An Arduino-Based System for Monitoring Air Pollution

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ABSTRACT:

A wide range of diseases have arisen as a direct result of the exponential growth of the human population, the use of automobiles, industrialization, and urbanization, making modern air pollution a major health problem. A new module developed for the Internet of Things (IoT) called Arduino Uno is proposed for use in wireless sensor networks that monitor ambient sound and air quality. Several dangerous gases, as well as temperature and humidity, and CO volume, are among the chosen environmental quality parameters. The humidity and temperature readings are sent by means of an Arduino Uno. Another dangerous gas that the module can detect is CO. A little increase in pollution could make it easier to identify the gases in the air.

Keywords Discussion topics include: industrialization, air pollution, air quality, the internet of things, and the Arduinodino.

1. INTRODUCTION:

Every country has the same big problem: air pollution. There has been a dramatic rise in health problems as well. industrialization and the proliferation of vehicles release a plethora of dangerous pollutants, causing everything from moderate allergic reactions like stuffy nose, watery eyes, and throat to more severe issues like bronchitis, heart disease, pneumonia, lung disease, and worsened asthma. Air pollution is having a devastating effect on a large number of individuals. Injecting different types of primary pollutants into the air causes chemical reactions, which in turn create other pollutants, often known as secondary pollutants. Almost all of these climate-altering pollutants are harmful to human health. A large portion of each person's day is spent inside. Cities in industrialized nations have seen a dramatic improvement in outdoor air quality over the last few decades. But, throughout the same time period, interior air quality declined for a variety of reasons, including energy saving measures, less ventilation, and the introduction of new sources and ventilation technologies that further affected the quality of the air within the structure.

1.1 EXISTING MODEL

ZigBee is generally used with ZigBee trans-receiver, Bluetooth is a short range communication system which is used for the GSM to notify through a message only. No such system is present that monitors various gases present in the environment like CO2, smoke, LPG, and some of the pollutants as well as th temperature and humidity in the environment at the same time and monitors these parameters at a remote location, provides extra precaution for the most crucial parameter and provides parameters important to all users such as temperature and humidity to every person in the range of the monitoring system. This paper proposes sound and air quality and it also used to detects the amount of CO in the atmosphere.

1.2 PROBLEM STATEMENT

During past decades, as result of civilization and urbanization there is a huge growth in Polluting industries, open burning of refuse and leaves, massive quantities of construction waste, substantial loss of forests and vehicles (particularly diesel-driven cars) on roads that give rise to health endangering pollution. Therefore, it is necessary to regularly monitor and report the hazardous impacts from air pollution. To monitor the quality of air, a new framework is proposed that monitors the parameters of the environment around us such as CO2, CO, presence of smoke, alcohol, LPG, temperature and humidity with the help of GSM, Bluetooth and WSN.

2. AIR QUALITY PARAMETERS

The important parameters that are considered in the proposed framework include:

Carbon monoxide gas CO is odourless, colourless, tasteless and highly poisonous gas. It is released when fuel in engine does not burn properly and road traffic is the primary source of 91% of all CO emissions [1]. In addition, after combining with the hemoglobin of blood, it forms carboxyhemoglobin (HbCo) which leads to reduction in oxygen carrying capacity of blood thus causes hypoxia. Human health is largely in danger with the exposure to 100ppm or more. Continuous exposure of CO even at low levels can cause depression, confusion, and memory loss. Carboxyhemoglobin can be reverted to hemoglobin but the recovery process is slow because of the stability of HBCO complex. The optimum treatment for CO poisoning although remains controversial, but providing hyperbaric oxygen therapy is considered as a treatment whether or not it provides necessary results. Half-life of CO gets shortens from 320 minutes to 80 minutes on normal air by managing oxygen via non-rebreathe mask.

