# LPG GAS LEAKAGE DETECTION, MONITORING AND CONTROL USING LabVIEW

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***Abstract*- The aim of this paper is to detect the leakage of Liquid Petroleum Gas (LPG) to avoid various fire accidents taking place in industries and factories. It's also used for home safety applications. It works on the principle that when there is an excess of concentration of LPG gas, it is sensed and the cylinder valve automatically shuts off. In this way gas leakage is controlled and fire accidents are avoided. For this purpose, we use a MQ6 sensor (which is the gas sensor here) and NI LABVIEW software. The system is programmed such that when the gas concentration crosses a certain value, an alarm buzzer is triggered to alert the surrounding. Thus the cylinder valve can be closed manually or an automatic shutting mechanism can be used.**

***Index Terms*- LPG, LabVIEW, MQ6 sensor ,alarm, leakage.**

## I. INTRODUCTION

Liquefied petroleum gas or liquid petroleum gas (LPG or LP gas) are highly flammable mixtures of hydrocarbon gases. It is also known as propane or butane and is used as a fuel for various heating and cooking purposes.

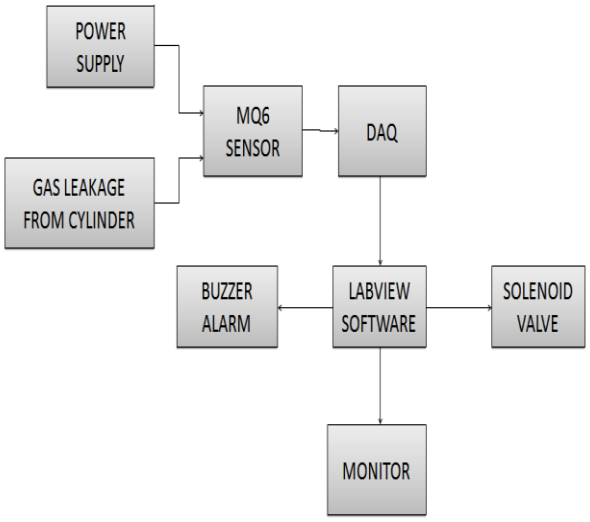
LPG is used as an alternative to provide electricity and heating oil (kerosene).It is also used as a fuel for both light weight and heavy weight vehicles. While LPG is composed of primarily propane and butane, propylene and butylenes and various other hydrocarbons are present in smaller concentrations. A small amount of ethanethiol (a powerful odorant) is added to check if there is any leakage. This is done since LPG is an odorless gas. However, there is a possibility of ignoring the smell in case the leakage is of considerably lower concentration. For this purpose an embedded system is used to continuously monitor the gas leakage. This system comprises of an MQ6 sensor which is used to sense and detect the LPG depending upon the varying concentration of gas in air. The sensor is highly sensitive and responsive in nature. The output of the sensor is given to a NI DAQmx9219 which is interfaced with the computer. The DAQ card will acquire the analog signal from the sensor and convert it into digital signal that can be used by the virtual instrument program. This is where the control action takes place when gas leak is detected. The VI program is used to energize the relay which will control the solenoid valve. This will push the cylinder valve to OFF mode. Thus the supply of gas through the cable is stopped and leakage is controlled. At the same time the system is programmed such that a buzzer alarm is triggered whenever the leakage goes beyond a certain level. This will alert the people living in the surrounding who can close the cylinder valve manually. Thus our system is used to avoid fire accidents and ensuring home safety.

## II. SYSTEM MODULE

The block diagram for the LPG detection and monitoring system is given below Fig(1). The system comprises of a MQ6 sensor, pc installed with labVIEW software, NI DAQmx9219, solenoid valve and a lpg cylinder for gas supply. In the first step the sensor will detect the gas in case there is a leak and send it in the form of analog signal to the DAQ card. The daq will convert it into digital signal and give it to the virtual instrument program. This program is

designed in labview platform. Here a comparator will compare the incoming signal with a preset value and will trigger a system of buzzer and alarm whenever it exceeds the threshold value. The alarm is in the form of a LED and will produce a beep sound indicating a warning message.

## III. BLOCK DIAGRAM




**MQ6 SENSOR**:

It is used for sensing LPG (composed of mostly propane and butane) and is often referred to as liquefied petroleum gas (LPG) sensor. The MQ6 sensor can detect gas concentrations anywhere within the range of 200-10000 ppm. It has high sensitivity and fast response time. It is highly sensitive to LPG, iso-butane, propane and less sensitive to alcohol, cooking fume and cigarette smoke. Its resistance changes as the concentration of gas changes. It requires a power supply of 5v (AC or DC).It consists of a Tin dioxide (SnO2) sensitive layer on the top, measuring electrode, and heater made of plastic and stainless steel. It has a Load resistance (RL) of about 20 K. The sensor has six pins out of which 4 pins are used for fetching signals and the remaining 2 pins are used for providing heating current.

