

Cloud Based Vehicle Pollution Detection and Monitoring System

Submitted in partial fulfilment of the requirements

Of the degree of

Bachelor of Engineering

in

Electronics and Telecommunication

Rakhange Musaddik (17DET56)

Kazi Hamdan Javid (17DET42)

Khan Sana Parveen (16ET04)

Khan Shahbaz (16ET20)

Under the guidance of

Prof. Bandanawaz Kotyal



Department of Electronics and Telecommunication Engineering

Anjuman-I-Islam's Kalsekar Technical Campus

Sector 16, New Panvel , Navi Mumbai

University of Mumbai

2019-20

CERTIFICATE



Department of Electronics and Telecommunication Engineering
Anjuman-I-Islam's Kalsekar Technical Campus
Sector 16, New Panvel , Navi Mumbai
University of Mumbai

This is to certify that the project entitled **Cloud Based Vehicle Pollution Detection and Monitoring System** is a bonafide work of **RakhangeMusaddik(17DET56), Kazi Hamdan Javid(17DET42), Khan Sana Parveen(16ET04), Khan Shahbaz (16ET20)** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering in Department of Electronics and Telecommunication Engineering.

Supervisor

Examiner

Head of Department/Director

Project Report Approval for Bachelor of Engineering

This project entitled "**Cloud Based Vehicle Pollution Detection and Monitoring System**" by **Rakhange Musaddik, Kazi Hamdan Javid, Khan Sana Parveen, Khan Shahbaz** is approved for the degree of **Bachelor of Engineering in Electronics and Telecommunication** .



Examiner

.....

Supervisor

.....

Date:

Place:

Declaration

We declare that this written submission represents our ideas in our own words and where others ideas or words have been included, We have adequately cited and referenced the original sources. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Rakhange Musaddik

(17DET56)

.....
Kazi Hamdan Javid

(17DET42)

.....
Khan Sana Parveen

(16ET04)

.....
Khan Shahbaz

(16ET20)

Date:

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Rakhange Musaddik (17DET56)

Kazi Hamdan Javid (17DET42)

Khan Sana Parveen (16ET04)

Khan Shahbaz (16ET20)

ABSTRACT

IOT(Internet of thing). It is a system of interrelated computing Devices, objects, animals or people to transfer data over a network without requiring human-to-human or human-to-computer interaction. Whenever we think of IOT systems, the most important and efficient application that stands out is smart home, ranking the highest IOT application. Other application are smart cities, smart grids, connected cars etc.

In our project we are concerned about health problem due to pollution. Pollution that is being caused due to vehicles. Thus we are trying to keep an eye on pollutant emitted by vehicle which is sensed using carbonmonoxide gas sensor. This sensor data is stored in database using Thingspeak server. If pollutant level goes above the predefined threshold level which is set in thingspeak then an alert will be send to the number which is feed in the twilio. Twilio is used for sending sms.Through this project we are aiming for better health of human being by reducing air pollution. It also helps for the better environment of the world.

