

# Smart IoT Based System For CO<sub>2</sub> Monitoring and Forest Fire Detection with Effective Alert Mechanism

M.S.Sruthi<sup>1</sup>, Dr. M. Newlin Rajkumar<sup>2</sup>, Dr. V. Venkatesa Kumar<sup>3</sup>  
<sup>1,2,3</sup> Anna University Regional Campus Coimbatore

**Abstract-** *Internet of Things (IoT) is a vision towards Future Internet where “things” are provided with enough intelligence to interconnects devices which may be machines, sensors or everyday objects that independently exchanges data between device-to-device and device-to-server either directly or over the internet without the human intervention. Implement IoT to monitoring atmospheric CO<sub>2</sub> rate using MG811 carbon dioxide sensor and early detection of forest fires using temperature and humidity sensor with Raspberry pi. Carbon dioxide, which is an important constituent of environment is causing global warming and air pollution on the earth’s surface. To save our earth, monitoring, controlling and preventing these changes is a big challenge. In terms of a long range control of CO<sub>2</sub> emission at their source is more desirable and effective method to protect our earth. This system aims to collect massive amount of data for detecting and controlling the pollution caused by the emission of CO<sub>2</sub> and store the data in secure server for effective analysis. Also all the process parameters within an interval selectable by the user are recorded online. This is very useful for future analysis and review of atmospheric condition of a particular area.*

**Keywords-** IoT (Internet Of Things), SNS (Simple Notification Service), GVG (green vehicle guide), GPS (Global Positioning System)

## I. INTRODUCTION

Air pollution has significant influence on the concentration of CO<sub>2</sub> in the atmosphere to effects like global warming, and acid rains. To avoid such negative imbalances in the nature, an pollution monitoring system is utmost important. Recent advances in data gathering and analysis are opening up new possibilities for pollution control system development.

Smart system for pollution control development focuses on reducing the amount CO<sub>2</sub> emission from various sources such as fossil fuel burning, motor vehicle exhaust and forest fires. High CO<sub>2</sub> level in the atmosphere have long term negative effects on ecosystem, human health, water resources, agriculture and forestry. The drastic increase in atmospheric CO<sub>2</sub> disturbed the balance of natural atmosphere. Developing simple, flexible, and scalable network systems for controlling the pollution is very essential for successful control of

pollution. This will be crucial to maintaining quality of air as urban populations rise, fast industrialization, rapid increase in vehicles on roads and other activities of human beings. Continuous monitoring of atmosphere for the pollutant should help us to know the emission levels.

### 1.1 Communicating with IoT

The Internet of Things is a paradigm where everyday objects can be equipped with identifying, sensing, networking and processing capabilities that will allow them to communicate between devices and servers over the Internet to achieve some objective. A number of Existing systems are used zigbee hybrid network connected to a Wi-Fi or Ethernet gateway to integrate sensors with cloud computing and IoT [1].

In this paper, wireless network is opted for communicating with physically equipped sensors and storage systems. This presented as the principal motivation of this work, as well as to implement the pollution control technique using the simple interaction of users with IoT.

### 1.2 Measurement of Atmospheric CO<sub>2</sub> rate

CO<sub>2</sub> sensor helps in real time monitoring of CO<sub>2</sub> emissions. This sensor exhibits a large change in carbon dioxide concentrations with industrial revolution. The CO<sub>2</sub> rate is determined by placing the sensor at physical environment. Which helps to sense the level of CO<sub>2</sub> emitted in terms of PPM. The corresponding change in the CO<sub>2</sub> level is sensed by the sensor and the sensor is connected with a raspberry pi. If the CO<sub>2</sub> level exceeds the normal PPM level (350 PPM) the PI sends a notification to the registered mobile of the owner. This data is acts as useful semantic to take decisions in reducing the gas level.

### 1.3 Forest Fire Detection

A network of Sensor Nodes can be placed at different areas in a forest to detect when a fire has started. The nodes can be integrated with sensors to measure temperature, humidity and gases which are produced by fire in the trees. The early detection is very essential for a successful action of

the fire-fighters and fire brigade will be able to know when a fire is started and how it is spreading.

## II. SYSTEM IMPLEMENTATION

### 2.1 Architecture

An architecture of Smart IoT based system for CO<sub>2</sub> monitoring and forest fire detection with effective alert mechanism is shown in Fig 2.1. The CO<sub>2</sub> from the vehicle, industries and forest fires are sensed using the Raspberry pi which is connected with the bread board which in turn is connected with the cloud server module. The Raspberry pi board is remotely connected to the Cloud using python code. This enables a secure connection with the Raspberry pi. The data that is received is checked for the threshold value. If it is greater than the threshold value then it is notified to the users by providing SNS.

