Harmful Gas Detection In Manhole Using Arduino

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Abstract : Harmful gas contamination causes threat to human life. In India, the manholes are still cleaned by unskilled workers. While cleaning the drainage the toxic gases like carbon monoxide, methane are emitted. These harmful gases can endanger the life of sanitation workers.To solve this problem we have made a tool kit which detects the presence of harmful gases, calculate the concentration level and identify safety limit, thereby protecting life of workers. The harmful gases can be detected by using different gas sensors. The sensors can detect the harmful gas along with their concentration in ppm. The sensed value is given to Arduino, if the value exceeds the threshold value then an alert message is send to the base station so, that the worker can immediately evacuate the area, thereby protecting from danger. The alert message is generated using GSM technology. So, using this tool kit sanitation workers can be protected from hazardous.

Keywords: Arduino, Carbon Monoxide, Gas Sensors, LCD Display, LPG, Methane

I. INTRODUCTION

The technology is growing day by day. As the evolving technology helps in making our work easier and efficient and have succeeded, there is one thing which we have not been able to preserve our environment which is our source of life . We have polluted the environment which results in degrading the quality of the environment we live. As we all know there are different types of pollution which includes water, soil and air pollution, and in these pollutions, air pollution is the major problem because others can be detected visually and by taste, but the toxic air cannot be detected as it can be colorless, odorless and tasteless. So there is an rapid growing ask for the environmental pollution control and monitoring systems which can be efficient and helpful for people.

The record breaking rising pollution comes with hazardous chemicals, In the present scenario the present systems must have the equipments to detect the sources fast. Harmful gases results in diseases that causes health issues, in fact are also produced in industries/plants in large amount. The gases present must be checked so that rise in the basic l level of these gases could be detected and precautionary measures can be taken. In fact the present systems available are costly and very tough to execute. So we have used ATMEGA 328 Microcontroller, for the implementation of detection of toxic gases , which in fact the dangers that have unfavourable effects on human lives. The harmful gases like CO, CH4 and LPG are used here. The system can be executed without facing any issue in the chemical factories and in neighboring side which is surrounded by the industries which have the harmful gases.. The present system which helps in detecting gases source, also has the equipment to give real-time checking of the gases amount which is present in the atmosphere. This procedure is preprogrammed and the information can be given very fast. So these systems can help in saving human lives in time..
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II. AIM OF THE PROJECT

This paper helps in implementation of detecting harmful gas detection in manhole using sensors and LCD. Municipal sewer of the city is one of the most important infrastructure..As it is relatively narrow and closed which helps in producing toxic, hazardous ,flammable gases. Due to poor management there is likely to gas leak which cause gases to store in large amount and therefore explosion occurs. Thus detecting the presence of harmful gases is necessary. So, the idea is to create a device which is easy to operate and have a low cost.

The process of the system is distributed in two steps.. In the first step, the harmful gases is detected by the gas sensors. The gas sensors helps in detecting harmful gases and provides the signal to the microcontroller. In next step the microcontroller receives the signal, which sent by gas sensors. Then, the microcontroller sends activation signal to the external devices connected which is LCD display .The LCD display helps in displaying which gas is detected and their corresponding values..

