World Journal of Engineering Research and Technology
WJERT
www.wjert.org
SJIF Impact Factor: 5.218

SMART GAS LEVEL MONITORING, BOOKING & GAS LEAKAGE DETECTOR OVER IOT

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Article Received on 07/02/2019 Article Revised on 28/02/2019 Article Accepted on 18/03/2019

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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. Gas leakage leads to various accidents resulting in human injuries and/or loss. The present work aims at designing a system that detects gas leakage and alerts the subscriber through an alarm and sending SMS on user mobile phone and turning off the gas supply valve as a primary safety measure. The designed system, more like a First Aid, automatically uses a normally closed solenoid valve for shutting off of the gas valve before calling for help via visual display and audible alarm to those within the environment. The system prototype is constructed and when a small amount of LPG is leaked near the system, the system sensor detects the leakage and sends the SMS to housemates and activates the alarm and switches on the exhaust fan and prevents the flow of gas using a solenoid valve. The LabVIEW and an

Arduino are the programming tools used for this system. LabVIEW is used to monitor the data continuously.

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

1. INTRODUCTION

LPG consists of mixture of propane and butane which is highly flammable chemical. It is odorless gas due to which Ethane thiol 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.

The design of a wireless LPG leakage monitoring system is proposed for home safety. This system detects the leakage of the LPG and alerts the consumer about the leak by SMS and as an emergency measure, the system will turn off the power supply while activating the alarm. Liquid petroleum gas is generally used in houses and industries. In homes, LPG is used mainly for cooking.[1] This energy source is primarily composed of propane and butane which are highly flammable chemical compounds. LPG leak can happen, though rarely, inside a home, commercial premises or in gas powered vehicles. Leakage of this gas is dangerous as it enhances the risk of explosion. An odorant such as ethanol is added to LPG, so that leaks can be detected easily by most people. Our work aims at the designing of a system that detects gas leakage and alerts the subscriber through alarm, sending SMS on user mobile phone and turning off the gas supply valve as a primary safety measure. The system acts more like a First Aid, automatically uses a normally closed solenoid valve for shutting off of the gas

valve before calling for help via visual display and audible alarm to those within the environment. The system prototype is constructed and when a small amount of LPG is leaked near the system, the system sensor detects the leakage and sends the SMS to housemates and activates the alarm and prevents the flow of gas using a solenoid valve.

2. 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.

3. Methodology Used

SnO_2 metal oxide is used in TGS gas sensor. When SnO_2 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 SnO_2 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.

Block Diagram

Depending on the manufacturer, the standard 555 package includes 25 transistors, 2 diodes and 15 resistors on a silicon chip installed in an 8-pin mini dual-in-line package (DIP-8). Variants available include the 556 (a 14-pin DIP combining two 555s on one chip),

and the two 558 & 559s (both a 16-pin DIP combining four slightly modified 555s with DIS & THR connected internally, and TR is falling edge sensitive instead of level sensitive). The **NE555** parts were commercial temperature range, 0 °C to +70 °C, and the **SE555** part number designated the military temperature range, −55 °C to +125 °C. These were available in both high-reliability metal can (T package) and inexpensive epoxy plastic (V package) packages. Thus the full part numbers were NE555V, NE555T, SE555V, and SE555T. It has been hypothesized that the 555 got its name from the three 5 kΩ resistors used within, but Hans Camenzind has stated that the number was arbitrary.

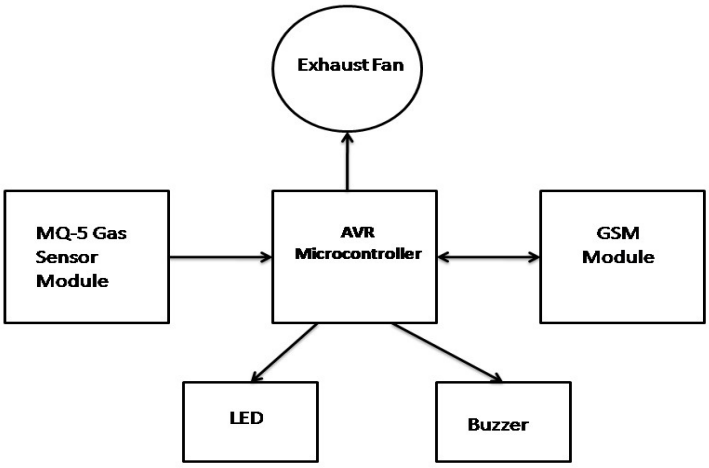

Fig. 1: Block Diagram.

