Automatic Gas Stove With Advanced Safety Features

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Abstract—**Gas stoves are now very common in all houses including urban and remote areas. The main power source for gas stoves are either LPG or biogas. Biogas is more cost effective compared to LPG. In both cases chemical energy stored in the fuel is converted into heat energy and this heat energy is used for cooking purpose. Explosive range of LPG is 1.8%-9.5% volume of gas in air. Biogas mainly contains methane as its flammable agent. The leakage of LPG or biogas accompanied with a small spark will results in a huge explosion that can even takes several life. So as a matter of safety leakage should be known in its early stage and should be compensated. The main source of the LPG is fossil fuels, so its huge consumption will definitely lead to its shortage in the near future. So to make sure the availability of fossil based fuels for future generation it is our responsibility to use the fuels at it minimum and avoid all wastage of fuels. In this paper, we report the automation of gas stove which will result in the minimum wastage of fuel and reduce the human interference in the process. This paper describes the distinct properties of LPG that favours its flammability. Some advanced safety features like alarm and automatic message sending facility during gas leakage is also reviewed. Analysis of percentage of reduction in gas wastage and sensing capacity of the sensors are also discussed.**

Index Terms—**Automatic gas stove, leakage detection sensor, GSM module.**

I. INTRODUCTION

In recent years, whole world is looking after the safety features of products than their costs and other subsidiary features. Particularly while talking about machines it should provide a safe environment for the working of humans. One should be more aware while dealing with flammable products. Small careless while dealing with flammable products can cause big damage to the properties and lives. More safety features should be included in machines dealing with flammable products. Almost every home is using gas stoves for cooking purpose. A gas stove is nothing but an apparatus with valves and regulators that allows the controllable flow of flammable gases like LPG, butane, propane, butane etc. LPG is categorized under highly flammable products. The auto ignition temperature of LPG is around 410-580º C and hence it will not ignite it's on at normal room temperature without a spark. During leakage of LPG even a small spark can cause big explosions. So it is important to add more safety features to gas stoves to sense the leakage of fuel gas. Since the most common wide range fuel gas we using in gas stove is LPG we will prioritize our view to LPG. The safety features that can be included are leakage detection sensor, alarm system for alarm during the leakage detection and most advanced safety features like automatic message genera-

tion during the detection of gas fuel leakage to a registered mobile number.

At present almost all the gas stoves are manually operated. The most advanced gas stove that is available at present have the feature of self-ignition while turning the knob to 'ON' position In the past decade, enormous progress has been made in developing new communication and sensor based techniques for developing automatic devices. The main purpose of the automation is to reduce the human interference in the work and hence provide more safety.

Figure 1.   Self ignition gas stove.

The main limitation of the automatic gas stove with advanced safety feature is that it require a power source for the working of the alarm system and sensors. The objectives of this paper are: 1) to describe the production of an automatic gas stove which detects the presence of vessel and automatically ignites the gas stove and OFF the flame during the absence of the vessel; 2) to outline the advanced safety features like automatic alarm 'ON' during the LPG leakage and auto generation of message during the LPG leakage to a registered mobile number; 3) to analyse the saving of LPG by using the automatic gas stove with advanced safety features over normal gas stove; and 4) to outline the possible challenges related with the automatic gas stove.

II. SYSTEM ARCHITECTURE

The system is controlled by the microcontroller. The MQ6 sensor is responsible for detecting the LPG leakage. When the MQ6 sensor detects the leakage it sends signal to the microcontroller. GSM module sends message to a prestored number. When the leakage is detected a buzzer system is activated during the period of leakage.

MQ6 MODULE	PROXIMITY SENSOR

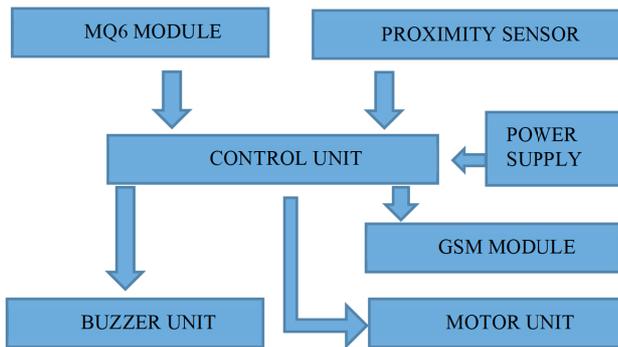| | POWER SUPPLY |
| CONTROL UNIT | |

| | GSM MODULE |

| BUZZER UNIT | MOTOR UNIT |

Figure 2. Block diagram of system.

