Embedding Realtime Multilevel Gas Leakage Control System

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Abstract – Gas leakage has been a major concern in recent times. Though its usage has been extended in various industries, a small unattended leakage can lead to catastrophic damage. Thus the Project titled on "Embedding Real Time Multilevel Gas Leakage Control System", can be used for the prevention of leakage threatening over Multilevel Pipeline system. This project involves the detection of gas leakage using sensors placed at regular intervals and gas leakage block is done by implementing Solenoid Valve to stop the gas passage through the pipeline to avoid excess leakage. In addition to automatic shutdown of gas flow of a single user pipeline in a multilevel based system, an alert message will be sent to the user and also to gas helpline number '1906' through GSM module provided along with a SIM card of any network providers. As the fulfillment of the project is been established using Arduino MEGA Processor, an immediate response for multilevel usage and Maximum efficiency is achieved.

Index Terms – Gas sensor, GSM, Arduino mega microcontroller, Buzzer, Solenoid valve, Multilevel Pipeline.

1. INTRODUCTION

Gas leak detection is a process of identifying hazardous gases in the surrounding environment by the use of sensors, thereby paving a way to prevent further repercussions. Liquified Petroleum Gas, is commonly known as LPG. It is used in many applications in the industrial sector namely in space and process-heating, powering industrial ovens, production of food, kilns, furnaces, production of packing material as well as in powering forklift trucks in warehouses.

A gas line leak comes with a number of negative possibilities, such as the chance of there being a fire, an explosion, or rising levels of dangerous carbon monoxide. Gas leaks in homes and businesses usually occur when a change is made that affects the gas lines. Flexible gas lines can be crimped and can develop leaks. Gas lines made from improper materials may become brittle or even corrode away. Improper installation may be the source of present or future leaks. Gas lines buried, or embedded in concrete, can break with shifting soil or corrode causing gas leaks under your foundation that may or may not explode. An area of dying vegetation may indicate an underground leak. Gas leaks are common in earthquakes, tornados, hurricanes, tsunami, mud slides and other events of nature. In the proposed system we are using the gas sensor to detect the gas leakage in the tubes for a multistoried building. Here the sensor will be placed at regular intervals. Whenever the gas leakage is detected the sensor will detect the leakage and an alert message will also be sent to the concern person regarding the gas leakage. As a preventive measure we are closing the gas tubes using the solenoid valve. Hence hazards can be avoided in a single and multiple level gas pipe lining systems.

2. RELATED WORK

The different LPG sensing technology is used in existing method. The LPG leakage is detected by semiconductor sensor. Nowadays accident occur due to LPG leakage is very common. When the main regulator valve remains open, the LPG leakage gets start. There are two remedial measures i.e. when the gas

leakage is detected, message send to the owner and fire station by using GSM module and the exhaust fan gets switch on[6]. In the first method, there is no controlling action taken automatically, it needs manual controlling which is harmful for human being which is the main disadvantage of that system. In the second method there are number of wiring of the exhaust fan, if the wiring is not proper then it will cause immediate explosion, this is the disadvantage of that system. In above method there is only detection and no controlling action is taken[3].

The input which are the gas es are sensed through the particular gas sensors. In this system sensors for detecting Methane, LPG and carbon monoxide are used. Then this sensed value is passed to the Programmable Interface Controller. The signals that are sensed are analog in nature and are converted into digital form by the analog to digital convertor which is built inside the PIC. The names of the gases which have been sensed are then displayed on the LCD and the concentration in percentage will be displayed on LCD according to the conditions present in programming.

2.1 Arduino Microcontroller:

Arduino is a source with open electronics prototyping platform based on flexible, easy-to-use hardware and software.

Arduino is capable to sense the environment by getting an input signal from a different sensors and can accordingly control different operations.

Fig.2 Arduino Microcontroller

The Arduino programming language is used to the program the microcontroller on the arduino board and it also uses the Arduino development environment. Here this Arduino gets the sensed information from gas sensor. An Arduino board consists of an Atmega microcontroller which is of 8-bits along with complementary components inorder to perform programming and its incorporation into the other circuits. A boot loader is used to preprogramme an Arduino microcontroller so that the programs to be uploaded on the on-chip flash memory is simplified to a great level in comparision with other devices that uses an external programmer.

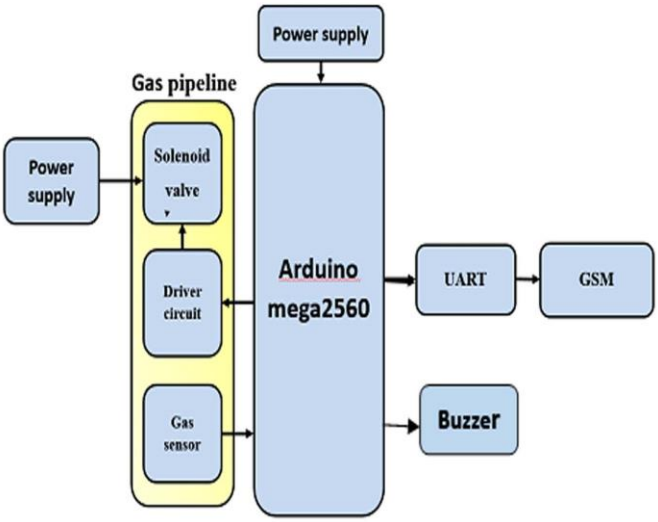

Fig.1 Block Diagram of the system

2.2 MQ -7 Sensor

MQ -7 sensors are used to detect carbon monoxide in devices that deals with this gas in factories and homes. They have stable and long life. They are very sensitive to the carbon monoxide.

