

Automatic Gas Controller Unit

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Abstract--Nowadays LPG cylinders have been an indispensable element in our daily life. These LPG cylinders that help us to make delicious food can also become dangerous and threatening to life. Therefore one needs to be alert in order to lessen the destruction caused by the cylinders. This paper aims at providing a safety assuring system that will detect the LPG leakage and the valve of the cylinder turns off automatically. The proposed system with its weighing sensor helps to measure the cylinder weight and continuously updates the user about the concentration of gas left in the cylinder. Thus the users can replace the cylinder with new in time. As an additional advantage, the proposed system includes a timer controlled knob which automatically turns off the burner after the specified cooking time provided. So hereby the system ensures safety before allowing the gas to leak thereby leading to accidents like explosion and suffocation. Hence the automatic gas stove controller is a solution for this.

Keywords-- Arduino Uno, Gas Sensor, Load cell, LPG leakage, Timer controlled knob.

I. INTRODUCTION

Gas is a leading source of energy used for heating and cooking purposes in our homes. The two major types of gas which serves these purposes are liquefied petroleum gas (LPG) and natural gas. These two gases are hydrocarbon gases. Natural gas is basically methane gas while LPG gas is a blend of butane and propane gas or purely butane or propane gas. Gas leakage detection is a method of identifying dangerous gases in the surrounding environment by the use of sensors, thereby leading to prevent further consequence. LPG is the most commonly used gas that serves the purpose of cooking. LPG is a highly flammable gas and if leaked it can lead to major destruction to life and property. The major characteristic of LPG is that the gas being heavier than air, it does not easily disperse and when inhaled it leads to suffocation. The ignition of these leaked gases may lead to explosion. The number of death reports caused by gas leakage explosions has been enlarged in recent years. The reason behind such explosions is mainly due to the old cylinder valves, drained out regulators, shortage of substandard cylinders, and lack of knowledge of using gas cylinders add to the danger.

This paper aims at proposing an automatic gas controller unit using arduino uno which detects the gas leakage and thereby closing the cylinder valve, a timer controlled knob which automatically turns off the burner and also detects the weight of the gas cylinder.

II. LITERATURE SURVEY

V. Abishek et.al [1] developed a system for detection of gas leakage incorporate with the tripping mechanism of main power supply which is to avoid any explosion due to it. The system was implemented and tested to conclude that the working of the system based on the concentration of gas present in the system. As the concentration level of the gas reaches to the threshold, the main power line gets shut-off and the alarm sounds loudly.

S. P. S. Selvapriya C et.al [2] a microcontroller based model for detecting the gas leakage in a closed environment using sensors was developed. The test result produces the audio and visual alarm to alert the human and also sends a short message service (SMS) to the user.

A. Shrivastava et.al [3] a gas leakage detector system was, designed, fabricated and installed. The system can detect the gas leakage and stop it automatically in vulnerable premises. The developed system was tested and worked satisfactorily by taking a small amount of LPG gas near to the sensor and observe that a buzzer sounds loudly and the message was shown on the LCD screen.

S. S. K. S. Senthilkumar et.al [4] proposed a wireless system for gas leakage detection. It consists of three major modules: the gas level and leakage detection module, transmission module and the receiver module. These modules detect the change in concentration of natural gas and LPG and turns on an audio-visual alarm when it goes beyond a threshold. Auto renewal system was implemented when the cylinder is going to be emptied and auto booking is done with the gas agency and also giving the information to the consumer.

R. N. Naik, et.al [5] proposed a system, which makes the entire LPG cylinder booking procedure automated without human intervention. The system continuously monitors the cylinder weight and when it attains the threshold value it will automatically informs the authorized LPG agency by sending message. It was designed for the safety of user in which the control system monitors the LPG leakage and alert the users to avoid accidents by using arduino mega microcontroller. But the automatic rebooking of cylinders does not aware the user.