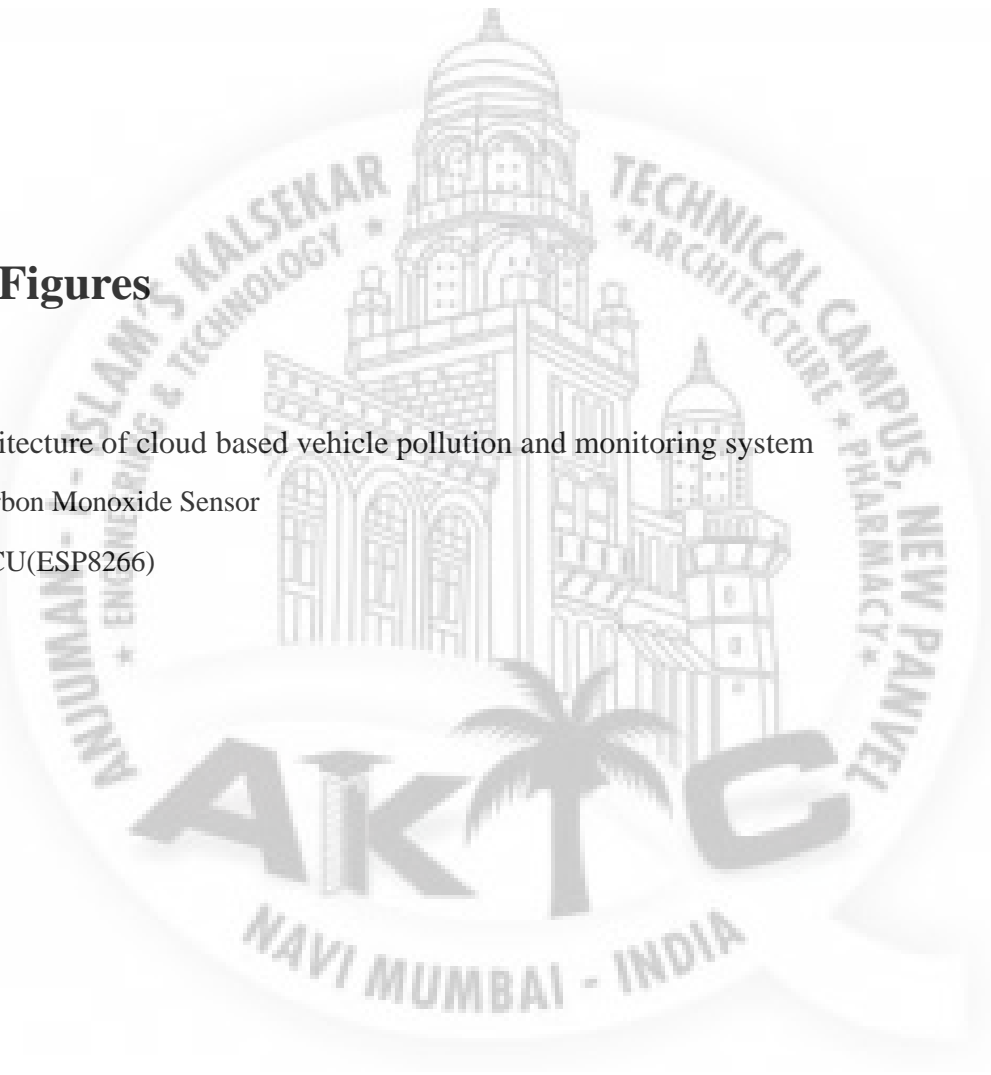
Contents

Project I Approval for Bachelor of Engineering	i
Declaration	ii
Acknowledgement	iii
Abstract	iv
List of Figures	vi
1 Introduction	1
1.1 Statement of Project	2
1.1.1 Project Architecture	2
1.1.2 Circuit diagram	3
1.1.3 Motivation	4
1.2 Objective and Scope	4
2 Literature Review	5
2.1 Paper Title	5
2.1.1 Weaknesses	5
2.1.2 How to Overcome	5
2.1.3 Survey	7
3 Technical Details	8
3.1 Methodology	8
3.2 Project Requirements	8
3.2.1 Software Requirements	8
3.2.2 Hardware Requirements	10
4 Market Potential	14
4.1 Market Potential of Project	14
4.2 Competitive Advantages of Project	14
4.3 Result	15

5 Conclusion and FutureScope	16
5.1 Conclusion	16
5.2 FutureScope	16
References	17

List of Figures

An Architecture of cloud based vehicle pollution and monitoring system	2
MQ7 Carbon Monoxide Sensor	3
Node MCU(ESP8266)	4





Chapter 1

Introduction

Now a days vehicles become a major source of air pollution which includes carbon- monoxide (CO), Nitrogen oxide and other smoke forming emission.^[1] The health risk of air pollutions are extremely serious. Poor air quality increases respiratory ailments like asthma and bronchitis, it also increase the risk of life threatening condition like cancer and burdens our health care system with substantial medical costs. Air pollution is singlehandedly responsible for up to 30,000 premature deaths for each year as per earlier report. In 2013, transportation contributed more than half of the carbon monoxide and nitrogen oxides. Air pollution contribute to over 1.2 million death in India in 2017. As per 2019 report air pollution kills an average of 8.5 out of every 10,000 children in India before they turn five. Every year, more people globally died from air pollution related diseases than from road traffic injuries or malaria. South Africa , Bangladesh, India and Nepal are the most polluted region with over 1.5 million air pollution related death. Every year 6,21,138 people died due to air pollution in which approx 40% people are died due to stop and ischaemic heart disease. This paper is mainly interested in reducing pollution mainly from the vehicles using IOT.

^[2]The advent of the Internet of Things and cloud computing brings a new approach, enabling to collect, transfer, store and share information on the logistics flow for better cooperation and interoperability among devices. IOT is an evolution in computer technology and communication that aims to connect objects together via the Internet. Objects mean everything that surrounds us and can communicate. An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments.

The definition of the Internet of things has evolved due to the convergence of multiple technologies, real-time [analytics](#), [machine learning](#), [commoditysensors](#), and [embedded systems](#). Traditional fields of [embedded systems](#), [wireless sensor networks](#), [control systems](#), [automation](#) (including [home](#) and [building automation](#)), and others all contribute to enabling the Internet of things.

1.1. Statement of Project:

In a developing world, India is one of the most populated country. as we all knows, now a days vehicle's became a part of our day to day life .So as much as the population is increases thee number of vehicle is also being increase which results in increasing of population ..Due to this various health issues like asthma ,cancer and many more have been faced . So we propose this project in order to lower pollution emitted by the vehicle which will reduce health issue.

1.1.1. Project Architecture:

An architecture of cloud based vehicles pollution detection and monitoring system is shown in fig 3.1. The pollution from the vehicle is sensed by using MQ7 gas sensor, which is connected to Node MCU(ESP8266). The data from the Node MCU is send to the thingspeak using internet. In the thingspeak the data is compared with the predetermined threshold level which is set in thingspeak. If the value rise above the threshold level the sms is send to the user mobile number. The message is send to the user using twilio In the twilio the user number is feed.

