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Gas leakage detection and alerting system using Arduino Uno

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Abstract

The presence of hazardous LPG gas leakage in a domestic, work place, also, stored gases container gas which exhibits ideal characteristic is use. For that sake, an alarm unit is used to vibrate an alarm which is buzzer. Buzzer gives an audible sign of the presence of LPG volume. The sensors are widely used to detect essence of propane, iso-butane, LPG and even smoke. The sensor has an advantage to combine a sensitivity response time. If the LPG sensor senses gas leak from work place or home, sensor output goes to active low (logic-0) condition. Arduino UNO is used in the project; low signals are overlooked by the Arduino and gas leakage is been noticed by the Arduino. The Arduino UNO turns on the LCD and buzzer. It even turns on the GSM modem after that, it continues to send messages SMS to mobile number specifically mentioned in the program of the source code for alerting danger to the people.

Keywords: Arduino UNO; MQ2 Gas Sensor; GSM Modem; LCD; Buzzer.

1. Introduction

The usage of the gas brings great problems in the domestic as well as working places. The inflammable gas such as Liquidized petroleum gas (LPG), which is excessively used in the house and at work places. The leakage of the gas causes destructible impact to the lives and as well as to the heritage of the people. So, by keeping it in the concept of the project we have determined to develop an examining system which finds the leak of LPG gas and protects the work places by taken correct precaution at correct time. This system provides the information such as when a gas leakage is noticed, sensors of in the project are used to notice the gas leakage and immediately turns ON the buzzer for the danger indication. Buzzer is a clear indication of gas leakage. By the detection of the hazardous gas the alerting message reached to the person who has control over it from the GSM. Detection of the gas leakage is important and halting leakage is important equally. The main objective of this project is that it is extremely accurate with a least cost, this project system is best to detect gas leakage and also warn people around by buzzer beep sound and an SMS is been send to the responsible person for preparatory safety calculations.

2. Related work

In [1] authors introduced GSM based gas leakage detection system, in which the GSM module is introduced for wireless alert and gas leakage detection, efficiently implemented.

In [2] authors proposed WSN based smart system for detection of LPG and combustibile gases, works in flexible ways of smart detecting of gases on recent techniques. In [3] authors presented embedded system for hazardous gas detection and alerting, comprises entire hardware into single embedded board for ease, low cost and sustainable. In [4] it describes the performance and functional characteristics of ARM based sensor. Developed to monitor changes in CO₂,

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temperature, alert in remote location. In [5] PIC18LF4620 based wireless sensor node, monitor the parameter humidity, light, oxygen around the pipeline

In [6] authors introduced dynamic adaptive a sensor based pedestrian crossing system at traffic junctions. This system employs ARM microcontroller, Wi-Fi, Camera module for sort of intersection framework that can give passer-by security also as drivers to see people on foot prior to stay away from any hazardous circumstance. In [7] authors present a low-cost flexible and reliable home monitoring and control system with additional security using ESP32, with IP connectivity through local Wi-Fi for accessing and controlling devices by formal user remotely using android smart phone application. In [8] authors proposed IoT Based Pollution Tracking and Alerting System using ESP 8266. This system records the values of pollution of various types they are air pollution, water pollution, sound pollution. If there is a raise of the values of pollution in air, water, sound the gas, turbidity, sound sensor detects these values respectively and gives it to NodeMCU. In [9] Cloud computing is defined as storing the data in the cloud and running the applications which are connected with it. Everything is hosted in the cloud, which is connected to many computers and servers through internet.

In [10], authors presented Modernization of Indian agricultural system using micro controller” using 8051 and GSM. This system is focused on atomizing the irrigation system for social welfare of Indian agricultural system and also to provide perfect irrigation in particular area. Soil moisture sensor sense the condition of the soil whether it is dry or wet and sends the information to microcontroller. Water level sensor senses the water level in the water source and sends the information to the microcontroller. So the information from the microcontroller is sent as SMS through GSM. By taking references from the above paper we proposed a system which is used to detect leak of gas simultaneously at three different location and but it even alerts people by buzzer and by sending SMS by the GSM to the person whose number is written in the source code.

3. Proposed method

Figure 1 represents the block diagram of the gas leakage detection and alerting system. Arduino UNO (Atmega-328) is the main unit of the system which performs the following tasks.

A signal conditioning of the Arduino UNO is done by output signal of the sensor, provided input to Arduino.

The detection results displayed on LCD.

Indicates the people of danger in work place, factory, home. Buzzer activity with beep(siren) sound is made.

Also send alert SMS to the in charge of the plant whose number is saved in SIM card by using GSM modem. The SMS received depends upon the leak of gas in the detection area of the sensor.

