

Implementation Of Embedded Wireless Air Pollution Monitoring System

Shashikant U.Suryawanshi¹, Deepganga I. Dhang² Ashish A. Chougule³,
Shailendra B. Mote⁴

¹(Department of Technology, Shivaji University, India)

²(Department of Electronics, DKTE'S College of Engineering, India)

³(Department of Electronics, K.I.T. College of Engineering, India)

⁴(Department of Electronics Dr.J.J.M.College of Engineering, India)

ABSTRACT : An Environmental Air Pollution Monitoring System for monitoring the concentrations of major air pollutant gases has been designed, developed, and tested complying with the wireless standard. This system measures concentrations of gases such as CO, NO₂ and SO₂, and using semiconductor sensors. [1] The hardware unit integrates a single-chip microcontroller, air pollution sensors array, a GSM-Module and a GPS-Module. [2] The Central-Server is a high-end personal computer application server with internet connectivity. The hardware unit gathers air pollutants levels (CO, NO₂, and SO₂), and packs them in a frame with the GPS physical location, time, and date. The frame is subsequently uploaded to the GSM-Modem and transmitted to the Central-Server via wireless network. The Central-Server is interfaced to Google Maps to display the location of hardware unit. The connection between the gas sensors and the microcontroller can be made by using signal conditioning electronic circuit. In the signal conditioning circuit is the combination of amplifier and analog to digital converter, The gas sensor provided output that is given to amplifier circuit and that output is given to the analog to digital converter and then to controller. [3] The microcontroller is the main component of a pollution detection unit. The program run inside the chip coordinates the substances measurement process.

Keywords: - Air pollution Monitoring; GSM Module; GPS Module; ARM controller; Sensors.

I. INTRODUCTION

Generally, the pollution has been defined as the presence of a substance in the environment due to which chemical composition or quantity prevents the functioning of natural processes and produces undesirable environmental and health effects.

There are various pollutants; these can be classified as primary or secondary. Primary pollutants are substances that are directly emitted into the atmosphere from sources. The main primary pollutants known to cause harm in high enough concentrations are the following [1]:

- Carbon compounds, such as CO and C₂
- Nitrogen compounds, such as NO and N₂O
- Sulfur compounds, such as H₂S and SO₂

Secondary pollutants are not directly emitted into atmosphere from sources, but instead form in the atmosphere from primary pollutants, the main secondary pollutants known to cause harm in high enough concentrations are the following [1]:

- NO₂ and HNO₃ formed from NO
- Ozone (O₃) formed from photochemical reactions of nitrogen oxides.

A variety of air pollutants suspected harmful effects on human health and the environment. Nitrogen dioxide, Sulphur dioxide, Carbon dioxide gases irritate the airways of the lungs, increasing the symptoms of those suffering from lung diseases. Carbon Monoxide gas prevents the uptake of oxygen by the blood. This can lead to a significant reduction in the supply of oxygen to the heart, particularly in people suffering from heart disease, there is also increasing evidence for adverse effects of air pollution not only on the respiratory system, but also on the cardiovascular system. This evidence stems from studies on both acute and chronic exposure. The most severe effects in terms of the overall health burden include a significant reduction in life expectancy of the average population by a year or more, which is linked to the long-term exposure to high levels of air

pollution. [2]

The proposed work here is capable of measuring the following gases in the atmosphere:

- Carbon Monoxide (CO) – Carbon Monoxide is a colorless and odorless gas. It is mainly due to automobile traffic, industrial activity and volcanic eruptions. This gas affects cardiovascular and nervous systems and in large concentrations, inhibits the blood’s capacity of exchange oxygen with vital organs. In extreme cases, may provoke death by poisoning.
- Sulphur Dioxide (SO₂) – Sulphur Dioxide is a colorless gas, detectable by the distinct odor and taste. Like CO₂, it is mainly due to fossil fuels burning and to industrial processes. Its high concentration may cause respiratory problems, especially in sensitive groups, like asthmatics. It also contributes to acid rains.
- Nitrogen Dioxide (NO₂) – Nitrogen Dioxide is a brownish gas, easily detectable for its odor, very corrosive and highly oxidant. It is produced as the result of fossil fuels burning. Usually NO thrown to the atmosphere is converted in NO₂ by chemical processes. In high concentrations, NO₂ may lead to respiratory problems. Like SO₂, it contributes to acid rains.

This detection system can be used, where pollution in atmosphere is above hazards level. For example industrial area, high traffic roads. The monitoring system can be used by clients such as the municipality, environmental protection agencies, travel agencies, insurance companies and tourist companies to connect to the Central-Server through the Internet and check the real-time air pollutants level using a normal browser on a standard PC or a mobile device. The Pollution- Server can be physically located at the Environmental Protection Agency (EPA) or similar government agencies.

