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Pic Microcontroller Based Truly Time Air Quality Observing Frame Work

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ABSTRACT: The system to monitor various parameters of environment using Arduino microcontroller, WSN and GSM Technology is proposed to improve quality of air. With the use of technologies like WSN 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), Sulfureted Hydrogen (H₂S), alcohol etc. Another aspect of measuring particulate matter can be introduced to make it more advanced.

I.INTRODUCTION

Air pollution is the presence of substances in the atmosphere that are harmful to the health of humans and other living beings, or cause damage to the climate. There are many different types of air pollutants, such as gases like ammonia, carbon monoxide, sulfurdioxide, methane, etc. smoke and other chemical vapours delivered from the factories is also a major cause to pollute the air. Air pollution may cause diseases, allergies and even death to humans & it may also cause harm to other living organisms such as animals and food crops, damage the natural environment(for example, climate change, ozone depletion or habitat degradation) or built environment (for example, acid rain). Both human activity and natural processes can generate air pollution. Air pollution is a significant risk factor for a number of pollution-related diseases, including respiratory infection, heart disease. Indoor air pollution and poor urban air quality are the worst toxic pollution problems. Outdoor air pollution alone causes million of deaths across the world.

According to the concern department survey of individual countries, overall, air pollution causes the deaths of around 7 million people worldwide each year, and is the world's largest single environmental health risk. The scope of the air pollution crisis is enormous: 90% of the world's population breathes dirty air to some degree. Various pollution control technologies and strategies are available to reduce air pollution. Even though to reduce the impacts of air pollution, one must take proper precautions at domestic side, means indoor pollution must be controlled by measuring the air quality. In this regard this instrument is designed to measure the air quality by which appropriate action like sucking the fresh air from outdoor or pumping out the bad air from indoor can be done automatically.

The air pollution detecting sensor mq135 is a specially designed device which is intended to detect the smoke and other toxic gases present in the air. This is a fast responding device, if the air is clean its output remains in stable condition, otherwise depending up on the concentration of polluted air, its output increases and based this level, and according to the international index, its output will be tallied and displayed in percentage of pollution, accordingly the program is prepared. The detailed description of this sensor is provided in following separate chapter.

Microcontrollers are increasingly being used to implement instrumentation systems. It is therefore important to understand Microcontroller based systems well. Today, microcontrollers have become an integral part of all instruments. Dedicated system that use microcontrollers, have certainly improved the functional, operational and performance based specifications.



The architectural changes in instrumentation and control systems where and are due to the computing and communication capability of the Micro controller devices. Micro controller must be treated as a tool for computing and communication; Knowledge of microcontrollers is meaning full and very rewarding if it is applied to design a product that is useful in the industry or for the society in general. This is a subject, which has direct relevance to industrial product development and automation. In this project work, microcontroller is programmed to perform the function of encoding and decoding techniques, which is essential for any instrument.

All Micro-controllers works with respect to the program written in it. Here the program is prepared in such a way, so that the system performs the function of gathering information from the air pollution detecting sensor, as this sensor output will be in the form analog data and where as the controller doesn't accept the analog data, it has to be converted in to digital, for this purpose ADC is used for decoding the data in to digital. This ADC is interfaced with microcontroller chip and this chip is programmed to read the values and convert in to measurable pollution level which can be displayed through an LCD interfaced with controller chip at its output port. This is the over view of this project work and it is explained in detail in following chapter, I.e. functional description.

It is clear that the above functions cannot be performed without microcontrollers, therefore these devices are said to be heart of the instruments, now a days there is no such instrument that works without microcontroller. Hence micro-controllers are increasingly being used to design all sorts of communication systems, instruments, control systems, robots, etc. It is therefore important to understand micro-controller based instruments well.