Fig 3.1 An Architecture of Cloud Based Vehicles Pollution Detection and Monitoring System

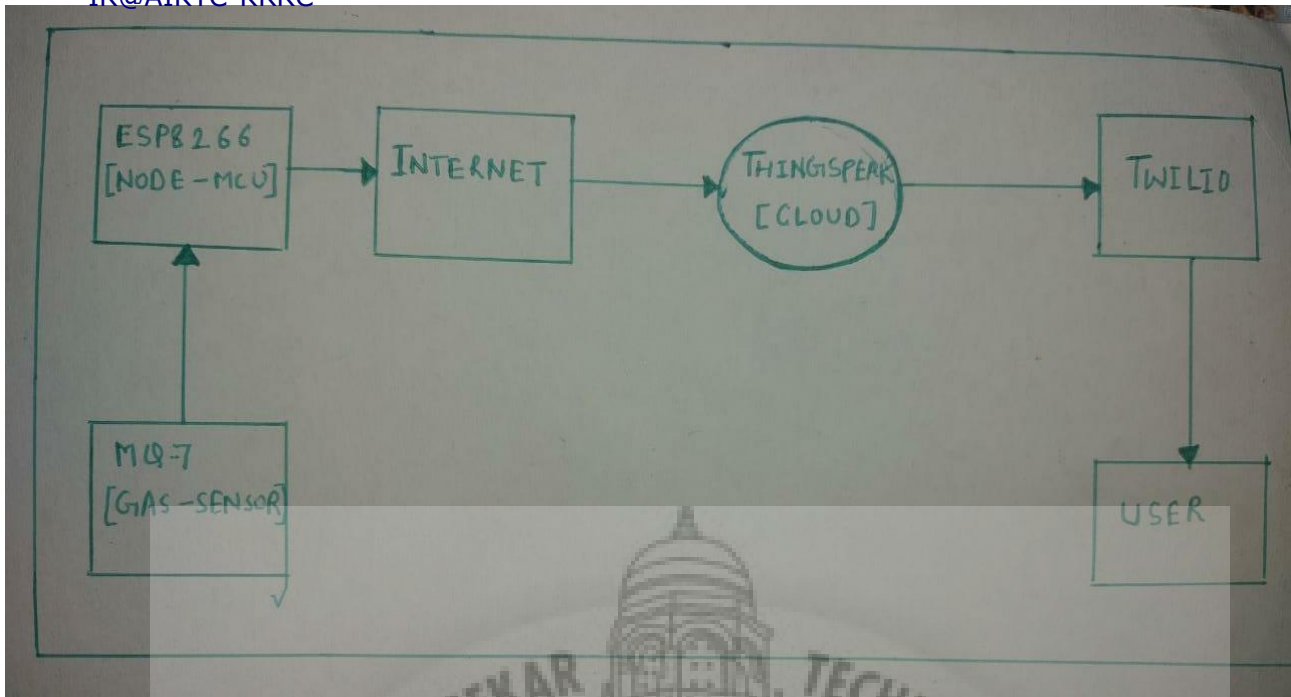
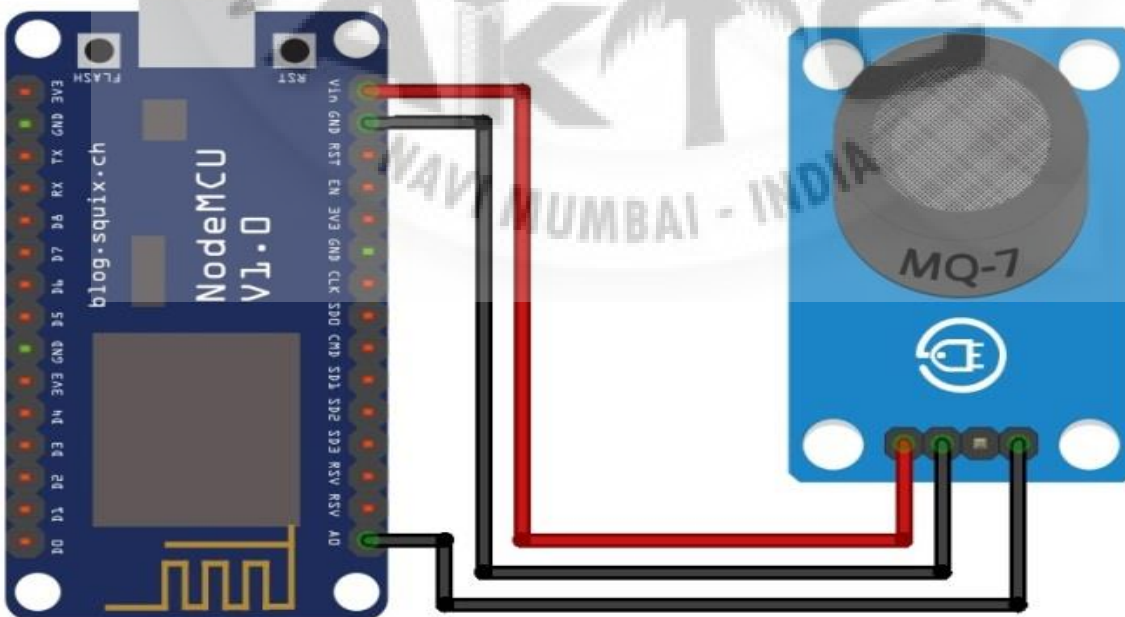


Fig 3.1 An Architecture of Cloud Based Vehicles Pollution Detection and Monitoring System

Circuit - diagram:



1.1.2. Motivation:

As number of vehicle increases day by day, it lead to increase in air pollution. The are many metropolitan cities around the world have begun to face this problem. One such example is New Delhi.. Due to these problem environment, animals, human health as well as other living things. So we proposed a model to reduce the air pollution and save the environment.