Fig.3 MQ-7 Sensor

3. PORPOSED MODELLING

Arduino MEGA module is selected as the microcontroller unit for the project. GSM module is connected, as it is the signaling system which sends the SMS to the user's smartphone. Solenoid valve is connected to the gas pipeline. MQ-6 gas sensor is connected near to the gas source. All the necessary circuit connections and piping connections are made to make the gas detection more accurate and efficient. When the gas sensor detects a gas leakage, an input signal is sent to the arduino and the microcontroller processes the signal. With respect to the gas detection, arduino sends output signals to activate the solenoid valve and the GSM module.

The LPG gas consists of isobutene, propane, methane, etc. A sensitive, efficient gas sensor is required that senses only LPG gas contents and is less sensitive to other gases like cooking

fumes, cigarettes, etc. Sensitive material of MQ-7 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist the sensor's conductivity is higher along with the gas concentration rising. MQ-7 gas sensor [4][10] has high sensitivity to Propane, Butane and LPG, also response to Natural gas. The sensor could be used to detect different combustible gas, especially Methane, it is with low cost and suitable for different application. It senses the leakage of LPG gas and sends the alert signal to the microcontroller alternatively turn on Buzzer when it reaches the danger level.

The GSM module sends the message to the smartphone using the SIM card provided in the slot.be used in Domestic applications as well as in industries. Efficient, Compact Design and Component usage. Use of many sensors makes the device more efficient in detecting the gas leakage. Decreased Response time than the previous model as it uses solenoid valve rather than stepper motor. Exhaust Fan is not used. Hence power is saved. The solenoid valve runs on rechargeable battery. Hence works even in the absence of power supply.

4. RESULTS AND DISCUSSIONS

The prototype of leakage system has been tested by sensing a small amount of LPG, Methane and carbon monoxide gas near to the sensor.

MQ-4, MQ-2 and MQ-7 gas sensor detects Methane, LPG and carbon monoxide gas and sends a signal to the microcontroller. After that microcontroller send an active signal to other externally connected devices. As a result LCD display will show the names of detected gasses. When reset button is pressed, the system refreshes itself and whole system regains its initial position. Hazardous gas detection device which uses an embedded system has been implemented in this paper. In this system we have describe a new approach for gas leakage detection system at a low concentration. The leakage is detected with the help of MQ-4, MQ-2and MQ-7 gas sensors. Sensor sends a signal to microcontroller. In the next step 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 over the manual methods which require large amount of time.

When the gas leakage is detected, the GSM module sends a programmed message to the mobile numbers which are stored in the SIM card. and also, the solenoid valve closes the gas pipeline simultaneously, preventing any more damage and reducing the risk of explosion or combustion. Hence, the objective of our project has been achieved by utilising the microcontroller of Arduino mega board. The gas sensor lifetime will be from 2 to 4 years based on the surrounding environment. Hence a yearly replacement of the sensor is advisable for efficient gas detection.

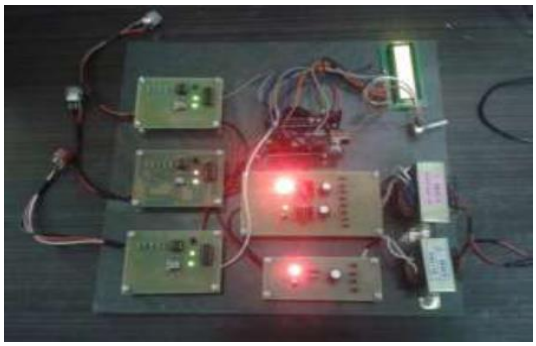

Fig.5 Hardware Model Of The System

5. CONCLUSION

This is an efficient method for automatically detecting and controlling the LPG gas leakage. Moreover, the fire accidents are also prevented by switching off the power supply. The system provides control action by closing the regulator knob, after that the system sends a alert message to the user and fire station within short time of leakage. It has more advantageous function than the existing system thus the real-time automatic approach is proposed in case of rebooking of cylinder. This monitoring and detection system is proposed mainly to meet the safety standards and to avoid fire accidents because of leakage. This prototype not only suits for single user applications but also has its possibilities to work under high pressure industrial applications. In future work, all the wires can be replaced by wireless systems facilitated with Bluetooth or Wi-Fi connectivity which in turn increases the response time and flexibility of the placement of the sensors.

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