

# IOT Based Smart System for Controlling CO<sub>2</sub> Emission

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## ABSTRACT

Pollution has a major role in damaging our earth. The rapid industrialization, fast urbanization, rapid growth in population, drastic increase in vehicles on roads and other activities of human beings have disturbed the balance of natural atmosphere. It changes the quality of climate and those climate change is brought about by the accumulation of greenhouse gases in the atmosphere. One of the greatest environmental problem facing the world today is global warming caused by emission of greenhouse gases. Carbon dioxide, which is an important constituent of environment is causing a warming effect on the earth's surface. To save our environment, monitoring and controlling these changes is a big challenge. In terms of a long range control of CO<sub>2</sub> emission at their source is a more desirable and effective method through preventive and control technologies. The main objective of this paper is to implement IoT to measure the CO<sub>2</sub> emission from public transports, industries and forest fires using Raspberry pi which is sensitive to CO<sub>2</sub>. The amount of Carbon dioxide emitted is sensed continuously in a city and also finding the area which is polluted the most. Also implement a smart system for early detection of forest fires or wild fires. Wild fires, are uncontrolled fires occurring in wild areas and cause significant damage to natural and human resources and the wildfires emit more CO<sub>2</sub> gas than assumed in state climate target. These are then integrated to the IOT which is more securable and many services can be used along with it. This would enable a Simple Notification Service (SNS) to the mobile phone if the particular area is causing higher level of CO<sub>2</sub>.

**Keywords :** IoT(Internet Of Things), SNS(Simple Notification Service), GVG(green vehicle guide), GPS ( Global Positioning System ), MAQUMON(Mobile Air Quality Monitoring Network)

## I. INTRODUCTION

The life and health of all living beings are related to the prevailing climatic conditions. A warming climate will make changes that can affect our water supplies system, agricultural production, power and transportation systems, the natural environment interactions, and even our own health and safety. Certain changes to the climate are unavoidable these disturbances tend to reduce biodiversity. Pollution is unwanted, harmful stuff contaminating an environment and it leads to a major imbalance and threatens the normal ecological cycles. Poor air quality causes many respiratory problems like asthma and bronchitis, intensify the risk of life-threatening conditions with substantial medical costs. This Particulate matter is singlehandedly responsible for up to 20,000 premature deaths each year. The immediate alterations that the world is witnessing is Global warming. With increased temperatures worldwide, Gradual increase in sea levels

and melting of ice from colder regions and icebergs, displacement and loss of habitat of many lives have already signaled an threatening disaster if actions for preservation and normalization aren't initiated immediately.

The Internet of Things (IoT) is an emerging technology, the interconnection of embedded computing devices within the existing Internet infrastructure which allows direct device to device communicationns.

The IoT concerns the connection of physical device to the Internet. IoT is about interfacing these autonomous devices to communicate fastly without human intervention and generate integrated data. The system consists of sensor nodes, a raspberry pi and a user interface module. This system is mainly deployed in main cities to monitor and controlling the carbon dioxide (CO<sub>2</sub>) concentration caused by vehicle

emissions and urbanization, Also monitoring of the forest environmental conditions in an effort to predict wildfires to reduce the rate of CO<sub>2</sub> emission.

## II. METHODS AND MATERIAL

### A. CO<sub>2</sub> Emission from Vehicles

The principle emission from motor vehicles are greenhousegases, which contribute to climate change. In vehicles, the principal greenhouse gas is carbon dioxide (CO<sub>2</sub>). The vehicle's level of CO<sub>2</sub> emission is linked to the amount of fuel consumed and type of fuel used. The road transport sector depends on petroleum based fuels. increases the level CO<sub>2</sub> emission On the green vehicle guide (GVG),which a higher CO<sub>2</sub> number

means the car produces higher level of CO<sub>2</sub> from the tailpipe. The blanketing effect of man made CO<sub>2</sub> in the atmosphere leads to the progressive warming up of the earth's surface.

### B. CO<sub>2</sub> Emission from Industries

CO<sub>2</sub> emission are produced from a variety of industrial activities which are not related to energy. The main emission sources are industrialization processes which an economy that chemically or physically transform materials. During these processes, many different greenhouse gases, including CO<sub>2</sub> , CH<sub>4</sub> , N<sub>2</sub>O, and CFCs can be released. Cement production is a notable example of an industrial process that emits a significant amount of CO<sub>2</sub> . CO<sub>2</sub> from use of biological carbon as feedstock and fermentation processes should not be reported under industrial production if they originate from sources of carbon that are from a closed cycle.