This Wireless Air Pollution Monitoring System provides real-time information about the level of air pollution in these regions, as well as provides alerts in cases of drastic change in quality of air. This information can then be used by the authorities to take prompt actions such as evacuating people or sending emergency response team. The pollution level at each sensor node can be provided to server by using GSM system or we can display the pollution level information on large display close to square. People generally have more than one alternate path to reach at same destination; if person knows the pollution information in advance he can follow the safe path, and simultaneously pollution can also control.

II. METHADODOLOGY

The basic block diagram of proposed system is shown in fig (1) and fig (2) Figure (1): Basic block diagram of GSM Transmitter

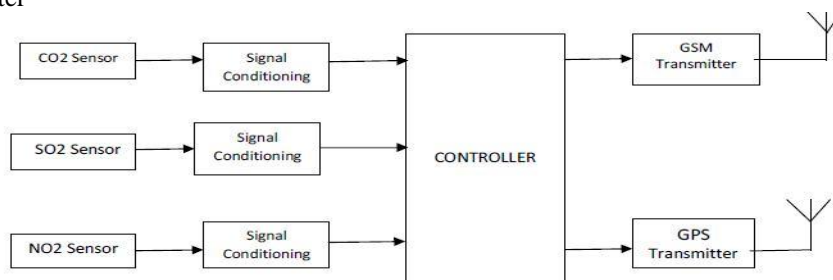
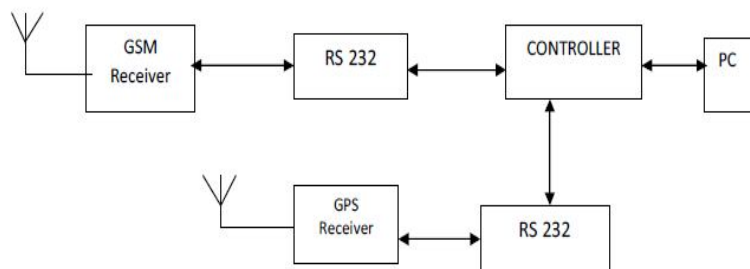
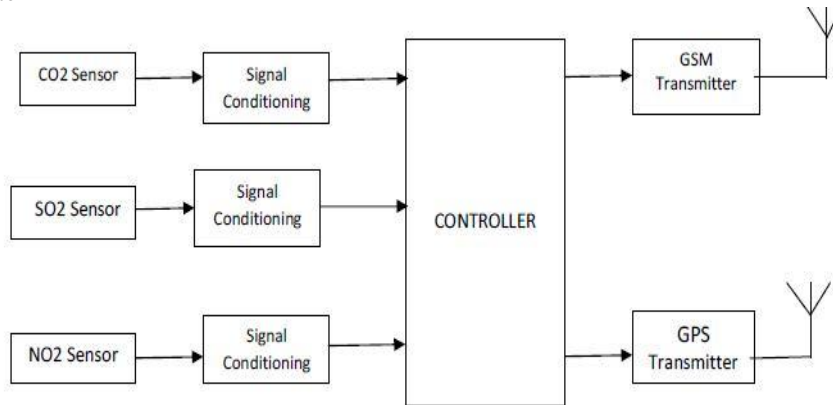


Figure (2): Basic block diagram of GSM Receiver



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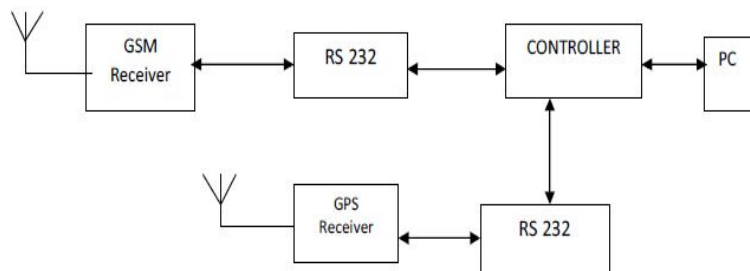


TABLE: SENSOR ARREY SPECIFICATION

Sensor _i	CO	NO2	SO2
Resolution (ppm)	< 1.5	< 0.02	< 0.1
Resp. time (t90)(s)	< 25	< 60	< 25
Op. range (ppm)	0-1000	0-200	0-200
Operating life (yrs)	> 2	> 2	> 2
Diameter (mm)	20	20	20

III. CONCLUSION:

Wireless Air Pollution Monitoring System provides real-time information about the level of air pollution in these regions, as well as provides alerts in cases of drastic change in quality of air. This information can then be used by the authorities to take prompt actions such as evacuating people or sending emergency response team. The system utilizes remote controlled rover to collect pollutant gases such as CO, NO2, and SO2. The pollution data from sensor array is transmitted to a central server that makes this data available on the Internet. The data shows the pollutant levels and their conformance to local air quality standards. The usage of the semiconductor sensors adds several advantages to the system such as low cost, quick response, low maintenance, ability to produce continuous measurements, etc.

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