

Air Quality Meter

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Abstract— Air pollution is the biggest problem of every nation, whether it is developed or developing. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants. The researches suggests that the number of deaths tied to air pollution will continue to rise in the coming decades due to increasing rate of emission of these dangerous pollutants. Policymakers across the globe have responded to air pollution with a slew of new regulations, many of which focus on curbing pollution from coal. China denied of new coal mines for three years till the end of 2015. Also cities in China have come up with warning systems to get cars off the streets and halt industrial pollution during periods of intense smog. This brought down level of pollution to a very descent level improving the conditions of the environment, various kinds of anthropogenic emissions called primary pollutants thrust into the atmosphere that undergoes chemical reaction and leads to the formation of new pollutants normally called as secondary pollutants.

Index Terms— ARDUINO, OLED, LCD, POLLUTION, GSM

I. INTRODUCTION

Air pollution is the biggest problem of every nation, whether it is developed or developing. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants. The researches suggests that the number of deaths tied to air pollution will continue to rise in the coming decades due to increasing rate of emission of these dangerous pollutants. Policymakers across the globe have responded to air pollution with a slew of new regulations, many of which focus on curbing pollution from coal. China denied of new coal mines for three years till the end of 2015. Also cities in China have come up with warning systems to get cars off the streets and

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II. AIR QUALITY PARAMETERS

2.1 Carbon monoxide gas

CO is among one of the poisonous gases which is released when fuel in engine does not burn properly. The primary source of all CO emissions, 91%, is road traffic. The controversial treatment for CO poisoning is considered to be hyperbaric oxygen.

2.2 Carbon dioxide gas

CO₂ is a non-combustible gas. If it is not available for 3-5 minutes, it can cause damage to brain or even death in some cases.

2.3 Smoke

Majority of the population having a habit of tobacco smoking are from developing countries. According to 2007 report, nearly 4.9 million people die every year due to smoking.

2.4 Temperature and humidity

Temperature measurement is an important factor for safety of people. Greenhouse effect can be monitored by measuring the temperature and comparing its changes from historical to present time especially after the industrial revolution using the climate data.

III. GLOBAL SYSTEM FOR MOBILE COMMUNICATION

GSM, a mobile communication modem, stands for global system for mobile communication. In 1970, the idea was developed at Bell Laboratories. It is an open digital cellular technology that is used for transmitting mobile voice and data services. It operates at 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. It was developed using time division multiple access (TDMA) technique for the purpose of communication. Its data rates is 64 kbps to 120 Mbps. The various cell sizes are as macro, micro, Pico and umbrella cells.

3.1 Use of GSM Module in Proposed Project

The GSM module can be used to make a computer or any other processor communicate over a network. It requires a SIM card to operate. GSM modem is usually preferred over Zigbee and other wireless modules. It is widely used in transaction terminals, supply chain management, security applications, weather stations and GPRS mode remote data logging.

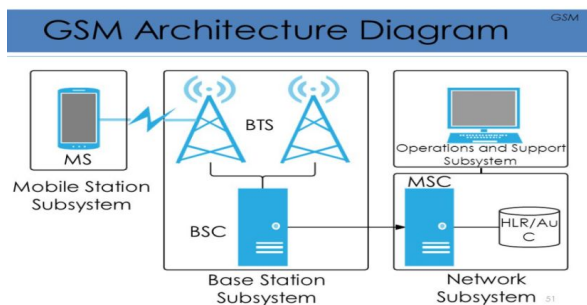


Fig.1 working of GSM

The various functions provided by GPRS module are the transmission of the data, real-time clock functionality, and data storage on a Micro SD card. The two parameters that are transmitted using GPRS techniques are Info (contains metadata information) and readings (contains temperature, humidity and timestamp values).

IV. BLOCK DIAGRAM AND WORKING

The MQ135 gas sensor provides an output voltage signal corresponding to the concentration of gas example- ammonia, CO₂, benzene etc. The DHT11 sensor provides a digital signal output variation in temperature and humidity. The SDS 011 sensor measures the size of the gas particles in air in microns. The real time clock provides the date and time corresponding to the air pollutant concentration. All these values from the sensors & RTC are sent to the Arduino for processing. Arduino mega 2560 transmits these parameter values to the ESP 8266 WIFI module and SIM 900a GSM module. The GSM module receives the data and sends it to the mobile handset as an alert SMS in case the pollution values increase above a certain threshold and the WIFI module ESP 8266 transmits these values via a router to a website that stores them as a database on an online web server. Later the data is fed to an LCD or OLED for display and assessment by the concerned authority.

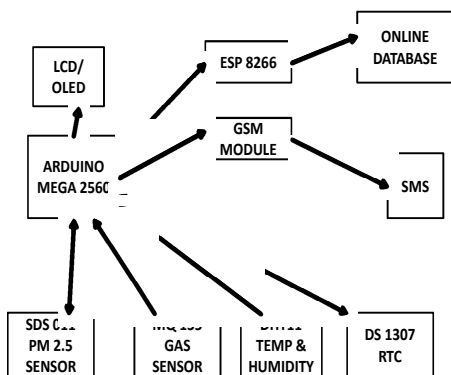


Fig.2 Block diagram of the proposed system

V. PROPOSED AIR QUALITY METER SYSTEM DESIGN

5.1 Arduino Mega

Mega 2560 is a microcontroller board based on the ATmega 2560. It has 54 digital input/output pins (15 can be used as PWM outputs), 16 analog inputs, 4 UARTS (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.



Fig.3 Arduino Mega

5.2 CO2 Gas Sensor

SnO₂ is a sensitive material used in MQ135 sensor. It has lower conductivity in clean air. Its conductivity increases with increasing concentration of target pollution gas. It can monitor different kinds of toxic gases such as sulphide, ammonia gas, benzene series steam and CO₂. Detection range- 10-10,000 ppm, voltage range- 5.0V±0.1V AC or DC.



