International journal of application or innovation in engineering and management

ijaiem.com/Jan 2017/ Volume 6/Issue 1/Article No-1/01-07
ISSN: 2319-4847

Collecting Data on the Go for Embedded System-Based Air Pollution Monitoring

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Article Info

Received: 17-10-2016 ***Revised: 21 -11-2016*** ***Accepted: 06-12-2016*** ***Published:15/01/2017***

ABSTRACT:
Keeping tabs on the various sites' air pollution levels is the primary goal of the suggested approach. In order to mitigate the harm that air pollution does to the environment, it is necessary to take the necessary steps. Part of the planned system for tracking environmental contaminants includes a database and a mobile data-acquisition (DAQ) device. An array of air pollution sensors (CO, SO2, and NO2 sensors), a single-chip microcontroller, a GSM-Modem, and a GPS-Module are all part of the mobile data-acquisition DAQ device. The Mobile-DAQ device measures the concentrations of air contaminants and stores them with the precise time and position as determined by GPS. The next step in research and analysis involves uploading the frame to the GSM-Modem and then transmitting it to the database over the public mobile network.
KEYWORDS : Mobile data acquisition,sensor array, air pollution, GSM, GPRS.

INTRODUCTION

Control and prevention of air pollution is a major environmental challenge facing modern society. Meeting this challenge is especially important to the millions of people who live and work in urban areas, where Although the problem of air pollution has been throughout recorded in history, including the ancient Greek and Roman societies, it was not until the latter half of the 20th century that many countries took action to address the problem. There are many options for the types of air quality information that can be collected, and the cost of air quality monitoring systems can vary by orders of magnitude.

SYSTEM REQUIREMENT

The system can be characterized according to its functional and nonfunctional requirement. Functional requirements describe the primary functionality of system while non functional requirements describe attributes like reliability and security, etc.

Functional Requirements are:-

System must support accurate and continuous real data collection.

1. System needs to store the data and provide access to a location map interface.
2. System needs to support mobility.
3. System must use minimum power.
4. System must be compact.
5. System must support two way communications between the client and server.
6. System should be easy to deploy.

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Nonfunctional requirement for the system is reliable, portable, accurate, maintainable secure, accessible, and usable. In addition the system must support performance standards for an accurate response time and storage space for data.

Hard ware requirements

To satisfy the system functional and nonfunctional requirement two major building blocks are mobile data base and server station.

A. Single chip micro controller

The PIC micro controller is microcomputer on chip it is everything built in it, its advantages are smaller components, low cost, less size. The micro controller is single chip device that has rich built resource for digital input, output ports.

High-Performance RISC CPU, Interrupt based operation, 40 MHz osc/clockinput, Priority levels for interrupts, Threeexternal interrupt pins, Up to 10 MIPs operation,
1 Serial Port, CMOS technology, Changeinterrupts.

B. Sensor Array

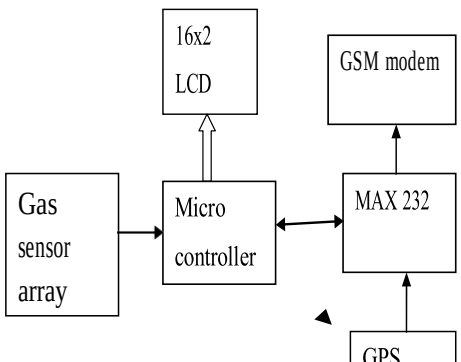
The sensor array consists of two pollutants that are liquid petroleum gas sensor (LPG), carbon monoxide (CO) sensor and temperature sensor.

The CO sensor is high sensitivity to carbon monoxide, stable and long life. Theyare used in gas detecting equipment for carbon monoxide in family and industry or car. Its detecting range is from 20ppm-2000ppm. The enveloped MQ-7 has 6 pins, 4 of them are used to fetch signals, and other 2 are used for providing heating current. Mm

The MQ-6 LPG sensor is highsensitivity to LPG iso butane propane, small sensitivity to alcohol smoke, fast response, stable and long life, simple drive circuit. It suitable for detecting of LPG ISO butane, Propane LNG avoids the noise of alcohol and cooking fumes and cigarette smoke.

Resistance value of MQ-6 is difference tovarious kinds and various concentration gases.

Mobile module



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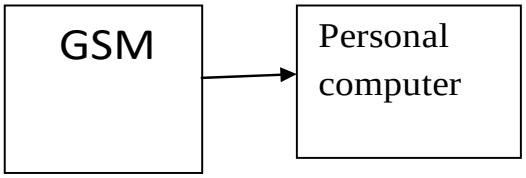

Data base module

C. GPS Module

The GPS Module provides the physical coordinate location of the mobile DAQ timeand date in national marine electronics association (NMEA) format the NMEA format includes the complete position, velocity and time computed by a GPS receiver where the position is given in latitude and longitude the data pocket from the GPS module includes the RMS header followed UTC time data validity check sum latitude, longitude velocity heading date, magnetic variation and direction mode the only information required for the proposed system is date time latitude, longitude. The GPS Modem is inter faced with the microcontrolled using the RS/232 communicationstandard.

D. GPRS Modem

The general pocket radio receiver is a pocket oriented mobile data service used in 2G and 3G cellular communication system global system for mobile communication (GSM).The proposed system uses a GPS Modem as a communication device to transmit time date physical location and levels of air pollutant. It transmits a message showing the vehicle latitude and longitude coordinates and pollution levels in the area where vehicle islocated.