1.2. Objective:

The Main Objective of our project is to make it simple, effective and low cost product which is used to reduce the pollution emitted by vehicles, by using IOT and gas sensor.



Chapter 2

Literature Review

2.1. Paper Title

Development of IOT based Vehicular Pollution Monitoring System.

2.1.1. Weakness:

The main source of pollution in cities is due to vehicles. Transportation is main source for generating carbon monoxide that contributes 72% of total pollution in the metropolitan cities like Calcutta, Mumbai and Delhi. In the above project “Development of IOT based vehicular pollution Monitoring System” [3] they have used MQ-2 gas sensor which is suitable for detecting carbon dioxide and sulphur oxides concentration in air. They have used RFID technology which increases the project cost.

IOT Based Air Pollution Monitoring System.

As earlier mentioned, carbon monoxide contributes 72% of total pollution in metropolitan cities. In above project “IOT Based Air Pollution Monitoring System” they have used MQ-135 gas sensor which is suitable for detecting other gases rather than Carbon Monoxide gas.

2.1.2. How to overcome:

In our project we have used MQ-7 Carbon Monoxide gas sensor which is very much accurate in detecting Carbon Monoxide gas. It also detect other harmful gases which gives additional advantage to our project.

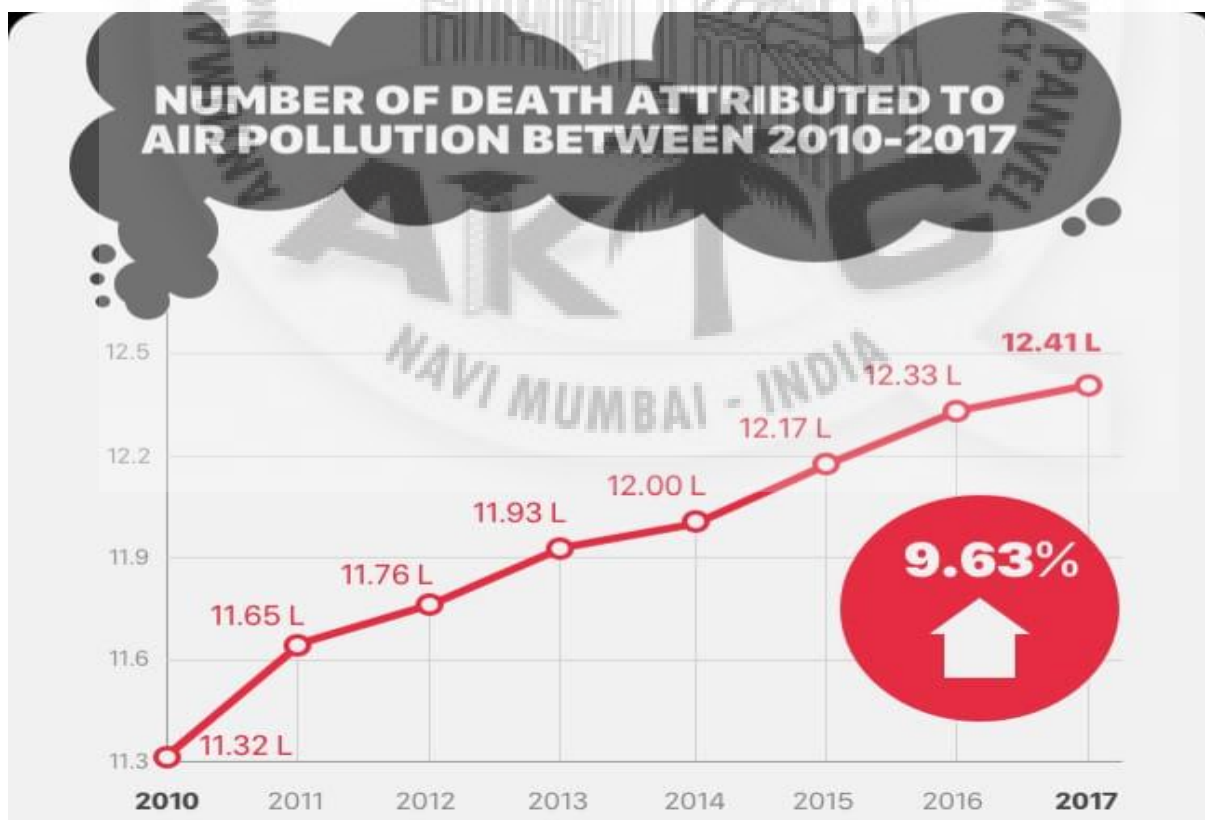
2.1.3.Survey :

- people die due to the vehicle's Air -pollution

Year	People Died
2015	3,65,000
2016	5,00,000
2017	1.2 million
2018	2.1 million
2019	2.3 million

Air pollution in India is a serious health issue. Day by day or year by year the NO. of people who died due to air pollution have been increasing. As per a study based on “2019” data, 140 million breath air that is 10 times or more over the W.H.O safe limit from which 2.3 million people were died due to those harmful gases which is released by vehicles.

