

Microcontroller Based LPG Gas Leakage Detector Using GSM Module

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Abstract: Gas leakage is a major problem with industrial sector, residential premises and gas powered vehicles like CNG (Compressed Natural Gas) buses, cars etc. One of the preventive methods to stop accidents associated with the gas leakage is to install a gas leakage detection device at vulnerable places. The aim of this project is to develop such a device that can automatically detect and stop gas leakages in vulnerable areas. The system detects the leakage of the LPG (Liquefied Petroleum Gas) using a gas sensor and uses the GSM to alert the person about the gas leakage via SMS. When the LPG concentration in the air exceeds a certain level, the gas sensor senses the gas leakage and the output of the sensor goes LOW. This is detected by the microcontroller and the LED and buzzer are turned ON simultaneously. The system then alerts the customer by sending an SMS to the specified mobile-phone.

Keywords: GSM (Global System for Mobile Communications), LPG (Liquefied Petroleum Gas), Gas Sensor MQ-5, LCD (Liquid Crystal Display), LED (Light Emitting Diode).

I. INTRODUCTION

LPG consists of mixture of propane and butane which is highly flammable chemical. It is odourless gas due to which Ethanethiol is added as powerful odorant, so that leakage can be easily detected. We can detect the presence of dangerous LPG leakage in the cars, industrial sectors and residential premises using an Ideal Gas Sensor. We can easily integrate the LPG gas leakage detector unit into a unit that can sound an alarm or give a visual suggestion of the LPG concentration. The sensor used in this Project will have both admirable sensitivity and rapid response time. This sensor can also be used to sense other gases like iso-butane, propane, LNG and even cigarette smoke. The output of the sensor goes LOW as soon as the LPG sensor senses any gas leakage. This is detected by the microcontroller and the LED & buzzer are turned ON. After a delay of few milliseconds, the exhaust fan is also turned ON for throwing the gas out and a "GAS LEAKAGE" message is sent to a pre-defined mobile number using GSM Module.

II. LITERATURE REVIEW

Various research groups are working all over the world for the development of Microcontroller based LPG Gas Leakage Detectors using GSM Module. LPG, first produced in 1910 by Dr. Walter Snelling is a mixture of Commercial Propane and Commercial Butane having saturated as well as unsaturated hydrocarbons. Before the development of electronic household gas detectors in the 1980s and 90s, gas presence was detected with a chemically infused paper that changed its colour when exposed to the gas. Since then, many technologies and devices have been developed to detect, monitor, and alert the leakage of a wide array of gases.

The main applications of a LPG Gas Leakage Detector would be :

- To protect ourselves from any gas leakage in cars, industries, homes, hospitals etc.
- To safeguard ourselves from gas leakage in heating gas fired appliances like boilers, domestic water heaters.
- To be used in large industries which use gas as their production.
- To provide safety from gas leakage in cooking gas fired appliances like ovens, stoves etc.

This project has many advantages which are as follows:

- The Project is easy to use and it gives remote indication to the user.
- The Sensor used in this Project has excellent sensitivity combined with a quick fast response time.
- The system is highly reliable, tamper-proof and secure.
- In the long run the maintenance cost is very less when compared to the present systems.
- It is possible to get instantaneous results and with high accuracy.

This Project has a lot of Future Scope in the sense that using this project we can provide a voice feedback system in the future. With recent development in technology, Temperature display during periods wherein no message buffers are empty is one such theoretical improvement that is well possible. Another very interesting and significant improvement would be to accommodate multiple receiver MODEMS at different positions in the geographical area carrying duplicate SIM cards. Multilingual display can be another added variation in the project. Audio output can be introduced to make it user Friendly.

III. METHODOLOGY USED

SnO₂ metal oxide is used in TGS gas sensor. When SnO₂ is heated at a particular temperature in air, the oxygen gets absorbed on the crystal surface with a negative charge. From the crystal surface donor electrons are transferred to the absorbed oxygen which results in leaving positive charges in the space charge layer. Thus the surface potential serves as a potential barrier against the electron flow.

