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Automated Unified Trolley System for LPG leakage detection with safety measures and Refill booking

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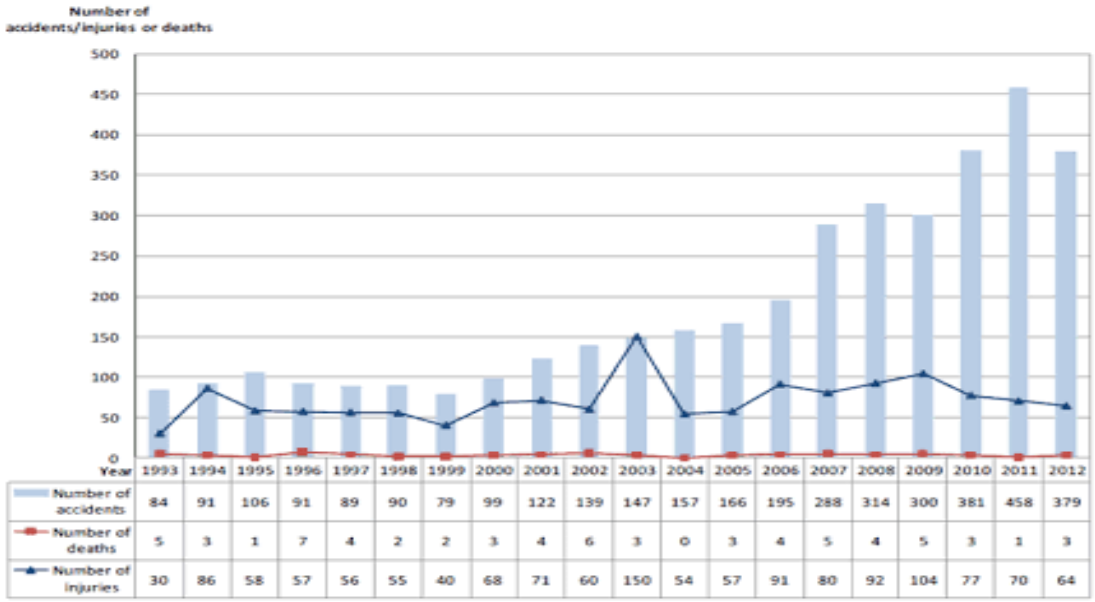
ABSRACT: The aim of this paper is to design Automated Unified Trolley System for LPG leakage detection with safety measures and Refill booking. This system will detect leakage of LPG and implement security against gas leak such as it will switch off the main power supply. It also switch on the exhaust fan automatically to decrease the gas concentration in air. This system will also help customer to regular update about weight of cylinder. So they are being not cheated by gas agency by providing less amount of gas. Also it is helpful to know about the status of gas. If gas in the cylinder is about threshold value, the system will immediately register gas booking through GSM technology by sending SMS to the distributor company and also send an alert to user at same time. By implementing this, the LPG provider can reduce the delivery delay time and helps to improve customer support service in transparent manner

KEYWORDS: LPG Automated booking system, Leakage detection, GSM, PIC Controller.

INTRODUCTION

LPG first produced in 1910 by Dr.Walter Snelling is mixture of Commercial Propane and Commercial Butane having saturated and unsaturated hydrocarbons [1]. As LPG is versatile in nature it is used for many needs such as domestic fuel, industrial fuel, automatic fuel, heating, illumination etc.



Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of accidents	84	91	106	91	89	90	79	99	122	139	147	157	166	195	288	314	300	381	458	379
Number of deaths	5	3	1	7	4	2	2	3	4	6	3	0	3	4	5	4	5	3	1	3
Number of injuries	30	86	58	57	56	55	40	68	71	60	150	54	57	91	80	92	104	77	70	64

Fig 1: Number of Gas Related Accident

In most of our homes no safety measures are taken against LPG cylinder. This is a very dangerous approach and needs to be changed. An explosion results in a pressure wave and a large fireball [2].The gases being heavier than air, do not disperse easily and may lead to suffocation when inhaled, also when gas leaks into the air may lead to explosion [3]. Due to the explosion of LPG gas the number of deaths has been increased in recent years. As shown in fig (1).