### C. CO<sub>2</sub> Emission from ForestFires

Globally, fires have been overlooked as a key player in the global CO<sub>2</sub> cycle. Some studies showing that CO<sub>2</sub> emission from fires can be as high as half of the total emissions from human fossil fuel use. Carbon emission from fires across Indonesia in 1997 emitted between 13 to 40% of the size of global human fossil fuel emission.

## III. DESIGN CHALLENGES

### Connectivity

Variety of wired and wireless connectivity standards are required to enable different application needs and communication purposes in this system.

### Power is Critical

Many IOT applications need to run for year's over 2 batteries and minimize the overall energy consumption. Power failure can cause a lot of disruptions.

### Complexity

Development of IOT application needs to be easy for all developers, not just to experts. Also depend very much upon the revenue and economy of the country. Any failure or bugs in the software or hardware will have serious issues.

### Environmental impact

A concern regarding IOT technologies affects to the environmental impacts of the manufacture, use, and eventual disposal of all these semiconductor-rich devices. Electronic components are often simply burned or dumped in regular landfills, thereby polluting soil, groundwater, surface water, and air.

## IV. METHODOLOGY

The proposed design falls in the IOT framework. The framework of IOT, serves as a transparent path between physical world like objects, and social world together with itself to form an intelligent system. The process of the system where CO<sub>2</sub> emission is monitored consists of four major modules:

- 1) **Sensing Control Module** : This layer has been directly interfaced with physical environment, in which the MG811 sensor senses the level of CO<sub>2</sub> gas. The signals are generated and notifies if CO<sub>2</sub> levels are beyond expected levels. These signals are sent to the upper layer.
- 2) **Data-semantic-storage module**: Here the data from the sensor control module is put in the data base and efficiently analyzed. Before that the sensed data in the form of analog signals ,should be converted into digital format using ADC.
- 3) **Decision-making module**: It uses the data abstracted from the lower semantic layer to make the decisions. The decisions in our system are

sending of alerts to the central control board when . These decisions are made based on the abstracted data.

- 4) **User interface module:** This module shares important interfaces with social networks such as mobile applications and website view. In which feedback and the evaluation result forms the control process. The entire model is divided in to two sub models, one is monitoring and controlling the carbon dioxide(CO<sub>2</sub>) concentration caused by vehicle emissions and urbanization and second module is monitoring of forest environmental conditions in an effort to predict wildfires to reduce the rate of CO<sub>2</sub> emission.

### Real Time Monitoring Of CO<sub>2</sub> Emissions

CO<sub>2</sub> is the major contributor of the greenhouse gases. The main aim of this project is to reduce the global warming effect by real time monitoring and controlling of CO<sub>2</sub> emission caused due to vehicles and industries using IOT . The Internet of Things (IOT) extends internet connectivity to a different range of electronic devices and everyday things that take advantage of embedded technology to communicate and interact with the external environment, all via the Internet. The proposed system have tried to make the CO<sub>2</sub> detector intelligent by saving the CO<sub>2</sub> rate in different regions. This model adheres to IOT and provides information for utilization of vehicular and industrial features based on the CO<sub>2</sub> levels. The model is cost effective and also can be easily produced and integrated with vehicles and also in industries. Intelligent Pollution Control System detects the variations in atmospheric carbon with the help of CO<sub>2</sub> sensor. Saving the CO<sub>2</sub> levels in different regions in a cloud database by connecting internet to sensors with the help of Raspberry pi. The user interface part, which contains a webportal and an application. The application with the help of GSM module sends message to the multiple phone connected and it also calling to any of the phone connected at biased conditions. The web portal Broadcasts the most recent time atmospheric status. In case if the application user didn't view the message or if he/she is not able to attend the call, an alert system i.e. buzzer with help of the GSM module, it rings.