II.RELATED WORK

GIS based system is designed, implemented and tested to monitor the pinpoints of air pollution of any area. It consists of a microcontroller, gas sensors, mobile unit, a temporary memory buffer and a web server with internet connectivity which collects data from different locations along with coordinate's information at certain time of a day. The readings for particular location are averaged in a closed time and space. The Global Positioning System (GPS) module is attached to a system to provide accurate representation of pollution sources in an area. The recorded data is periodically transferred to a computer through a General Packet Radio Service (GPRS) connection and then the data will be displayed on the dedicated website with user acceptance. As a result large number of people can be benefited with the large information gathering network [1].

GSM/GPRSbased system for recording environmental data such as temperature and humidity using Arduino Uno Microcontroller is proposed in which values are stored using SD card attached to GPRS module rather than Arduino Uno memory. The GPRS module is used to provide various functions like the transmission of the data, real-time clock functionality, and data storage on a Micro SD card. Hydrologic Information System (HIS) software created by Consortium of Universities for development of Hydrologic Sciences Inc. (CUAHSI). On software side HTTP GET request is generated to transmit data and to provide timestamps over the internet. Info (contains metadata information) and readings (contains temperature, humidity and timestamp values) are two parameters which are transmitted using GPRS technique. The data stored in HIS can be categorized in international catalogues such as the Global Earth Observation System of System (GEOSS) catalogue through WaterML encoding [12].

The system is proposed which integrate different technologies like frequency hopping communication technology and virtual instrument technology to fulfil wireless data transmission for monitoring of air quality.The carrier frequency is adjusted according to the result and full radio spectrum is used with the use of a spectrum hole detection sample. The wireless transmission of data is performed without interference with this specimen and real time information can be received by a system effectively. Moreover, this system is useful for non-professional staff also as the data is easy to read and shown clearly [13]

III.METHODS

The commercial meters available in the market are Fluke CO-220 carbon monoxide meter for CO, Amprobe CO2 meter for CO2, ForbixSemicon LPG gas leakage sensor alarm for LPG leakage detection. The researchers in this field have proposed various air quality monitoring systems based on WSN, GSM and GIS.

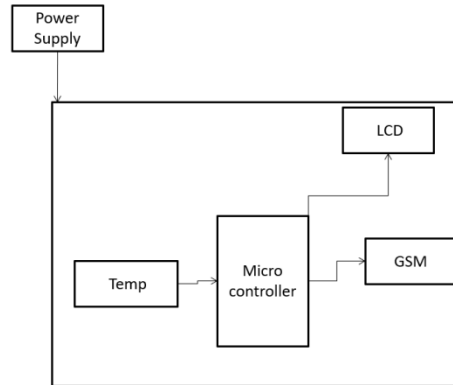


Fig 1: PROPOSED SYSTEM

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 haemoglobin of blood, it forms carboxyhaemoglobin (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 [16]. Continuous exposure of CO even at low levels can cause depression, confusion, and memory loss. Carboxyhemoglobin can be reverted to haemoglobin 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 [17]. Half-life of CO gets shortens from 320 minutes to 80 minutes on normal air by managing oxygen via non-rebreathe mask 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 [20]. Generally CO₂ levels of outdoor air are under 350ppm.

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.

