"IOT BASED AIR & SOUND POLLUTION MONITORING SYSTEM USING RASPBERRY PI."

A PROJECT REPORT

Submitted in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

Submitted to

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

Submitted By

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Under the Guidance of

Prof. A. A. Trikolikar

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

JSPM's IMPERIAL COLLEGE OF ENGINEERING & RESEARCH

WAGHOLI, PUNE- 412207

A.Y.2021-22

JSPM's Imperial College of Engineering & Research,

Wagholi Pune – 412207

CERTIFICATE

This is to certify that the Project entitled **"IOT Based Air & Sound Pollution Monitoring System Using Raspberry Pi"** submitted by **Abhishek Ghongade, Tukaram Barure and Chandrashekhar Ambure** is a record of the bonafide work carried out by him / her, under my guidance, and it is approved for the partial fulfillment of requirement of Savitribai Phule Pune University for the award of the degree **Bachelor of Engineering (E&TC Engineering).**

Prof. A. A. Trikolikar	**Dr. S. K. Bhatia**	**Dr. R.S. Deshpande**
Guide	**Head of Department**	**Principal**
Department of E&TC	**Department of E&TC**	**I.C.O.E.R, Pune**

(External Examiner)

Place: Pune

Date:

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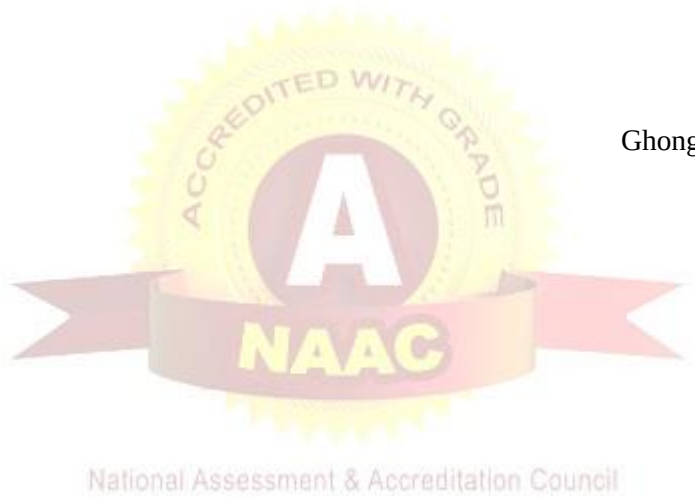

Signature of Student

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Place: Pune

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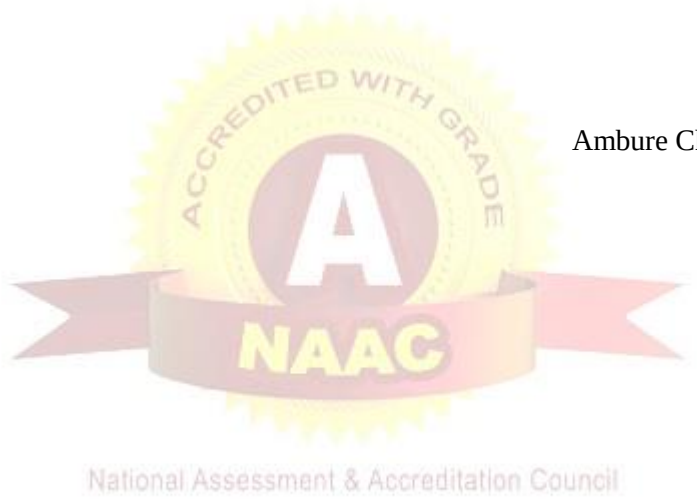

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Ambure Chandrashekhar Rajeshwar

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Date:

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3) Ambure Chandrashekhar Rajeshwar (B150513003) _____

Place: Pune

Date

ACKNOWLEDGEMENT

It's our great pleasure to present a seminar report entitled **"IOT Based Air & Sound Pollution Monitoring System Using Raspberry Pi"**. This report is an outcome of various efforts by us in collating and identifying the sources of information and knowledge. We use this occasion to thank my guide with whose guidance this effort would not have borne fruits. We find no words to express our gratitude to **Prof. A. A. Trikolikar** who not only advised and guided us during the report writing but also answered all our queries concerning collection of data, proper structuring of the report, and its improvement. We are virtually indebted to the Head of the Department **Dr. S. K. Bhatia** from Imperial College of Engineering and Research who have bestowed all their blessings in the form of guidance which was the leading light to complete this seminar report. We are also thankful for our principal, **Dr. R. S. Deshpande** who provided us valuable support in completion of the seminar by providing us different facilities in college and by giving permission for working out of college.

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Project Duration: 1st March 2021 – 28th february 2022

During the Internship his Performance was found to be excellent. We wish him "All the Best" for future endeavors.

For BitMap Technology,

Mr. Vinod Thete

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ABSTRACT

In today's world, the continuous rise in air and sound pollution has become a serious problem. Controlling and carefully monitoring the situation has become necessary in order to take the necessary steps to alleviate the situation. This research has proposed an IOT-based technique for monitoring the air quality index and noise intensity of a region. The Air Quality Index Monitoring Module, the Sound Intensity Detection Module, the Cloud-based Monitoring Module, and the Anomaly Notification Module are the four modules that makeup the recommended technology. To begin with, the air quality index is calculated based on the presence of five specific air contaminants. The sound intensity is then detected using the appropriate sensor. After that, the Cloud-based Monitoring Module ensures the data collection process with the support of the Raspberry Pi's Wi-Fi module, achieving the goal of data analysis on a regular basis.

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CHAPTER 1

INTRODUCTION

Chapter 1

INTRODUCTION

1.1 Background and Basics

To control and monitor of different activities focused by Present innovations in technology. To reach the human needs these are increasingly emerging. Most of this technology is focused on efficient monitoring and controlling different activities. To monitor and assess the conditions in case of exceeding the prescribed level of parameters (e.g., noise, CO and radiation levels) an efficient environmental monitoring system is needed. In an environment when an object equipped with sensor devices, then in this case microcontroller and various software applications becomes a self-defending Self-monitoring and self-controlling environment and it is also called as smart environment.

In such environment when LED alerts automatically or some event occurs the alarm. Smart Environmental Monitoring System monitor and control the ecological changes on animals, plants and human beings on the basis effects due to environmental changes. By using embedded intelligence into the environment makes the environment interactive with other objectives, this is one of the application that smart environment targets Human needs demands different types of monitoring systems these are depends on the type of data gathered by the sensor devices. Event Detection based and Spatial Process Estimation are the two categories to which applications are classified. Initially the sensor devices are deployed in environment to detect the parameters (e.g., noise, CO and radiation levels etc.) while the data acquisition, computation and controlling action (e.g., with respect to the specified levels, the variations in the noise and CO levels). To predict the behavior of a particular area of interest and to collect the data, the Sensor devices are placed at different locations. The main goal of the this Project is to design and implement an adequate monitoring system through which the needed parameters are monitored and controlled remotely by using internet and the data collected from the sensors are stored in the cloud and on the web browser to project the estimated trend.

This project aims at benefitting the modern society aided with the constantly increasing use of internet. IoT (Internet of Things) IoT is simply the network of interconnected things/devices which are embedded with sensors, software, network connectivity and necessary electronics that enables them to collect and exchange data making them responsive. Internet of Things is essentially an architectural framework more than a concept in which data exchange and integration allowed

between the computer systems and physical world over consisting network infrastructure which exists in real world. With the help of sensors and actuators when IoT is augmented, the technology becomes an instance of the more normal class of cyber- physical systems, which also circumscribe technologies such as an intelligent transportation, smart grids, smart homes, and smart cities. Through its embedded computing system each thing is uniquely classifiable but within the existing internet infrastructure it is able to interoperate. With the help of various existing technologies the devices collect useful data and then autonomously flow the data between other devices.

1.2 Problem Statement

The incessant increase in air and sound pollution prove to be an alarming problem. It has become mandatory to control and appropriately monitor the situation so that the required steps to curb the situation can be undertaken for that we suppose to develop an apparatus and method that detects the air and sound pollution in smart cities using Internet of Things (IOT) and sensors.

1.3 Objectives

1) To Study Various Sensors and related technology.
2) To Study IOT for efficient communication between sensors and processor.
3) To develop low cost sensor based processor for air pollution measurement.
4) To develop a centralized supervising/monitoring system for air pollution.

