Control of vehicle pollution through Internet of things (IOT)

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Abstract: The large majority of today's cars and trucks travel by using internal combustion engines that burn gasoline or other fossil fuels. The process of burning gasoline to power cars and trucks contributes to air pollution by releasing a variety of emissions into the atmosphere. Emissions that are released directly into the atmosphere from the tailpipes of vehicles are the primary source of vehicular pollution. With the increase in urbanization and industrialization and due to poor control on emissions, a great amount of particulate and toxic gases are produced. So, in our proposed system we use of a spectrophotometer (Spectrophotometry method) as a sensor to identify the toxic gas. Missions are measured during regular basis and informed to the user if above the permitted level and the failure of the sensor. If the user doesn't take any action within a week the alert is passed to the server of the pollution monitoring center through Internet of Things (IoT). The center decides the fine amount and intimates the user.

Keywords: Toxic Gases, Spectrophotometry, Monitoring Unit, Internet of Things, Permitted Level.

I. INTRODUCTION

Nowadays, vehicle usage is very much higher. Most of the people are using gas fuel instead of petrol or diesel. This method is quite easy but on the other hand, it is harmful also. Transportation can be responsible for more than 50% of carbon monoxide in the air. The air pollution may lead to Chronic Obstructive Pulmonary Disease (COPD) and escalates the risk of cancer. The public health is affected due to pollution from cars and trucks can also be very high in the large metropolitan cities. One of the major reasons of air pollution is the emission of polluting gases from vehicles which is responsible for 70% of the total air pollution. So, these types of vehicles required proper monitoring. So the amount of air pollution needs to be monitored and vehicles responsible for polluting should be identified. Internet of Things may become helpful in cities for monitoring air pollution from vehicles and also data related to the amount of pollution on different roads of a city can be gathered and analyzed. Recent approaches in sensing technology, especially in the area of Wireless Sensor Networks (WSNs), it now empowers environmental monitoring in real time at special and temporal scales [3]. This paper specially designed to operate the system using sensor network and gather the information about pollutant levels discharged by the vehicles. IoT is a new technology which draws the consideration for both academia and industry. This paper aims to modify an existing safety model employed in the domestic field. The aim of this paper is designing a microcontroller based toxic gas detection, and if the gas has detected it automatically alert the owner and also the vehicle door will be automatically opened then it transmits the warning message to the authorized user.

II. DESIGN METHODOLOGY

A. SPECTROPHOTOMETRY

Spectrophotometry is a method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through the sample solution. The basic principle is that each compound absorbs or transmits light over a certain range of wavelength. This measurement can also be used to measure the amount of a known chemical substance. Spectrophotometry is one of the most useful methods of quantitative analysis in various fields such as chemistry, physics, biochemistry, material and chemical engineering and clinical applications. A spectrophotometer is

an instrument that measures a number of photons (the intensity of light) absorbed after it passes through the sample solution. With the spectrophotometer, the amount of a known chemical substance (concentrations) can also be determined by measuring the intensity of light detected. Depending on the range of wavelength of light source, it can be classified into two different types: 1. UV-visible spectrophotometer: uses light over the ultraviolet range (185 - 400 nm) and visible range (400 - 700 nm) of electromagnetic radiation spectrum. 2. IR spectrophotometer uses light over the infrared range (700 - 15000 nm) of electromagnetic radiation spectrum. Invisible Spectrophotometry, the absorption or the transmission of a certain substance can be determined by the observed color. For instance, a solution sample that absorbs light over all visible ranges (i.e., transmits none of the visible wavelengths) appears black in theory. On the other hand, if all visible wavelengths are transmitted (i.e., absorbs nothing), the solution sample appears white. If a solution sample absorbs red light (~700 nm), it appears green because green is the complementary color of red. Visible spectrophotometers, in practice, use a prism to narrow down a certain range of wavelength (to filter out other wavelengths) so that the particular beam of light is passed through a solution sample.
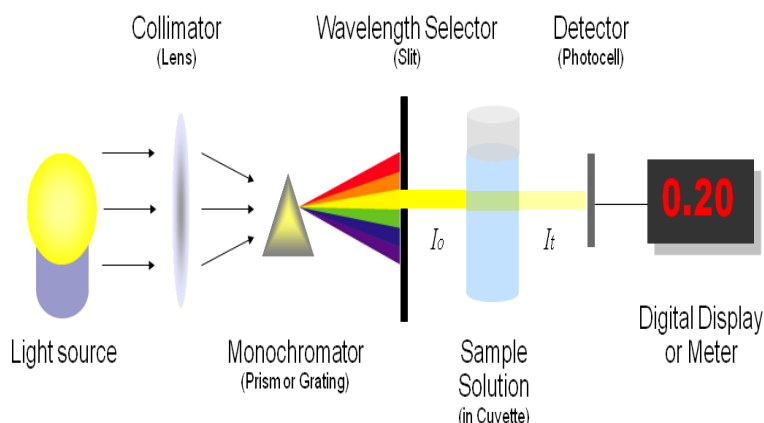

