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GSM BASED VEHICLE CARBON DIOXIDE EMISSION PREDICTION SYSTEM

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ABSTRACT

Transportation sector accounts for a large proportion of global greenhouse gas and toxic pollutant emissions. Even though alternative fuel vehicles such as all-electric vehicles will be the best solution in the future, mitigating emissions by existing gasoline vehicles is an alternative countermeasure in the near term. The aim of this study is to predict the vehicle CO_2 emission per kilometer and determine an eco-friendly path that results in minimum CO_2 emissions while satisfying travel time budget. The vehicle CO_2 emission model is derived based on the theory of vehicle dynamics. Particularly, the difficult-to-measure variables are substituted by parameters to be estimated. In this paper, we present a solution to monitor CO_2 emissions produced by vehicle. We integrated CO_2 sensor to predict emissions give to Arduino microcontroller. It process the data if emission level is fine it ignores else it alert using buzzer and send GSM SMS to the registered mobile number. The system is implemented based on distributed sensor nodes. We determine that the CO_2 levels in our vehicle which is within tolerable limits. The system developed has been used as a tool to take actions in order to reduce the environmental pollution, and at peak hours when the system indicates that pollution levels are high.

1. INTRODUCTION

Since the industrial revolution, the concentration of CO_2 in the atmosphere has increased significantly. Nowadays, the CO_2 concentration has increased in the atmosphere at least a 30% than in 1975, leading to increase greenhouse gases that contribute to global warming. The main cause of greenhouse is CO_2 contamination, which contributes about 64% to these phenomena. Currently, we are aware about climate change around the world, however we often think that pollution does not affect our daily activities, and we indirectly perceive its effects and therefore we are unable to generate effective changes to prevent pollution. It is estimated that in the global context around 24,000 million tones of CO_2 are emitted per year, in first place by the countries of the Organization for Economic Cooperation and Development (OECD) with 52%, followed by Russia with 14%, and China with 13%. United States CO_2 emissions are about 5,500 million tones, representing almost a quarter of the global total. Latin America including Mexico, with 360 million tons represents about 1% of global emissions. According to the World Health Organization (WHO), 2.7 million people worldwide die each year due to health problems related with pollution by CO_2 emissions.

Previous works in the literature are proof of the increasing human concern to try to change the effects caused by CO_2 emissions indoor or outdoor. The gas in larger quantities that has been monitored is CO, for example in a mathematical model for monitoring CO in indoor scenarios is presented. In, an evolution in the treatment of the data produced by using a Zigbee network is showed, however the main problem and limitation of such implementation is the equipment used since the modules had a proprietary code. In, a study to determine the Vehicle Ad- hoc Networks (VANET) and to inform contaminated routes to vehicles for not running on these routes is showed. As we can see, in the previous cases, monitoring of CO_2 related to vehicles emissions has been already previously conducted. In this sense, we propose to use open source equipment; in this way we can use multiple platforms and development environments for its implementation according to the requirements. The use of Wireless Sensor Networks (WSN) allows an easy deployment of nodes with the Zigbee communication protocol in order to send and receive data. The most common health problems related to CO_2 exposure are: asthma, allergy, stress, among others. In such sense, the aim of this work was to determine the level of pollution generated by vehicles circulating around campus, and to report these levels and the times where the CO_2 emissions increase. We divided our study in two stages, the former in order to acquire information about the air pollutants, specifically CO_2 gas, a real-time wireless air pollution monitoring system was designed and developed, and later the analysis of data sensed. With the fast development of the industrialization and urbanization process in the world, environmental pollution is now a common problem in most of the countries. Environmental pollution includes; air pollution, water pollution and soil pollution. Air pollution can be defined as the presence of contaminants or pollutant substances in the air that interfere with human health or welfare, or produce other harmful environmental effects. These pollutant substances usually result from vehicle emissions, Industrial emissions and volatile organic compounds. The health issues caused by air pollutants are difficulty in breathing, coughing and aggravation of existing respiratory and cardiac conditions. The World Health Organization states that 2.4 million people die each year from causes directly attributable to air pollution, with 1.5 million of these deaths attributable to indoor air pollution. Based on the fact mentioned above, there is a need to focus on air pollution monitoring activities. Due to the rapid development of communication technology, network technology and remote sensing technology, there is a trend that air pollution monitoring system is often designed in wireless mode. Wireless Sensor Network (WSN) has been rapidly developed during recent years. Starting from military to industrial controls and its advantages include the liability, simplicity, and low cost. The (WSNs) are a kind of self-configuring networks which consist of large numbers of low-cost, low-power, multi-functional wireless sensors nodes. These wireless sensor nodes, which are small in size, are capable of sensing and reacting to specific physical or environmental conditions, such as temperature, sound, pressure, speed, humidity, and so on. These sensor nodes have the wireless

communication ability in short distances and pass their data through the network to their desired locations. In a WSN, the position of wireless sensor nodes need not to be pre-determined, this is because, a wireless sensor node may join in or leave the network very quickly and unpredictably. WSN provides a bridge between the real physical and virtual worlds. It has the ability to observe the places where it is difficult to fix the wired system and at terrestrial environments at a fine resolution over large scales. Its characteristics give the WSN a wide range of applications, such as industrial automation, agricultural monitoring, air pollution monitoring, health care, security systems, etc.