To avoid this developed system will help by switching off regulator as well as main supply immediately on gas detection. It also switches on the exhaust fan automatically to decrease the gas concentration in air.

Consumers are mostly frustrated with quantity of LPG in the cylinder do not meet the promised quantity during delivery [4].So as additional advantage, this system will monitor weight of cylinder regularly and update information on LCD display. Further it can automatically register booking to Distributor Company when cylinder is going to be empty. The cylinder booking is done through a message sending process by the system when the weight of the cylinder is at its threshold. Threshold can be set by consumer simultaneously system will sent alert message to user mobile number.

EXISTING METHODOLOGY

In all existing methods, different gas sensing technologies are used. However most of the accidents happen because of our negligence to not switch off the regulator. The detection of gases and its monitoring has already been done. However no control action is being taken.

LPG gas comes in metal cylinder and therefore one cannot keep the track of the quantity of the consumption of the fuel. As a result sometimes in fact often it happens that one does not comes to know whether how much amount of fuel is remaining. So that booking for a new refill cylinder could be done before the gas in the container gets empty and the user gets deprived of the fuel till new refill is at doorstep..

PROPOSED METHODOLOGY:

Proposed methodology will perform certain actions simultaneously on detection of gas leakage.

Advantages of proposed system:

1) Detection of LPG leakage and implementation of security against gas leak.
LPG leakage detection procedure happens through the aid of MQ5 sensor especially designed for the application needed. MQ5 sensor modules are responsible for detecting LPG concentration. When sensor detects gas leak the o/p of sensor is given to the signal conditioning circuit for manipulating the analog o/p to meet the requirement of the processor.

2) Automatically turn off the valve to avoid the Gas flow.
As leakage happens first action takes place as follows; Control unit which will execute a program that will drive the relay circuit to switch off the valve so as to stop the flow of gas from cylinder.

3) Automatically turn on the Exhaust fan to release the gas
One other precaution system takes that program will turn on the exhaust fan to release the leaked gas into open atmosphere so that intensity of gas in a closed can is mitigated.

4) Switch off mains power supply
To avoid further hazards the main supply from to the home is switched off.

5) Regular update about weight of cylinder
To get regular consumption of LPG, a gas tank is placed onto load cell. The program will display the recent weight of the tank. This will help consumers to know whether they are being cheated by gas agency by providing less amount of gas.

6) Automatic Booking of cylinder when it is going to empty.
Implementation of automatic booking for new refill of gas cylinder can be done using wireless M2M device. Predefined threshold is defined in the program which will indicate that the fuel in the tank is about to end and when this threshold is met, the processor will send a RF signal through

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wireless device interfaced to it. The wireless device at the dealer side will receive the signal and does the booking for the new refill.

