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| **Effective prediction and prevention of air pollution caused by automobiles using IoT and Data Analytics techniques.**  Project synopsis  2/13/2016  Adarsh (1MS12CS005), Anvitha(1MS12CS005),Vishal(1MS12CS134),Vishwanath(1MS12CS135) |

**PROBLEM STATEMENT**

Climate change and Environmental Hazards have been burning issues all around the globe. Even the super powers of the world are facing these problems and solutions to these issues are the need of the hour.  
Air Pollution is a major contribution to the Environmental Pollution which not only deteriorates the quality of air and surroundings but also causes catastrophic consequences on the human health.  
Air Pollution is the presence in the ambient atmosphere of substances that interfere in the normal health of the life forms and quality of the substances causing hazards in both.  
The problem ahead of us mainly is to develop a technical solution for the air pollution occurred due to the usage of automobiles. Problems include:  
-How to reduce the emission of toxic gases from vehicles?  
-How to assist the owners of automobile in notifying them about the emission of their automobile and harm caused by it to the surroundings?  
-How to reduce the air pollution in the city as a whole by routing the vehicles to different routes prioritized based on the pollution of the specific areas?  
-How to frequently notify people about the increasing pollution in specific areas and provide solutions to reduce it?  
-Most importantly, how to deploy technology in solving the above mentioned problems?

Technology will be vital in formulating a solution to these problems provided some of the following barriers are overcome:  
-The solution should be eco-friendly.  
-The solution should be of low cost and judicial power consumption.  
-Since the solution consists of a hardware product, it should be made compact and user-friendly.  
-The solution should be durable and fault tolerant.  
-The solution provided must be subjected to timely update and scaling with reference to the changing parameters

**SYNOPSIS**

Air pollution is the introduction of particulates, biological molecules, or other harmful materials into Earth's atmosphere, causing diseases to humans, damage to other living organisms such as animals and food crops, or the natural or built environment. Air pollution can be caused due to various human activities such as industries, automobiles and burning of fossil fuels like wood ,coal etc or naturally. The air pollution from vehicles in urban areas, particularly in big cities, has become a serious problem. With the increase in the number of vehicles due to urbanization, air pollution has increased rapidly in the past few years. The primary pollutants emitted from these automobiles are carbon monoxide, oxides of nitrogen and unburned hydrocarbons. CO is considered to be the most dangerous among all these. The health risks of air pollution are extremely serious leading to various diseases such as cancer, asthma ,**Cardiovascular Disease, diabetes, bronchitis and also putting the elderly and the kids at a higher risk. As a result various measures are taken to reduce the vehicular pollution.**

**The factors that contribute to vehicular pollution are poor fuel quality,oldvehicles,inadequatemaintenance,oldautomativetechonologies and traffic management. Thus vehicles that are more fuel efficient and those that produce fewer emissions are some of the means by which we can reduce transport related air pollution..** Emission from vehicles cannot be completely avoided but, it definitely can be controlled. **In this system we are trying to control the emission of poisonous gases due to incomplete combustion** which can be achieved by restricting the fuel supply to the engine when the level of pollutant let out by the vehicle exceeds the predefined safe value.

**OBJECTIVES:**

This basically project aims at reducing the air pollution and finding a technical solution for the same. We aim currently on the vehicular emissions and try to use a technological solution to restrict the excess exhaust of pollutants from the vehicles.

The project aims at enabling facilities such as:

***Message intimation by the system to the owner of the vehicle for the service that is required by the vehicle on excess of the carbon monoxide and/or nitrogen oxides.***

A message will be sent to the owner of the vehicle whenever his/her vehicle emits excess of CO and/or NOx, which is decided by the threshold set for these values and also based on the area the owner resides. This message will intimate the owner to get the vehicle serviced so as to get the vehicular emissions under control. The time period provided for getting the vehicle serviced will again depend on severity of pollution in that particular area where the vehicle is registered.

***Warning message to be sent to the owner as a reminder to the inactivity towards servicing of the vehicle.***

After the first message intimation, if at all the owner is unable to get the vehicle serviced; this second message will serve as a reminder to the owner about the status of the vehicle’s bad condition.

***A device to be developed that blocks the supply of fuel to the engine thereby deactivating the vehicle if the owner fails to get the vehicle serviced after series of intimations.***

Even after both the intimations if the owner doesn’t respond towards the servicing of the vehicle, in order to stop the usage of the vehicle, this device will block the fuel supply and hence will ensure that the vehicle can’t be used until and unless it is serviced .

***Ranking the various areas of the city based on the air pollution levels. Graphical representations for various parts of the city based on various parameters should be provided.***

Based on the contamination level in the air for a particular region, it will be provided with a rank which will eventually be used in deciding the amount of time provided to the vehicle owners when their vehicle’s emissions are exceeding threshold. Various graphical representations for the same are to be provided based on various parameters like locality or type of area etc.

***Predictions should be provided based on the current levels of the pollution and certain precautionary measures to be suggested.***

Based on the available data, certain predictions will be made informing people about the adverse effects of the rising air pollution. These predictions will be basically about what all can happen if the same contamination rate of air continues for certain period of time. Along with such predictions, precautionary measures can be suggested to the general public and to spread the awareness about it. We call it “Tip of the week” and "Tip of the day". The former will alert the people about uneven increase of the pollutants in the atmosphere of the area over a week and provides air pollution preventive measures. The latter is a daily notification sent to all the registered vehicle users which contains information about the highly polluted area and asking the residents/passers of'/from that area not to use their vehicles unless there's necessity.