2. LITERATURE SURVEY

A number of air quality monitoring systems have been developed by researchers. For instance, In 2008, Völgyesi, P. et al introduced a Mobile Air Quality Monitoring Network (MAQUMON) that utilized moving vehicles equipped with sensor nodes to monitor air quality in a large area. Each sensor node consisted of a microcontroller, an on-board Global Positioning System (GPS) unit, and a set of sensors to detect the concentrations of ozone (O3), Carbon Monoxide (CO), and nitrogen dioxide (NO2). The node was able to send the sensed data to the gateway in a car through the Bluetooth connection. When the car move, the sensor node detects the concentrations every minute and store the data tagged with location information into a memory. When the car moves to a Wi-Fi hotspot, the gateway in the car transmits the data to the server, and the data would be processed and published on the sensor Map portal. MAQUMON provides a record regarding air quality and pollutant dispersion within the area. But this monitoring system could not immediately send the monitoring data back. Kavi K. Khedo, at el proposed an innovative system named Wireless Sensor Network Air Pollution Monitoring System (WAPMS) to monitor air pollution in Mauritius through the use of wireless sensors deployed in huge numbers around the island. In order to improve the efficiency of WAPMS, they designed and implemented a data aggregation algorithm named Recursive Converging Quartiles (RCQ). The algorithm is used to merge data to eliminate duplicates, filter out invalid readings and summarize them into a simpler form which significantly reduce the amount of data to be transmitted to the sink and thus saving energy. For better power management they used a hierarchical routing protocol which causes the nodes to sleep during idle time. North, R., et al developed an integrated mobile environmental sensing system to support the management of transport and urban air quality. Sensor nodes are deployed on vehicles and infrastructure to monitor traffic, weather and pollutant concentrations at far higher spatial and temporal resolutions and send data into a dynamically configurable computing platform that supports both near real-time incident management and longer term strategic planning decisions. The work done by Jelicic et al. introduces an Indoor Air Quality monitoring (IAQ) system using a sensor network that integrates a power management approach to reduce sensors energy consumption by using an adaptive duty cycling mechanism for metal

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oxide semiconductor (MOX) gas sensors. The work done by Liu et al. proposes a Wireless Sensor Network (WSN)-based urban air quality monitoring system that is connected to a GSM system for centralized control by a Lab VIEW program that stores sensed data in a database. They implemented the monitoring systems in the city road of Taipei to monitor the carbon monoxide (CO) concentration caused by vehicle emissions. central chip that initializes all variables in the environment and thus enable the necessary ports to power sensors and sensor boards, one of the biggest advantages of these modules is that they support different communication protocols, Fig. 1 shows a photo of the current Wasp mote module, the battery consumption levels are low (ON: 15mA, Sleep: 55µA), and it is possible to connect a solar panel to recharge the battery. The American company Digit manufactures the XBee modules. These devices have embedded RF modules with different wireless protocols, in outdoor environments they can reach up to 1.6 km with line of sight. For our System, we use XBee Pro series 2 modules, which is depicted in Fig. 2, them use the ZigBee protocol for communicate with each other, and a firmware called DigiMesh which allows mesh networking, this ensures that all modules are communicating even if one fails, the other nodes supply this missing [10].

3. EXISTING SYSTEM

In the existing system of CO_2 monitoring model we can detect the Pollution level depending on CO_2 concentration. This information is monitor on LCD alert to user does get any alerts if it increases the level. In this proposed system we integrated automated LED indicators for every level of CO_2 emission it's very useful to user to detect CO_2 level easily. It automatically alerts us using buzzer and GSM mode. CO_2 information we posted into GSM SMS so that we can monitor CO_2 data from anywhere in the world.

4. PROPOSED SYSTEM

Our proposed work consists of various units that make up the system: the power supply unit, the pollution detection unit, display unit, alarm unit and indicating unit. An LCD display will be fitted inside the campus. The ATmega328 microcontroller under the brand name of Arduino Uno will be used to keep looking for the output from the pollution sensor MQ2 sensor. The Arduino Uno sketch which is the environment for programming is used to write the code, compile, generate hex file and load it to the microcontroller.