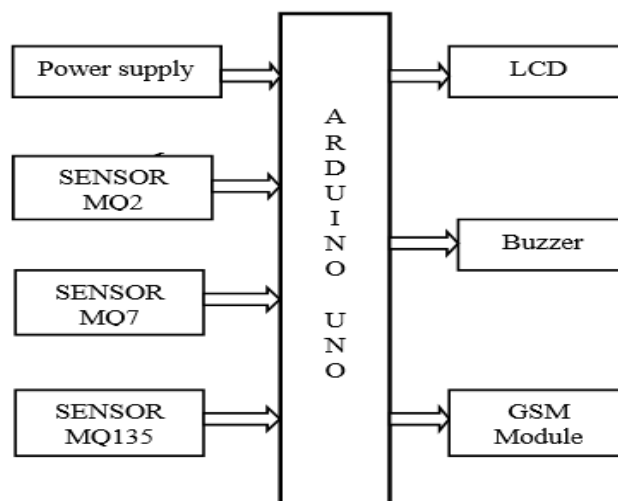


Figure 1 Block Diagram of gas leakage detecting and alerting system

3.1. Hardware Description

Arduino UNO: Microcontroller Arduino UNO is employed is shown in fig.2. The central unit of the system is Arduino board, where all the components are interfaced externally on the board and programmed as per their functionality to work in synchronization. it's an electronic prototyping platform/ board supported Atmega-328 which is of 8-bit, 16 Mhz. during this serial communication is enabled and has 14 digital input /output pins (out of which 6 are PWM) and 6 analog input pins. It operates at 5v. every pin contains a specific function to control.

The storage is non-volatile storage and EEPROM. The key comparison of a non-volatile storage with the EEPROM is that the incontrovertible fact that non-volatile storage contents are erasable. In contrast to a EEPROM, the entire device is erased. where one can erase and judge on bases of Byte and section. The availability of the non-volatile memory during which the blocks of the contains are divided and therefore block by block the portion is erased, where an no erased option is provided for the EEPROM byte. thanks to the actual fact that the programming of the non-volatile storage performed while it's on the system board socket. BIOSROM of the PCB is the new upgrade which is immensely used.



Figure 2 Arduino Uno

MQ2 Sensor: MQ-2 gas sensor module is shown in fig.3. It is a sensor detector used to detects the flammable gas and smoke concentration of the combustible gas in the air, and output is read in the analog voltage and digital value output. Supply input voltage is 5v. it is very sensitive to H₂, LPG, CH₄, CO, SMOKE, PROPANE. It has three pins for transmitter, receiver, ground and sensitivity can be adjust by the potentiometer. Detects LPG from 200ppm to 10000ppm.



Figure 3 MQ-2 Gas sensor

GSM Module: SIM900 GSM module is employed to send SMS alerting on gas detection. GSM is meant as a device used for exchanging the information. SIM card is recovered from the GSM to control the wireless node 5 volts of the DC supply is required by the GSM for functioning. The modem needs only three connection (transmitter, receiver, ground) to interface with Arduino controller Atmega-328 the excess power supply is used. Arduino microcontroller is connected

with the receiver pin to the device. The Arduino provide information to the GSM device [2]. The GSM will send an output to through the SIM inserted into its SIM slot to number written into the code to alert about the leakage of the LPG gas or the other gas sensed by the sensor. AT commands are accustomed communicate with GSM module and it's shown in figure 4.



Figure 4 SIM900A Quad Band GSM/GPRS Module with RS232 Interface

Buzzer: Buzzer is used to alarm the beep sound to indicate and warn the danger to the people working around. The buzzer is the output of the system. The sound of the buzzer is beep-beep, which indicates the danger.

LCD: LCD is employed for displaying the message indicating that " gas detected at zone" into the display, which is initially coded in program to display the danger. The message been displayed on the LCD, data and command both are register of LCD and it's shown in fig.5. The register selects is employed to modify the registers. data register RS=1, whereas for the command register RS=0 is employed.



Figure 5 16x2 LCD display

3.2. Software Implementation

Figure 6 shows the chart flow of implementation of the software proposed system. This system monitors the gas, smoke by sensor 1, sensor 2, sensor 3. If any gas is detected the signal of sensors goes low and activate the Arduino UNO. Which send signals to the LCD ("GAS DETECTED AT ZONE), where sensor 1 is for zone 1, sensor 2 for zone 2 and sensor 3 for zone 3 respectively, Buzzer and GSM to alert the people about danger and if no gas is detected then LCD displays "NO GAS DETECTED" in its 16x2 display.