In the sensor the electric current flows in the sensor through combination part of SnO₂ micro crystals. Potential barrier forms at the grain boundaries which prevent the carrier to move freely. The electrical resistance of the sensor is recognized by this potential barrier in the presence of deoxidizing gas which reduces the barrier height in the grain boundary. The sensor resistance decreases due to this reduced barrier height.

ATMEGA16 Microcontroller Details

Description:

The ATMEGA16 is a low power CMOS 8-bit microcomputer and high performance microcontroller. Erasable read only memory and which have 16K bytes of Flash programmable. For manufacture this device The Atmel's high-density non-volatile memory technology is used. The on-chip flash also allows reprogramming in-system.. The Atmel ATMEGA16 is a powerful microcomputer, reliable and a highly-flexible solution to many embedded control applications by combining a versatile 8-bit CPU.

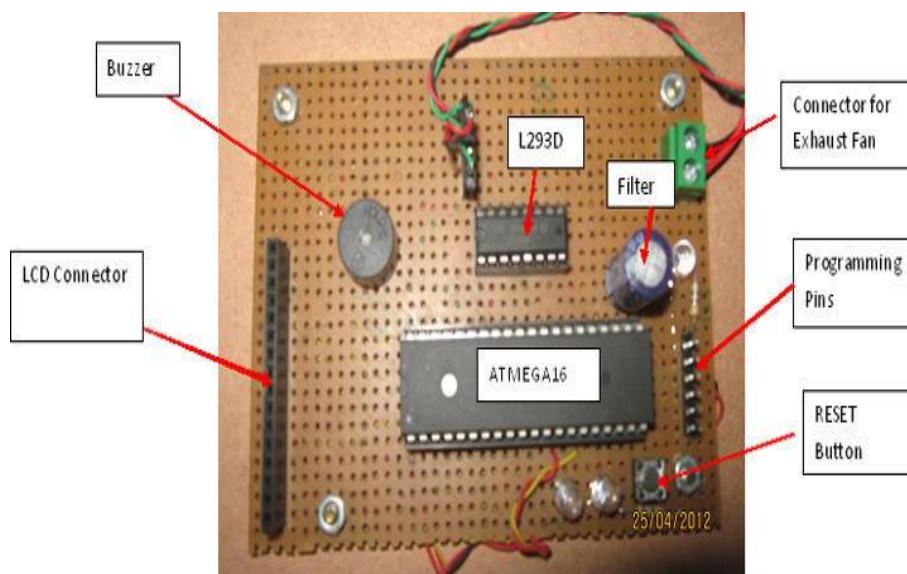


Figure.1 Microcontroller Circuit with Peripherals

GSM Module:

GSM module is used to send a message .The name of GSM module SIM_300 with RS232.Buzzer, power supply and audio interface are used. This can be connected to PC by using a USB to Serial Adaptor. Real terms are used to send & receive data.

The interface between microcontroller and GSM module can also be done directly with the help of wires.

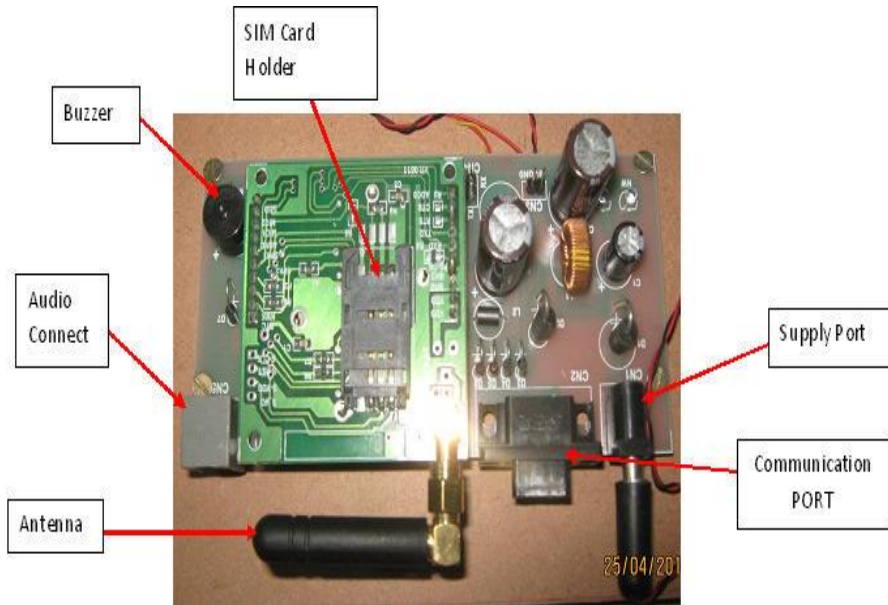


Figure.2 SIMCOM_300 GSM Module

Connection between Microcontroller and GSM Module:

Transmitter Pin (Tx) of Microcontroller is connected to the Receiver Pin (Rx) of GSM Module and Receiver Pin (Rx) of Microcontroller is connected to the Transmitter Pin (Tx) of GSM Module.

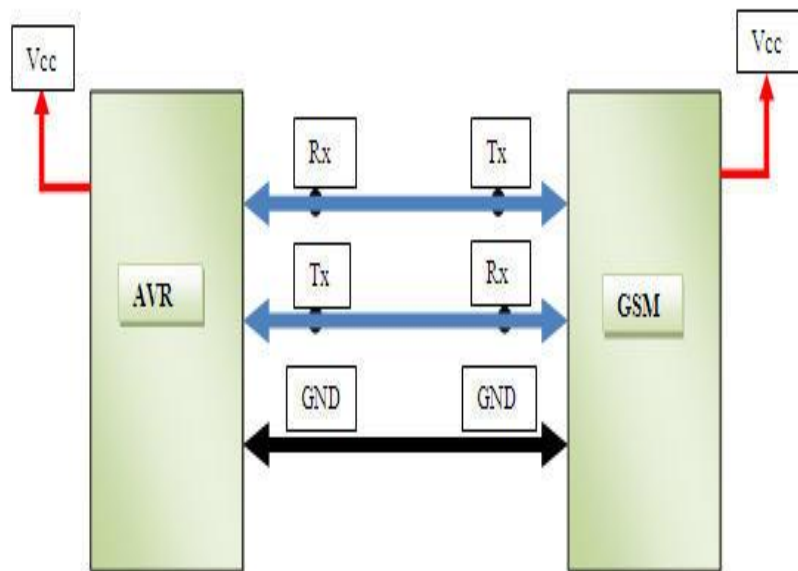


Figure.3 Connection between Microcontroller and GSM Module

Power Supply:

With the help of step down transformer of 230V AC primary to 0-12V, 500mA secondary power supply is taken from main supply. Full-wave rectifier and a capacitor filter provide the output voltage and then fed to 5-volt regulator (LM7805) whose output is used as power supply for IC's and microcontroller.