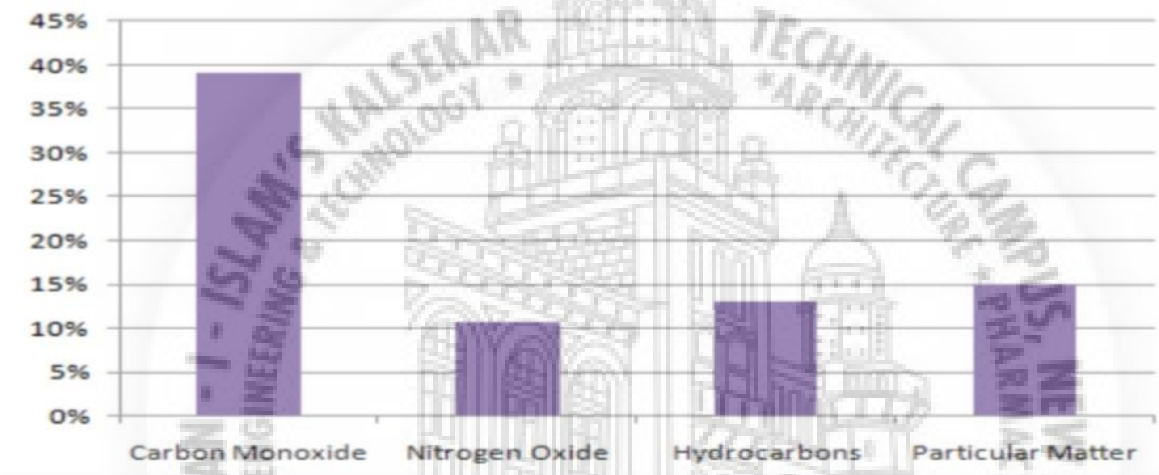
According to recent research, “1 lakh” children under 5 years of age die due to air pollution in India every year.



- **harmful gases that causes human-health and environment:**

Passenger vehicles are a major pollution contributors, produce significant amount of Nitrogen oxides, Carbon mono-oxide and other pollution. In more than half of the carbon mono-oxide and Nitrogen oxides, and almost a quarter of the hydrocarbon emitted into air.

Buses



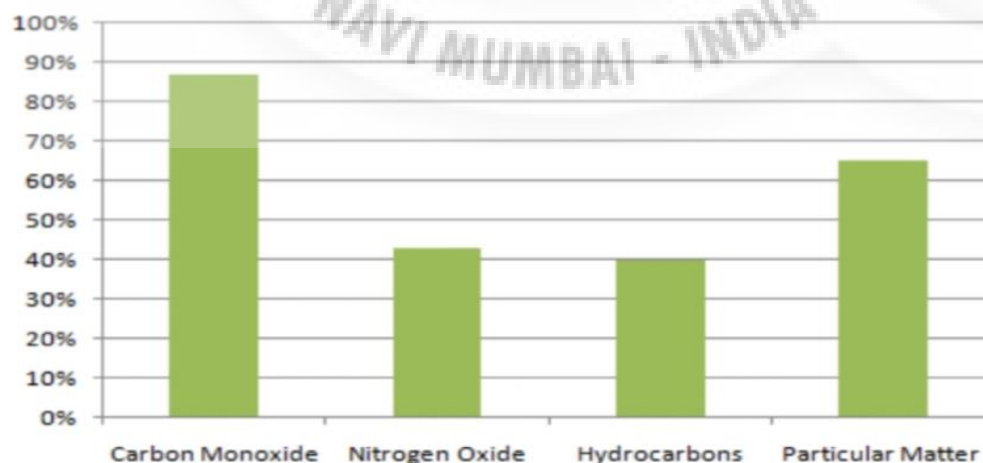
Chapter 3

Technical Details

3.1. Methodology:

In this system mq7 sensors placed at the vehicle exhaust, monitor the hydrocarbon, carbon monoxide and nitrogen oxide value emitted from the exhaust. The analog value received from the sensors is processed by the controller with Wi-Fi connection to the internet. The value obtained from the sensors is continuously updated to thingspeak cloud. When the value obtained from the sensor reaches the threshold limit, the controller will alert to the user using twilio. IOT helps the system to update the value to the thingspeak cloud. The Node MCU connected to the sensors helps to update the value obtained from the sensors to thingspeak cloud when Wi-Fi is connected to the internet. The value is continuously updated to vehicle owners cloud storage. when the value reaches the threshold limit set in the twilio, it will indicate it to the vehicle owner by sending alert message.