1.4 Scope of Project

1) Aims to keep a track of air quality of a surrounding and keep the data updated over internet.
2) Highly accurate when used with high quality sensors
3) Data recorded is of immense use to control pollution.
4) A step towards living a better environment.

CHAPTER 2

LITERATURE REVIEW

Chapter 2

LITERATURE REVIEW

2.1 Arnab Kumar Saha1 , Sachet Sircar2 , Priyanshu Chatterjee3 , Souvik Dutta4 , Anwesha Mitra4 , Aiswarya Chatterjee4 , Soummyo Priyo Chattopadhyay1, Himadri Nath Saha1 In recent day scenarios, the incessant increase in air and sound pollution prove to be an alarming problem. It has become mandatory to control and appropriately monitor the situation so that the required steps to curb the situation can be undertaken. In this project, an IOT-based method to monitor the Air Quality Index and the Noise Intensity of a region, have been proposed. The recommended technology comprises four modules namely, the Air Quality Index Monitoring Module, the Sound Intensity Detection Module, the Cloud-based Monitoring Module and the Anomaly Notification Module. Firstly, the Air Quality Index is measured consider- ing the presence of the five criteria air pollutants. Then the sound intensity is detected using the respective sensor. After that, the Cloud-based Monitoring Module ensures the process of acquiring the data with the help of Wi-fi-module present in Raspberry Pi which fulfills the objective of analysis of information on a periodical basis. Finally, the Anomaly Notification Module alerts the user in case of an undesired condition. Keywords—Raspberry Pi 3B; MQ -135; LM 393; Air Quality Index;Sound Intensity.

2.2 Xuan Zhao, Siming Zuo, Rami Ghannam, Qammer H. Abbasi and Hadi Heidari Microelectronics Lab (meLAB), School of Engineering, University of Glas- gow, G12 8QQ, Uk Air pollution is becoming an increasingly serious issue, leading to many environmental problems such as the fog-haze weather phenomenon, which can cause great harm to human health. This paper focuses on the design and fabrication of a portable sensory system for air pollution monitoring, which can detect the tem- perature, humidity and particulate matter (PM). This will be used as a tool to help reduce the harm of air pollution on people. This sensor mainly consists of a micro programmed control unit, a temperature humidity sensor DHT11, a dust sensor GP2Y1010AU0F, LCD, keys and LEDs. Ambient dust concentrations, temperature and humidity values will be displayed on the LCD. The corresponding light alert signals and sound alert signals are sent when the

measured values are beyond their safe ranges. Keywords— Air Quality; LCD Display; Temperature and Humidity Detection; Dust Detection

2.3 Manisha Sharma1 , Ajay Kumar2 , Abhishek Bachhar3 1, 2, 3 Department of Electronics and Communication Engineering, Hyderabad Institute of Technology and Management, Affiliated to JNTU, Hyderabad, Telangana, India. Air pollution is an addition of harmful substances in the atmosphere, which results in environmental damage. The industrial development and reduction in forests, which are two main root causes of air pollution, has increased the death rates of people dying from diseases like breathing problems and lung cancer. So, to fight against this serious threat to mankind, we decided to stand by this society and we made up our mind to do something to detect the amount of impurities in the air and considerably reduce the amount of impurities present in the air. In the project, we are detecting impurities using a gas sensor. Impure air is input to the gas sensor. The sen- sor is connected to the Arduino which consists of code which will help us in detecting the amount of impurities in the air. After taking the inputs regarding the amount of impurities from the doctor we have set a limit up to which extent impurities are not harmful. If the limit exceeds then a buzzer sounds along with the LCD display which gives us the information that it's time to switch ON the filtering device. After that filtering device gets turned ON and air gets purified. Coming to applications it can be used in the place where there is a need for oil mist collectors, dust collectors, UV air purifiers etc. Keywords- Arduino, Gas Sensor (MQ-2), Temperature Sensor (DHT11), LCD (16x2), Buzzer, Filtering device (consisting of several layers).

2.4 K. Cornelius1, N. Komal Kumar, Sagar Pradhan, Priyesh Patel, N.Vinay Department of Computer Science and Engineering. The growth of pollution is broadening day by day with certain factors that affect the environment and result in the loss of biological degradation. This could be due to rapid industrialization and urbanization. It is directly affecting the health of the people in one way or another and results in the degradation of the population. It is very important to examine the air quality as well as the sound level and put it under governance for a good future and wholesome living for all. The Major decline has been seen in infrastructure and industrial plants and their expedition's growth creating several environmental problems like pollution such as air, water, Noise, climatic changes, atmospherics differences, the glitch that has environment corollary for the requirement of an anatomically adjustable, effectual, affordable and smart monitoring system. Here we design an air quality as well as a sound contamination surveillance system that permits us to observe and check live air peculiarity as well as sound contamination in a specific area through the

latest technology IoT. The level of air and sound contamination is growing all of a sudden. To make it under inspection and surveillance is highly preferred. To conquer this problem, we are establishing a structure through which the growing issue of sound and the pres- ence of dangerous gases in the environment can be identified.

2.5 Baihaqi Siregar. The continuous monitoring of pollution level in urban areas is impor- tant for a smart city. There are several parameter changes that indicate the pollution: dust particle density in the air, humidity, light intensity, and the level of sound noise. A technology that can be developed for an integrated pollution monitoring system is wireless sensor network (WSN) utilizing waspmote smart cities device, connected with several sensors, such as dust sensor PM-10 (GPY21010AU0F), humidity sensor (808H5V5), luminosity sensor (LDR), and microphone (dBA). As a communication protocol we used 3G connectivity to store the data to the cloud system. Prototype of this system had been tested in a controlled laboratory environment and the performance of the developed system was as expected. The Results of this system can be used by government and policy makers as basic information to take further actions reducing pollution level. Keywords: wireless sensor network, smart cities, waspmote, pollution, dust, luminosity, humidity, noise.

2.6 Yong WANG, Shuyu LIN. Suspended particles are a general term for solid and the liquid particulate matter suspended in the atmosphere. Total suspended particles in air quality evaluation are an important general pollution index. This paper aims to find a simple acoustic method to measure the volume of the total suspended particles. In order to measure the volume fraction of suspended particulate matter in the air, we studied the effect of the volume fraction and the density of the suspended particulate matter on the speed of the sound wave in the air. We considered the suspended particulate matter to the vibration model of the air, and get the equivalent sound velocity by solving the equation of the mass conservation and the energy conservation of the air element when they are vibrating. We found that the sound speed of the mixture will be affected by the density and the volume fraction of the suspended particulate matter, it will decrease with increasing the particle density when one keeps the vol- ume fraction constant, and so does the volume fraction when one keeps the particle density constant. So we think that, in a certain range of error, the volume fraction of the suspended particulate matter can be determined by measuring the sound velocity in the mixture

of the solid particles and air. Keywords: Acoustic measurement; Suspended particulate matter; Equivalent sound velocity; Volume fraction

2.7 P. Mayorga1 Numerous studies including annual reports by Blacksmith Institute clearly document the magnitude of regional pollution and associated health risks. In particular the air pollution encompassing PM10 and smaller particles significantly contributes to the prevalence of respiratory diseases. Specifically, the city of Mexi- cali with a PM10 ranking of 137 in 2010 is considered as the most polluted city in Mexico largely due to the contribution of unusual environmental factors. Resulting respiratory abnormalities are often reflected in peculiar auscultatory indicators and their assessment can be accomplished using low cost technologies. These economic aspects are critical not only in Latin America but also other population centers glob- ally considering the limited level of health services. Any classification of ausculta- tory indicators as reflected in lung sound (LS) characteristics needs to account for a noisy environment and the influence of heart sounds (HS). The aim of these studies was to utilize Hidden Markov Models (HMM) in light of the previously conducted assessment of lung sounds (LS) utilizing the Mixture Gaussians Models (GMM). In particular, the application of HMM models provides robustness to cope with noise and other interferences, to which the Mixture Gaussians Models (GMM) are more vulnerable. The conducted studies document that presented quantitative assessment of LS may add in more objective and economic scanning for respiratory abnormal- ities. Keywords — Quantile Vectors, Lung Sounds, Classification, Hidden Markov Models (HMM)