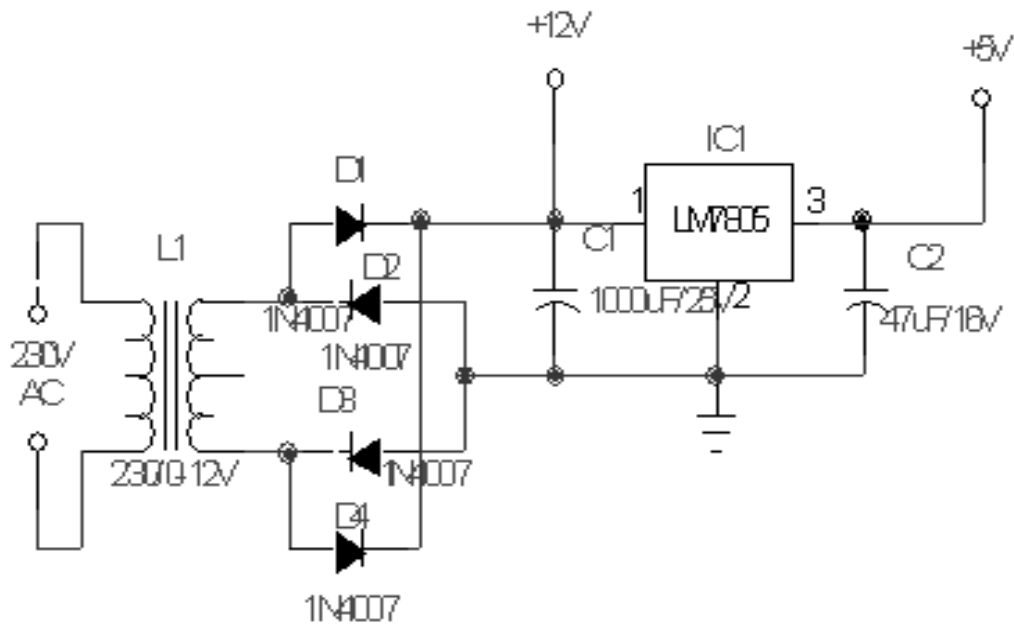


Figure.4 Power Supply Circuit

Complete Connection Diagram:

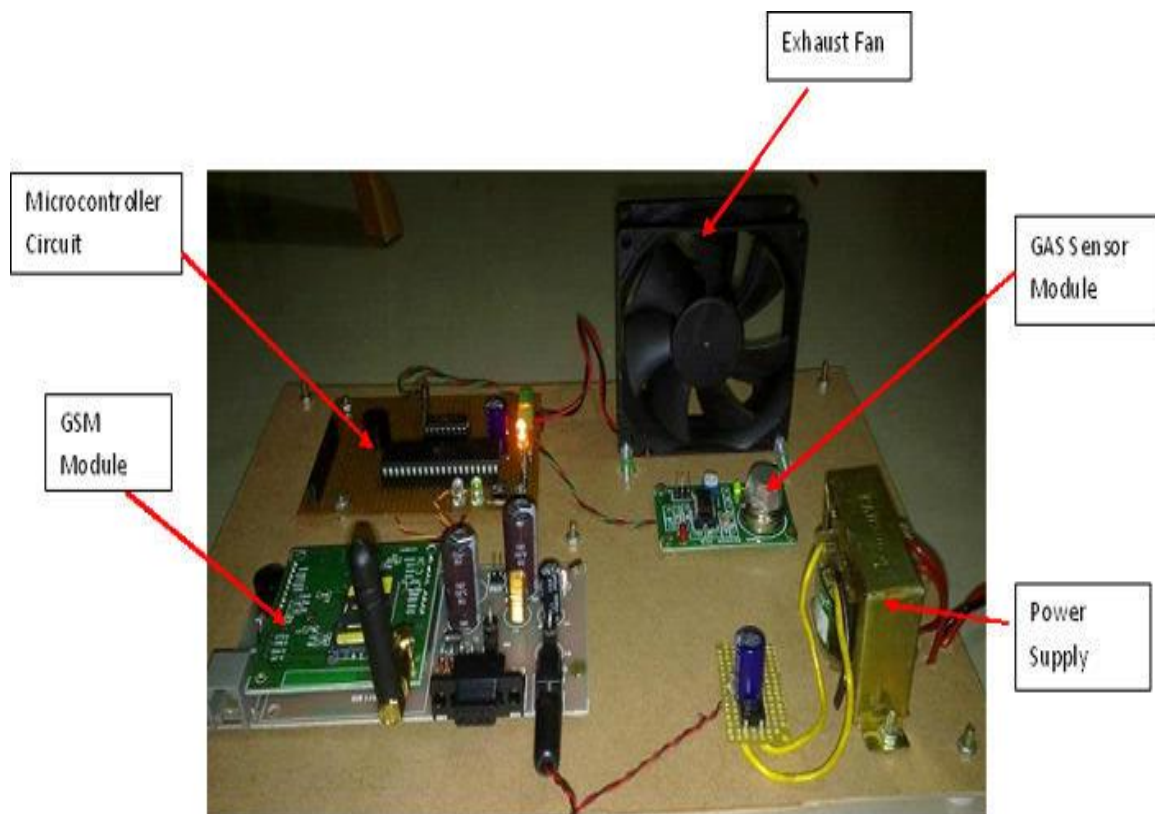


Figure 5 Complete Connection Diagram

The Complete Connection Diagram consists of the Microcontroller Circuit, GSM Module, Power Supply, GAS Sensor Module and Exhaust Fan. The Power Supply is fed to the GSM Module. The output of the sensor goes low as soon as the MQ-5 Gas Sensor senses any gas leakage from the storage. This is detected by the microcontroller and the LED & buzzer are turned ON. After the delay of a few milliseconds, the exhaust fan is also turned ON for throwing the gas out and the microcontroller continues sending message as "GAS LEAKAGE" to a pre-defined mobile number using GSM Module.