Working: This tool is designed to detect harmful gases in manhole/sewage system which includes the gases like CO i.e(Carbon Monoxide), SO2 i.e.(Sulphur dioxide), CH4 i.e. (Methane) and many other harmful gases. So to detect these gases we use gas sensors which senses the gases while cleaning the drainage system. These gas sensors then sends the values which are recorded and therefore are forwarded to the analog ports of microcontroller which is present in the Arduino board. Then, the microcontroller weigh up the values of the sensor to the threshold value of each present sensor which is coded in the microcontroller. So, now if the values of sensors goes past the threshold value which is set previously in the microcontrollers. Then the microcontrollers gives the signal to the buzzer and also provides the message to the base office via GPS module and that displays the value in the LCD display. LCD display shows us the gas name with corresponding values. This will immediately warns the workers so that safety measure must be taken or to get out from the area.
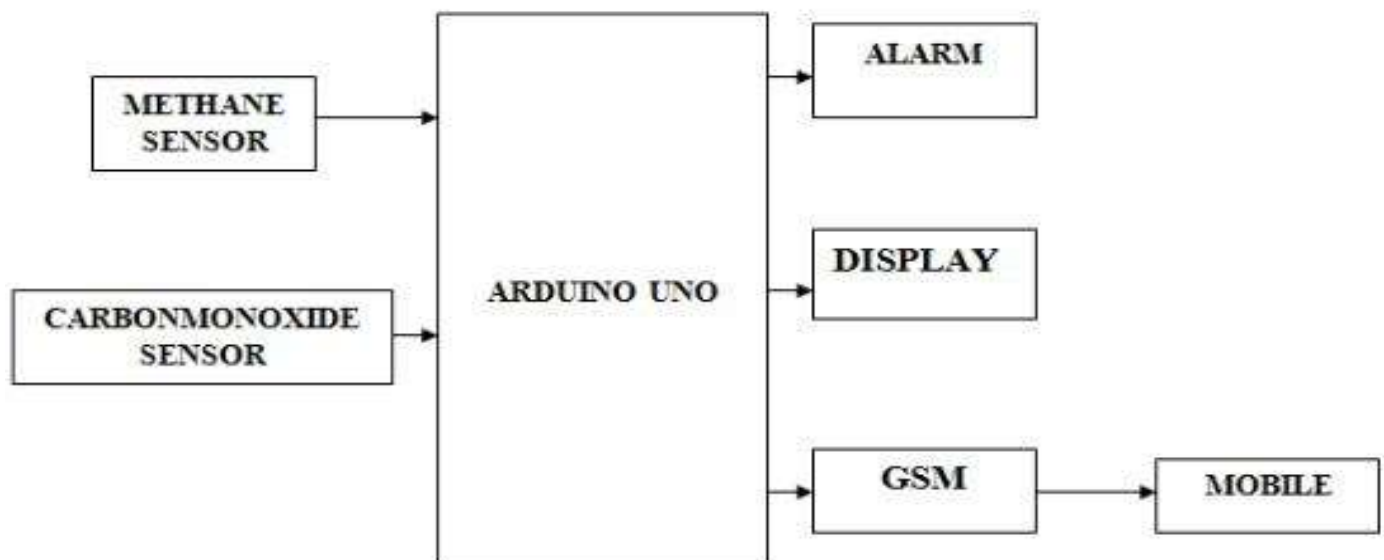
A. Block diagram of the system

Fig.1 Basics block diagram

The input which are the gases are sensed through the particular gas sensors. In this system of detecting harmful/toxic gases we use gas sensors for detecting CH4 and CO i.e. MQ4 and MQ7 respectively. And after that the recorded value is provided to the Programmable Interface Controller(PIC). The message signals which are sensed are defined analog in nature and then they are changed into digital form with the help of analog to digital convertor which is made inside the PIC. The names of the gases which have been sensed are then displayed on the LCD and the concentration in ppm will be displayed on LCD according to the conditions present in programming.

B. MQ4 Sensor

Methane is a colorless, flammable and explosive gas that can cause fire immediately. MQ4 sensor detects the presence of methane (CH4) gas at concentrations from 300 ppm to 10,000 ppm. This methane gas sensor detects the concentration of methane gas in the air and reading its output as an analog voltage. The MQ4 sensor can work at temperatures ranges from -10 to 50°C and it also uses less than 150 mA at 5 V.

Fig.2 MQ4 Sensor

C. MQ7 Sensor

The colorless and odorless gas – carbon monoxide, is generally produced off whenever charcoal is burnt in badly ventilated areas. **MQ7** sensor detects the presence of Carbon Monoxide (CO) at concentrations ranges from 10 to 10,000 ppm. This Carbon Monoxide (CO) gas sensor detects the concentrations of CO in the air and reading its output as an analog voltage. The sensor generally operate at temperatures ranges from -10 to 50°C and absorbs less than 150 mA at 5 V.