Fig.1.0 MQ-6 gas sensor.

**LabVIEW:** LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a platform for system designing and provides a development oriented environment for visual programming in National Instruments. It is a graphical programming language used for creating, measurement and automation applications. Here we use graphical icons instead of text to create applications**.** The Programming language used in LabVIEW is dataflow programming language commonly known as G.G is used to execute the flow of data. It is used for parallel execution, multi processing and multi threading. LabVIEW is used for user interfacing. It consists of subroutines or programs called virtual instruments VI). The VI comprises of a block diagram, a front panel and a connector panel. The front panel consists of control and indicator. The control is used for providing input and the indicator displays the output. The block diagram comprises of the graphical source code.

**NI-DAQ:** It stands for Data Acquisition. It is used for acquiring and generating signals. Here we interface the MQ6 Sensor with the PC using the DAQ. We can also use NI-ELVIS for this purpose. The DAQ will receive the analog signal from the sensor and convert it into digital signal that is used to control the LabVIEW program. The DAQ Hardware is used to acquire, measure and analyze data. We use a DAQ Assistant express VI to create a task in NI-

DAQmx. NI-DAQmx is a programming interface to communicate with DAQ.


Fig. 1.2. DAQ card

## IV. TOOLS USED IN LabVIEW

**WHILE LOOP:**

While loop is a control flow statement that allows code to be executed continuously based on a given Boolean condition. It executes the sub diagram until the conditional terminal receives a particular Boolean value. It will continue to execute the condition until it is true. It is found in the structure palette under function palette of LabVIEW. The while loop will execute a condition at least once even when the condition is false.

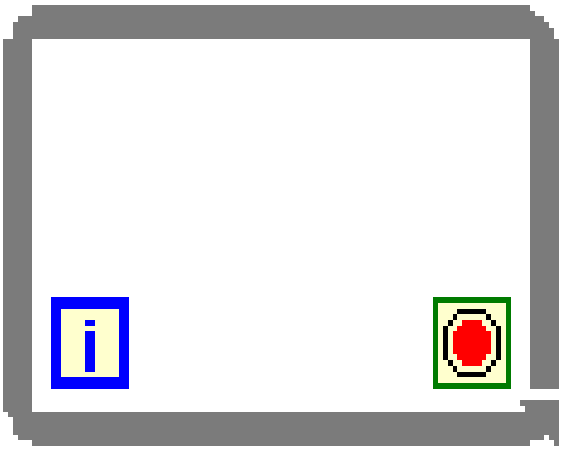


Fig.1.2 While loop

**CASE STRUCTURE:**

It has two or more sub diagrams or cases. Only one case is executed at a time. It is similar to if..then..else statement. The case selector label is present at the top and it contains the name of the selector value with increment and decrement arrows on both sides. These arrows are used to scroll through the cases. There are two cases (TRUE and FALSE).

**SELECTOR:**

It returns the value wired to T or F input depending on the value of S. The function returns the value wired to T if S is TRUE. If S is false it returns the value wired to F, if S is FALSE. The selector function is selected by clicking the select function from the comparison palette.

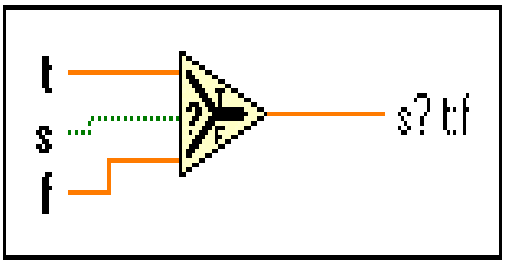



Fig.1.3 select switch

**INDICATOR:**

Here we use LED, Buzzer and toggle indicators. Whenever there is a gas leakage, it will be indicated as a numeric in the front panel the LED will glow correspondingly to the leak value. If it crosses the limit, the toggle switch turns on.

**GRAPH:**

The graph displays the output depending upon the change in input values. There are various types of graphs such as XY, waveform chart, Bar graph etc.