III. PROPOSED SYSTEM

The proposed system comprises of a gas sensor that detects the gas leakage and is interfaced with Arduino microcontroller. If the gas leakage was detected, Arduino informs the motor driver unit and immediately rotates the dc motor to close the gas cylinder regulator. The system uses a load sensor that continuously monitors the LPG

level present in the gas cylinder. If the gas level reaches below the threshold limit, the user is alerted by an indication. Thus the user can replace the old cylinder with new in time. An additional feature of the system is that if the users accidentally leaves the gas stove burner on, the system will automatically turns it off. The system has included a timer controlled knob, which is used for setting the duration of cooking. When the timer count is completed, the controller automatically turns off the burner.

IV. DESIGN AND IMPLEMENTATION

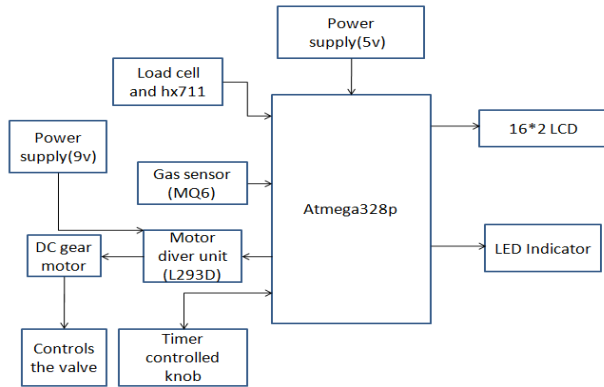


Fig1: Block diagram of the system

Arduino Uno: The main component of the proposed system is Arduino Uno microcontroller which works on ATmega328P. It needs a 5V power supply which can be build by different components like step down transformer, rectifier, filter and regulator. Arduino controls the major three sections of our proposed system. When there is a gas leakage, Arduino informs the motor driver regarding this and thereby closing the cylinder valve. The load cell senses the cylinder weight and informs Arduino regarding the threshold values and indicates the user accordingly. Finally it controls the burner knob for different specified cooking times.

MQ6 Sensor: Gas sensor MQ-6 has higher sensitivity to LPG, isobutene and propane and avoids the noise signal of alcohol, cooking fumes and smoke. When the sensor detects the gas, it gets ionized into its constituent particles and is thereafter adsorbed by the sensing element. This adsorption produces a potential difference which is informed to the microcontroller through the output pins in the form of current. Thus when the concentration of gas detected exceeds the predetermined value, leakage of gas will be detected.



Fig2:MQ6 Gas Sensor

Load Cell: When the weight of the cylinder is applied as load to the sensor, there occurs a change in the resistance, which thereby leads to a change in output voltage. If the weight is less than the threshold value, it informs the microcontroller and alerts the user through an indication. The values from the load cell sensor are in milli-volts, so it needs a HX711 amplifier which amplifies these voltages before giving it to the Arduino board.

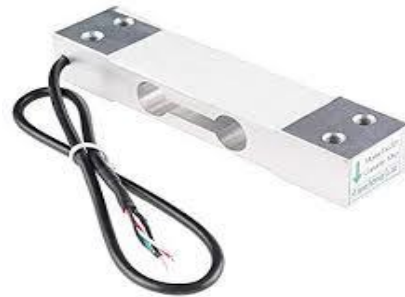


Fig3: Load Cell Sensor

LCD Display: The 16x2 LCD is used to display various status of the system. When the system is turned on, "Controller Unit" is displayed. If any gas leakage has been detected, it shows "gas leakage detected". It shows the status of the gas cylinder whether it is below the threshold level or not. It also displays the time we have provided with the timer controlled knob.

DC Motor: When gas leakage is detected, the DC motor rotates to close the cylinder valve. Also after the specific cooking time provided, the motor turns to close the burner knob. A motor driver IC L293D is used to drive the motor in both directions. It can control a set of two dc motors at the same time. It works on H- bridge concept.

Software tools: the proposed system is designed on ExpressSCH software.

The software platform used for Arduino is Arduino IDE version 1.8.5.

