

Wireless Sensor Robot to Detect and Locate Gas Leakage using Microcontroller

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Abstract: *This project presents the development of a prototype of an autonomous controller based mobile robot for gas leak detection and localization in large industrial facilities. The thought came up with the system that's able to perform scrutiny tasks in industrial facilities while not having to access unsafe areas directly -and while not requiring any human presence. The robot may be used for routine inspections of facilities or for targeted inspection of specific system components. The development of innovation monitoring processes that make the most of state-of-the-art measuring and automation technology as well as robotics promises improvement in the reliability, efficiency and cost effectiveness of inspections.*

I INTRODUCTION

This system helps you to upgrade your safety standards, comply statutory requirements on environmental commitments and most important and basic function being prevent accidents and protect life and property from disaster. In the past, it has been a conventional practice to employ combustion apparatus such as a furnace, heater, stove or LPG kit in cars, which utilizes a combustible vapor or gas to produce heat energy when properly ignited. In the use of combustible apparatus in which a combustible gas such as natural or liquid propane gas is burned in heating boilers, domestic water heaters, ovens, stoves and the like, the apparatus or appliance is generally of an automatic recycling type. That is to say, the equipment is generally in operation for short periods of time after which is shut down for a short period of time.

The equipment has intermediate operation and the appliance is generally started and stopped at the signal of an automatic controller, such as a thermostat, which may be actuated by temperature, pressure, or the like. The LPG Kit installed is many times installed inside the car creating possibilities of large accidents. This type of appliance/Kits is normally unattended by any operating personnel, since it is automatic in operation and, therefore, one hazard encountered in the use of such an appliance is the possibility that during a standby period or a

period in which it is not in operation, a gas leak may occur thereby resulting in a large accumulation of combustible gas which can produce an explosion if the detection is not quickly noticed. Although some sophisticated detector means have been provided, it is contemplated that the indicator means should be simple and economical so that the entire system may be readily incorporated into mobile trailers, campers, boats and other vehicles or living quarters having appliances dependent upon storage of pressurized gas.

The LPG is finding wide range in homes, industries and in automobiles as fuels. In the year 1910 LPG, first produced by Dr.Walter Snelling the U.S Bureau of mines investigated gasoline to see why it

evaporated so fast and discovered that the evaporating gases were propane, butane and other light hydrocarbons.

Both LPG and natural gas are environmental friendly they easily be detected These gases are normally stored in

pressurized Steel cylinders in liquid form and vaporize at normal temperatures. With comparison of air LPG is

heavier therefore it flows along the floor and also settles in low points which make it difficult to disperse. LPG

is a mixture of commercial butane and commercial propane having both saturated and unsaturated

hydrocarbons.LPG marketed in India shall be governed by Indian Standard Code IS-4576 and the test methods

by IS-1448.

Characteristics of this dangerous gas include (a) vapor pressure: The pressure inside a LPG storage

vessel/ cylinder will be equal to the vapor pressure corresponding to the temperature of LPG in the storage

vessel. The vapor pressure is dependent on temperature as well as on the ratio of mixture of hydrocarbons; (b)

Flammability: LPG has an explosive range of 1.8% to 9.5% volume of gas in air. This is considerably narrower

than other common gaseous fuels; (c) Combustion: The combustion reaction of LPG increases the volume of

products in addition to the generation of heat. LPG requires up to 50 times its own volume of air for complete

combustion;(d) Odour: LPG has only a very faint smell, and consequently, it is necessary to add some odourant

,so that any escaping gas can vapor phase, but can, however, suffocate when in large concentrations due to the fact that it displaces oxygen.;(e) Toxicity: LPG even though slightly toxic, is not poisonous in can pose a serious effect if they leak. Impacts: LPG may leak as a gas or a liquid. If the liquid leaks it will quickly evaporate and form a relatively large cloud of gas which will drop to the ground, as it is heavier than air. LPG vapors can run for long distances along the ground and can collect in drains or basements Cylinders can explode if involved in a fire. The health impact this dangerous gas can cause cold burns to the skin and it can act as an asphyxiant at high concentrations. Leak cause a negative effect to the health such that the hydrocarbons and other chemicals of the LPG causes very long sleep. It also causes irritated respiratory tract, nose and eyes.