2.8 Mostafa Haghi, Kerstin Thurow Human exposure to environmental harmful factors (e.g. air pollu- tion and high sound levels) which are known as hazardous might cause many chronic diseases (e.g. asthma) and mental health disorders (e.g. anxiety) in particular for people who are exposed for a long time. However, the use of fixed environmental sta- tions is limited due to large required facilities and high cost. In addition, these sys- tems do not provide detailed monitoring of individuals. A new generation of low cost portable devices has recently been introduced to the market. Due to restriction in the size, battery life time and single task (limited number of parameters) they are not suitable for laboratory and clinical work places. In this paper, we introduce the device “MLMS-EMGN-4.0” which is wrist worn and monitors several physical and chemical environmental

parameters (air humidity, temperature, air pressure, sound level, CO and NO2) as well as motion tracking. The device is based on a multi-layer approach where the sensors are located appropriately on top of each other through a board to board connector. Furthermore, the device is equipped with a notification system for real time user warning. The collected data are sent to a smartphone for logging and monitoring. Keywords-wearable device; environmental monitoring; hazardous gases; sound pressure level, sensor

2.9 Varun Jain, Mansi Goel, Mukulika Maity, Vinayak Naik, Ramachandran Ramjee Air pollution levels have been rising at an alarming rate for the past ten years. The situation is considerably worse in developing nations, such as India. The average concentration of PM10 in Delhi has increased by over 66% between the years 2007 and 2010 and continues to increase further. Rising air pollution has been shown to have a detrimental effect on human health. The first line of action is to sensitize people about the problem by informing them about the quality of air that they are breathing in their immediate vicinity. Unfortunately, India still lacks the infrastructure required to measure pollution at a granular scale. Most of the pollution monitoring stations are placed in regions of low population density, and hence, it is difficult to calculate the personal exposure to air pollution for most of the population. It is also not economically viable to add pollution monitoring devices at such a scale in a short period of time. We propose a framework to estimate air pollution for a given locality by leveraging the existing infrastructure of monitoring stations and looking at factors, such as traffic conditions and greenery. We evaluate our framework by estimating the pollution exposure for long trips undertaken by users, given the seed pollution values at a few spots. Our framework incurs a reasonable accuracy. We find that greenery has more impact on pollution than traffic conditions.

2.10 Archit Aggarwal, Tanupriya Choudhary, Praveen Kumar Delhi was declared the most polluted city in the world in 2014 by the world health organisation. There are three major sources of pollution in Delhi namely road dust, industry and vehicles. Majority of the pollution is caused by road dust and industries. The Air Quality Index (AQI) is the standardised way of describing the level of pollutants and overall air quality. AQI is dependent on the measurement of eight pollutants. The traditional method used is linear interpolation where only one pollutant is considered to calculate AQI. This paper proposes a fuzzy interface system for the calculation of AQI using two pollutants with each having six linguistic variables. The system gives satisfactory results and can provide many solutions for industrial air pollution.

2.11 Somansh Kumar, Ashish Jasuja Air pollution is the largest environmental and public health challenge in the world today. Air pollution leads to adverse effects on Human health, climate and ecosystem. Air is getting polluted because of release of Toxic gases by industries, vehicular emissions and increased concentration of harmful gases and particulate matter in the atmosphere. Particulate matter is one of the most important parameter having the significant contribution to the increase in air pollution. This creates a need for measurement and analysis of real-time air quality monitoring

so that appropriate decisions can be taken in a timely period. This paper presents a real-time standalone air quality monitoring system which includes various parameters: PM 2.5, carbon monoxide, carbon dioxide, temperature, humidity and air pressure. Internet of Things is nowadays finding profound use in each and every sector, plays a key role in our air quality monitoring system too. Internet of Things converging with cloud computing offers a novel technique for better management of data coming from different sensors, collected and transmitted by low power, low cost ARM based minicomputer Raspberry pi. The system is tested in Delhi and the measurements are compared with the data provided by the local environment control authority and are presented in a tabular form. The values of the parameters measured are shown in IBM Bluemix Cloud.

2.12 Alka Yadav, Durga Toshniwal The cities in India are classified into Tier I, II and III based on population. Air pollution is an issue of major concern as it has adverse impact on human health and ecosystem. Tier I cities in India have high levels of pollutants due to increased vehicles, industrial units etc. In the present work, the air quality data from New Delhi, Mumbai, Chennai and Bengaluru has been used. Initially, dimension reduction has been performed on the data. After that, the data has been de-seasonalized. Finally, a modified ARIMA model has been proposed which is applicable to numeric data streams. This is denoted as SDA (Streaming Data ARIMA). Principal Component Analysis (PCA) has been used for dimensionality reduction. The results of SDA and ARIMA are compared with each other and also with GARCH Model and have been found to be very promising.

2.13 Dr. P.B.Chopadea*, Smruti Akmanchib, Nalini Singhc, Sayali Paward With the evolution of technology and population there is a rapid growth in infrastructure and industrial plants which is degrading environment and issues like climate change, malfunctioning and pollution. Hence there is an urgent need of a device to overcome these problems, we are proposing a system for monitoring

the noise and air pollution levels in industries, mines or any particular polluted area. The presented project contains the technology IOT and modules, the Air Quality Index monitoring module, Sound Intensity detection module, Cloud based monitoring module, Alerting module. All of these modules are interfaced with Raspberry pi, respective sensor devices for detecting the presence of air pollution and noise intensity level, cloud-based monitoring with the help of Wi-Fi module present in Raspberry pi. The collected information is analyzed repetitively and when there is an undesired situation it alerts the user.

2.14 1Dr. N. Suma, 2Dr. C. Vimalarani, 3Dr. N. Shanmuga Vadivu & 4Dr. M. Shanmugasundaram Carbon monoxide (CO) is a toxic gas produced by partial combustion of various carbon based fuels. It can cause headache, nausea, vomiting and confusion for humans and critical to environment. Hence this work finds a solution to measure and analyze the level of Carbon monoxide emission in the vehicle used for transportation on roads. This system uses MQ-7 gas sensor to track the content of Carbon monoxide that act as a pollutant in the atmospheric air. MQ-7 sensor is used to measure the carbon monoxide level and it intimates to the vehicle. If the carbon monoxide level is present, the message will be sent automatically to the pollution control board and display the release of this level from the vehicle. As a result the office has the authority to file the case against the vehicle that produce the over pollution. MQ-7 sensor measures the current value of the emitting Carbon monoxide from every vehicle and WIFI modules are connected with every raspberry pi-3 and it will send the message to the PHB based IOT monitoring. It can be used in globally for monitoring of pollution.

CHAPTER 3

PROJECT PLANNING

Chapter 3

PROJECT PLANNING

3.1 SYSTEM REQUIREMENT SPECIFICATION (SRS)

3.1.1 EXTERNAL INTERFACE REQUIREMENTS

Hardware Requirements:

1) Raspberry Pi
2) MQ9 (Gas Sensor)
3) LM35 (Temperature sensor)
4) Sound sensor
5) Buzzer
6) MQ135 (Gas Sensor)
7) AD Convertor

Software Requirements:

1) Proteus 8.11
2) Programing language: Python

3.1.2 Performance Requirements

Performance of the functions and every module must be well. The overall Performance of the hardware will enable the users to work efficiently.

3.1.3 Safety Requirements

The application is designed in modules that are fixed easily. This makes it easier to install and update new functionality if require

3.2 PROJECT PROCESS MODELING

We are using a waterfall model for our project.