Fig.3 MQ7 Sensor

D. Arduino Microcontroller

Arduino is generally divided in two parts. Firstly, Arduino which consists of hardware and second Arduino software which we define it as Arduino IDE. In hardware system we have the board which has 14 digital input output pins, in which 6 pins can be worked as analog inputs and 6 pins as PWM outputs. Also there is a USB port present for connecting with the Arduino board to a computer system with the help we can program our Arduino UNO, a power jack, and also an ICSP (In-circuit serial programming) header that can be coded without disconnecting them from the circuitry and a reset button that is being utilised to restart the program from the initial line of the sketch.
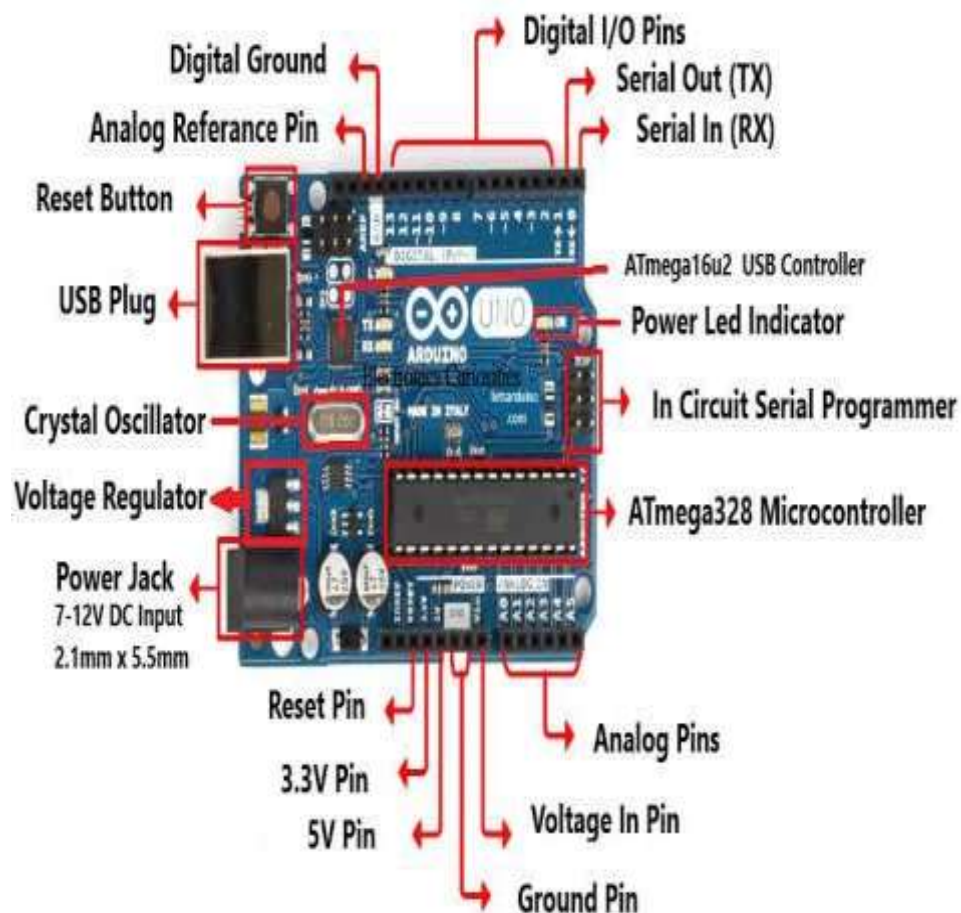
Fig.4 Arduino Microcontroller