Cars and two wheelers



3.2. Project Requirement:

3.2.1. Software Requirement:

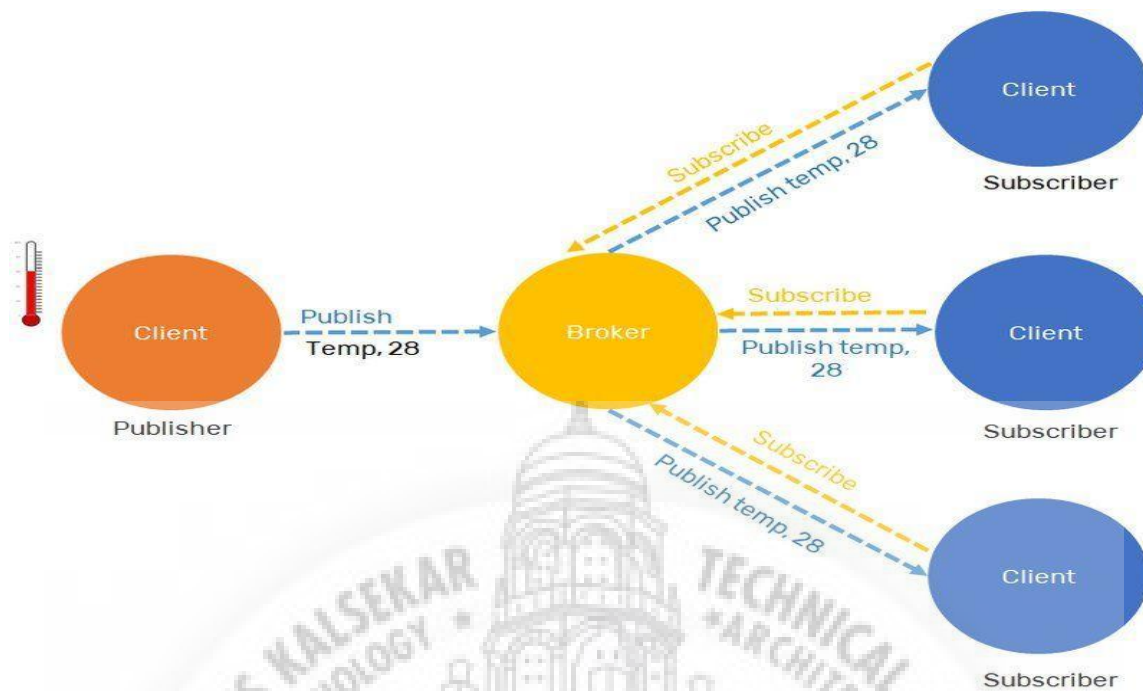
Arduino IDE, MQTT protocol, Thingspeak, twilio.

Arduino IDE:

^[4]The [Arduino](#) Integrated Development Environment ([IDE](#)) is a [cross-platform](#) application (for [Windows](#), [macOS](#), [Linux](#)) that is written in functions from [C](#) and [C++](#).^[5] It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. The source code for the IDE is released under the [GNU General Public License](#), version 2. The Arduino IDE supports the languages [C](#) and [C++](#) using special rules of code structuring. The Arduino IDE supplies a [software library](#) from the [Wiring](#) project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable [cyclic executive](#)^[6] program with the [GNU toolchain](#), also included with the IDE distribution. The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, *avrdude* is used as the uploading tool to flash the user code onto official Arduino boards.

MQTT protocol:

^[7]MQTT is a lightweight message transport protocol developed in 1999. Since this protocol is very lightweight and bandwidth-efficient, it is best suitable for IOT applications with different wireless sensor network communications that are involved. It follows the Pub/Sub model which is a publisher-subscriber model that is entirely different from the HTTP protocol's Request/Response model. One of the key features of MQTT is that it is an asynchronous protocol. The client need not be connected with the broker for the operation.



Pub/Sub model

^[7]In the Pub/Sub model, the clients don't connect directly. Instead, they are connected through a broker. The communication between publisher and subscribers are not directly either and the broker acts as a communication link between clients. Clients send messages by specifying a topic. Subscriber clients subscribe to interesting topics and messages from that topic are sent by the broker once they receive them. This model ensures that both subscriber and clients need not be connected all the time and directly each other, which enhances the security of each client.

Thingspeak cloud:

ThingSpeak is an [open-source Internet of Things](#) (IOT) application and [API](#) to store and retrieve data from things using the [HTTP](#) and MQTT protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates. ThingSpeak was originally launched by ioBridge in 2010 as a service in support of IOT applications. ThingSpeak has integrated support from the numerical computing software [MATLAB](#) from [MathWorks](#), allowing ThingSpeak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from Mathworks.

Twilio:

Twilio is a [cloud communications](#) platform as a service ([CPaaS](#)) company based in [San Francisco, California](#). Twilio allows [software developers](#) to programmatically make and receive [phone calls](#), send and receive [text messages](#), and perform other communication functions using its [web service APIs](#).

3.2.2. Hardware Requirement:

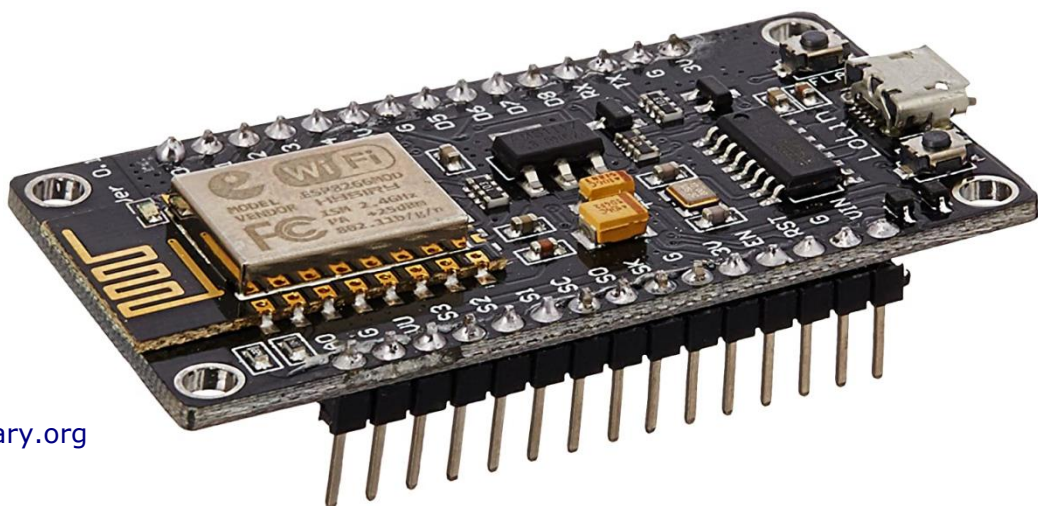
^[8]Node MCU (ESP8266), ^[8]MQ7 gas sensor, Connecting wires.