II OBJECTIVE

The primary objects of the present project to provide a novel means for safely detecting any malfunction of a pressurized gas system in order to prevent accumulation of combustible gases so that damage or explosion due to such an accumulation of gases is prevented.

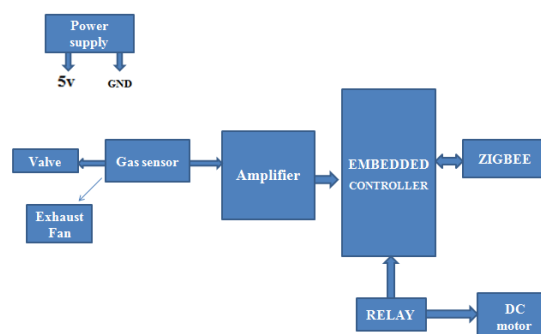
Another object of the present invention is to provide a novel safety means for detecting the leakage of gas into the area of an appliance when the appliance is in a shutdown condition and not in operation. Yet another object of the present invention is to provide a novel gas detection and monitoring system which is economical to manufacture and which may be readily installed in conventional trailers, boats or the like which are normally dependent upon a stored supply of pressurized gas.

Typical installation areas being gas yards (Bullets), gas banks with multi cylinders in manifold, user production departments / utility areas like kitchens.

Ideal sensor for use to detect the presence of a dangerous LPG leak in your car or in a service station, storage tank environment. This unit can be easily incorporated into an alarm unit, to sound an alarm or give a visual indication of the LPG concentration.

The sensor has excellent sensitivity combined with a quick response time. The sensor an also sense iso-butane, propane, LNG and cigarette smoke.

III SYSTEM OPERATION



Microcontroller

An efficient and smooth working controller is needed to continuously sense both leakage and level of

the gas. And also fast response is require when leakage found .Along with this the monitoring system must

provide additional leakage information which can be used in further processing. The detection system includes Arduino duemilanove microcontroller board which is Arduino compatible with microcontroller chip ATmega328p. The Duemilanove is a microcontroller breakout board featuring ATmega328 based on the popular Arduino Footprint. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

Gas Sensor:

The LPG gas consists of isobutene, propane, methane, etc. A sensitive, efficient gas sensor is required

that senses only LPG gas contents and is less sensitive to other gases like cooking fumes, cigarettes, etc.

Sensitive material of MQ-2 gas sensor is SnO₂, which with lower conductivity in clean air.

Display:

It is necessary requirement to put a display about system monitoring and controlling performance, which displays the various messages such as leakage of gas detection, booking of cylinder in case of refilling of cylinder. Additionally the system also, displays the actions carried out in the microcontroller. For the work of displaying the alert messages Liquid crystal display (LCD) of 16*2 characters operating on +5 volt supply and operated 4-bit mode is implemented.

ZIGBEE:

Field data signals are collected by ZigBee nodes based on CC2530 core chip, ZigBee sensor nodes are distributed in every corner of the building to constitute strongly self organized wireless sensor networks with wide range. CC2530 has an excellent RF transceiver, industry-standard enhanced 8051 CPU, programmable flash memory, 8-KB RAM and many other advantages.

DC Motor

The basic principle of DC motor is the creation of rotating magnet inside the mobile part of the motor, rotar. Motor indicates fixed magnet and rotar indicates rotating magnet. The power for the stator electromagnet is supplied by separate DC source. The relative angle between these magnets is maintained near 90 degrees. When gas leak occurs this monitoring system senses the leak by means of sensor and the value is given to the microcontroller.

IV CONCLUSION

The system provides control action by closing the regulator knob, after that the system sends a alert message to the user and fire station within short time of leakage. It has more advantageous function than the existing system thus the real-time automatic approach is proposed in case of rebooking of cylinder. This monitoring and detection system is proposed mainly to meet the safety standards and to avoid fire accidents because of leakage.

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