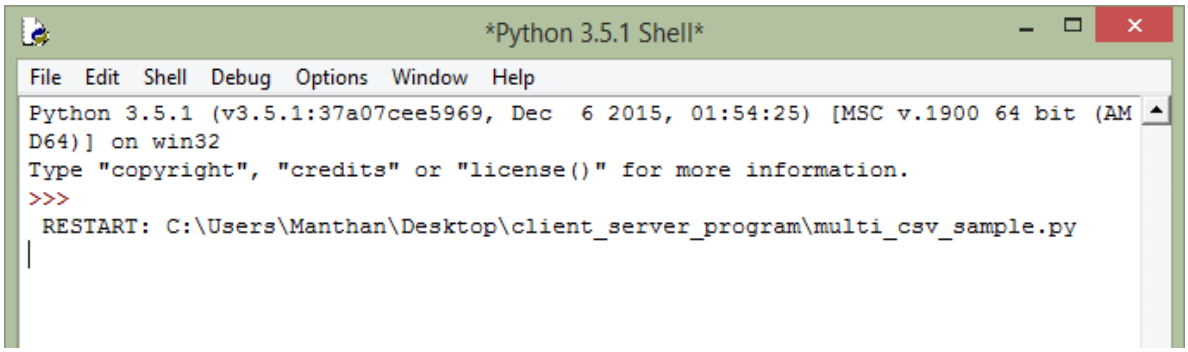

Figure 9

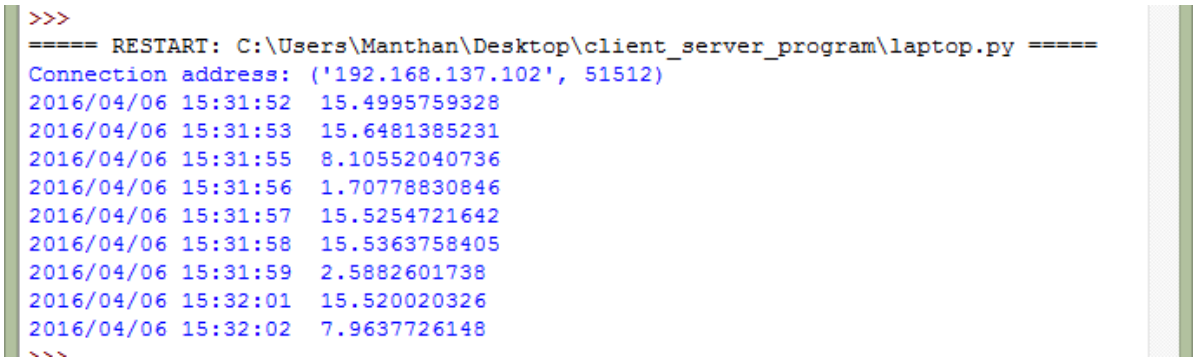

Figure 10

Figure 9 and 10 shows the output of client server program. The code for the same is given in figure 11. When the code run, it will create a TCP connection and waits for the response from the client as shown in figure 9. After the successful connection between client and server, raspberry pi(client) will sends the data and server will receive it and note down the time of receiving the data to the file in the same format as shown in figure 10. The file will be periodically uploaded to host website where the data will be displayed in the form of graph or table. The python code at client side is given as below in figure 11.