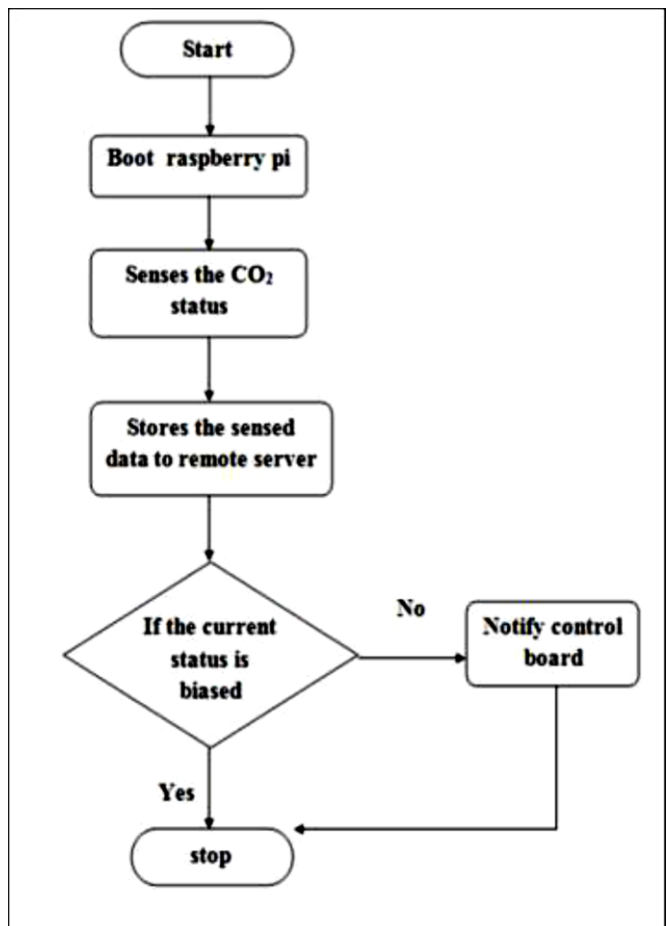


Figure 1. Flow diagram of the model

Sensor has been directly interfaced with physical environment, in which the MG811 sensor senses the CO<sub>2</sub> gas. The signals are generated if CO<sub>2</sub> levels are beyond expected levels and system gives notifications to certain authority. Decision making can happen at the central server at the environment board or the Pollution control board. It helps in reducing Global warming, Greenhouse effect, Ozone depletion and Acid rain.

### FAST FOREST FIRE DETECTION

Forest is play an important role in the ecological environment and recreational system . Forest fire is one of the most dangerous disasters for the ecology. It destroys animal habitation and food chain, damages ecosystem and deaths of forest lives. Therefore fast fire detection and monitoring system may help to protect the forest ecosystem. Currently sensing modules can monitor a variety of phenomena including temperature, relative humidity, and smoke which are all helpful for wild fire detection systems. Sensor nodes can operate for continuous monitoring during the fire season.

Moreover, the system protocol make sensor nodes having ability of organizing themselves into a self configuring network, thus removing the overhead of manual setup. Senses the current status by using temperature sensor, humidity sensor and CO<sub>2</sub> sensor at various locations in the forest. Collect and analyze the sensed data accordingly by storing it in a database with the help of raspberry pi. The knowledge abstracted from the cloud database to make the decisions and the decisions in our system are sending of alerts to the central control board. The IoT concerns the connection of physical device to the Internet. IoT is about interfacing these autonomous devices to communicate fastly without human intervention and generate integrated data. The system consists of sensor nodes, a raspberry pi and a user interface module. This is mainly deployed to monitoring of the forest environmental conditions in an effort to predict wildfires to reduce the rate of CO<sub>2</sub> emission.

#### Advantages

- ✓ Smart sensing.
- ✓ Efficient log management.
- ✓ Broadcasts the most recent time atmospheric status.
- ✓ Users can get the current environment status using android app and web portal.
- ✓ Buzzer which is attached to the system gives more alert central control board.
- ✓ User friendly system. Because easy to use.
- ✓ Cost effective.

#### V. FUTURE SCOPE

The proposed model detects only emission of carbon dioxide. But, there are many harmful gases which pollute the environment like carbon monoxide, methane, nitrous oxide etc. The prototype can be extended to detect these gases which cause damage to our precious earth. The sensor currently used is MG811 for detection of CO<sub>2</sub> emissions, DHT22 for measuring temperature level and humidity. It can withstand a temperature up to 70 degrees. A high grade sensor can be used to withstand higher temperature the prototype can only be used for controlling CO<sub>2</sub> emission. but also many industries to measure the harmful gases to reduce air pollution caused due to these gases.

#### VI. CONCLUSION

This paper mainly aims in monitoring and controlling the pollution by the emission of carbon dioxide from vehicles, industries and forest fire using Raspberry pi embedded into a Cloud Server. The temperature sensor, humidity sensor and carbon sensor senses the temperature, humidity and CO<sub>2</sub> level respectively between the given interval of time. The sensed data are passed to the raspberry pi connect along with sensors. The Raspberry pi is well programmed using python in order to send the information to a secure server with connection protocol IPV6. The remote server collects all the information's and stores to the corresponding tables in the predefined database. Users are able to check the history and current Atmospheric status which stored in the database. To achieve real-time monitoring of carbon dioxide concentration in a particular place could be reviewed from mobile communication devices, such as PDAs, smart phones, and tablet PCs to help keep air quality in check. It control the CO<sub>2</sub> emission considerably.

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