The IR Proximity sensor detects the presence of vessel on the burner and starts the motor ON which automatically ignites the flame ON and when the vessel is removed the motor is rotated in the reverse rotation to turn the flame OFF.

A. MQ6 Sensor

The main function of MQ6 sensor is to detect the presence of leakage LPG. Features of MQ6 sensor is high sensitivity to LPG, iso-butane, propane, Small sensitivity to alcohol, smoke, Fast response, Stable and long life, Simple drive circuit. The MQ6 sensor is composed by micro AL_2O_3 ceramic tube, Tin Dioxide (SnO_2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-6 have 6 pin, 4 of them are used to fetch signals, and other 2 are used for providing heating current. Resistance value of MQ-6 is difference to various kinds and various concentration gases. So, when using this components, sensitivity adjustment is very necessary. we recommend that you calibrate the detector for 1000ppm of LPG concentration in air and use value of Load resistance (RL) about 20KΩ(10KΩ to 47KΩ). When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence.

B. Proximity Sensor

IR proximity sensor is used to detect the presence of the vessel on the burner. It emits light from the source and when an opaque body is hindered the path, the light is reflected back to the sensor and it will activate the circuit. According to the pre-program in the microcontroller when the circuit of the proximity sensor become active the microcontroller will send activation signal to the motor to turn the knob and flame ON. IR proximity sensor is cheap compared to other class of proximity sensor. Proximity sensor is nothing but a sensor which will sense the presence of a body within its working range. The sensitivity of the IR proximity sensor used in this project is adjusted by a small potentiometer provided on the IR proximity sensor module.

C. Control Unit

The device that control the entire system is AT 89S52 which belongs to the 8051 microcontroller family. This microcontroller is produced by Atmel. Four different ports are the main specification of the AT 89S52 microcontrol-

ler. Each port have 8 input/output pins. Hence all the 4 ports integrally contains 8*4=32 pins. Each of this pins are either input or output lines. Usually the input pins are used to get external signals or read from the sensors and those pins which are configured to the output state will drive external devices such as motors or LEDs. In this project input pins of the microcontroller are connected to gas leakage detection sensor MQ6 and vessel detection proximity sensor. The output pins of the microcontroller are connected to the motor, the GSM module and the LCD module. According to the pre-program in the microcontroller it sends activation signals to the GSM module, LCD display and the motor unit.

D. Buzzer Unit

The function of the buzzer module in this project is to make the alarm sound during the detection of the leakage of the LPG. A relay is integrated in the buzzer module to activate the alarm system. When the MQ6 sensor become activated it will send signal to the microcontroller and as a result according to the pre-program done in the microcontroller it will send the activation signal to the relay of the buzzer module, which will activates the buzzer.

E. GSM Module

The main function of the GSM module is to send leakage detection message to a pre-programmed mobile number. When the MQ6 sensor become activated it will send signal to the microcontroller and as a result according to the pre-program done in the microcontroller it will send the activation signal to the GSM module. When the GSM module become activated by the microcontroller it will start sending gas leakage detection message to the user mobile number. This message sending process will continue till the MQ6 sensor senses the LPG leakage.

F. Motor Unit

The gear motor we used in the work is directly coupled with the cylinder valve with a rigid joint. Hence when the motor is rotated it compels the valve to turn ON/OFF, according to the direction of rotation of the motor. For making the motor to rotate in both direction that is clock vice and anti-clock vice direction two different relay circuits are used. Turning in clock vice direction will turn the valve to ON position and simultaneously generates the flame which results in the ignition and to anti-clock vice direction will shut the flame OFF. The motor gets the input voltage only when the proximity sensor detects the presence of vessel and when the vessel is taken out the proximity sensor will lose its contact with the vessel and gives the input to the motor to rotate in opposite direction to shut the flame OFF.