**Routing of vehicles based on Air pollution at different locations.**

The route which a vehicle takes to reach a destination from a source is usually decided based on the distance, traffic etc but the project aims at considering another important parameter: Air pollution levels, to route. The vehicles can take different routes from the usual so as to account as least as possible for the air pollution in the city.

**TECHNICAL DETAILS:**

**MQ7 –CO Sensor**

Sensitive material of MQ-7 gas sensor is SnO2, which with lower conductivity in clean air. It make

detection by method of cycle high and low temperature, and detect CO when low temperature (heated

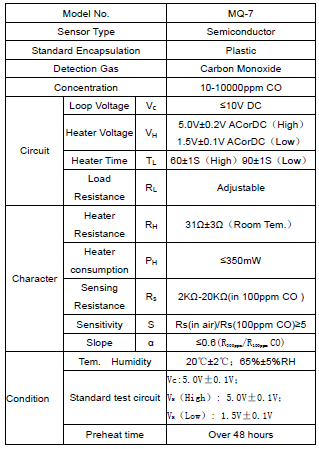
by 1.5V). The sensor’s conductivity is more higher along with the gas concentration rising. When high

temperature (heated by 5.0V), it cleans the other gases adsorbed under low temperature. Please use

simple electro-circuit, Convert change of conductivity to correspond output signal of gas concentration.

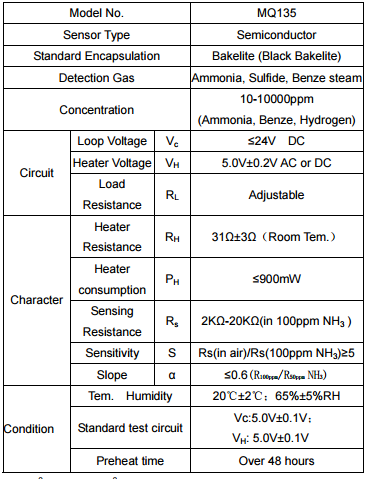
MQ-7 gas sensor has high sensitity to Carbon Monoxide. The sensor could be used to detect

different gases contains CO, it is with low cost and suitable for different application.



**MQ135 GAS Sensor**

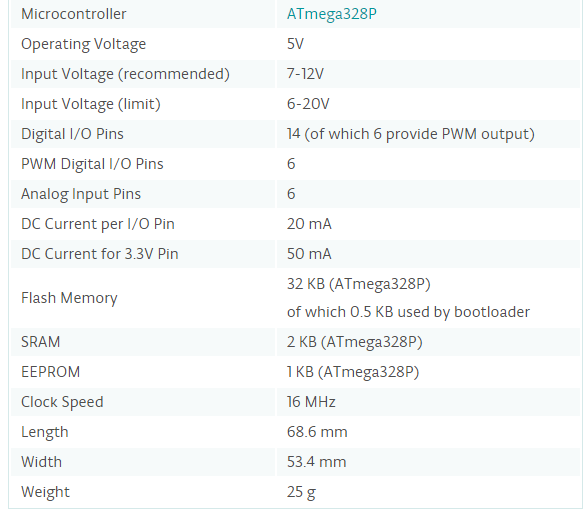
MQ135 Semiconductor Sensor for Air Quality Control Sensitive material of MQ135 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, The sensor’s conductivity is more higher along with the gas concentration rising. Please use simple electro-circuit, Convert change of conductivity to correspond output signal of gas concentration. MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benzene steam, also sensitive to smoke and other harmful gases. It is with low cost and suitable for different application.



**Arduino**

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino is an open-source computer  hardware and software company, project and user community that designs and manufactures [microcontroller](https://en.wikipedia.org/wiki/Microcontroller)-based kits for building digital devices and interactive objects that can sense and control objects in the physical world. [Arduino boards](https://www.arduino.cc/en/Main/Products) are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.  Arduino consists of both a physical programmable circuit board (often referred to as a [microcontroller](http://en.wikipedia.org/wiki/Microcontroller)) and a piece of [software](http://arduino.cc/en/Main/Software), or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board

The Uno board can be powered via the USB connection or with an external power supply. The power source is selected automatically. The board can operate on an external supply from 6 to 20 volts. The ATmega328 has 32 KB (with 0.5 KB occupied by the boot-loader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the [EEPROM library](https://www.arduino.cc/en/Reference/EEPROM)).





**INNOVATIVENESS AND USEFULNESS:**-Deployment of a technical solution to an environmental issue.  
-Devising a user-friendly, eco-friendly, low cost device to control the toxicity of the vehicular emissions.  
-Using Data Analytics to analyze the air pollution parameters and derive insights out of the data to acknowledge people about the amount of air pollution and preventive measures of it.  
-Enforcing effective solutions to restrict the usage of automobile.  
-Using analytics to predict the growth of air pollution and provide solutions to avoid the hazards.  
-Innovative method of routing the vehicles based on the pollution levels of different areas so as to avoid over pollution at key locations unlike the existing routing algorithms that prioritize routes based on the traffic.  
-Easily implementable hardware which eventually might be ubiquitous in automobile.  
-Most important use of the whole project is to tackle causes of air pollution and reduce the same.