Low-power versions of the 555 are also available, such as the 7555 and CMOS TLC555. The 7555 is designed to cause less supply noise than the classic 555 and the manufacturer claims that it usually does not require a "control" capacitor and in many cases does not require a decoupling capacitor on the power supply. Those parts should generally be included, however, because noise produced by the timer or variation in power supply voltage might interfere with other parts of a circuit or influence its threshold voltage.

Modes

The 555 has three operating modes

Monostable **mode**: In this mode, the 555 functions as a "one-shot" pulse generator.

Applications include timers, missing pulse detection, bounce free switches, touch switches, frequency divider, capacitance measurement, pulse-width modulation (PWM) and so on.

Astable (free-running) mode: The 555 can operate as an oscillator. Uses include LED and lamp flashers, pulse generation, logic clocks, tone generation, security alarms,pulse position modulation and so on. The 555 can be used as a simple ADC, converting an analog value to a pulse length. E.g. selecting a thermistor as timing resistor allows the use of the 555 in a temperature sensor: the period of the output pulse is determined by the temperature. The use of a microprocessor based circuit can then convert the pulse period to temperature, linearize it and even provide calibration means.

Bistable **mode or** Schmitt trigger: The 555 can operate as a flip-flop, if the DIS pin is not connected and no capacitor is used. Uses include bounce-free latched switches.

Rectifier

A **rectifier** is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as **rectification**. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury-arc valves, copper and selenium oxide rectifiers, semiconductor diodes, silicon-controlled rectifiers and other silicon-based semiconductor switches.

Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduinoboards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Atmega 16 Microcontroller

Details Descriptions

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 nonvolatile 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.

PIN Diagram

The ATMEGA16 is a low-power, high-performance CMOS 8-bit microcomputer with 16K bytes of Flash programmable and erasable read only memory (EPROM). The device is manufactured using Atmel‟s high-density nonvolatile memory technology and is compatible with the industrystandard MCS-51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel ATMEGA16 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

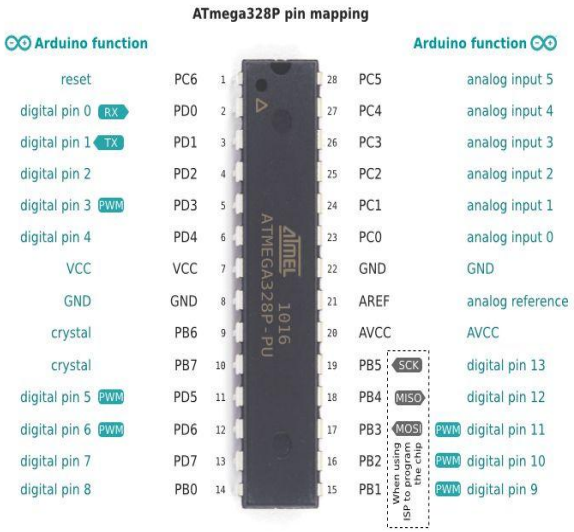

Fig. 2: Pin Diagram.

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.

Working Principle

The sensing material in TGS gas sensors is metal oxide, most typically SnO2. When a metal oxide crystal such as SnO2 is heated at a certain high temperature in air, oxygen is adsorbed on the crystal surface with a negative charge. Then donor electrons in the crystal surface are transferred to the adsorbed oxygen, resulting in leaving positive charges in a space charge layer. Thus, surface potential is formed to serve as a potential barrier against electron flow. Inside the sensor, electric current flows through the conjunction parts (grain boundary) of SnO2 micro crystals. At grain boundaries, adsorbed oxygen forms a potential barrier which prevents carriers from moving freely. The electrical resistance of the sensor is attributed to this potential barrier. In the presence of a deoxidizing gas, the surface density of the negatively charged oxygen decreases, so the barrier height in the grain boundary is reduced. The reduced barrier height decreases sensor resistance.

Fig. 3: Hardware setup.

CONCLUSION

As we shorted out the issues looked by LPG gas customers so we concoct a few answers for meet the couple of prerequisites of them, as we made our framework is totally robotise the procedure of refill booking without human mediation. Our framework is additionally contemplated to enable clients to redesign their security standards, to act in as needs be with least necessities on natural issues and generally the essential capacity being forestalled by real calamities and shield life and property from rumoured Accidents. The essential goal of our venture is to gauge the gas show in the chamber when weight of the barrel is beneath the settled load, this should be possible utilizing the weight sensors.

The gas retailer gets the request for another barrel and the house proprietor (purchaser) gets the affirmation message in regards to the status utilizing IoT and the auxiliary target is to give any breakdown in gas adjusting framework with a specific end goal to counteract harm or blast of LPG. In this manner the framework created by us will some way or another assistance the LPG Gas Consumers to have an agreeable existence.

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