G. Power Supply Unit

The power source of the project is a 12 volt rechargeable battery. Battery is directly connected to the rectifier unit. The electronic board used in the project is very sensitive to overvoltage. The power required for the proper functioning of the electronic board is 5 volt. To convert the 12 volt to 5 volt we use a rectifier and regulator unit.

The regulator we used to convert 12V to 5V is 7805. The capacitor is used to ground all the ac components. The rectifier is used to convert the ac to dc.
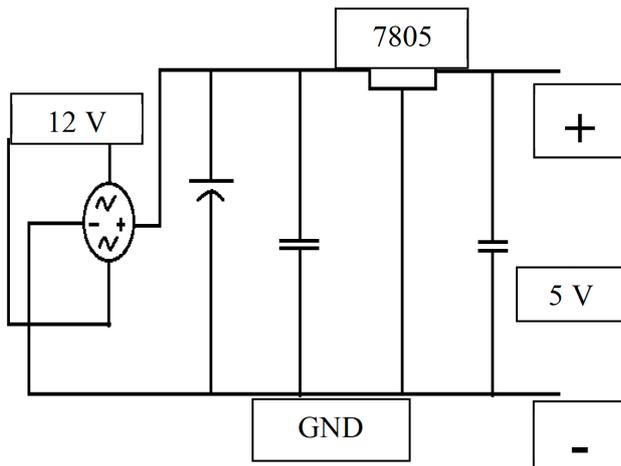
Figure 3. Power supply circuit diagram

Figure 4. Complete Project Setup

III. WORKING METHODOLOGY

The main components used in this work are MQ6 module, proximity sensor, power supply unit, control unit, buzzer unit and motor unit. The working depends on the input signal from the MQ6 and IR Proximity sensor. The MQ6 sensor will active when the leakage of LPG is detected and will send signals to the microcontroller. Now when the leakage of LPG is detected the microcontroller will active the buzzer system for the alarm and GSM Module. The GSM Module will continue sending messages to the prestored number till the leakage is detected. The IR Proximity sensor is used to detect the presence of the vessel on the burner. When the vessel is detected by the IR Proximity sensor it gets activated and send signals to the microcontroller and correspondingly the microcontroller will activate the motor unit and the motor is rotated in clockwise direction to open the gas supply valve and automatically generates the spark for flame. Two separate relay units will control the rotation of motor in both clockwise and anti-clockwise direction. When the vessel is taken out from the burner the motor is rotated anti-clockwise direction to close the gas supply valve and hence the flame is off.

IV. RESULT AND ANALYSIS

It is noted that the when a vessel is placed on the burner it automatically starts the flame ON and when the vessel is removed from the burner the flame is turned OFF. This will save wastage of LPG while changing the vessels. When the MQ6 sensor detects the leakage of LPG the GSM Module starts sending message to a prestored number and the alarm system will on the alarm. The user will get the leakage message till the MQ6 sensor detects the leakage of LPG.
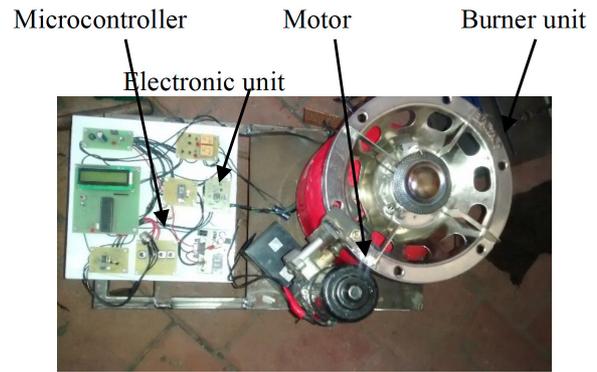
V. CONCLUSION

In this paper design and working method of automatic gas stove with advanced safety features is explained. The whole system is works on microcontroller and actuates the motor, GSM and buzzer unit. The input to the microcontroller is from MQ6 sensor and IR Proximity sensor. This method of automation reduces the human interference and wastage of LPG. The advanced safety features provide more safety warnings during the leakage of LPG.

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