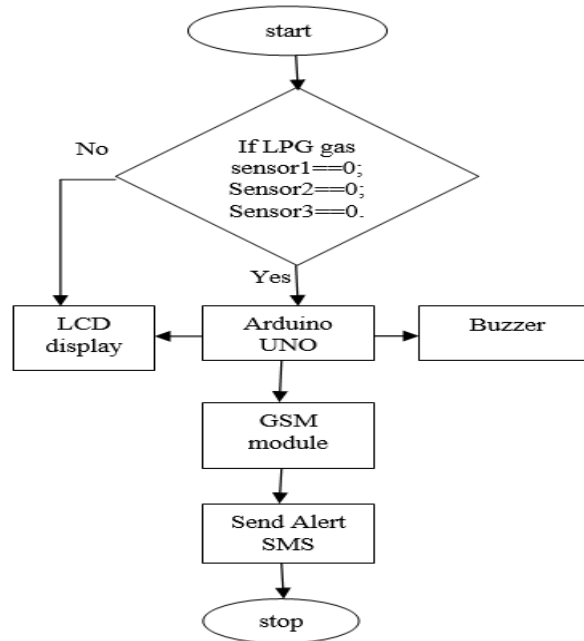


Figure 6 Flow Chart of Proposed System

4. Results and discussion

Figure 7 shows the schematic diagram of our project. This technique has been tested by leak of gas almost about sensors, MQ2 gas sensor sends the signal to the Arduino UNO after detecting the gas leakage. Arduino to other externally connected device such as LCD, buzzer and GSM send vigorous signals. SMS is sent by GSM module to the provided mobile number as a result. In practice, results for are noticed by the people surrounding by the area are displayed in the LCD and buzzer sound indicate the danger to the people by making beep sound.

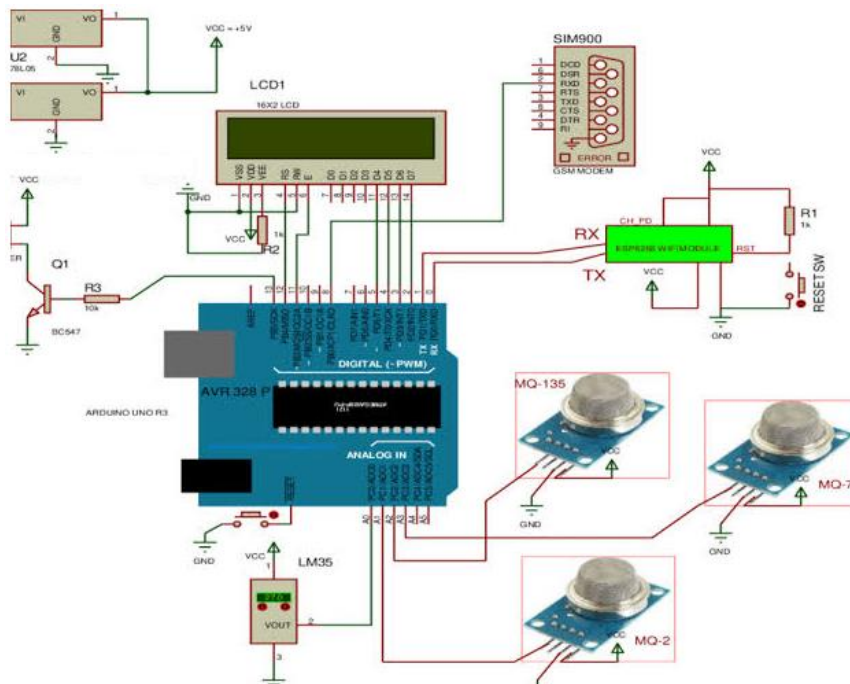


Figure 7 Schematic diagram of Proposed System

The figure 8 shows the prototype of the proposed system. Figure 9 shows the result of sensor 1 which displays the result as “GAS DETECTED AT ZONE 1”, and the entire hardware is embedded into a single board shown with wireless GSM result.

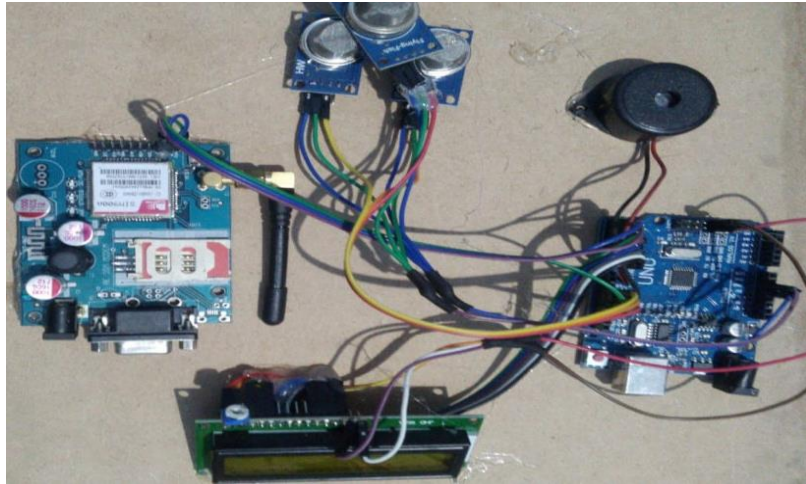


Figure 8 Prototype of the proposed system



Figure 9 Results of proposed system

5. Conclusion

After this project performance, can conclude that detection of the LPG gas leakage is incredible in the project system. Applicable usefully in the industrial and domestic purpose. In danger situations we are able to save the life by using this system. An alert is indicated by the GSM module. A sensor node senses gas like CO₂, oxygen, propane. The estimated range of transmission and consumption of power is obtained. The simple procedures and Arduino UNO Micro controller area used to build the sensor.

Compliance with ethical standards

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Disclosure of conflict of interest

Author claims that he has no conflict of interest.

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