E. LCD Display

LCD (Liquid Crystal Display) is defined as an electronic display module and also discover a wide scope of uses. A 16X2 LCD is an extraordinarily fundamental module and is generally used in different gadgets as well as circuits. A 16×2 LCD suggests it can display 16 characters for each line and there are 2 such lines. This LCD given have each character appeared in a 5×8 pixel grid. Mostly used LCD has two registers, Command register(CR) and also a Data register(DR). So, the Command instructions presented by the microcontroller is kept/stored in the command register(CR). Also, Command instruction is a predefined task; which can either be used for clearing the LCD screen, or printing on the screen or setting positions of cursor etc. The data register(DR) are used to store the valid information to be displayed on the LCD screen. The displayed information is the ASCII value of the given character which is displayed on the LCD screen.
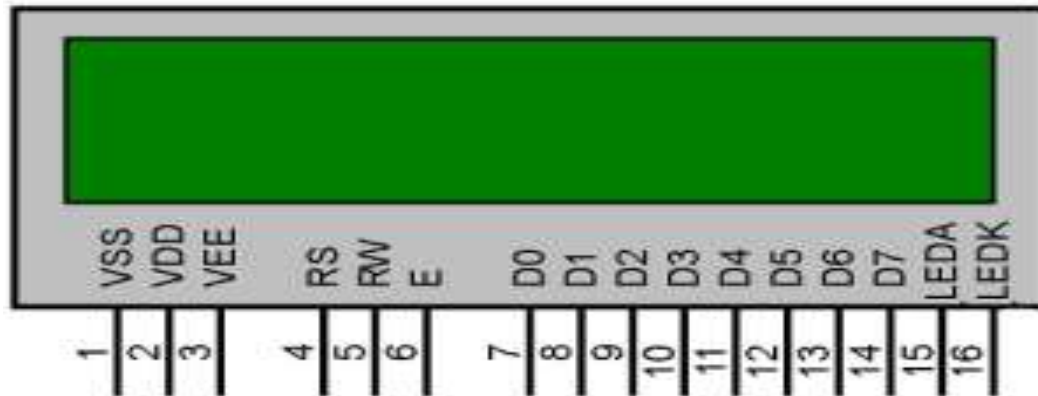

Fig.5 LCD Display

LCD 16 x 2 Pin Descriptions

S.No.	Pin Function	Pin Name
1.	Ground (0 V)	VSS/GROUND
2.	Supply voltage (4.7 – 5.3 V)	VCC
3.	Contrast adjustment; through a variable resistor of 10k ohm	VEE
4.	Select data register when high and command register when low	Register select - RS
5.	High to read from the register and low to write to the register	Read/Write - RW
6.	Send data to data pins when a high to low pulse is given	Enable - E
7.	Data Pin (1- bit)	D0
8.	Data Pin (1- bit)	D1
9.	Data Pin (1- bit)	D2
10.	Data Pin (1- bit)	D3
11.	Data Pin (1- bit)	D4
12.	Data Pin (1- bit)	D5
13.	Data Pin (1- bit)	D6
14.	Data Pin (1- bit)	D7
15.	Backlight VCC 5V (Anode)	LED +
16.	Backlight Gnd 0V (Cathode)	LED -

F. GSM

GSM stands for "Global System for Mobile Communications" is a system which was developed as a digital system which used Time Division Multiple Access (TDMA) technology for communication purpose. It is the GSM itself that digitizes and decompresses the data, and then sends it down a channel with two separate streams of client data. And also the Digital systems have the capacity to load the data rates ranges from 64 kbps to 120 mbps. A GSM module also known as GPRS module consists of chip circuit that is used to set up communication between a mobile device or we can also use computing machine and a GSM system. The modem (modulator-demodulator) is a critical part in the GSM . So the modules have a GPRS modem generated by a power supply circuit and also communication interfaces (like RS-232, USB 2.0, and others) for computer system .Therefore, a GSM modem is a customized modem device with a serial, USB or Bluetooth connection. It can use mobile phones that provides GSM modem abilities..

FIG.6 GSM Module

III. RESULTS

The prototype of system has been tested by sensing a small amount of Methane and carbon monoxide gas near to the sensor. MQ-4 and MQ-7 gas sensor detects Methane and carbon monoxide gas respectively and sends a signal to the microcontroller.