Carbon dioxide gas CO2 is colourless, odourless gas and non-combustible gas. Moreover, it is considered under the category of asphyxiate gases that have capability of interfering the availability of oxygen for tissues. It is certified study that if the oxygen is unavailable for 3 to 5 minutes, it can cause brain damage or death. Many times, occupant generated CO2 act as a substitute for measurement of IAQ. The requirement of outdoor air can be easily predicted by the content of CO2 and according to the

guidelines of ASHRAE CO2 levels must be less than 1000ppm. Generally CO2 levels of outdoor air are under 350ppm.
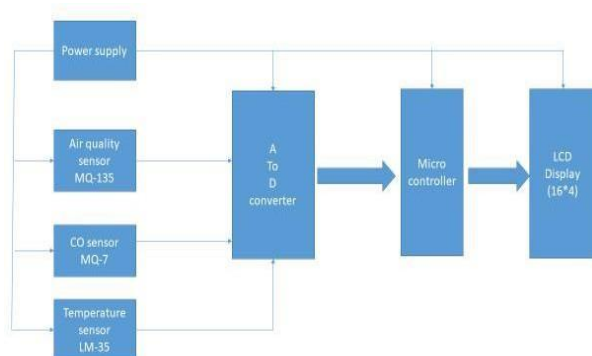
Smoke about 1 million people are in habit of tobacco smoking globally of which majority population is from developing countries [21]. Every year nearly 4.9 million people died due to smoking according to 2007 report [22]. In addition, second hand smoke is serious threat to the health of people of all age's causes 41000 deaths each year.

LPG Liquefied petroleum gas (LPG) is an odourless and colourless liquid which evaporates readily into a gas. Leakage is normally detected by adding an odorant into it. It is considered under the category of highly flammable gases and it can be classified as a carcinogen and mutagen if Butadiene content is more than 0.1%. LPG may leak in the form of a gas or a liquid. If it leaks in the form of a liquid it evaporates quickly and will eventually form large cloud of gas in air which is relatively heavier than air thus drops to the ground. Whereas, LPG vapours travel along the ground for a long distance and gets collected in drains or basements. Gas leads to burn or explode after getting in touch with a source of ignition.

Temperature and humidity measurement of temperature is important for safety of people and affects our life skills. Greenhouse effect can be monitored by measuring temperature and comparing temperature changes from historical to present time especially since the industrial revolution usingclimate data.

Humidity is a type of gas that protects us from UV rays from the sun and helps trap heat on Earth, thereby making the climate on Earth, a pleasant one for living. But as humidity increases, the warmth on Earth also increases which makes our life uncomfortable. Humidity is essential for various storage and food processing facilities.
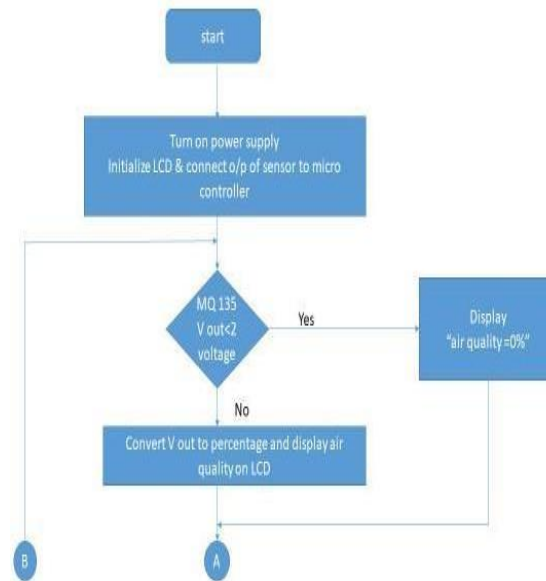
3. BLOCK DIAGRAM AND WORKING

