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IOT Enabled Carbon Dioxide and Carbon Monoxide Monitoring and Control for Vehicles to Reduce Air Pollution

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Abstract: With rise in the amount of heat trapping gases the earth is getting warmer day by day, leading to global warming. CO_2 and CO is the major contributor of the greenhouse gases. The main aim of this project is to reduce the greenhouse effect by real time monitoring and controlling of CO_2 and CO emission caused due to vehicles and industries using IOT. The Internet of Things (IOT) extends internet connectivity to a diverse range of devices and everyday things that utilize embedded technology to communicate and interact with the external environment, all via the Internet. In this proposal, we have tried to make the CO_2 and CO detector intelligent by saving the CO_2 and CO levels in different regions. This model adheres to IOT and provides information for utilization of vehicular features based on the CO_2 and CO levels. The model is cost effective and also can be easily produced and integrated with vehicles and also in industries.

Keywords: - Global warming, Greenhouse gases, Internet of Things (IOT), Environment.

I. INTRODUCTION

Environmental problems due to air pollutants from motor bikes, buses, cars and trucks growing rapidly, which causes skin diseases and respiratory diseases and trigger asthma attacks. Transportation can be responsible for more than 50% of carbon monoxide in the air. This carbon monoxide can show degradation impact on human health the air pollution may lead to chronic obstructive pulmonary disease (COPD) and increase the risk of cancer. The effect of air pollution in metropolitan cities is very large and leads to effect of chronic diseases. 70% of the total air pollution is due emission of polluting gases from vehicles.

Every vehicle has its own emission of gases, but the problem occurs when the emission is beyond the standardized values. The primary reason for this breach of emission level being the incomplete combustion of fuel supplied to the engine which is due to the improper maintenance of vehicles. This emission from vehicles cannot be completely avoided, but it definitely can be controlled. To alleviate the air pollution problem caused by vehicle emissions, different vehicle inspection programs have been introduced, in which vehicles are examined by undergoing a number of emission tests. However, these emission tests are usually cost-ineffective and time-consuming.

It is also difficult to enforce the vehicle owners on monitoring the health of their engines daily and taking immediate action to fix their vehicle emission problems. Therefore, this project proposes a new vehicle emission inspection and notification system to help daily monitoring of engine health through the concept of Internet of Things (IOT) and GSM technology. The Internet of Things (IOT) is new concept which have attracted the attention of both academia and industry. IOT is implemented as a network of interconnected different objects, each of which can be addressed using unique id and communicates based on standard communication protocols.

This proposed project presented here is to monitor the Carbon dioxide and carbon monoxide emissions in vehicles using gas sensors which are connected to Arduino Mega 2560 for processing the information and passing it to cloud via an Ethernet shield the data can be accessed on any standard computer connected to internet or on Android smart phone using Blink application.

This real-time information is accessed by RTO or authority responsible to control pollution. The system also sends an alert SMS to the owner to rectify the problem of emission if the emission level exceeds the limit and provides a period of one week to rectify the same, even after the receiving the SMS and within the period allotted the vehicle is not rectified and being used in the same condition the allotted authority can turn off ignition of the vehicle using IOT, thus making it mandatory for the owner to service the vehicle to use it further.

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II. LITERATURE SURVEY

Prachi Shahane, Preeti Godabole et al [1] have studied that with rise in the amount of heat trapping gases the earth is getting warmer day by day, leading to global warming. CO_2 is the major contributor of the greenhouse gases the main of this research is to reduce the green effect by real time monitoring and controlling of CO_2 emission caused due to vehicle and industries using cognitive IOT. The internet of things(IOT) extends internet connectivity to a diverse range of device and everyday thing that utilize embedded technology to communicate and interact with the external environment, all via internet.

P. vlacheas, R. Giaffreda, V. stavroulaki, et al [2] IOT is expected to substantially support sustainable development of future smart cities. This article identifies the main issues that may prevent IOT from playing this crucial role, such as the heterogeneity among connected objects and the unreliable nature of associated services. To solve these issues, a cognitive management frame work for iot is proposed, in which dynamically changing real-world objects.