BLOCK DIAGRAM

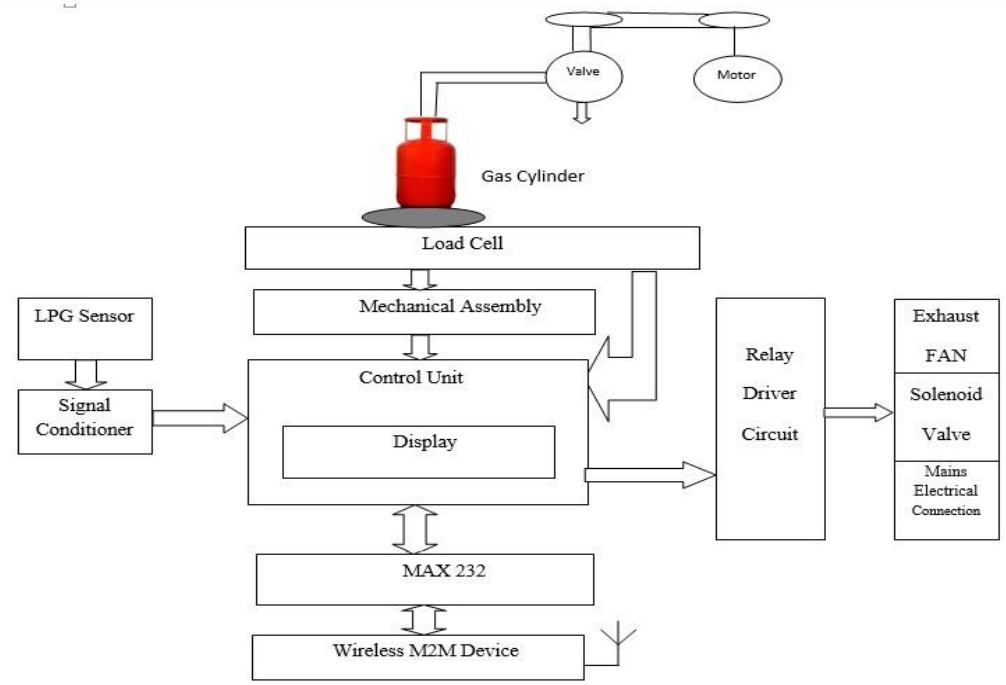

Fig.2: Proposed system Block diagram

SYSTEM OPERATION

The a home project is use embedded system which uses a very efficient, control unit and GSM technology which is capable of doing automatic booking for a new refill, detect gas leakage first and then take preventive measures an d avoid LPG gas wastage [1]. On the detection of LPG, at first it will switch off mains power supply and then alert user through SMS. So there is no possibility of fire hazards by using this system.

The above block diagram shows main blocks that can be used to develop a system.PIC 16Fxxxx series microcontroller. It is a 40 pin IC, having five ports and eight channels may be used to process and control whole system [5]. Load is used to measure the weight of gas cylinder through weighing sensor [1]. Weighing sensor is transducer which converts force applied to it in electrical signals. The change in output of the load cell can be measure in the form of voltages which is analog. That analog output will be given to analog to digital converter.MQ-5 is sensor used to sense gas leakage; it is suitable for sensing LPG concentration in air [6]. When sensor detects gas leak the output of sensor given to the signal conditioning circuit for manipulating the analog output to the meet the requirement of controller. The protection circuit consists of solenoid valve, exhaust fan and energy meter.

The solenoid valve drive unit controls the opening and closing of the solenoid valve which controls the flow of gas from the supply to the point where the gas is being used. The solenoid valve drive receives signal from the control unit and the carries out the appropriate action [7]. Display is used to provide the information to user. A 16*2 LCD is used in this project work. It is placed on front face of control box. It will display all the information like weight display, gas leakage detection message on LPG leakage and also display symbol message of message sent to agency or user.

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The protection circuit has exhaust fan which does not provide spark so it is safe. A drive circuit is designed to activate the exhaust fan using relay [3]. When concentration of gas exceeds the safety level then controller switch on the exhaust fan by which gases sent out. So to drive real world appliances like solenoid valve exhaust fan and energy meter relay drive circuit will be used. Wireless M2M device like GSM SIM 800/300/900 can be used to modify user in emergencies and for booking purpose [8].GSM stands for Global System for Mobile communication with the help of this module user gets alerted through message on gas leakage detection and cylinder gets automatically booked to agency when it going to empty.

FLOWCHART:

Flow chart will describe step to step functionality of smart LPG Trolley. As shown in fig. 3, when system gets switched on it will display weight of cylinder on LCD screen. When system switches on, gas sensor Mq-5 also starts sensing any LPG leakage and after leakage detection certain actions are performed by microcontroller as safety precautions. If high amount of gas leakage is detected then microcontroller sends signal to RF receiver and motor to shut down mains power and regulator respectively. And an alert of gas leakage also sent to user.