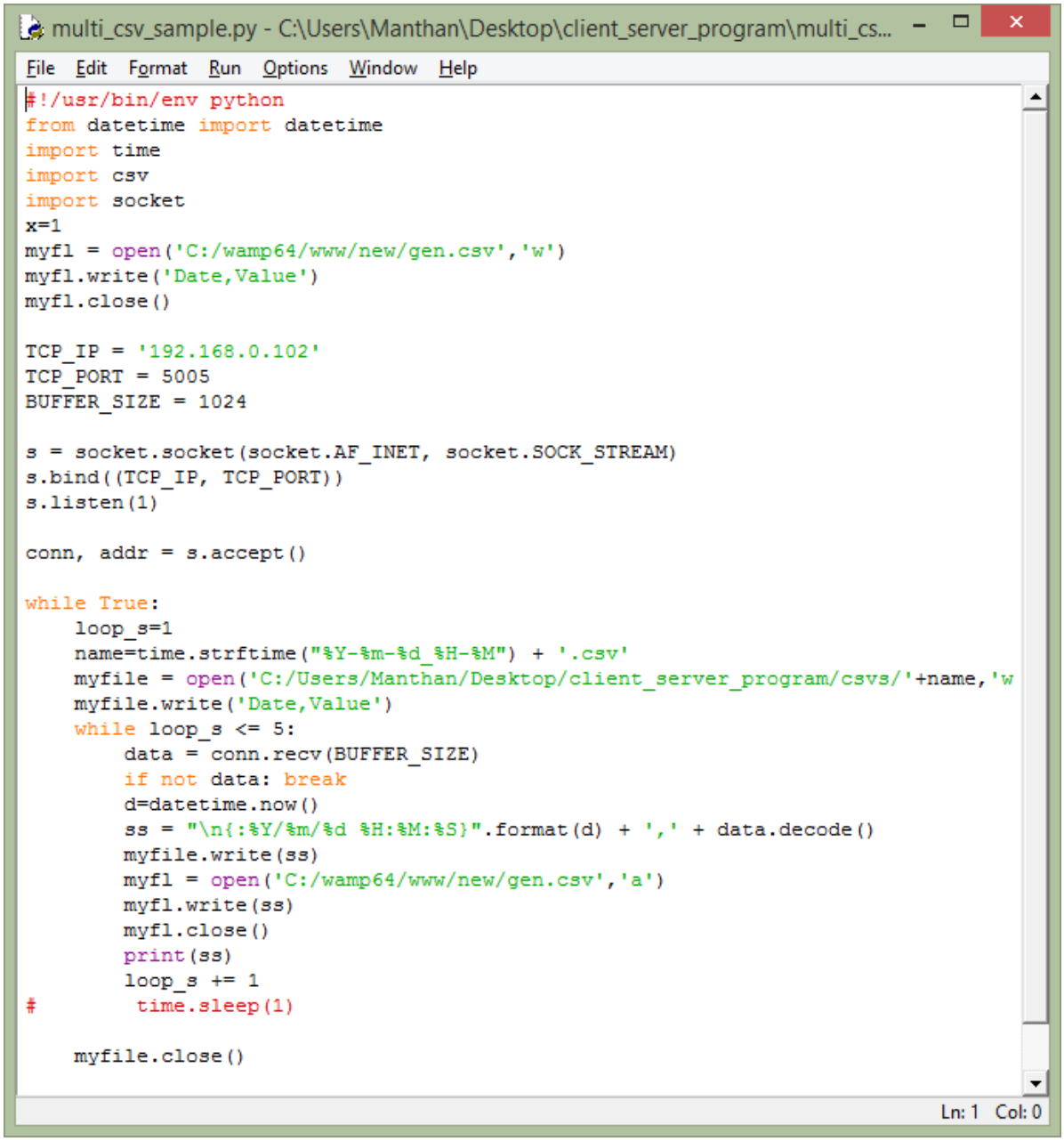
multi_csv_sample.py - C:\Users\Manthan\Desktop\client_server_program\multi_cs...
File Edit Format Run Options Window Help
#!/usr/bin/env python
from datetime import datetime
import time
import csv
import socket
x=1
myfl = open('C:/wamp64/www/new/gen.csv','w')
myfl.write('Date,Value')
myfl.close()
TCP_IP = '192.168.0.102'
TCP_PORT = 5005
BUFFER_SIZE = 1024
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.bind((TCP_IP, TCP_PORT))
s.listen(1)
conn, addr = s.accept()
while True:
loop_s=1
name=time.strftime("%Y-%m-%d_%H-%M") + '.csv'
myfile = open('C:/Users/Manthan/Desktop/client_server_program/csvs/'+name,'w
myfile.write('Date,Value')
while loop_s <= 5:
data = conn.recv(BUFFER_SIZE)
if not data: break
d=datetime.now()
ss = "\n{:%Y/%m/%d %H:%M:%S}".format(d) + ',' + data.decode()
myfile.write(ss)
myfl = open('C:/wamp64/www/new/gen.csv','a')
myfl.write(ss)
myfl.close()
print(ss)
loop_s += 1
# time.sleep(1)
myfile.close()
Ln: 1 Col: 0