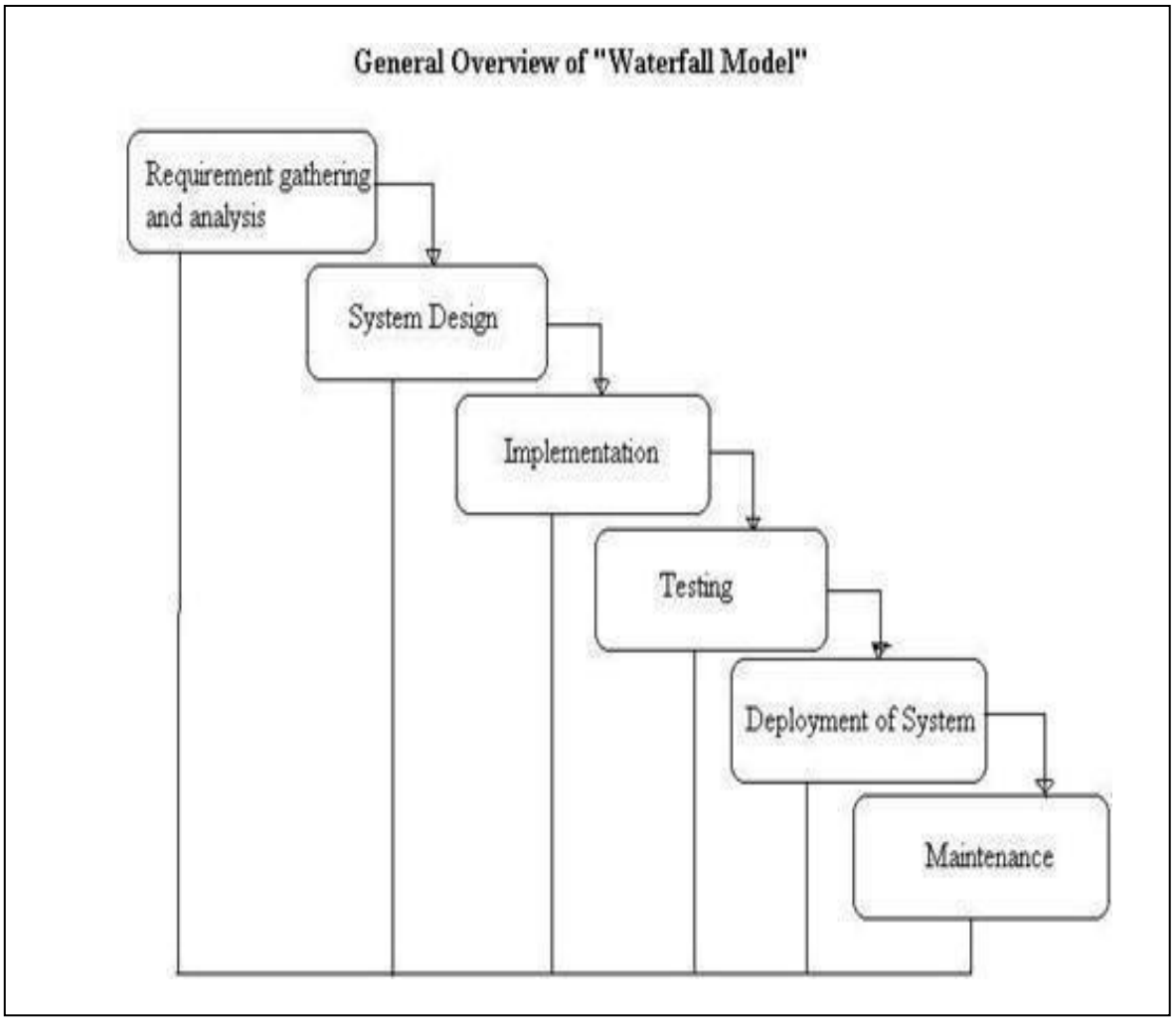


Figure 1: Waterfall Model

The Waterfall Model was the first Process Model to be introduced. It is also re- ferred to as a linear-sequential life cycle model. It is very simple to understand and use. In a waterfall model, each phase must be completed fully before the next phase can begin. This type of model is basically used for the project which is small and there are no uncertain requirements. In this model the testing starts only after the development is complete. In waterfall model phases do not overlap.

Phases in Waterfall Model

1) Information Gathering: In this we gather the information required to our system.
2) Design: After gathering the information required we design the model based upon that information.
3) Implementation: In this phase we actually implement the system using the design done in the design phase.
4) Testing: In this phase we perform the unit as well as integration testing to check whether the system is working as per our requirement or not.
5) Deployment: After testing the system we deploy the system in the market
6) Maintenance: According to user feedback maintenance will be done

3.3 SYSTEM IMPLEMENTATION PLAN

The System Implementation plan table, shows the overall schedule of tasks compilation and time duration required for each task.

Sr. No.	Name/Title	Start Date	End Date
1	Preliminary Survey		
2	Introduction and Problem State- ment		
3	Literature Survey		
4	Project Statement		
5	Hardware Requirement And Speci- fication		
6	System Design		
7	Partial Report Submission		
8	Architecture Design		
9	Implementation		
10	Deployment		
11	Testing		
12	Paper Publish		
13	Report Submission		

Table 1: System Implementation Plan

CHAPTER 4

SYSTEM DESIGN

Chapter 4

SYSTEM DESIGN

4.1 BLOCK DIAGRAM

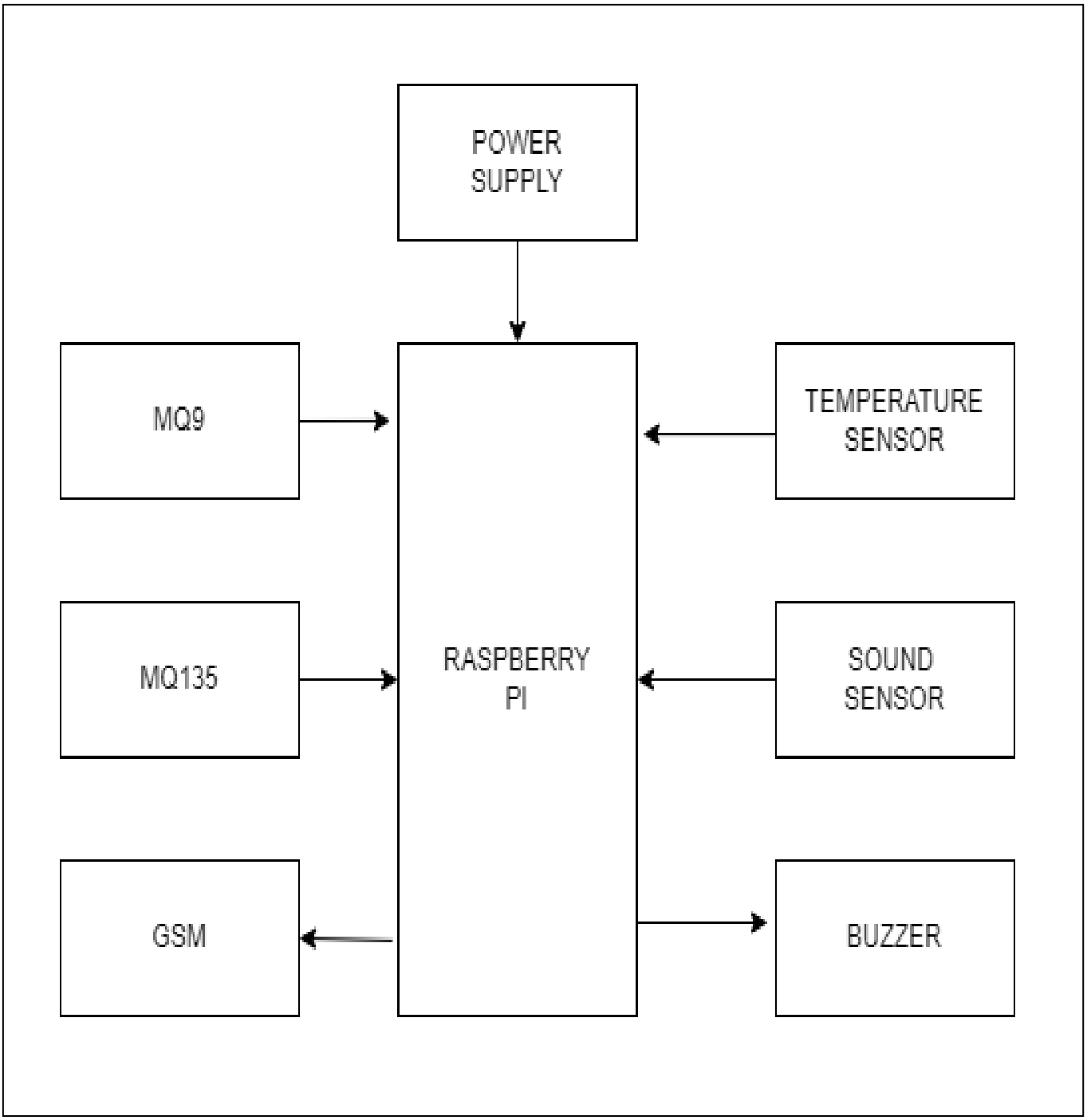


Figure 2: Block Diagram

4.2 BLOCK DIAGRAM EXPLANATION

System detects air and sound pollution. The Air and Sound Pollution Monitoring System consists of Raspberry Pi 3 Which is integrated ARM based central processing unit (CPU) and on-chip graphics processing unit (GPU),Raspberry pi has GPIO pins where all the sensors and output devices are connected. In the project MQ9 and MQ135 are the two sensors used to detect the air pollution. MQ9 is the sensor which detects air pollution due to gasses like methane, carbon monoxide. MQ135 is the gas sensor which detects NH3, CO2, NOx gases. These sensors are given as input to the raspberry pi. Sound sensor used to detect the sound pollution and given as input to the raspberry pi. Buzzer is attached to the system which gives an alert if the pollution level rises too high. Also the system is featured with the technology that sends alert messages on the municipality mobile. So the required action will be taken. The sensors interact with raspberry pi which processes the collected data from the sensor and transmits it over the application. The data is stored on the Cloud through which we can check live air quality and noise level. Thus, everything in this system is controlled by Raspberry Pi also system keeps measuring sound level, air quality, temperature continuously over the internet.