John A.Stankovic, et al[3] many technical communities are vigorously pursuing research topics that contribute to the iot now-a-days, as sensing, actuation, communication and control become even more sophisticated and ubiquitous, there is a significant overlap in these communities, sometimes from slightly different perspectives. More cooperation between communities is encouraged.

Qihui Wu et al [4] Current research on Internet of Things (IoT) mainly focuses on how to enable general objects to see, hear, and smell the physical world for themselves, and make them connected to share the observations. In this paper, we argue that only connected is not enough, beyond that, general objects should have the capability to learn, think, and understand both physical and social worlds by themselves.

III. RELATED WORK

In the Internet of Things (IOT) paradigm, many days to day objects that are around us will be on a network in some form or another and first was used in context of supply chain management. The definition was reframed and included a wide range of applications like healthcare, utilities, transport, etc. The main goal of making computer sense information without the aid of human intervention is the gist of IOT. IOT is based on harvesting information from the environment (sensing) and interact with the physical world (actuation/command/control).

It uses existing Internet standards to provide services for information transfer, analytics, applications, and communications. Various open wireless technologies have boosted the development of IOT such as Bluetooth, radio frequency identification (RFID), Wi-Fi, and telephonic data services as well as embedded sensor and actuator nodes. The research on Cognitive Internet of Things (CIOT) is very limited. A cognitive management framework is presented to empower the IOT to better support sustainable smart city development.

Cognition mainly refers to the autonomic selection of the most relevant information for the given application. CIOT is viewed as the current IOT integrated with cognitive and cooperative mechanisms to promote performance and achieve intelligence. The survey reveals that total CO_2 emissions from an average car showed that 76% were from fuel usage where as 9% was from manufacturing of the vehicle and a further 15% was from emissions and losses in the fuel supply system.

IV. PROPOSED WORK

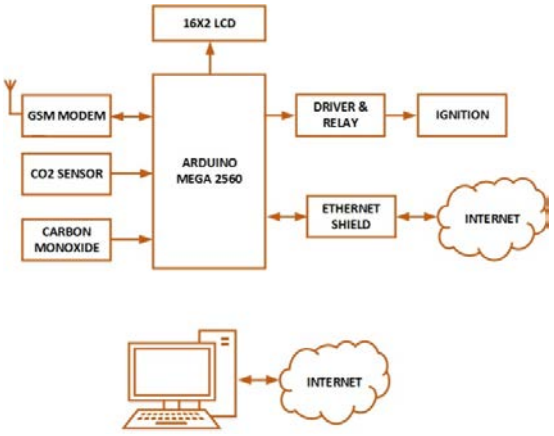

Fig 1. Proposed Unit

A. *Arduino Mega 2560:*

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can be communicating with software running on your computer (e.g. Flash, Processing, MaxMSP.) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

B. *16X2 LCD:*

A Liquid Crystal Display (LCD) is a low cost, low-power device capable of displaying text and images. LCDs are extremely common in embedded systems, since such systems often do not have video monitors like those that come standard with desktop systems. It can be found in numerous common devices like watches, fax and copy, machines and calculators.

C. GSM:

GSM800A is a Quad-band GSM/GPRS Modem that works on frequencies 850MHz, 900 MHz, 1800 MHz and 1900 MHz.SIM800A can fit almost all the space requirement in your application, such as Smart phone, PDA phone and other mobile device. The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the RF antenna interface.

The SIM800A is designed with power saving technique, the current consumption to as low as 2.5mA in SLEEP mode. The SIM800A is integrated with the TCP/IP protocol Extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, which is very useful for those data transfer applications.

D. CO_2 Sensor:

The MG-811 is highly sensitive to CO_2 and less sensitive to alcohol and CO. It could be used in air quality control, ferment process, in-door air monitoring application. The output voltage of the module falls as the concentration of the CO_2 increases.

E. CO Sensor:

MQ-7 gas sensor has high sensitivity to Carbon Monoxide. The sensor could be used to detect different gases contains CO, it is with low cost and suitable for different application.