Fig 1: Basic Structure of Spectrophotometers (Illustrated by Heesung Shim)

You need a spectrometer to produce a variety of wavelengths because different compounds absorb best at different wavelengths. For example, p-nitrophenol (acid form) has the maximum absorbance at approximately 320 nm and p-nitrophenolate (basic form) absorb best at 400nm, as shown in Figure2.
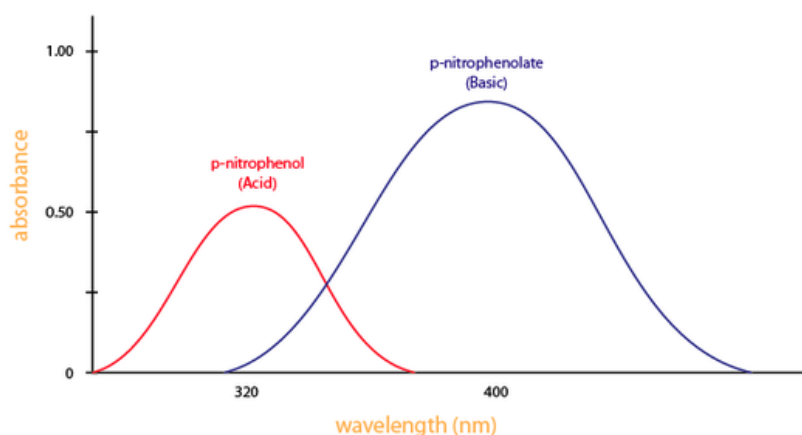

Fig 2: Absorbance of Two Different Compounds

B. IOT SYSTEM

IoT systems allow users to achieve deeper automation, analysis, and integration within a system. They improve the reach of these areas and their accuracy. IoT utilizes existing and emerging technology for sensing, networking, and robotics. IoT exploits recent advances in software, falling hardware prices, and modern attitudes towards technology. It's new and advanced elements bring major changes in the delivery of products, goods, and services; and the social, economic, and political impact of those changes.

III. PROPOSED SYSTEM

The proposed system is based on two units. It has two implementation parts: First, we monitor the emission level using a spectrophotometer. This is called as vehicle unit. Second, we maintain the database for making fine amount and future purpose. This is called as server unit. To reduce the complexity of multiple units, these two methods are used.

A. VEHICLE UNIT

The vehicle unit consists of sensors, ADC, microcontroller and Wi-Fi module. In this unit, the sensor is used to collect the data of pollution due to the vehicle. This data fed to ADC analog to digital converter which converts all analog data to digital data. This digital data afterward fed to the microcontroller. The microcontroller in each vehicle contains specific identity number. In this unit, the Wi-Fi module receives data from vehicle unit which consist of information regarding pollution and identity number of the vehicle. This data is fed to the server unit.

B. SERVER UNIT

Server side unit consists of the database at the server. This database consists of data regarding pollution standards and vehicle owner identity. The database is stored with the help of MY SQL. The server will compare original standard with data from the vehicle. If pollution overcomes predefined value a message will generate in the favor of vehicle owner to convey him his vehicle not working properly.
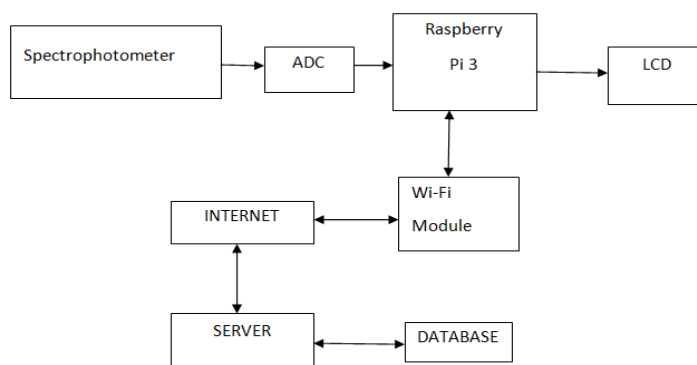
Fig 3: Proposed System

C. HARDWARE IMPLEMENTATION

I.SPECTROPHOTOMETER

A spectrophotometer is a method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through the sample solution. The basic principle is that each compound absorbs or transmits light over a certain range of wavelength. This measurement can also be used to measure the amount of a known chemical substance. A spectrophotometer is one of the most useful methods of quantitative analysis in various fields such as chemistry, physics, biochemistry, material and chemical engineering and clinical applications.