4.3 CIRCUIT DIAGRAM

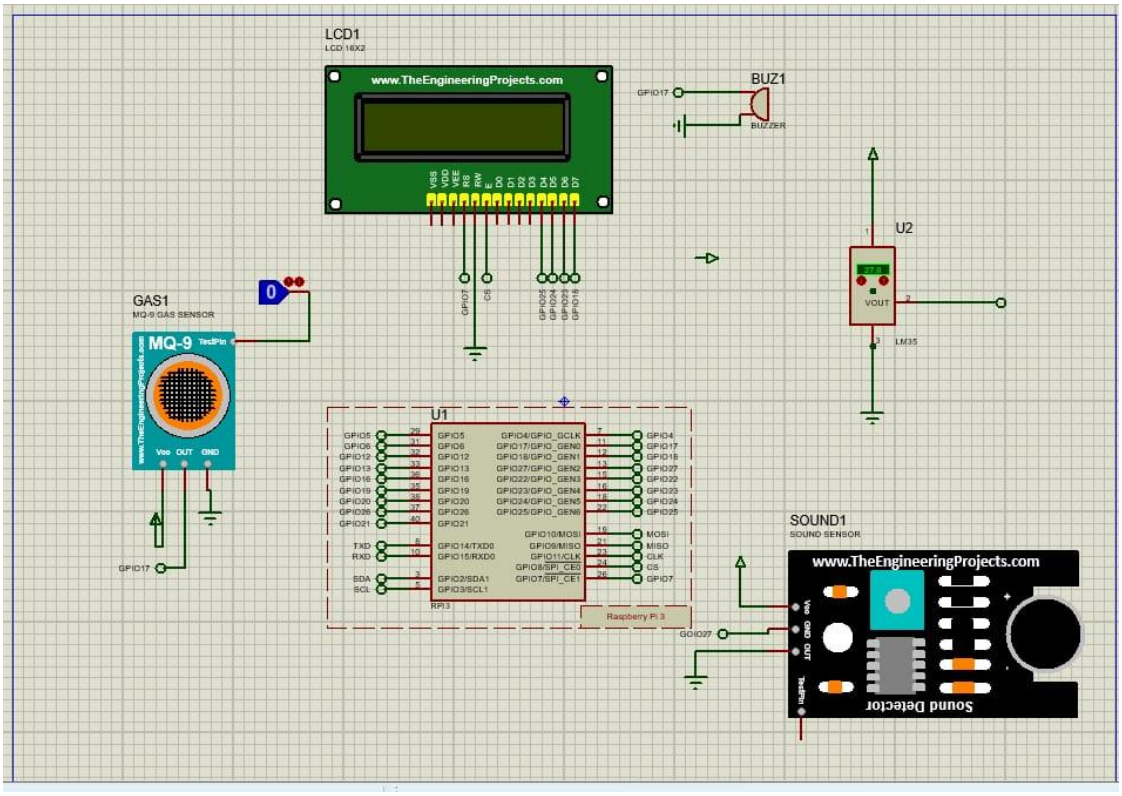


Figure 3: Circuit Diagram

4.4 CIRCUIT DIAGRAM EXPLANATION

System detects air and sound pollution. Raspberry Pi is the main processor. Raspberry pi has GPIO pins where all the sensors and output devices are connected. In the project MQ9 and MQ135 are the two sensors used to detect the air pollution. MQ9 is the sensor which detects air pollution due to gases like methane, carbon monoxide. MQ135 is the gas sensor which detects NH3, CO2, NOx gases. These sensors are given as input to the raspberry pi. Sound sensor used to detect the sound pollution and given as input to the raspberry pi. Buzzer is attached to the system which gives an alert if the pollution level rises too high. Also the system is featured with the technology that sends alert messages on the municipality mobile. So the required action will be taken.

CHAPTER 5

SYSTEM SPECIFICATION

Chapter 5

SYSTEM SPECIFICATION

5.1 HARDWARE REQUIREMENT

5.1.1 Raspberry Pi what is Raspberry Pi?

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games. The Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of digital maker projects, from music machines and parent detectors to weather stations and tweeting birdhouses with infra-red cameras. We want to see the Raspberry Pi being used by kids all over the world to learn to program and understand how computers work.

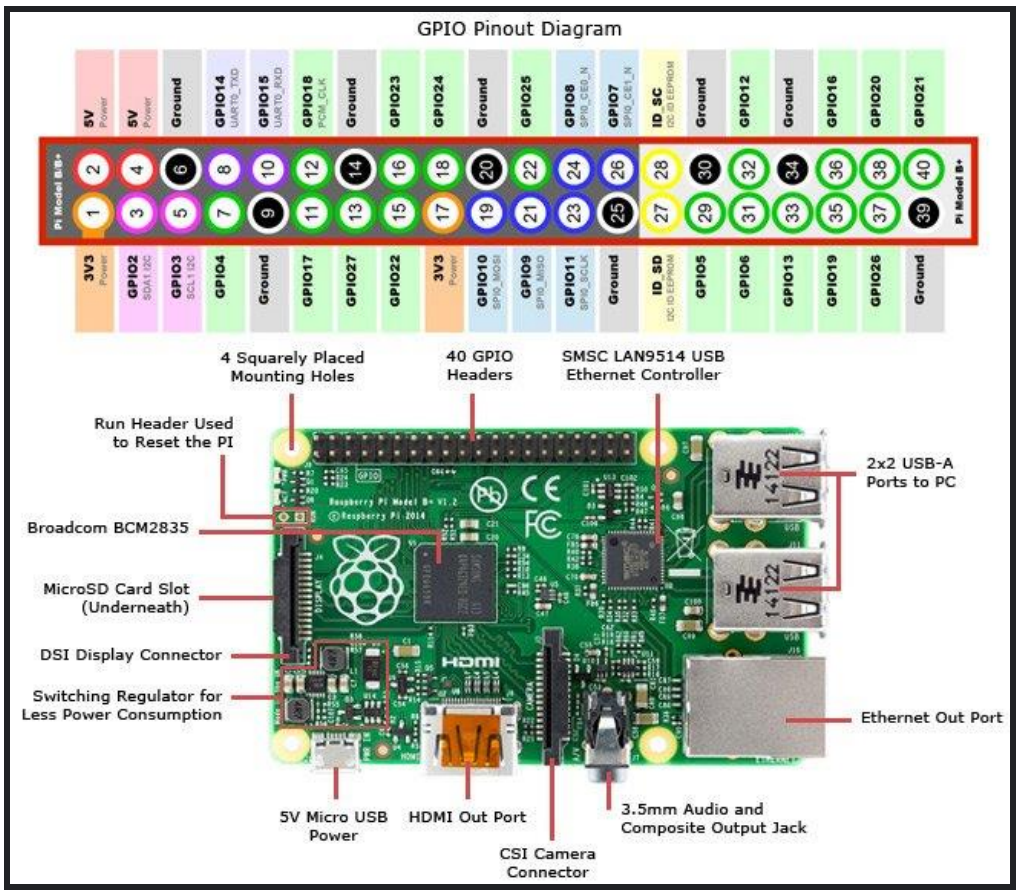


Figure 4: Raspberry pi

Raspberry Pi Specifications:

1) Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
2) 1GB RAM
3) BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board
4) 100 Base Ethernet
5) 40-pin extended GPIO
6) 4 USB 2 ports
7) 4 Pole stereo output and composite video port
8) Full size HDMI

Raspberry Pi Application:

1) Learn programming skills
2) Build hardware projects
3) Do home automation
4) Implement Kubernetes clusters and Edge computing
5) Use them in industrial applications

5.1.2 MQ9 Sensor

This MQ-9 Carbon Monoxide, Methane, and LPG Gas Sensor Module can be used to sense Carbon Monoxide and Methane Gas. Sensitive material of the MQ9 gas sensor is SnO2, which has lower conductivity in clean air. It makes detection by the method of cycle high and low temperature, and detect CO when the low temperature (heated by 1.5V). The sensor's conductivity is higher along with the gas concentration rising. When a high temperature (heated by 5.0V), it detects Methane, Propane, etc. combustible gas and cleans the other gases adsorbed under low temperature.