Figure 11

4.1.3 Python Script at Raspberry pi

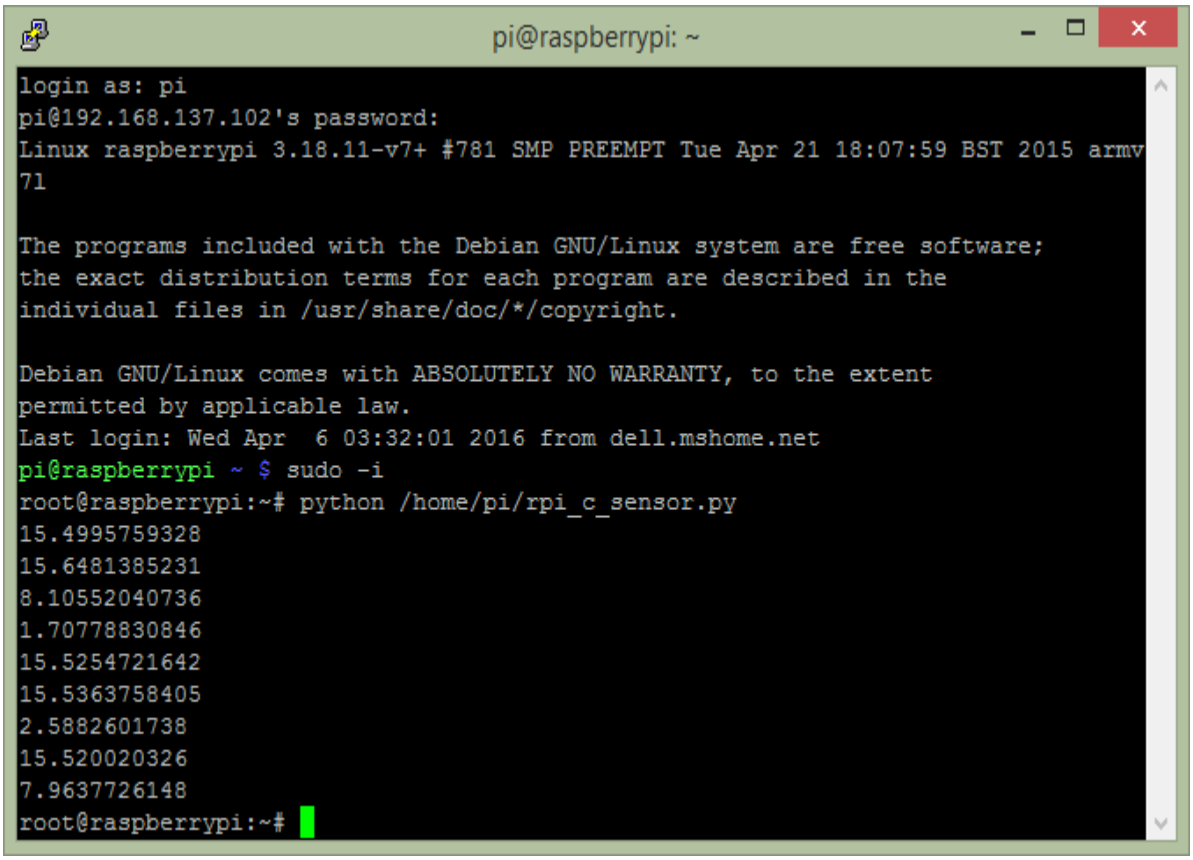

Figure 12

Figure 12 shows the screenshot taken from raspberry pi(client). As shown in figure 9, until the python code of raspberry pi will not run the server will wait. And after that the data as shown in figure 12 will sends to server in sequence. The whole process for the data transfer is done via wireless connection. Hence the hardware is small as well as mobile so that it can be placed anywhere nearer to Wi-Fi connection. And It just require one-time configuration for Wi-Fi setup.