Hardware implementation:

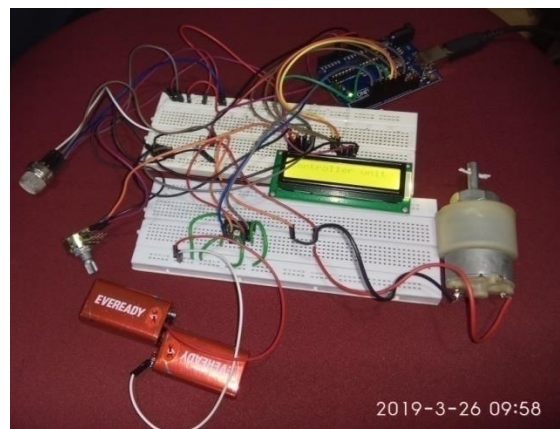


Fig4: Prototype of proposed system during initial condition (gas leakage detection)

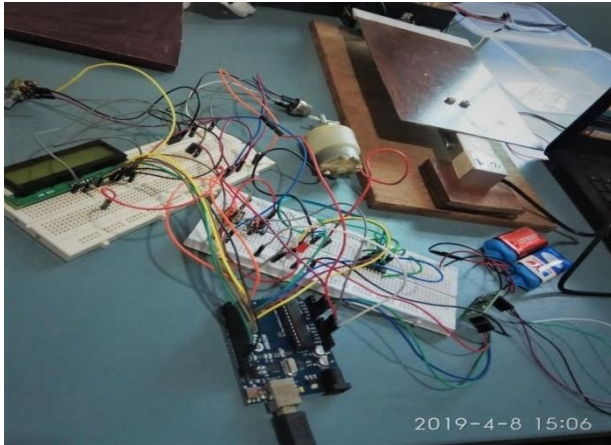


Fig5: Implementation of components for proposed system.

V. CIRCUIT OPERATION

Gas Leakage Detection: In this state, the MQ6 gas sensor is used which is highly sensitive to LPG, isobutene and propane gases. When a leakage of gas occurs, the sensor sends a signal to the microcontroller. LPG regulator fitted to the cylinder will be automatically turned off using a DC motor to avoid more leakage from cylinder.

Cylinder Weight Indication: For determining the weight of the cylinder, a load sensor is used. It continuously checks the LPG level present in the cylinder and if the level of gas goes below the threshold limit, the user is alerted by a led indication. So it is possible for the user to exchange the old cylinder with new in time.

Timer Set for Cooking: The time for cooking can be set with the help of microcontroller. When the timer count is completed, the servo motor inside the knob automatically turns off the flame or burner. In this way the stove accidents can be reduced to a greater extend.

VI. RESULTS

The testing of the proposed system was carried out using a lighter as a replicate of LPG gas source. The lighter was held closer to the gas sensor to detect high levels of gas concentration. When the concentration reached above the predetermined value, the gas leakage was detected and the motor rotates to close the valve.

When the weight of the cylinder is full, the proposed system showed a green led indication. When the gas level is below the threshold value, it alerts the user by a glowing a red led.

Two push buttons were used to set the cooking time. After the predetermined time, the knob controlled by a dc motor, automatically turned off the burner.

Thus the proposed system showed an excellent performance and provides satisfactory results during the period of testing.



Fig6: final prototype of proposed system

VII. CONCLUSION

In the modern scenario the usage of LPG has increased in a greater manner. As a result of this, the damages and accidents caused by the leakage of gas are increasing every day. The shortcomings on the existing systems include security measure during the gas leakage, rebooking facility without the awareness of the user, excess usage of gas after the usual time. All these shortcomings are headed to serious damages to the household belongings and human. These can be overcome by our proposed system which has an automatic gas valve controller. It updates the gas cylinder status, and the usage of timer controller unit for the better usage of LPG. Thus “Automatic Gas Controller Unit” is mainly designed for the safety of people and property. It has many other applications in automobiles, aircrafts, etc.

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