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GAS LEAKAGE DETECTION AND PREVENTION 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. The objective of this project is to present the design of a automatic alarming system, which can detect and prevent liquefied petroleum gas leakage in various premises. This system alerts the user by sending him an phone call and alerting the neighbors by buzzer alarm after the gas leaks above setpoint1.The servo motor is used to close the gas pipe valves. This device ensures safety and prevents suffocation and explosion due to gas leakage. This project is implemented using arduino uno and simulated using Arduino ide and proteus software.

Keywords—LPG Detection, gas leakage, gas sensor, servo motor, Arduino uno,, Buzzer.

I. 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. LPG also finds its usage primarily in domestic sector as a fuel for cooking, lighting and refrigeration. LPG is a flammable hydrocarbon which is composed of propane, butane, isobutane and mixtures of these gases. It has high calorific value, which produces less smoke, less soot, and does not cause much environmental damage. Having these desirable properties, leakage of this gas is very dangerous and increases the risks to fire explosion. This leads to both financial and human loss. The number of reports of death due to gas leak explosions has increased in recent years. The reason for such explosions is the lack of substandard cylinders, old valves, worn out regulators and lack of awareness using gas cylinders add to the risks. A solution to this problem is a gas leak detector device. In this project, we made a system that not only detects gas leak but also takes precautionary measure to prevent it.

In the proposed system, we employ a gas sensor to keep a check on the concentration of LPG in the surrounding. The user and his neighbors are audibly notified about the leakage by buzzer and a warning message is sent to the user. To reduce risk to human life, a servo motor is used to close the gas valves and the relay turns off the main power supply. As a visual indication to the user, a 16 X 2 LCD display warns the user regarding the leakage.

II. LITERATURE REVIEW

Many papers have been published on work related to GSM systems and gas leakage detection systems [2], [3], [4], [5], [6], [7]. These works have proved helpful in controlling hazardous impacts. We have built runtime preventive system. In [2], a wireless sensor based home system has been developed for the elderly but does not take into account gas leakage detection. In [3], ZigBee based smart residential neighborhood system is introduced, but does not work for detecting hazardous gas particles. A remote wireless security system discussed in ref [4]that can detect theft, leakage of gas and fire but lacks automatic control. In [5], embedded system based detection system for natural gas pipeline at a long distance is presented. However, it also lacks runtime prevention. In [6], an intelligent monitoring system that can monitor and warn fire sparks is discussed, it does have the capability of immediate gas stoppage. Work in [7], presents an odor compass system to detect the direction of odor but don't react in time.

III. METHODOLOGY/EXPERIMENTAL

A. Components used:

1.Gas sensor Mq6: A gas sensor is a device that detects the presence of gases in an area, often as part of a safety system. One such gas sensor used for LPG gas leak detection is MQ6 gas sensor.It consists of a steel mesh under which sensing element in housed. Sensitive material of MQ6 gas sensor is Tin Dioxide SnO2, which has lower conductivity in clean air. When the concentration of the combustible gases increases in the air, MQ6 senses and its conductivity is more higher along with gas concentration rising. The output of the Gas sensor is in analog form which can be converted into
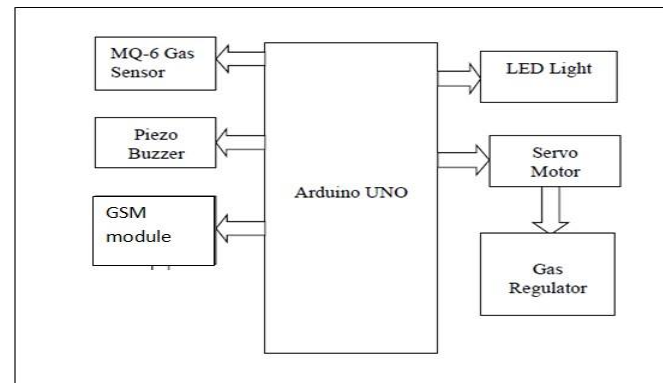
digital form using in built ADC (Analog to Digital Converter). Initially when there is a leak, the gas sensor detects it and gives voltage related to the amount of gas that is getting escaped. MQ6 gas sensor has high sensitivity to Iso-butane, propane, LPG and less sensitivity to smoke and alcohol. The MQ-6 can detect gas concentrations anywhere from 300ppm to 10000ppm. The sensor works with 5volt power supply2.Arduino uno: The **Arduino Uno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.The board is equipped with sets of digital and analog input/output(I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE(Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery

3.Buzzer : A buzzer is an electrical device that makes a buzzing noise and is used for signaling. A buzzer has a piezo disc and an oscillator inside. When the buzzer is powered, the oscillator generates a frequency around 2-4 kHz and the piezo element vibrates accordingly to produce the sound. As soon as the gas leak is detected, the buzzer automatically rings to alert the users about the gas leak.

4.Gsm module SIM900: The GSM stands for Global System for Mobile Communication. It is a digital cellular technology used for transmitting mobile voice and data services. The main purpose of GSM module is to alert the user about the gas leak. The type of GSM module used in this system is GSM module SIM900A. The GSM module allows microcontroller to communicate with mobile phones through UART. It requires a SIM card just like mobile phones to activate communication with the network. Also, they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification.
Once the gas leakage is detected, from the inserted SIM, an SMS alert is sent to the user number. If the user phone is not reachable, the same alert message is sent to the other registered numbers there by alerting the user about the same.

5.Servo motor: A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback.
6.Battery , Leds , Resistors ,jumper wires , breadboard

Practically the working of proposed system is split up into four main parts. In the first part the concentration of gas is detected by the MQ-6 gas sensor. Second part consist of Arduino uno unit in which a program is written. When a gas sensor detects gas leaked it sends signal to the arduino. In third part, once arduino traces the difference, it sends a signal directly to the linked alarm unit followed by sending a phone call to the owner of the house with the help GSM SIM 900 module. In fourth part, servo motor connected to valve after receiving signal from the arduino turns off the main gas supply.

After all this, the system restores to its initial position according to the instructions and programming in arduino, but the main gas supply remains off until someone on his/her own action can turns the supply on and correct the issue so that it does not happen again in future

IV. RESULTS

Gas leakages in households and industries cause risk to life and property. A huge loss has to be suffered for the accident occurred by such leakages. A solution to such a problem is to set up a monitoring system which keeps on monitoring the leakage of any kind of flammable gases and protects the consumer from such accidents. This circuit is a basic circuit which consists of a MQ6 gas sensor, Arduino Uno, servo motor to turn off the knob of the cylinder, GSM module to call the user that there is a gas leakage at home. By this system we can detect the leakage of LPG gas and prevent many accidents and save lives and property

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V.   LIMITATIONS

This system only prevent accidents by turning off the gas valve,It can't do anything if by chance the leaked LPG catches the fire .It can only control the flow of gas .This system can't extinguish the fire occurred.

VI.   FUTURE SCOPE

This monitoring system can be further enhanced by using Bluetooth in place of GSM to send the alert messages to user, which supports another real-time application. For industrial sector, the data collected by the mobile application is beneficiary and used for data analytics. The integration of other sensors like temperature, pressure sensors etc. makes the system as a home automation project.

VII.   CONCLUSION

This system provides a fast and cost-effective solution to prevent gas leak repercussions by reducing the risk to human life. The statistics of concentration of gas collected on to the application can be useful to recognize the faulty valves and regulators prior and do the necessary replacement. Apart from detecting the leakage, a two level prevention mechanism makes the system more reliable. The cost involved in developing the system is significantly low.

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