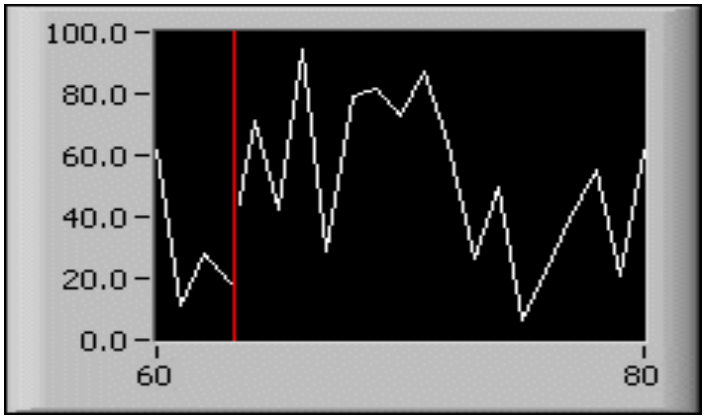



Fig.1.4 waveform graph

**COMPARATOR:**

Greater than and less than are the two comparison tools used to compare the input value with the set value.

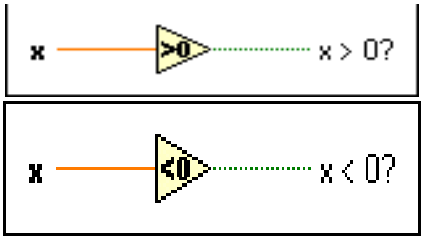
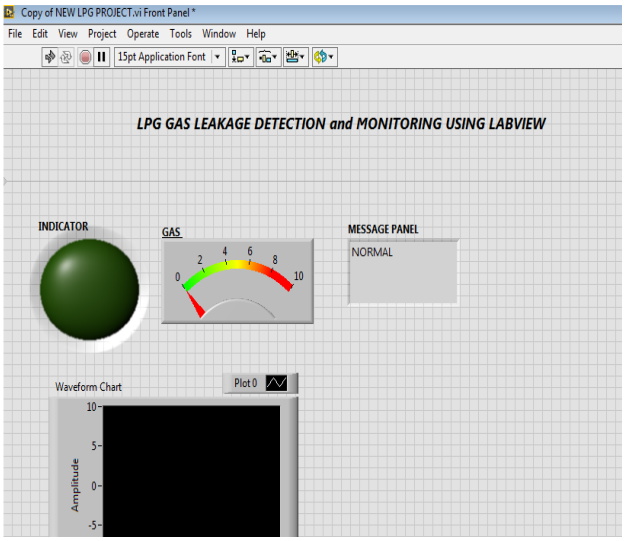
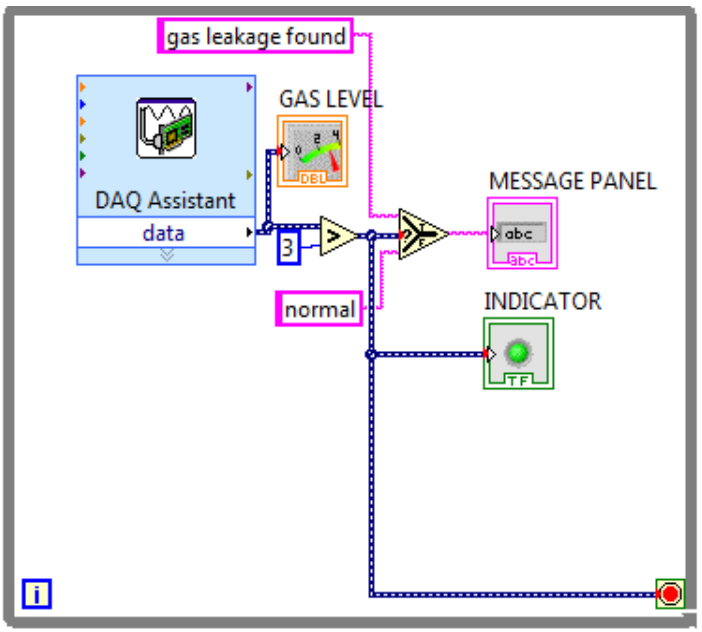



Fig.1.5 comparison function

**FRONT PANEL:**




**BLOCK DIAGRAM:**




## V. RESULT

Hence our system is used to detect and control the leakage of excess of LPG. The leakage is sensed by the MQ6 sensor and given as input to the LabVIEW program through the DAQ. This indicated by a system of buzzer and alarm which is used to send an alert signal incase of leakage. This is used to control the leakage with the help of solenoid valve. The valve consists of a relay which will automatically shut off the cylinder valve in case of leakage. Thus the leakage is stopped. Hence our system is used to avert major fire accidents occurring in industries, especially petroleum, gas pipe lines industries. It can be also used for domestic safety purposes. Hence it is used for providing home safety.

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