Following components are needed for smart IoT based system for CO<sub>2</sub> monitoring and forest fire detection with effective alert mechanism,

- MG811Carbon dioxide Sensor
- Raspberry Pi
- GSM Module
- Cloud server
- RHT03 Temperature Sensor

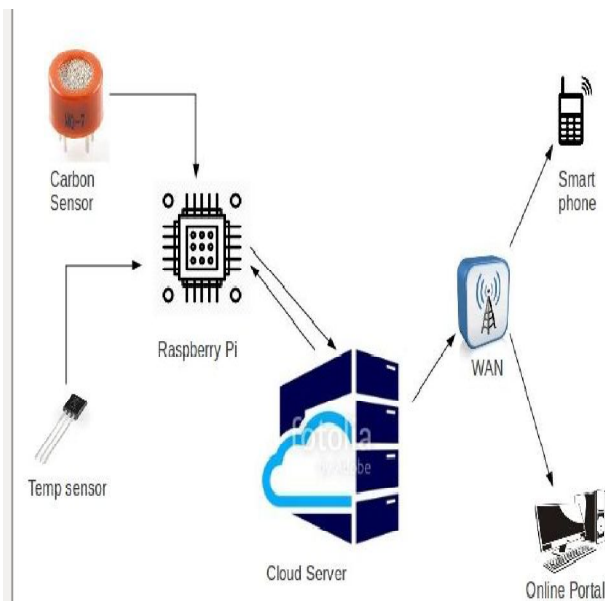


Fig 2.1 An architecture of smart iot based system for co<sub>2</sub> monitoring and forest fire detection with effective alert mechanism.

#### 2.1.1 MG811Carbon Dioxide Sensor

MG811 is a simple-to-use Carbon Dioxide (CO<sub>2</sub>) sensor, suitable for sensing CO<sub>2</sub> concentrations in the air. The MG811 can detect CO<sub>2</sub>-gas concentrations anywhere from 20 to 2000ppm. CO<sub>2</sub> sensor is a well- designed plug-and –play analog sensor. Carbon sensor is used to detect the variations in the atmospheric CO<sub>2</sub>.High sensitivity to CH<sub>4</sub>,Natural gas and Small sensitivity to alcohol, smoke Fast response Stable and long life Simple drive circuit.

#### 2.1.2 Raspberry Pi 2 Model B

The Raspberry Pi is a inexpensive, credit-card sized computer that connects into the monitor of a computer or TV, and uses a standard keyboard and mouse. It is a liable device that enables people of all ages to explore computing, and to gain an understanding of how to program in languages like Python and Scratch.

Raspberry Pi 2 Model B is the next generation of Raspberry Pi. It be a replacement for the original Raspberry Pi 1 Model B+ in February 2015. it has: A 900MHz quad-core ARM Cortex-A7 CPU 1GB RAM as compared to raspberry pi Model 1.

Raspberry PI is a dynamic microcontroller that is capable of just about anything like a computer .it runs with the python programming language, and it can connect with Ethernet .which helps to store the sensed informations.

#### 2.1.3 Cloud server

Cloud server means virtual server which run on cloud computing platform over the internet. A web hosting service is a type of Internet hosting service that allows users to make their website accessible via internet. Cloud servers possess and exhibit similar functionalities to a typical server but are accessed remotely from a cloud service provider. Web hosts are provide space on a server owned or leased for use by clients, with Internet connectivity, in a data center.

#### 2.1.4 Temperature Sensor and Humidity Sensor

The RHT03 sensor is a low cost humidity temperature sensors with a single wire interface. The sensor is calibrated and doesn't need any extra components and it helps to measuring relative temperature and humidity. The Grove - Temperature Sensor uses a thermistor to sense the atmospheric temperature. When the ambient temperature is decrease ,the resistance of a thermistor will increase. The detectable range of tempetarure sensor is -40 - 125°C, and the accuracy is ±1.5°C.

This system could only provide the sensing data every 24hours and it could not provide sensing data in a real-time manner.

### III. CONCLUSION

A novel CO<sub>2</sub> monitoring system with IoT via sensors and raspberry pi which detects the emission rate of CO<sub>2</sub> in a particular area. 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. It continuously monitor the CO<sub>2</sub> emission rate in many areas in a city and finding the area which is most polluted. This data can acts as useful semantic to take control measures to reduce the emission rate.

It also implement a system for early detection of forest fires with collection of temperature and humidity sensors placed at different places in forest. Beacuse the burning of forest trees increases the content in the atmosphere which inturn global warming.The collected data passed to raspberry pi connect along with sensors to store it in a cloud server. The Raspberry pi is well programmed using python in order to send the information to a secure server. The server collects all the informations and stores to the corresponding tables in the predefined database for further analysis. There is an effective alert system which gives alerts to the authorities through SMS at baised conditions.

This system provides actionable information that help to reduce the risks from climate change to the human race can be reduced to a large extend. User interface module provides current atmospheric status to user with a webportal and an android application.which broadcasts the most recent time atmospheric status by retrieving data stored in the cloud.

The data at the remote server is analysed using data analytics algorithm for the threshold, which already defined to check in the algorithm. To achieve real-time monitoring of carbon dioxide concentration in a particular place could be reviewed from mobile communication devices to keep air quality in check.

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