Speed of Response

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Figure: Speed response

Gas sensors:

Gas sensors interact with a gas toinitiate the measurement of its concentration.The gas sensor then provides output to a gasinstrument to displaythe measurements. Common gases measured by gas sensorsinclude ammonia, aerosols, arsine, bromine,carbon dioxide, carbon monoxide, chlorine,chlorine dioxide, diborane, dust, fluorine,

germane, halocarbons or refrigerants, hydrocarbons, hydrogen, hydrogen chloride, hydrogen cyanide, hydrogen fluoride, hydrogen selenide, hydrogen sulfide, mercury vapor, nitrogen dioxide, nitrogen oxides, nitric oxide, organic solvents, oxygen, ozone, phosphine, silane, sulfur dioxide, and water vapor.

Measurement Specifications

Important measurement specifications to consider when looking for gas sensors include the response time, the distance, and the flow rate.

1. The response time is the amount of time required from the initial contactwith the gas to the sensors processing of the signal.
2. Distance is the maximum distance from the leak or gas source that the sensor can detect gases.
3. The flow rate is the necessary flow rate of air or gas across the gas sensor to produce a signal.

Sensor Output

Gas sensors can output a measurement of the gases detected in a number of ways. Theseinclude percent LEL, percent volume, trace, leakage, consumption, density, and signatureor spectra.

1. The lower explosive limit (LEL) or lower flammable limit (LFL) of a combustible gas is defined as the smallest amount ofthe gas that will support a self-propagating flame when mixed with air (or oxygen) and ignited. In gas-detection systems, the amount of gas present is specified in terms of % LEL: 0% LEL being a combustible gas-free atmosphere and 100%.

   an atmosphere in which the gas is at itslower flammable limit. The relationship between % LEL and

% by volume differs from gas to gas.

2. Also called volume percent or percent by volume, percent volume is typically onlyused for mixtures of liquids. Percent by volume is simply the volume of the solute divided by the sum of the volumes of the other components multiplied by 100%.
3. Trace gas sensors given in units of concentration: ppm.
4. Leakage is given as a flow rate like ml/min.
5. Consumption may also be called respiration. Given in units of ml/L/hr.
6. Density measurements are given in unitsof density: mg/m^3.
7. A signature or spectra measurement is aspectral signature of the gases present; the output is often a chromatogram.

Common outputs from gas sensors include analog voltage, pulse signals, analog currents and switch or relays. Operating parameters to consider for gas sensors include operating temperature and operating humidity.

Standards

The International Society of Automation (ISA) specifies standard ISA 12.13.01 which describes test methods that apply to portable, transportable, and fixed devices for the detection and measurement of flammable gas or vapor c

Conclusion

It was possible to make a way to monitor air pollution that is both spread out and digital. Pollutant gases like CO, NO2, and SO2 are picked up by the system's city cars. The figures show the amounts of pollution and how well they meet area rules for air quality.

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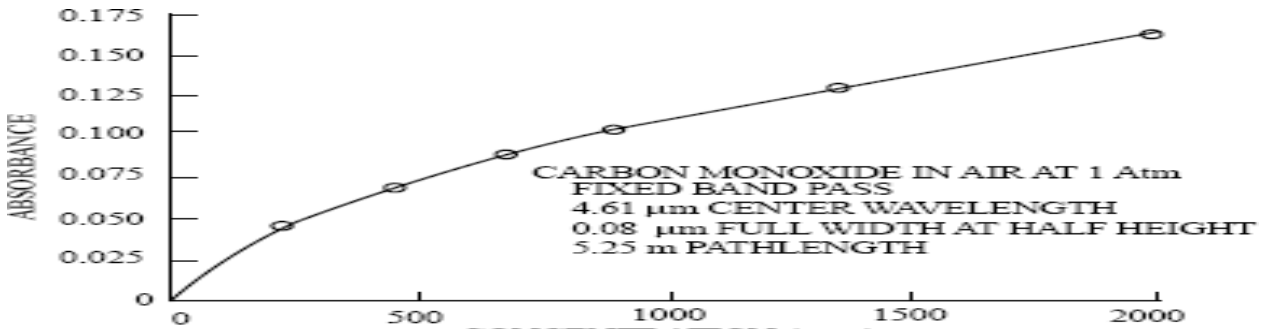

CARBON MONOXIDE SHOWS A LARGE DEPARTURE FROM THE BEER-LAMBERT LAW.

Keeping tabs on the various sites' air pollution levels is the primary goal of the suggested approach. In order to mitigate the harm that air pollution does to the environment, it is necessary to take the necessary steps. Part of the planned system for tracking environmental contaminants includes a database and a mobile data-acquisition (DAQ) device. An array of air pollution sensors (CO, SO2, and NO2 sensors), a single-chip microcontroller, a GSM-Modem, and a GPS-Module are all part of the mobile data-acquisition DAQ device. The Mobile-DAQ device measures the concentrations of air contaminants and stores them with the precise time and position as determined by GPS. The next step in research and analysis involves uploading the frame to the GSM-Modem and then transmitting it to the database over the public mobile network.The wavelengths of interest and removeundesirable wavelengths from the beam.The NDIR technique is most sensitive and selective for small molecules whose spectral fine structure is resolved under ambient conditions.It is suitable for continuous monitoring of CO.

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