II. LINEAR IMAGE SENSOR

A linear image sensor is a solid-state device that converts an optical image into an analog signal in a line-by-line fashion. There are two types of linear image sensors with distinct circuit configurations: CMOS image sensors and CCD image sensors. Linear image sensors are suitable for applications such as copier scanning components, image scanners, barcode readers and banknote recognition systems in banking terminals. The TCD1304DG is a high sensitive and low dark current 3648-elements linear image sensor. This device consists of sensitivity CCD chip. The TCD1304DG has electronic shutter function (ICG). Electronic shutter function can keep always output voltage constant that vary with the intensity of lights.

Fig 4: Linear Image Sensor

III. RASPBERRY PI 3

The Raspberry Pi is a series of credit card–sized single-board computers developed in the United Kingdom by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools and developing countries. The original Raspberry Pi and Raspberry Pi 3 are manufactured in several board configurations

through licensed manufacturing agreements with Newark element14 (Premier Farnell), RS Components and Egoman. The hardware is the same across all manufacturers.
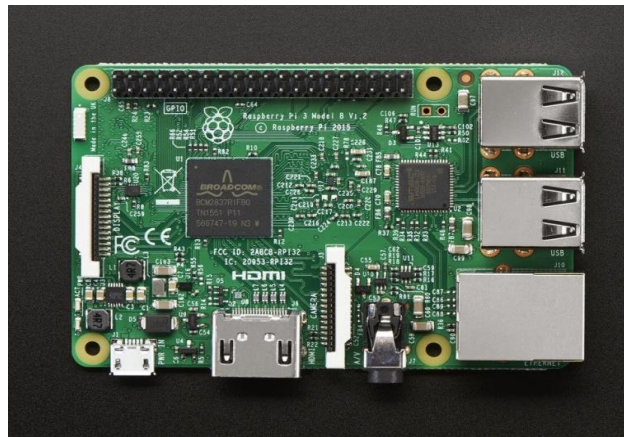

Fig 5: Raspberry Pi 3

D. SOFTWARE IMPLEMENTATION

I.CSS SOFTWARE

Cascading Style Sheets are arguably one of the greatest things that happened to the web just over a decade ago. As you were writing your HTML in the previous tutorial, you might have thought that building a web page was lacking something. CSS is not only beautiful and stylish, but it is also very efficient. Cascading Style Sheets reside on the client side, which means the user can, with the correct knowledge, see all of your CSS files. Style Sheets were invented because the internet was plum boring due to the creators being scientists who were primarily interested in using the internet as a medium for communication.

II. MySQL

Databases are a key component of the most Web-based business, storing everything from basic user credentials (e.g., username and password) to complex purchase histories. There are several facets of database systems that are courses in their own right and are beyond the scope of this document – for example, database implementation, and database normalization (i.e., designing tables to minimize the duplication of data). The typical setup for a database management system (DBMS) is based on a database server, which handles the storage of data and provides the interface between the users (i.e., programmers) and the data itself.

RESULTS

IOT based pollution monitoring system is developed and the performance of the developed system is verified successfully for various vehicles. The monitoring system displays the pollutants levels of the vehicle. The controller sends the details of the vehicle and the pollutant values to the server for monitoring the pollution levels of the vehicle. The Server displays the pollutant levels and vehicle number along with its IP address. If any vehicle exceeds the permissible pollution level then a message is sent to the vehicle owner that advice pollution level of vehicle and also a penalty for causing pollution.

CONCLUSIONS

The concept of detecting the level of Pollution and indicating it to the driver is implemented. This system is cost effective solution for vehicle emission problem. From analysis discussion, we concluded that co exhaust can be reduced by using this system. Security at server side is maintained as an only authorized person can only know the information of pollution through vehicles. Hence this system will be highly beneficial in curbing this problem.

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