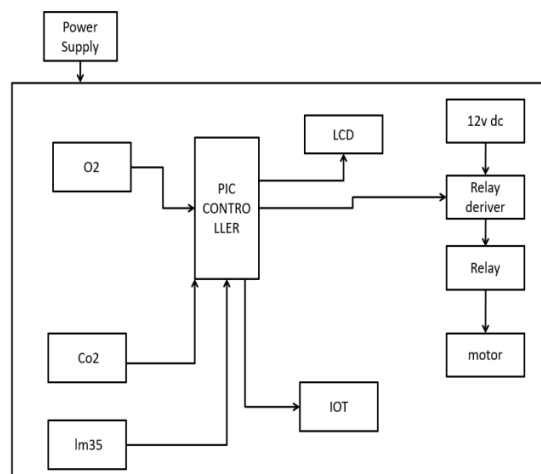


Fig 2: ENVIRONMENT MONITORING SYSTEM



The electrodes and semiconductor material are deposited on a ceramic tubular former. Inside the ceramic former the heater coil is located. The coil is made of 60-micron diameter wire. It has a resistance of 30 ohms... 240°C is the deformation temperature to this material. The Variation in resistance of the sensor measured indirectly as a Change in voltage appearing across the load resistor RL. In fresh air the current passing through the Sensor and RL in series is steady, but when a smoke or combustible gas such as propane, methane etc. The voltage Change across RL is the same when VC and VH are supplied from AC or DC sources. One can feel that this instrument is most suitable for evaluating the MQ135 performance because of the ease in measuring the output signal. The sensitivity characteristics of the Sensor are altered by changes in atmospheric temperature and humidity. The detection principle of the MQ sensor is based on Chemical adsorption and desorption of gases on the Sensor surface. Because these reactions are temperature dependent and water vapour is considered a gas, the effects of temperature and humidity changes cannot be eliminated from the Sensor. Environment monitoring is an IOT application which helps to monitor the environment condition of any locality or surrounding and the condition can be viewed by everybody with the help of internet. This application is more effective, rapid in providing environment conditions. It helps the individuals or government to take remedial actions if the condition of the environment becomes abnormal.

IV.RESULT ANALYSIS

The main function of this converter is to convert the analog information produced by the CT's, PT's and temperature sensing circuit in to digital through eight bit data. Most of the real physical quantities such as temperature, voltage, current etc. are available in analog form. Even though an analog signal represents a real physical parameter with accuracy, it is difficult to process further in digital circuits. Therefore for processing, it is often convenient to express this variable in digital form. It gives better accuracy for the process automation. The analog signal obtained from the transducer is sampled at a particular frequency rate. The sampled signal has to be held constant while conversion is taking place in ADC. This requires that ADC should be preceded by a sample and hold circuit built in with the same device. The ADC output is a sequence in binary digit.

Here in this project work Microcontroller is used to perform the numerical calculations of the desired control algorithm. The most commonly used ADC's are successive approximation and the integrator type. The successive approximation ADC's are used in applications such as data loggers and instrumentation where conversion speed is important. The flash (comparator) type is expensive for high degree of accuracy. Here the ADC is interfaced with microcontroller and the purpose is to display the data that is obtained from the ADC and to implement control action. The following is the brief description about microcontroller & ADC working together, i.e. control theory that is relevant to the ADC.

The 89C51 has a 128-bit internal RAM bank. On-chip memory is used for internal purposes. As a result, it is the quickest RAM accessible. It's also the most adaptable when it comes to reading and writing. Internal RAM is volatile, thus it is cleared when the 89C51 is reset. Internal memory is divided into 128 bytes. There are four register banks in the first 32 bytes. There are eight registers in each bank. There are 128 bits in internal RAM, which are addressed from 20h to 2Fh. These bits are bit addressed, which means that the user can address each individual bit of a byte. They have numbers ranging from 00h to 7Fh. These variables can be used with commands like SETB and CLR by the user.

V.CONCLUSION

To prove the concept practically and for the better results, the sensor along with fans must be arranged inside a small plastic container. For demonstration purpose or to create a bad environment inside the container, using a smoke stick AQI level can be increased, when the level is more than the predefined value, both fans will be energized automatically by which inside the container air will be purified. The idea of using a container is to simulate the closed room. As specified in the system, indoor air quality can be improved by using this technique. The approach of using exhaust & fresh air pumping fan can increase the quality of the indoor air automatically. Sometimes a temporary indoor air quality problem may create due to the overcrowded meeting inside the hall, at such places, this equipment functions perfectly. So, heavy crowded places like cinema halls, function halls, indoor stadiums, etc, can use these devices.



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