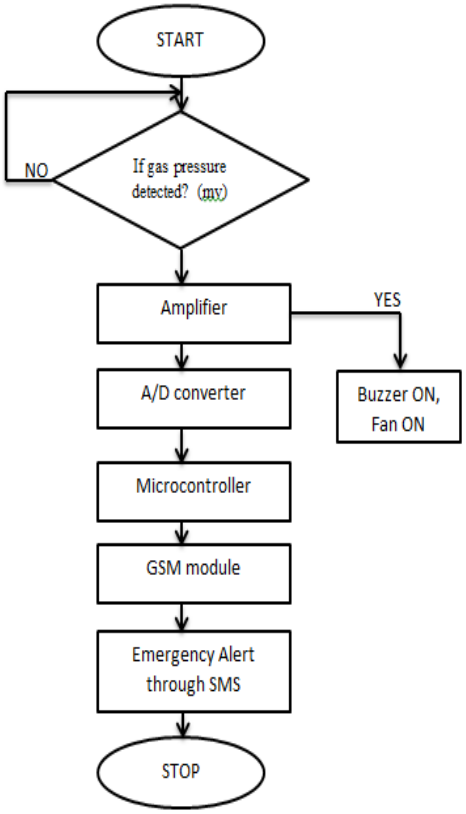

Fig.3: Flowchart of Gas Leakage Detection

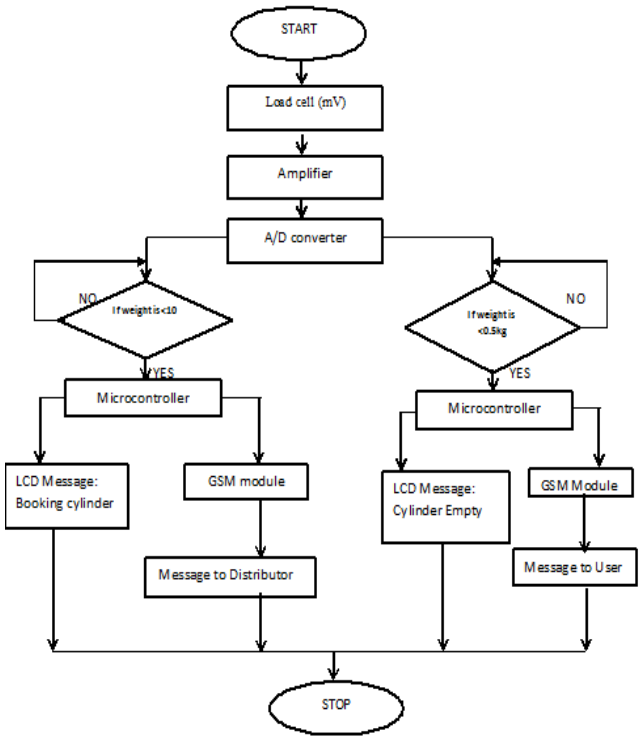

Fig.4: Flowchart of Automatic Gas Booking

For automatic booking of cylinder, system monitors weight of cylinder. If cylinder weight is below threshold (1Kg) then it will display weight on LCD screen with alert message. And to register cylinder, it will sent a message to agency with customer id. Customer also receives a response message from agency regarding gas booking shown in fig. (4).

CONCLUSION

This paper describes design and implements a Smart Stick with various programmed features for blind person. This paper describes the review of LPG leakage detection with safety measures.

For safety, this device switches off the main power supply and also turns on the exhaust fan to release the gas. In advance this system can also switch off the regulator on gas detection which will stop further leakage of gas. Additional advantage of system will monitor weight of cylinder regularly and update information on LCD display. Further it can automatically register booking to Distributor Company when cylinder is going to be empty.

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