Features:

1) Good sensitivity to CO/Combustible Gas.
2) High sensitivity to Methane, Propane, and CO Long life.
3) Low cost.

4) Simple drive circuit.

Figure 5: MQ9 Sensor

5.1.3 Temperature Sensor

A temperature sensor is a device used to measure temperature. This can be air temperature, liquid temperature or the temperature of solid matter. There are different types of temperature sensors available and they each use different technologies and principles to take the temperature measurement. Temperature sensors are used to measure temperature in many different applications and industries. They are all around us present in both everyday life and more industrial settings. Here in this project we are using the LM35 Temperature Sensor.

LM35 is an integrated analog temperature sensor whose electrical output is propor- tional to Degree Centigrade. LM35 Sensor does not require any external calibration or trimming to provide typical accuracies. The LM35's low output impedance, lin- ear output, and precise inherent calibration makes interfacing to readout or control circuitry especially easy.

Temperature Sensor specifications:

1) Calibrated directly in Degree Celsius (Centigrade)
2) Linear at 10.0 mV/°C scale factor
3) 0.5°C accuracy guarantee-able (at a25°C) Rated for full -55°C to a 150°C range Suitable for remote

Applications:

1) Low cost due to wafer-level trimming Operates from 4 to 30 volts
2) Surveillance

3) Automotive
4) Defense
5) Fire prevention
6) Industrial maintenance

Figure 6: Temperature sensor

5.1.4 Sound Sensor:

A sound sensor is defined as a module that detects sound waves through its intensity and converts them to electrical signals. Sound detection sensor works similarly to our Ears, having a diaphragm which con- verts vibration into signals. However, what's different is that a sound sensor con- sists of an in-built capacitive microphone, peak detector and an amplifier (LM386, LM393, etc.) that's highly sensitive to sound. Sound waves propagate through air molecules such sound waves cause the diaphragm in the microphone to vibrate, resulting in capacitance change Capacitance change is then amplified and digitalized for processing of sound intensity sound Sensor is used.

Apart from building various electronic projects with Raspberry Pi (covered in the later section) and more, sound sensors are used in many other day to day applications including: Consumer electronics such as phones, computers, music systems Security and Monitoring systems such as burglar alarms, door alarms, etc. Home automation such as lighting your house by detecting whistle/clap instead of physically turning the light switch ambient sound recognition and sound level recognition. Sound Sensor model. Based on the power amplifier LM386, the Grove – sound sensor module is a simple, low powered, and highly compatible option suitable to easily kickstart your next sound sensing project! With a wide voltage range and adjustable output by the potentiometer, it's readily capable of detecting the sound strength of the environment.

Applications:

1) Consumer electronics such as phones, computers, music systems
2) Security and Monitoring systems such as burglar alarms, door alarm, etc.
3) Home automation such as lighting your house by detecting whistle/clap instead of physically turning the light switch
4) Ambient sound recognition and sound level recognition

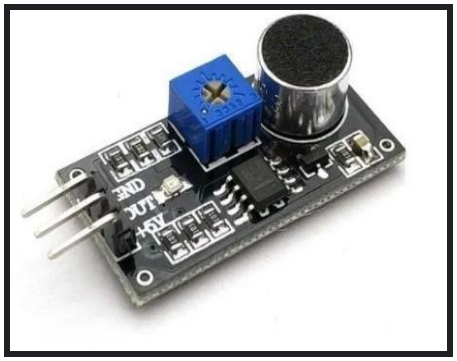


Figure 7: Sound sensor

5.1.5 What is MQ135

The MQ series of gas sensors utilize a small heater inside with an electrochemical sensor. These sensors are sensitive to a range of gases used at room temperature. MQ135 alcohol sensor is a Sno2 with a lower conductivity of clean air. When the target explosive gas exists, then the sensor's conductivity increases more increas- ing more along with the gas concentration rising levels. By using simple electronic circuits, it converts the charge of conductivity to correspond to the output signal of gas con- centration The MQ135 gas sensor has high sensitivity in ammonia, sulfide, benzene steam, smoke, and in other harmful gasses. It is low cost and suitable for different applications. There are different types of alcohol sensors like MQ-2, MQ-3, MQ-4, MQ-5, MQ-6, etc. MQ135:The MQ-135 gas sensor senses gases like ammonia nitrogen, oxygen, al- cohols, aromatic compounds, sulfide, and smoke. The boost converter of the chip MQ-3 gas sensor is PT1301. The operating voltage of this gas sensor is from 2.5V to 5.0V. The MQ-3 gas sensor has a lower conductivity to clean the air as a gas sensing material. In the atmosphere, we can find polluting gases, but the conductivity of the gas sensor increases as the concentration of polluting gas increases. MQ-135 gas sensors can be implemented to detect the smoke, benzene, steam, and other harmful gases. It has the

potential to detect different harmful gases. The MQ-135 gas sensor is a low cost to purchase. The basic image of the MQ-135 sensor is shown in the below figure.

MQ135 Sensor specifications:

1) Operating Voltage: 2.5V to 5.0V.
2) Power consumption: 150mA.
3) Detect/Measure: NH3, Nox, CO2, Alcohol, Benzene, Smoke.
4) Typical operating Voltage: 5V.
5) Digital Output: 0V to 5V (TTL Logic) @ 5V Vcc.
6) Analog Output: 0-5V @ 5V Vcc.

Figure **8**: MQ135 Sensor

5.1.6 BUZZER

The buzzer is a sounding device that can convert audio signals into sound signals. It is usually powered by DC voltage. It is widely used in alarms, computers, printers and other electronic products as sound devices. It is mainly divided into piezoelectric buzzer and electromagnetic buzzer, represented by the letter "H" or "HA" in the circuit. According to different designs and uses, the buzzer can emit various sounds such as music, siren, buzzer, alarm, and electric bell.

Buzzer Specifications:

1) Voltage V 5V working voltage of the board:

2) 23.5mm*13mm 1.27mm-spacing 4Pin interface connected with sensor hub.

3) The CAD drawing of the sensor: File:Sensor CAD.zip Technical parameters

4) Drive with 2K 5K square wave

5) The sound frequency is controllable. Connection this sensor can be connected to the following interfaces of core: A0 A7, D2 D13

Figure 9: BUZZER

5.2 SOFTWARE REQUIREMENT

5.2.1 PROTEUS

Proteus Professional 8.11 is the simplest and most advanced software for designing circuits. In which you will have to search for components, place them in the workspace and connect these with wires. Proteus 8.11 Download free Proteus soft- ware is mostly used for designing and testing circuits.

Proteus Specifications

1. Circuit designing and testing.

2. Includes all the components for circuit designing More than 800 different microcontrollers Different Simulations

3. Save cost and time for testing circuit

5.2.2 PYTHON IDE

IDE stands for Integrated Development Environment. It's a coding tool which allows you to write, test, and debug your code in an easier way, as they typically offer code completion or code insight by highlighting, resource management, debugging tools,… And even though the IDE is a strictly defined concept, it's starting to be redefined as other tools such as notebooks start gaining more and more features that traditionally belong to IDEs. For example, debugging your code is also possible in Jupyter Notebook

CHAPTER 6

RESULT

Chapter 6

RESULT

6.1 RESULT

The air and sound pollution monitoring system monitors air and noise pollution employing a mobile application. It shows the digital value of air and noise pollution and user can analyse it with a graph. It becomes very easy for us to rectify the amount and air and sound pollution around and plan for a healthy living and surrounding. The figures that are included in our paper shows the way the system works and the way the output is obtained from the input after processing