After that microcontroller send an active signal to the LCD display. LCD will show the names of detected gases and their concentration level in ppm. When the concentration level is over than fixed amount (which is mentioned in AURDINO code) then GSM Module will send a message to the users, that the concentration of gases are over the danger level. So workers should avoid too entered under the manhole until the concentration of gases are reduced.When reset button is pressed, the system refreshes itself and the whole system regains its initial position.
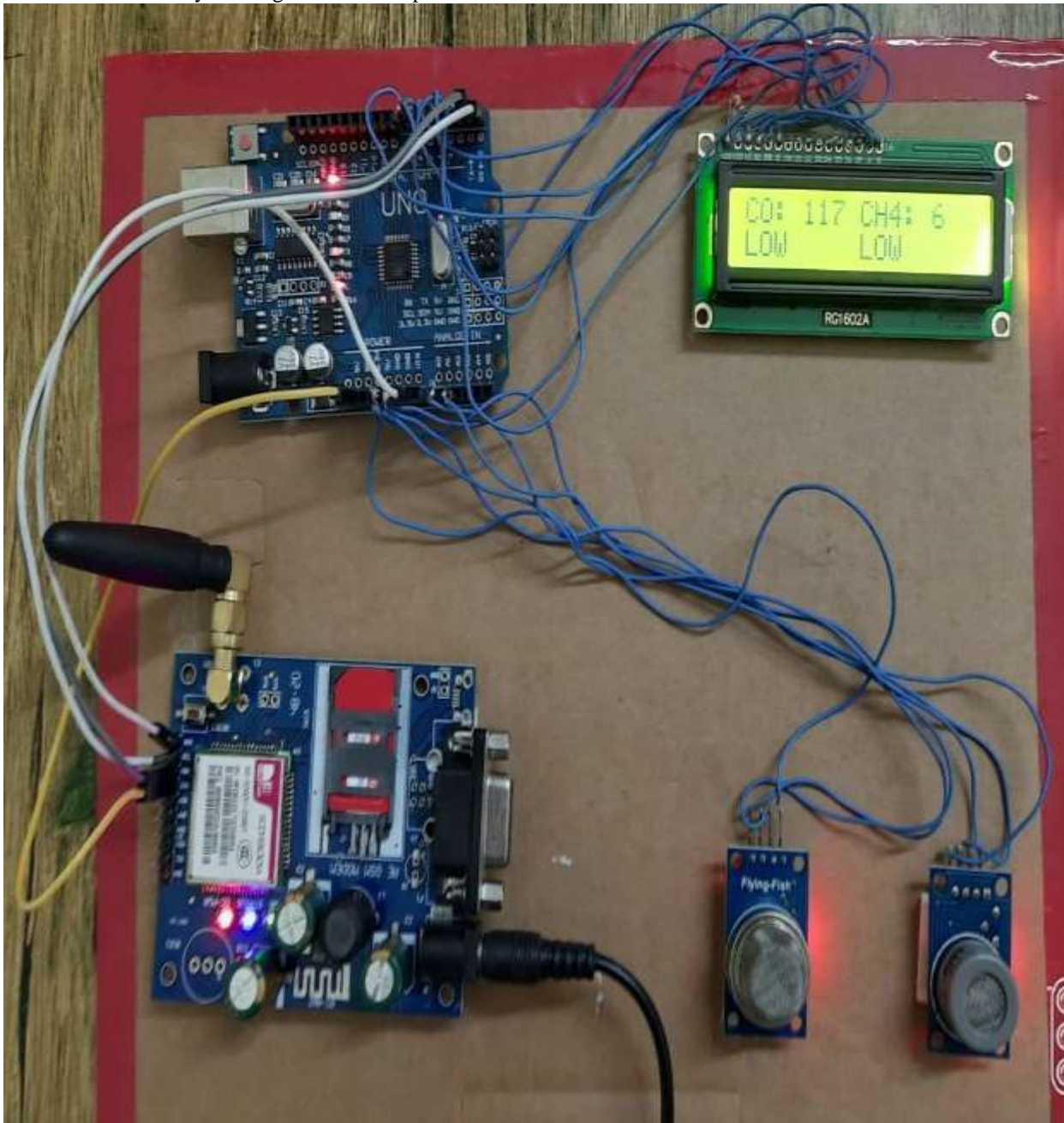

FIG.7 Hardware Model of the System

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IV. CONCLUSION

Harmful gas detection circuit device which applies the embedded system has been carried out in this paper. In this system we have described a new approach for detecting concentration of gases.

The concentration of gases is detected with the help of MQ-4and MQ-7 gas sensors. Sensor sends a signal to microcontroller. In the next step the microcontroller sends an active signal to other externally connected devices. A quick response rate is provided by this system.With the help of this system the critical situations can be solved quickly and comparatively required less time than manual method.

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