Node MCU(ESP8266):

Node MCU is a low-cost open source IOT platform. It initially included [firmware](#) which runs on the [ESP8266Wi-FiSoC](#) from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support for the [ESP32](#) 32-bit MCU was added. Node MCU is an open source firmware for which open source [prototyping](#) board designs are available. The name "Node MCU" combines "[node](#)" and "MCU" ([micro-controller](#) unit). The term "Node MCU" strictly speaking refers to the firmware rather than the associated [development kits](#).

Specification of Node MCU

- Operating system - XTOS.
- CPU - ESP8266
- Memory - 128kBytes
- Storage - 4MBytes
- Power
 - USB



MQ7 Carbon Monoxide gas sensor :

This is a simple-to-use Carbon Monoxide (CO) sensor, suitable for sensing CO concentrations in the air. The MQ-7 can detect CO-gas concentrations anywhere from 10 to 500ppm. The sensor can operate at temperatures from -10 to 50°C and consumes less than 150 mA at 5 V.

This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC.

Specification of MQ7 gas sensor

- Heating voltage (high):
5V±0.1
- Heating voltage (low):
1.4V±0.1
- Load resistance: Adjustable
- Heating resistance: 33Ω±5%
- Heating time (high): 60±1 seconds
- Heating time (low): 90±1 seconds
- Heating consumption: About 350mW
- Using temperature: -20°C-50°C
- Storage temperature: -20°C-50°C



- Relative humidity: Less than 95%RH
- Oxygen concentration: 21%(stand condition) the oxygen concentration can affect the sensitivity characteristic
- circuit voltage: $5V \pm 0.1$