6.2 Image of system

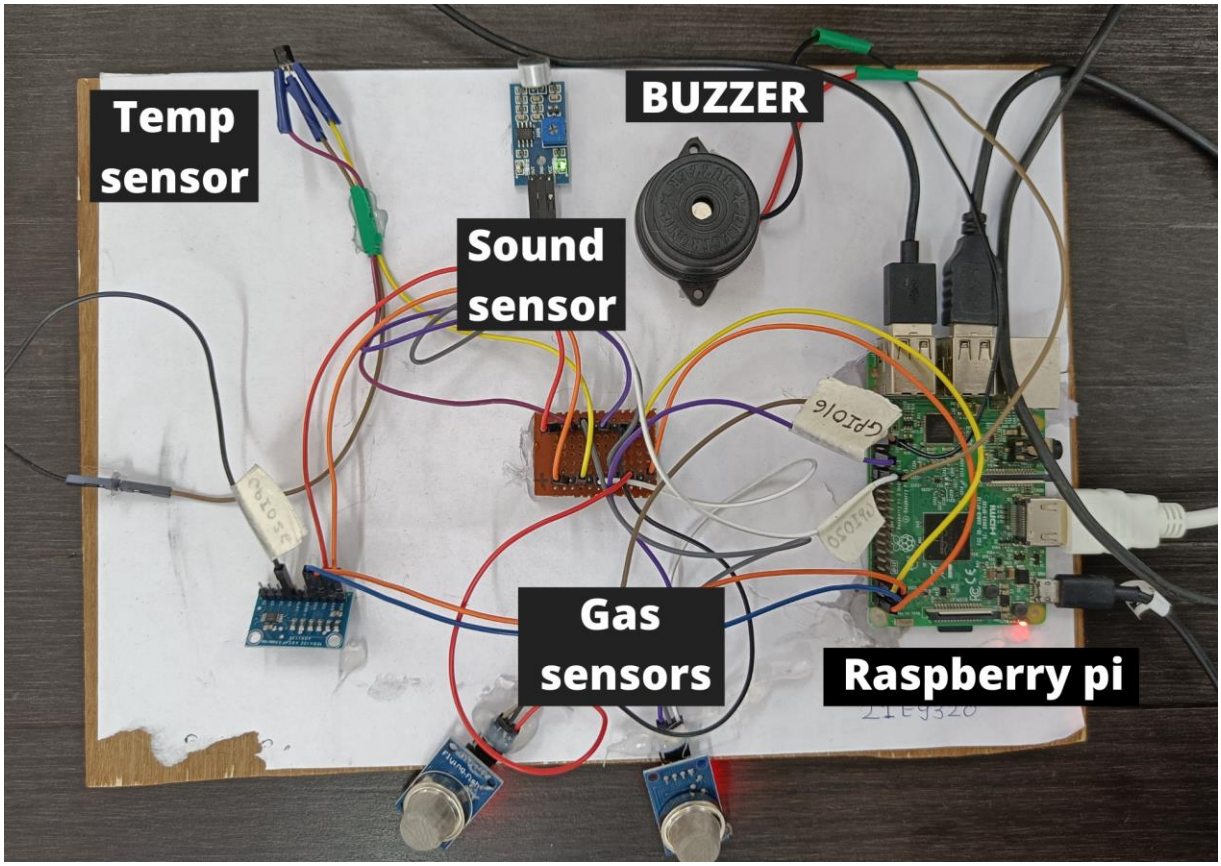
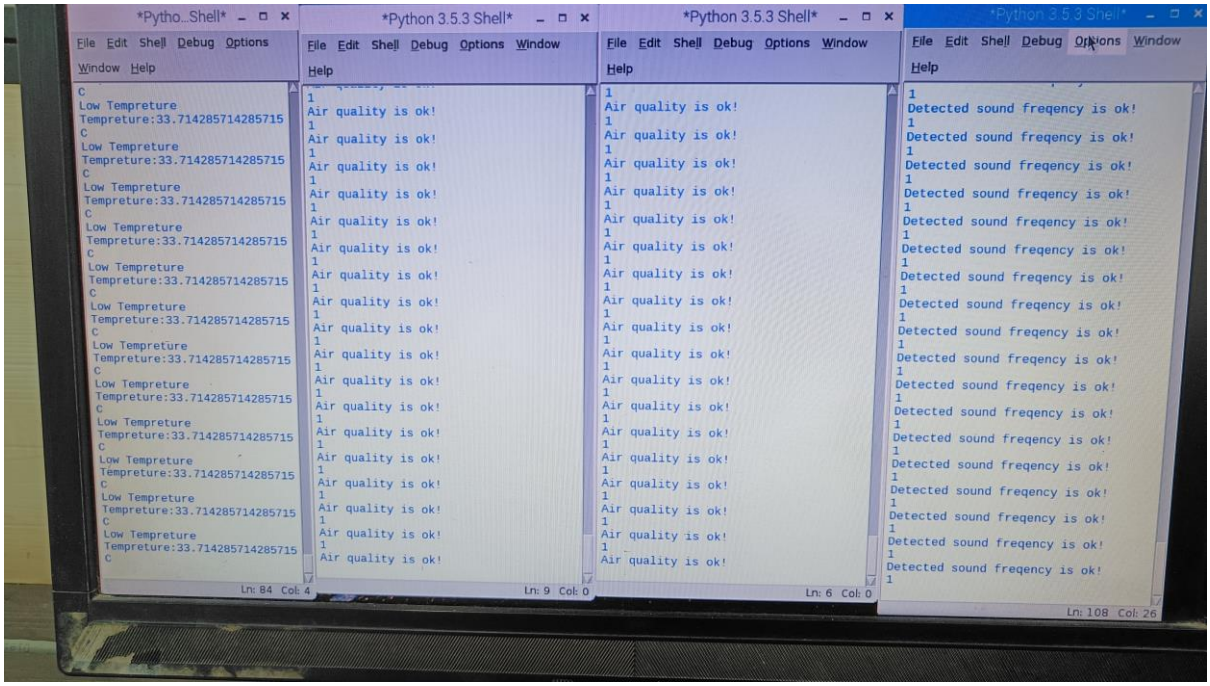
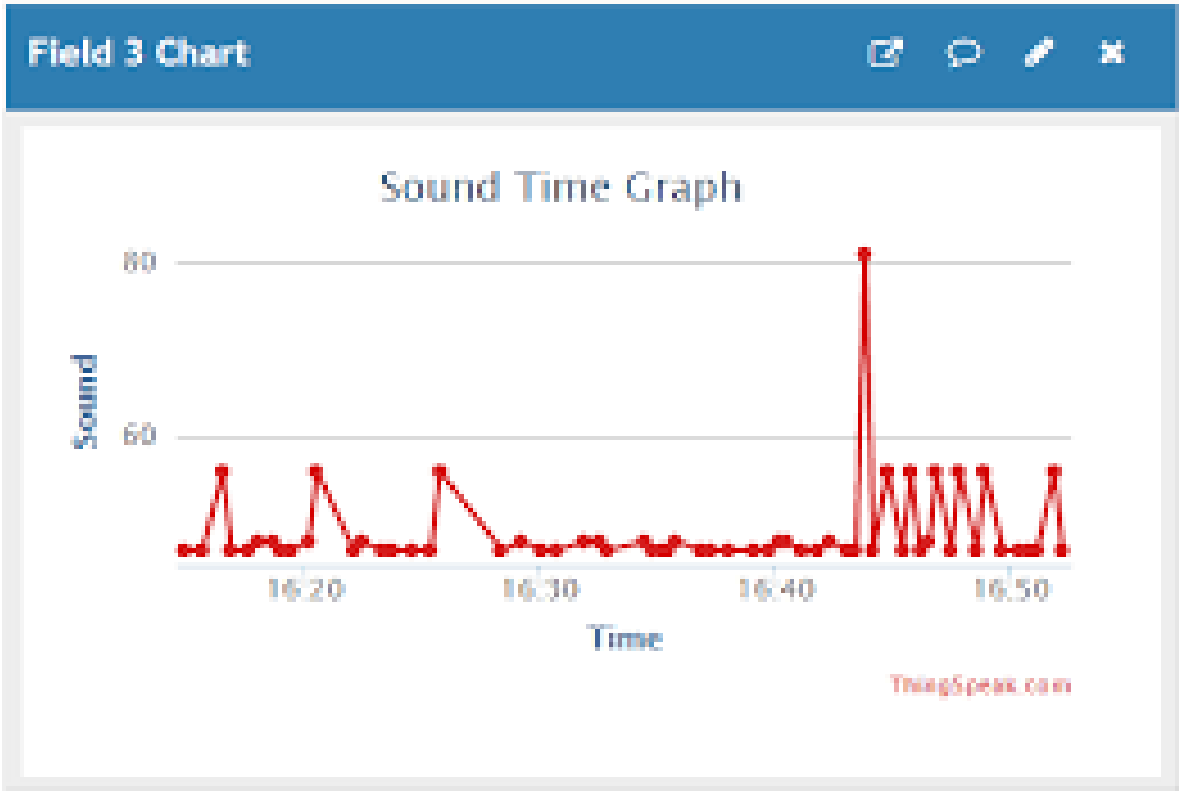