F. Ethernet Shield:

The Arduino Ethernet Shield allows an Arduino board to connect to the internet. It is based on the WiznetW5100 ethernet chip (datasheet). Use the Ethernet library to write sketches which connect to the internet using the shield.

V. DESIGN FLOW

A. Server Module:

Billions of smart objects will be immersed in the environment, sensing, interacting, and cooperating with each other to enable efficient services that will bring tangible benefits to the environment, the economy and the society as a whole. The central board receives alerts and respective credentials from millions of vehicles. The amount of data collected at the central control is very huge. The most cost-effective solution to this is cloud. The data generated at the central board has to be put on the cloud. The data at the central server is abstracted using Data Analytics Algorithm. The abstracted data can reveal the number of alerts of a particular vehicle over a period of time say one month. If the alerts of a particular vehicle exceeded the threshold over a period of time, heavy fine can be levied on the owner. The abstracted data also provides service to the RTO or environmental office for evaluation of the vehicles.

B. Owner Module:

The vehicle owner has to install a designed CO_2 and CO detector at the exhaust to sense the level of CO_2 and CO emitted in terms of PPM. The CO_2 and CO sensor is communicating with the Arduino in the vehicle. If the CO_2 and CO level exceeds the normal PPM level (600 PPM) the Arduino sends a notification to the registered mobile of the owner. This notification is like a warning message given to the owner so that owner is allowed to rectify the vehicle.

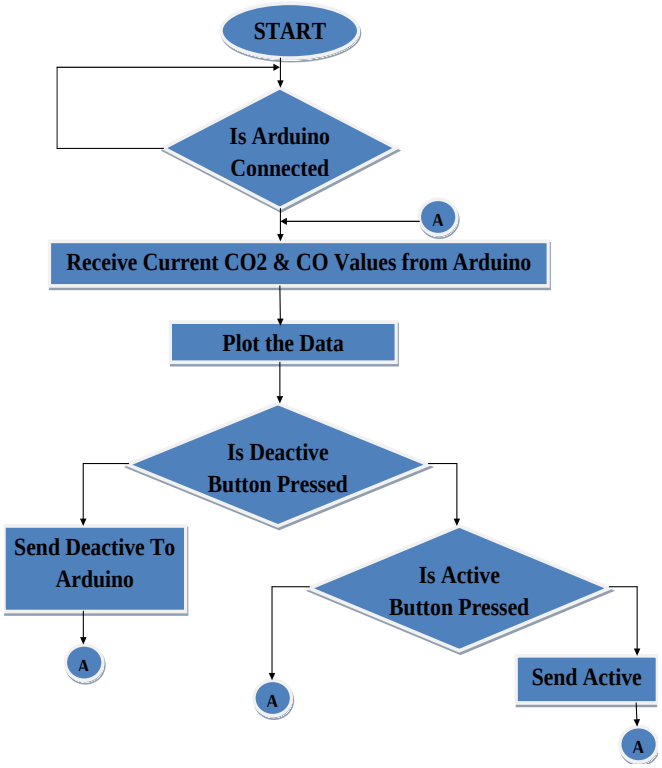

Fig 2. Server Module

If the owner does not take any action to reduce the emissions, an alert is sent to the central board via GSM module on the Arduino. This data is acts as useful semantic to take decisions about the owner at the central board. The decision taken by central board becomes a major step in reducing greenhouse effect. If the alerts at the central board exceed threshold (T1) then the board sends an warning SMS to the owner the message is like to turn off the ignition in the vehicle. The average of the alerts taken over a period of time exceeds threshold (T2) then automatically it connects to the RTO or Environmental office then the RTO or Environmental officers stop the ignition of the vehicle to the BLYNK software and further action will takes place.

VI. LIMITATIONS

Internet facility or WIFI facility is always needed to observe the movements of vehicle.