Chapter 5

TESTING

Testing is critical for newly developed system as a prerequisite for it being put into an environment where the end user can use it. Exhaustive testing is conducted to ensure accuracy and reliability and to ensure that bugs are detected as early as possible. In the process of designing the system, three levels of testing will be conducted, namely, unit testing, user acceptance and system testing.

5.1 Unit Test

Unit test is the testing period where the system is tried somewhat and freely, segment by segment, to guarantee that specific segment or module is workable inside it. In Air pollution detection system, each module of website is tested independently and then they are integrated. And each module of data receiving and transferring via first wired connection to server also checked and integrated to the website. and after successful wired connection, we tested for wireless connection and integrated by replacing wired connection from website.

5.2 System Test

A system ordinarily comprises of all segments that add up as an aggregate system to provide desired work. It will be required to guarantee that the entire system is running smooth, and it ought to execute as desired and as required. Here the technical testing is performed. The technical testing includes the procedure of testing system capacity with the equipment, operating system, data integrity in the database and user authorization access right.

5.3 User Acceptance Test

Clients will be included to dissect worthiness and convenience and furthermore to distinguish modules that may require alteration before the system can completely be dispatched for use.

No.	Testing Case	Input	Expected Output	Output	Result
1	Sensor value case	None	Display values bases on the concentration of the gas	Display digital data based on changes of concentration of the gas	Correct
2	Connection establishment case	None	Display the IP address of client when connection is established and then data from client	Server waits till the connection accepted by client and then display the ip address and then the received data from client	Correct
3	Saving data case	None	Save the data in .csv files with fixed number of rows having date-time and sensors values	Saves data in given .csv files with date-time and readings of sensors.	Correct
4	Displaying data from files case	File name	Display the data in table form from the given file	Display the data in table form from the given file	Correct
5	Thresholding the sensor data for displayed data	Threshold value and sensor number	Highlight the rows having higher values then threshold values	Highlight the rows having higher values then threshold values	Correct

Chapter 6

FUTURE ENHANCEMENTS

This is the first version for our project. At present, this is a standalone application but it can be integrated with various features, websites and used. Some basic enhancements possible are adding alert system that pop up values greater than threshold value to the website or by sending SMS to a particular authority that will handle the situation of the pollution in the area. Also other features like raspberry pi power on-off via website. We can also try to reduce the size as well as price for the hardware so that number of users will increase and the area for getting the reading will increase and then we can integrate the map in website with tag which says that in that area the sensor is active or present. So there is a lot of enhancement and future scope for this project.

Chapter 7
Conclusion

This report provides with an insight to what can be considered a sub-part to a whole bigger air pollution measurement module. The efficiency and accuracy can be further improved using better sensing devices. With the given module we can only detect a few of the many pollutants and the scope to extend this module remains to the commercial designers.

In conclusion, this a small step to put a leash on the technologies and industrial units which are causing the degradation of natural environment, especially air and with more and more work in this direction we are guaranteed to get positive results.

Chapter 8
Appendix

8.1 TOOLS USED

- CoffeeCup
- Putty
- Python
- Microsoft word
- Microsoft Powerpoint

8.2 TECHNOLOGY USED

- Python
  It is used for two main purposes. First is for connection between server and raspberry pi using client-server program. And second is for getting analog data converted from the mcp-3008 IC into digital data of the connected sensors to the raspberry pi.
- HighCharts
  HighCharts is used for displaying the data stored in .csv files to graph having date and time on horizontal axis and values of sensor on vertical axis. It is also used for taking snap shot or pdf for the particular time.
- HTML/CSS/JavaScript/PHP
  It is used for creating webpage as well as visualizing data into table form and also for highlighting the rows for the values above thresholding value.

CHAPTER 9

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