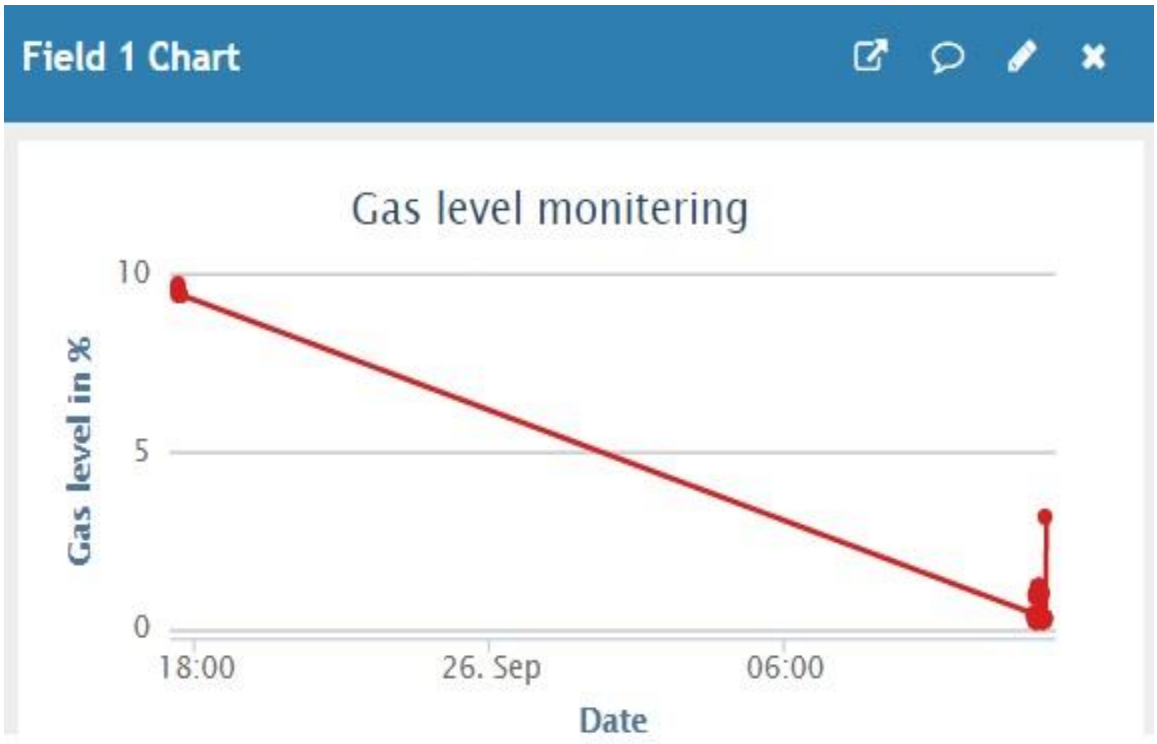
Figure 10: Image of System

6.3 Output on monitor

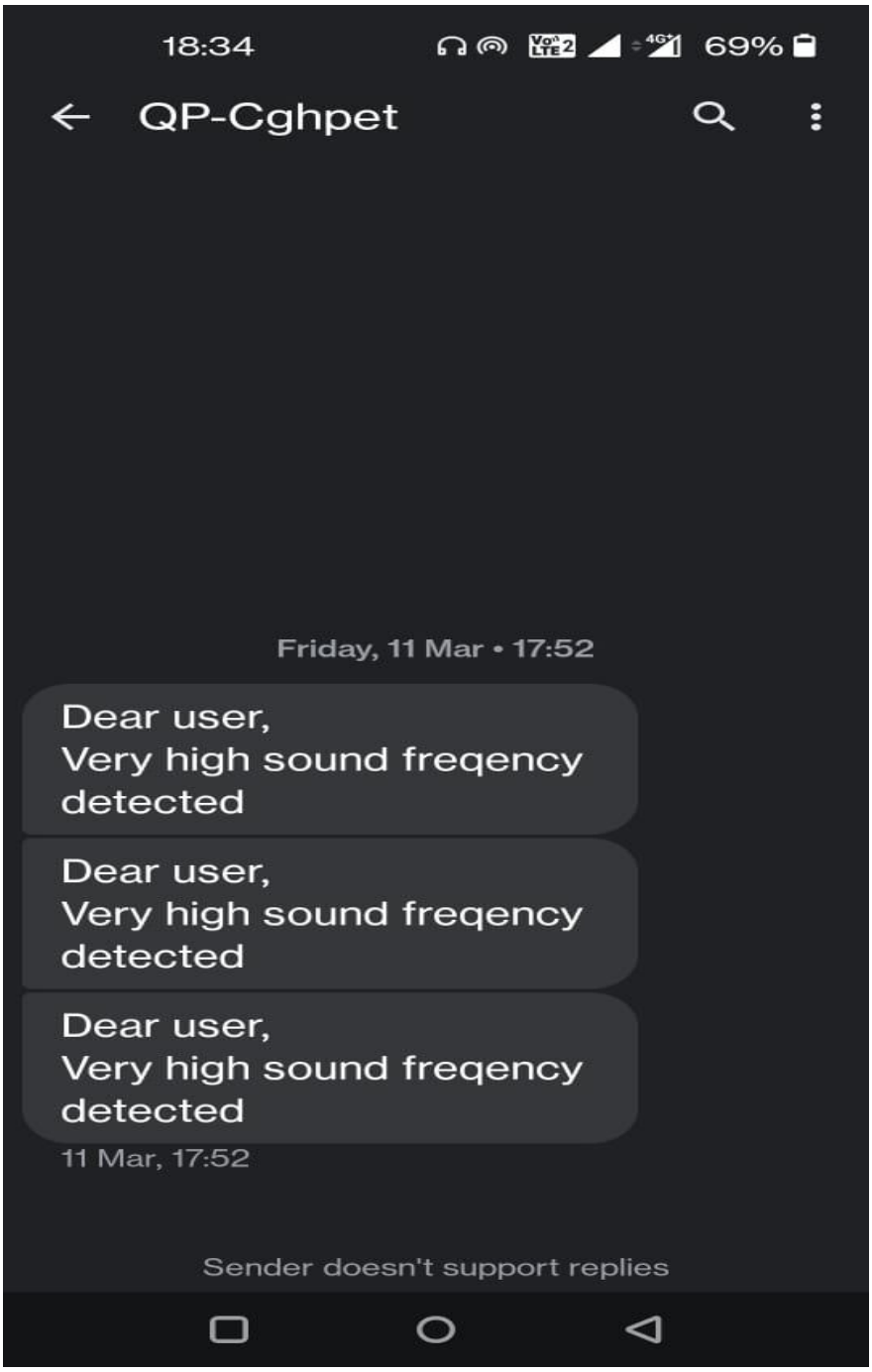


6.4 Output of Thingspeak


Field 3 Chart
Sound Time Graph
80
60
Sound
16:20
16:30
16:40
16:50
Time


Field 1 Chart
Gas level monitering
10
5
0
Gas level in %
18:00
26. Sep
06:00
Date

6.5 SMS on mobile



CHAPTER 7

CONCLUSION

Chapter 7

CONCLUSION

The smart way to monitor environment and an efficient, low cost embedded system is presented with different models in this paper. In the proposed architecture functions of different modules were discussed. The noise and air pollution monitoring system with Internet of Things (IoT) concept experimentally tested for monitoring two parameters. It also sent the sensor parameters to the cloud (Google Spread Sheets).This data will be helpful for future analysis and it can be easily shared to other end users. This model can be further expanded to monitor the developing cities and industrial zones for pollution monitoring. To protect the public health from pollution, this model provides an efficient and low cost solution for continuous monitoring of environment.

CHAPTER 6

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CHAPTER 7

PROJECT COMPITION CERTIFICATES

IEEE Pune Section

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MIT Art, Design and Technology University, Pune

MIT School of Engineering,

Techo-Genesis 2022

Certificate of Participation

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ECE Dept. MITSOE

Prof. Dr. Kishore Ravande
Principal, MITSOE

Prof. Dr. Mangesh T. Karad
Executive President & Vice Chancellor,
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