Automatic Power Tripping on Gas Leakage Detection
Jitendra Sharma¹ Vivek Vinayak² Subodh Kumar³ Suman Kumar⁴ Raviram Rakhyani⁵
¹,²,³,⁴,⁵Department of Electrical Engineering
¹,²,³,⁴,⁵RTU University, Rajasthan, India

Abstract— Due to advancement in science and technology, our lives have become easier. But, it can’t be ignored that it has many a times resulted in a severe hazard. Hazards related to gas leakage in household and coal mines is increasing and has taken many precious lives. In most of the cases, the accident is caused by the electrical spark produced during gas leakage while switching which results in huge loud explosion. We, hereby present our idea to overcome this hazardous problem by installing a device which senses the gas leakage through gas sensor and sends the signal through microprocessor to the relay. After the gas leakage has exceeded the threshold value, the relay sends a signal to trip the power to prevent accident.

Key words: Microprocessor (HT12E & HT12D), Gas sensor(MQ-6), RF Module, Relay

I. INTRODUCTION

By the advancement of Science and Technology, we have started using such energy sources which are easy to handle and are convenient to use. LPG is used in most of the houses and also used in automobiles now a day as an alternative to petrol and diesel. For the mass production of electricity, we use coal as a fuel because of its easy availability. Although it is easily available, convenient and clean fuel but it can’t be neglected that there is a threat to our life and property as it is highly combustible. There is a great chance of leakage of LPG, because it is either available in pressurized metal cylinders or in pipeline supply. The same threat is present in coal mines because there is a of inflammable gases from time to time. So if the leakage occurs there is a huge chance of an explosion even when an electrical spark occur which may result in loss of life and property.

So our idea and work is mainly focused on reducing accidents related to gas leakage in households as well as in industries or maybe coal mines. Our system uses RF Module, which is a wireless technology and is more reliable and mobile.

II. IMPLEMENTATION

The above mentioned wireless gas leakage system comprises of two main parts: the gas leakage detecting and transmitting module, and the receiving module. An alarm is raised by the detecting and transmitting module, whenever the amount of LPG increases above threshold value. A Radio Frequency system is used to send an alarm to the receiver. The receiver module is movable and can be moved to any part of the house according to requirement and convenience so as to raise an alarm as soon as possible.
III. GAS LEAKAGE DETECTION- TRANSMISSION MODULE

The function of this part of the system is to detect the change in the amount of LPG and if such a change is observed an alarm is raised as a warning. Transmitting system comprises of a gas detection sensor (MQ-6 gas sensor), a sensing circuit, a microcontroller(HT12E), and an RF transmission system(TWS-418). A gas sensor which is sensitive to LPG, natural gas and other gases like as CO and H₂ but is not sensitive to the normal air is used; so the sensing of concerned gases is not affected by normal air. The sensing part is composed of Tin Dioxide (SnO₂) layer which is resistive in nature and its resistance changes according to the change in the amount of the gases like LPG, methane, carbon monoxide, and alcoholic gas. MQ-6 gas sensor is shown in the figure. The sensor can respond to changes of very small concentrations of the LPG, CO, H₂ and natural gases as low as 0.1 mg/L, which makes it most appropriate for gas leakage detection system. The sensor is also sensitive to room temperature and humidity. A DC power supply of 5 Volts and a load resistance (RL) is required by the circuit. A heating element having a fixed resistance (RH) is used to raise the temperature to a certain level so that the circuit may function properly. The circuit needs to remain switched on for a specific amount of time before making any observations or readings. The same power supply is used for the sensing circuit as well as the heating element. The output voltage Vo from the sensing circuit is given by:

\[ V_o = \frac{R_f}{R_s + R_L} V_C \]

Fig. 4: MQ-6 gas sensor.

Voltage from the sensor is used by the microcontroller for making calculations regarding the changes in concentration levels of the gases. When operating in normal circumstances the microcontroller starts with a stage in which the sensor voltage read by it is used as the zero value. The reading of the sensor voltage is done continuously so as to compare it with the calibrating voltage. A message is sent to the receiver segment if there is a change in the predetermined voltage threshold. In order to do this the microcontroller sends a USART encoded packet through the I/O port into the input pin of the Radio Frequency transmitting module. The RF transmitting segment is a low power frequency modulated (FM) one-way link which can reach a distance up to 200 m outdoors and approximately 30 m indoors.

IV. GAS LEAKAGE DETECTION- RECEIVING MODULE

The receiver module is a mobile unit which receives state information from the gas detection and transmitting segment of the system. It comprises of a Radio Frequency receiver and a microcontroller (HT12D). The RF receiver collects the information from the transmitter and forwards it to the microcontroller. The microcontroller does the reading, decoding and displaying of the data through output devices (LED & buzzer). Apart from indication, a relay switch is used so as to trip the power supply in order to prevent sparking which can cause damage to household.

V. RESULTS

The Radio Frequency based gas detecting and Automatic power trip system which is used, depends on many factors such as the distance of the receiver and the concentration of the gas present in the air. The system is calibrated for a threshold concentration value of the gas, so when the concentration of the gas drops below the threshold value, the power will be untrip again.

VI. CONCLUSION AND SCOPE FOR FURTHER IMPROVEMENT

The work of this implemented idea can be used or installed for household purpose or in any industry or coal mines, where there is a chance of gas leakage and threat to precious human lives. Beside many advantages of this system, it provides a very accurate result because the receiver part of this system is sensitive to minute changes of concentration of gas. It can detect small concentrations down to 100 ppm. The sensitivity of the entire system can be adjusted by changing the small load resistor of the sensor through which we can calibrate it manually. This system will well serve in mines because the receiver and the transmitter module are not attached and are wireless. It makes it mobile to be placed anywhere within the range. We can make further improvements in our system such as installing temperature sensors, humidity sensors through which the power will be tripped automatically when it senses a certain high value of moisture during monsoon or high temperature during any accident. We can also implement silicon control rectifier (SCR) instead of a electromagnetic relay coil for power trip which will be more effective and further reduce sparks while tripping power.

REFERENCES

[1] Luay Fraiwan, Khaldon Lweesy, Aya Bani-Salma, Nour Mani, Jordan University of Science & Technology.
[5] indane.co.in/