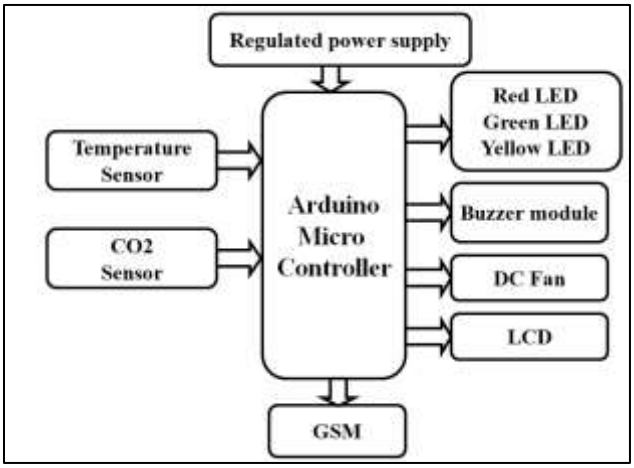

Fig.1. Proposed block diagram

WORKING MODEL:

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The system proposes a design to fit monitoring applications on smart phones. Sensors positioned at planned locations sense the level of carbon monoxide, nitrous oxide, in the air. It provides simple access to the users to supervise real time air quality in their vicinity. It uses cost-effective and readily accessible devices such as an air quality sensor, carbon monoxide gas sensor, nitrous oxide gas sensor MQ-2 sensor. Microcontrollers are used at the sensor node for supervising these sensors. In the cloud, the data analysis is done so that the society takes measures to mitigate air pollution.

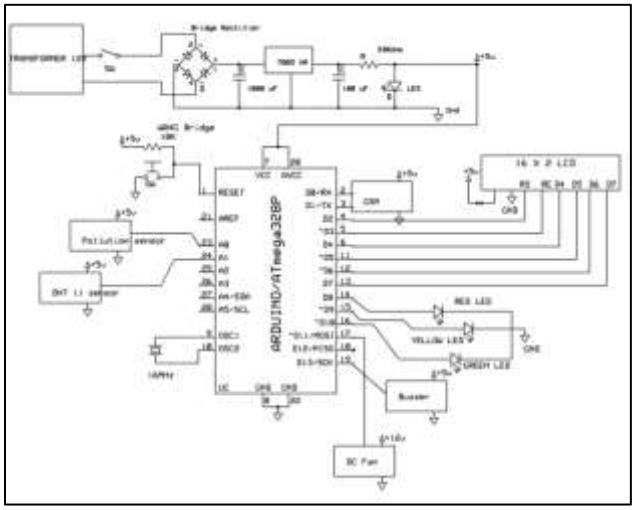

Fig.2. Proposed Circuit diagram

PIN DESCRIPTION

MQ2 pollution sensor will continuously monitor the pollution level and gives to the Arduino controller. If the pollution level is very low, then controller indicates with green LED. If the pollution level is medium, then controller indicate with yellow LED. If the pollution level is very high, then controller indicates with RED LED with buzzer alarm along with GSM sms.

5. RESULTS

Fig.3. Proposed Output model

First, we have to give the contact number to whom the messages and the pollution readings should be send, then it gives the message as number is registered.

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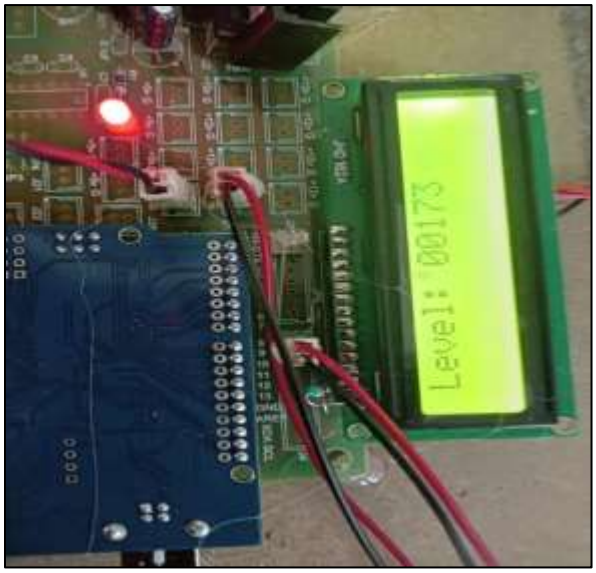

Fig.4. LCD Output Level Indication

Table.1 Results comparison Table

Parameter	Existing Model	Proposed Model
Microcontroller	8051	Arduino
Speed	Low	High
Complexity	High	Low
Efficiency	LOW	HIGH

6. CONCLUSION

We designed and implemented GSM bae-sed system to predict carbon dioxide emission levels in vehicle**.** We integrated C02 sensor to predict emissions give to Arduino microcontroller. It process the data if emission level is fine it ignores else it alert using buzzer and send GSM SMS to registered mobile number. The system is implemented based on distributed sensor nodes. We determine that the CO2 levels in our car which is within tolerable limits. The system developed has been used as a tool to take actions in order to reduce the environmental pollution, and at peak hours when the system indicates that pollution levels are high. We executed successfully results.

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