Chapter 4

Market Potential

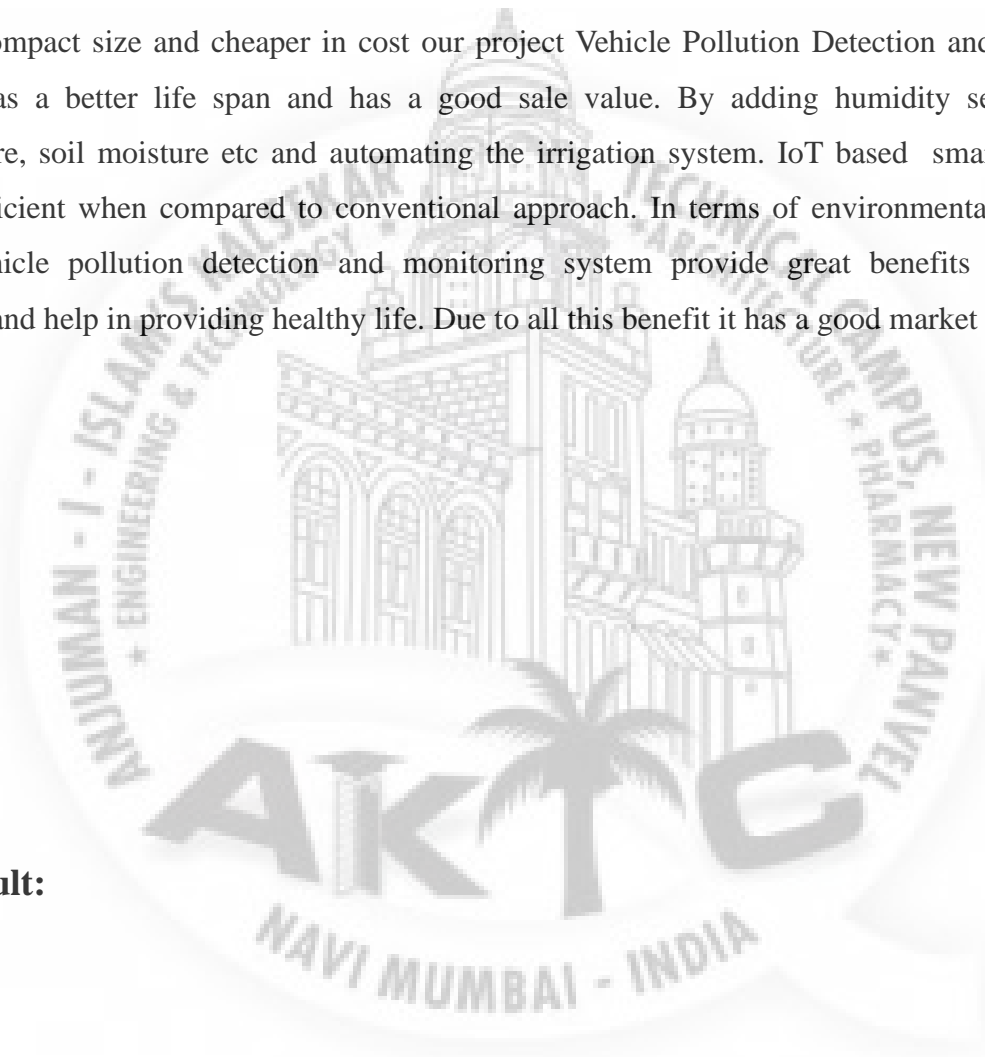
4.1. Market Potential Of Project

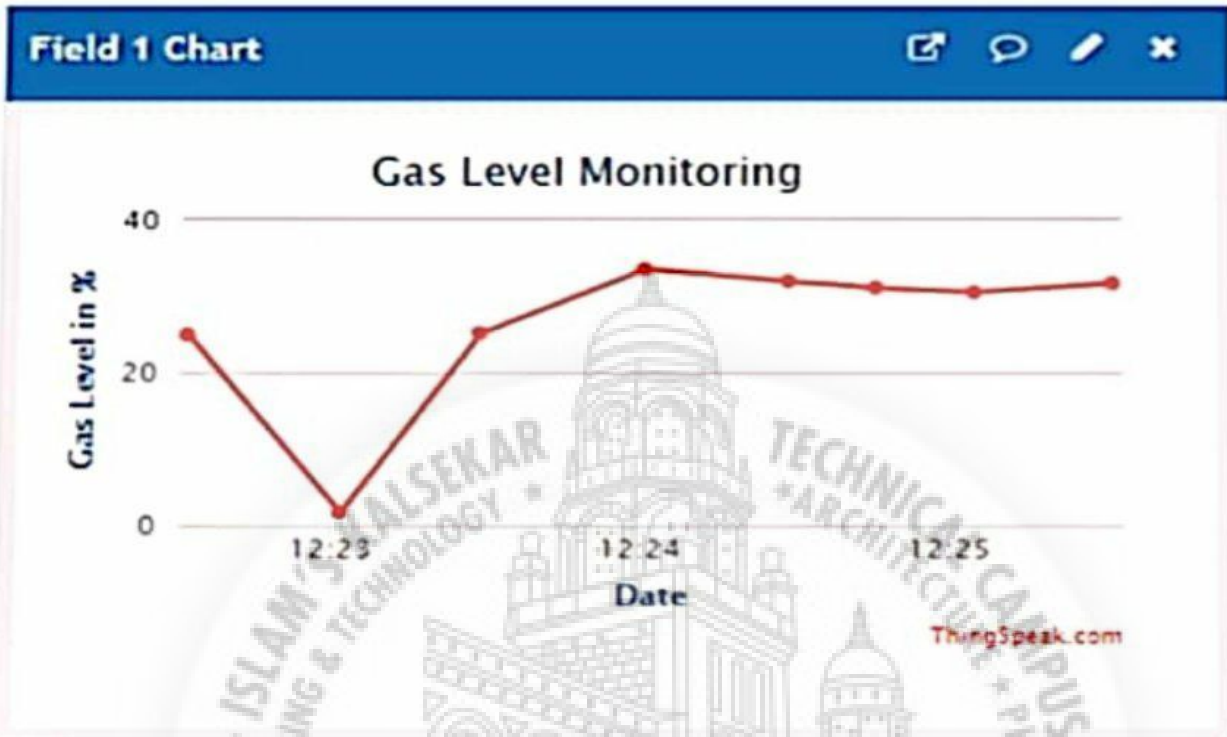
Air Quality Monitoring market is expected to grow \$6889 million by 2022. Our project Vehicle Pollution Detection and Monitoring System has a good market value because, it helps the society to protect environment and to save earth from global warming. Our project also helps the Human being to have a healthy life.

4.2. Competitive Advantage of Project

Due its compact size and cheaper in cost our project Vehicle Pollution Detection and Monitoring System has a better life span and has a good sale value. By adding humidity sensors, light, temperature, soil moisture etc and automating the irrigation system. IoT based smart farming is highly efficient when compared to conventional approach. In terms of environmental issues, IoT based vehicle pollution detection and monitoring system provide great benefits by reducing pollution and help in providing healthy life. Due to all this benefit it has a good market advantage.

4.3. Result:





VM-540604

Text Message
Fri, 28 Feb, 12:12 PM

Sent from your Twilio trial account - Smoke Concentration: %
%channel1001859%
%field1=%Be safe%

Chapter 5

Conclusion And Future Scope

5.1. Conclusion

Through this project the amount of air pollution will be considerably reduced. It will detect the presence of the pollutants only when it reaches to a particular level. It uses very cost effective parts hence it is affordable and user friendly. This model can be fit at the mouth of the silencer in the two wheelers hence when it gets the smoke input it gives an alert by checking the threshold level. This model will be a great use for the government in order to maintain the transport laws across the country.

5.2. Future Scope

The future enhancement includes a technology called rf safe stop. If the user does not respond for any of the warning messages sent then this rf safe stop technology can be used to disable the vehicle's engine. This technology is introduced by the e2v. e2v has extensive experience in the designing and manufacturing of technologies related to engine Vehicles stopping, this includes high power RF and microwave devices as well as the alike subsystems that are assembled to provide a self-contained unit. It can be triggered within a distance of 650 feet. It has been successfully tested on unmanned vehicles and boats.

Reference

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Z. David R.Gnimpieba^{a,b}, Jérôme Fortin^a

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[8]hardware requirement

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