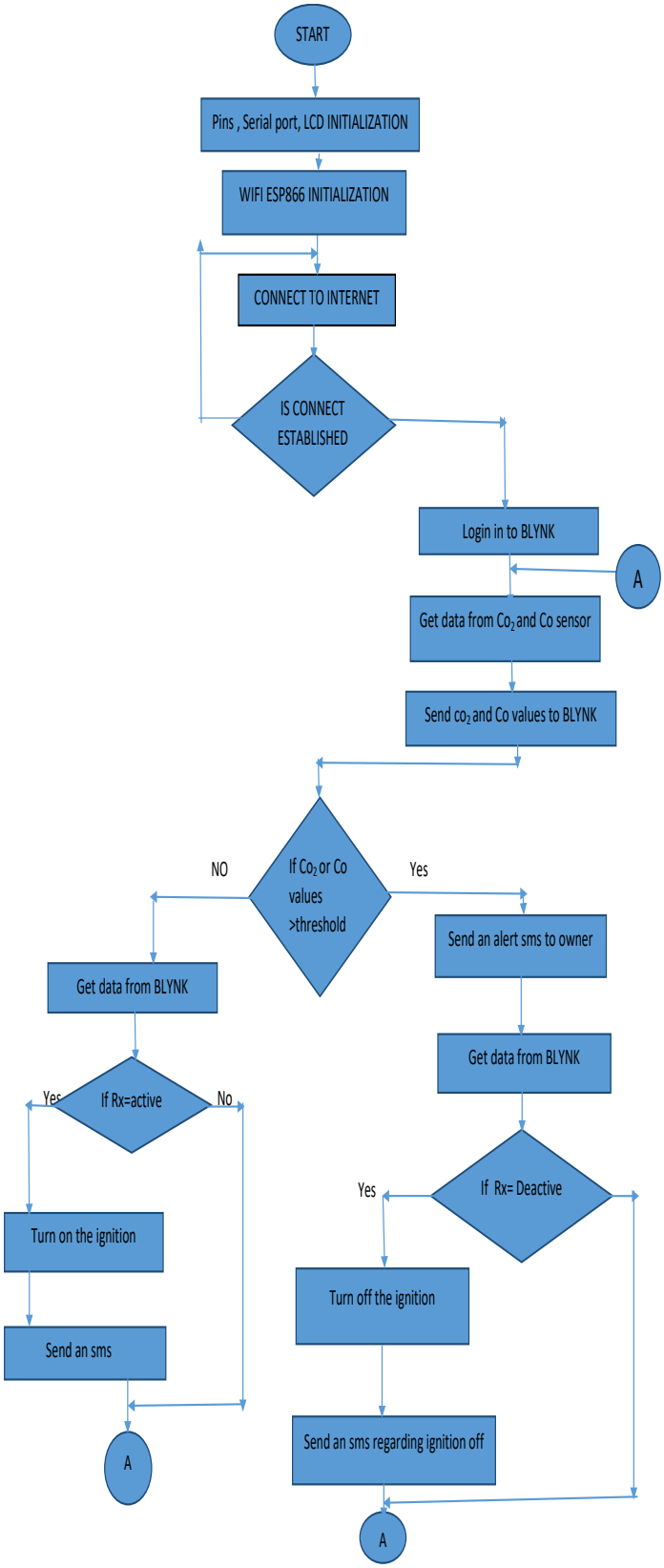

Fig 3. Flow of the design

VII. Future Scope

The proposed model detects emission of carbon dioxide and carbon dioxide. But, there are many harmful gases which pollute the environment like carbon monoxide, carbon dioxide, methane, nitrous oxide etc. The prototype can be extended to detect these gases which cause harm to our precious environment. The sensor currently used is MG811 for detection of CO_2 emission and MQ7 for detection of CO emission. It can withstand a temperature up to 70 degrees. The entire system can be installed in the exhaust of the vehicle. The prototype can not only be used in vehicles but also in many industries to measure the harmful gases to reduce air pollution caused due to these gases.

VIII. Conclusion

Pollution Check has to be done every 15days and hardly people get it done. Also the model adheres to real time monitoring of CO_2 and CO which can reduce the greenhouse gas in the environment as compared to the existing system of pollution check. This Product can cut down and control the emission considerably. It will gradually reduce Global Warming, if implemented on global scale.

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