The proposed air quality monitoring is based on the block diagram as shown in the data in air is acquired by CO sensor, air quality sensor and temperature and humidity sensor. After the data acquisition stage, the pre-processing stage comes in which the Arduino processes the information received from the sensors and changes it into more viable form to be accessed at the base station and by the user. Arduino board is a gateway for the communication between Arduino Uno and the base station. Which were connected with some of the sensors like temperature sensors a microcontroller and an LCD display and power supply is given to the arduino board.. The online growing community backing Arduino consists of programmers like us that share their examples for others to make it a more reliable platform.**CO2 Gas Sensor**: The Sensitive material used in MQ135 sensor is SnO_2. The conductivity of this material is lower in clean air. The sensor conductivity increases with the increasing concentration oftarget pollution gas. MQ135 can monitor different kinds of toxic gases such as sulphide, ammonia gas, benzene series steam and CO_2. The detection range is 10-10,000 ppm with the voltage rate of about $5.0V\pm0.1V$ AC or DC. The important features are long life span, low cost, simple driver circuit and good sensitivity to toxic gases. MQ 135 gas sensor is widely used in industrial gas alarm, portable gas detector and domestic gas alarm. MQ-135 is used in this framework for monitoring CO_2 in air. The amount of CO_2 present in the atmosphere is 400.7 ppm according to which the sensor is calibrated.

Gas Leakage Detection Sensor: It is basically used for detection of LPG, Hydrogen, i-butane, propane, alcohol, smoke and methane in houses and industries. The resistance value of MQ2 sensor varies for various kinds of gases; therefore the sensitivity adjustment is necessary which uses this component. The sensor is calibrated with a load resistance of about 20 KΩ and the concentration of the gas to be detectedis selected as: 1000 ppm Liquefied Petroleum. Temperature and Humidity Sensor: DHT11 is featured to measure temperature and humidity sensor complex by using temperature & humidity sensing technology and digital-signal-acquisition technique with output in the form of calibrated digital signal. The sensor consists of NTC (Negative Temperature Coefficient) component for temperature measurement and resistive type component for measuring humidity.

4. COMPONENTS REQUIRED

1. MQ135 air quality sensor
2. Lm 35 Temperature and humidity sensor

3. MQ 7 CO sensor

4. Power supply

5. A to D converter

6. Micro processor

7. Display board-LCD or LED

5. WORK FLOW DIAGRAM

6. WORKING:

The air quality monitoring system involving gas sensors for monitoring of various parameters has been successfully implemented. The data received from the sensors is displayed on the serial monitor of IDE is shown in and the data received on the console log of X-CTU software at control station. The serial monitors of IDE displays values of temperature in Celsius, humidity in percentage, volume of CO_2 and CO in ppm received from the sensors is displayed on the serial monitor of IDE. The values received for the parameters shows that the quality of air in the University environment is good as the value of CO is very less and the value of CO_2 is also not a very big value. There was no presence of smoke and the value temperature and humidity was the same as predicted on the internet. The coding in C language is performed in the simulation environment of Arduino (IDE).The values received at the control station when the system was implemented have been shown the The shows the console log of X-CTU simulation software which shows values received from various sensors attached to the monitoring equipment. ASCII codes for the received information are also shown in the right hand side of the console log. TERA TERM software provides a virtual terminal serial communications. The selected port for serial communication is Port 4 as shown on the top of software window. The values are received at the serial port through Bluetooth communication. The displayed value of temperature is in Celsius and the value of humidity is in percentage.

7. CONCLUSIONS :
To enhance air quality, a system is suggested to monitor several environmental factors utilizing GSM technology, wireless sensor networks (WSN), and Arduino microcontrollers. This study proposes a method for improving environmental monitoring by making use of technologies like WSN and GSM. One such method is the monitoring of air quality. Here, relevant safeguards in the form of a warning

message and a buzzer allow for the essential action to be performed in the event of hazardous gas detection and monitoring. Being a centralized system for a full monitoring function, it is anticipated that this system would be well accepted in the market. Additional gas sensors, such as those for sulfurated hydrogen (H_2S), ammonia (NH_3), nitrogen dioxide (NO_2), alcohol.

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