Flow Chart Diagram:

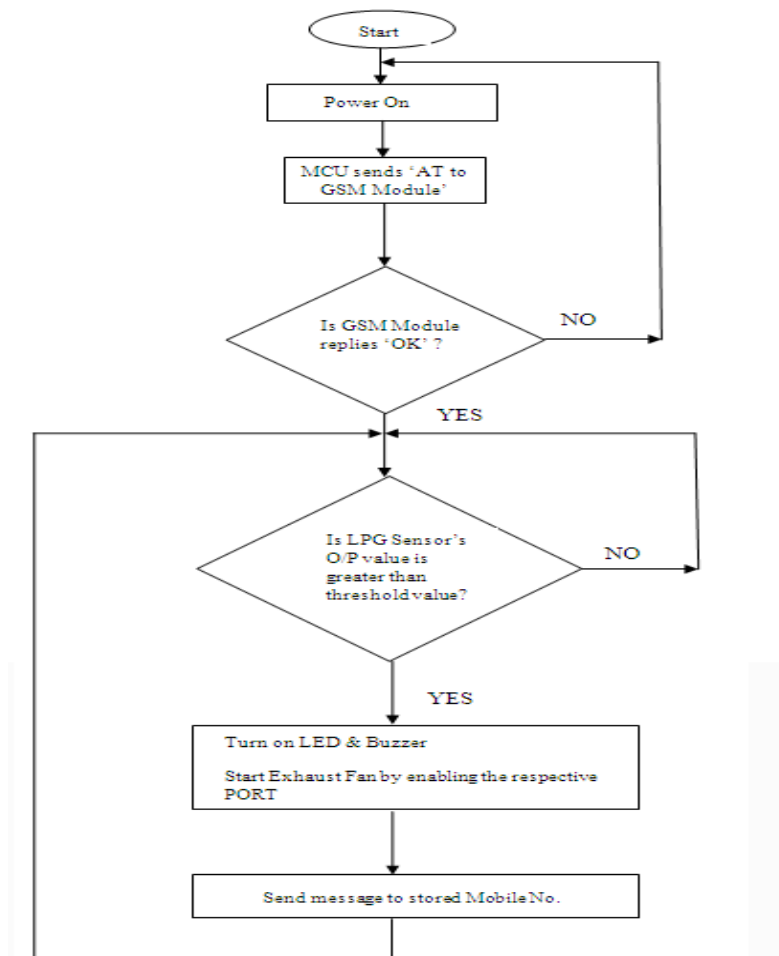


Figure.6 Flow Chart Diagram

IV. RESULT

The designed system prevents gas leakage inside homes as well as outside homes. The system detects the LPG gas concentration in the air if it exceeds a safety level and then responds by using GSM to send an SMS to the consumer. The LED and Buzzer are activated to alert the consumer in case of gas leakage and the system displays the message on LCD display.

V. CONCLUSION

LPG Gas Leakage is a major problem in many industries and households. We have designed such a system which can detect Gas Leakages effectively using a gas sensor and alert people either by using GSM to send a message to their mobile phones or by activating the LED, Buzzer. Hence our Project will definitely prove to be a boon for households and industries in preventing future gas leakages.

This research work has many advantages which are as follows:

- The Research Work is easy to use and it gives remote indication to the user.
- The Sensor used in this Research Work has excellent sensitivity combined with a quick fast response time.
- The system is highly reliable, tamper-proof and secure.
- In the long run the maintenance cost is very less when compared to the present systems.
- It is possible to get instantaneous results and with high accuracy.

The Research Work being carried out is useful in the following fields :

1. Homes
2. Gas cars
3. LPG storage
4. Gas detector
5. Gas leakage detector
6. Combustible gas detector
7. Factories

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