Fig.4 MQ135

5.3 Temperature and Humidity Sensor

DHT11 can either be a 4 pin or a 3 pin sensor. DHT11 is featured to measure temperature and humidity and the output in the form of calibrated digital signal. For temperature measurement it consists of NTC (Negative Temperature Coefficient) component and for measuring humidity it consists of resistive type component as shown in Fig.5.

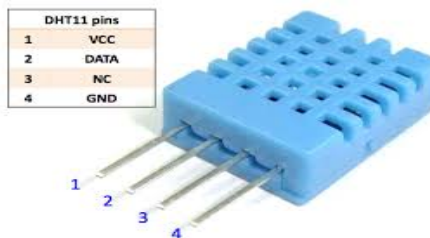


Fig.5 DHT11 Sensor

5.4 GSM SIM 900A

Communication with the shield can be done easily by using AT commands. Features supported are Data, Voice, GPRS, SMS and integrated TCP/IP stack. Any wireless/wired device is connected through serial port/to microcontroller through serial interface with the use of MAX232 (which is basically inserted in the slot). For different applications particular specifications are required which are mentioned in datasheet of GSM module as shown in Fig.6.

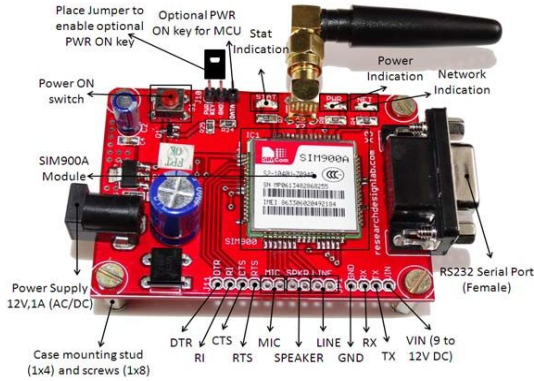


Fig.6 GSM module

SMS application is used to notify the person monitoring the value of CO or checking for any pollutant in a room or an industry whenever it exceeds a particular safe limit chosen according to a particular application. The threshold or safe limit as well as the mobile number of the person to which the text message is to be sent is programmed in the Arduino which can be changed for any specific purpose.

5.5 WIFI module

Wi-Fi, a technology that uses radio waves to provide network connectivity, is established using a wireless adapter to create hotspots - areas in the vicinity of a wireless router that are connected to the network and allow users to access internet services. By emitting frequencies between 2.4GHz - 5GHz Wi-Fi provides wireless connectivity to your devices based on the amount of data on the network.

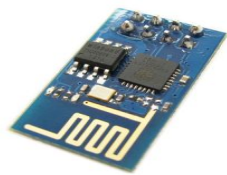


Fig.7 WIFI module

5.6 Real Time Clock

A real-time clock (RTC) is a computer clock that keeps track of the current time. RTCs are present in almost any electronic device which needs to keep accurate time. RTCs have an alternate or say an external source of power, so it basically provides the flexibility to operate when no power is available. In older times lithium battery was used as an external power source but now the systems can be operational using only one super capacitor, because they are rechargeable and can be soldered.



Fig.8 RTC

5.7 PM 2.5 SENSOR SDS011

The basic principle of laser scattering in the air and detect the size of particle, which can be obtained from 0.3 to 10 microns suspended particulate matter and gives stable & reliable data and has in -built fan. It requires 5v dc power supply to operate.

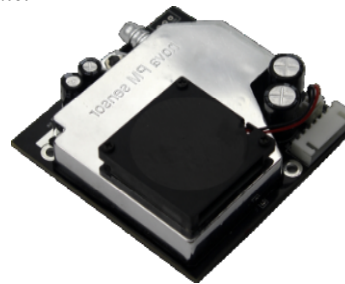


Fig.9 SDS011

CONCLUSIONS AND PERSPECTIVES

The system to monitor various parameters of environment using Arduino microcontroller, WIFI and GSM Technology is proposed to improve the quality of air. With the use of technologies like WIFI and GSM enhances the process of monitoring various aspects of environment such as air quality monitoring issue proposed in this paper. The detection and monitoring of dangerous gases is taken into account in a serious manner and related precautions have been considered here in the form of an alert message and a buzzer so that the necessary action may be taken. It is estimated that this system will have a great acceptance in the market as it is a centralized system for a complete monitoring function. This monitoring system can be enhanced by adding wireless network card for storage of values from sensors attached to microcontroller as well as more gas sensors could be used like Nitrogen dioxide (NO₂), Ammonia (NH₃), Sulphured Hydrogen (H₂S), alcohol etc. Another aspect of measuring particulate matter can be introduced to make it more advanced.

REFERENCE

[1] Tudose, D. Ş., Pătraşcu, N., Voinescu, A., Tataroiu, R., and Țăpuş, N., “Mobile Sensors in Air Pollution Measurement.”, in Positioning Navigation and Communication (WPNC), IEEE, pp. 166-170, 7 Apr 2011.
 [2] TERI. 2015. Air Pollution and Health. Discussion Paper by The Energy and Resources Institute: New Delhi by Rinki Jain (Associate Fellow, TERI), Karnika Palwa (Research Associate, TERI)
 [3] Al-Haija, Q. A., Al-Qadeeb, H., & Al-Lwaimi, A., “Case study: Monitoring of air quality in king Faisal University using a microcontroller and WSN”, Procedia Computer Science, volume 21, pp. 517–521, 31 Dec 2013.aPushpa U S - Electronics and telecommunication dept.
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