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Smart Gas Leakage Detecting System: A review

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Abstract:- Nowadays, gas stoves are found in nearly every home, both in urban and rural regions and their primary power source is either liquefied petroleum gas (LPG) or biogas. Methane is the primary combustible component of biogas, and even a small spark can cause a massive explosion that may claim many lives. Therefore, leakage should be detected early on and compensated as a matter of safety. In daily living, LPG is a necessity. LPG is used as fuel for a variety of appliances, including those for heating and cooking, for industrial purposes, transportation, and as a propellant and refrigerant. When LPG leaks, it creates poisonous and dangerous effects for both people and other living things. In light of this, this article presents a review of presently available gas leakage and detection systems and their applications in different areas.

Keywords:- *LPG; Gas stove; Sensors; Safety; Microcontroller;*

I. INTRODUCTION

LPG falls within the category of highly flammable products. Even a tiny spark during an LPG leak might result in large explosions. To detect fuel gas leaks, it is crucial to incorporate more safety features into gas stoves [1-9]. Leakage detection sensors, alarm systems for when a leak is detected, and the most sophisticated safety measures like automatic message production can all be added as safety features. Currently, practically all gas burners are operated manually. The most modern gas stove now on the market can self-ignite when the knob is turned to the "ON" position. In the last ten years, new communication and sensor-based device development methodologies have achieved significant advancements [10-12]. Automation's primary goal is to increase safety by minimizing human influence in the workplace. Since polluted air can be odorless, tasteless, and colorless, it is just as dangerous as other aspects that can be identified visually and by taste [13]. Systems for detecting and reducing environmental contamination are more in demand. An embedded system was created with the PIC 16F877 Microcontroller to detect dangerous gas leaks and prevent the endangerment of human lives [14-16].

The use of wireless communication devices to operate home appliances is made possible by smart home automation technology, which increases consumer comfort. If the gas knob is left open without an ignite to start the fire, unexpected, unattended gas flow happens [16,17]. The major goal of this review is to provide an overview of new research happening in the detection of gas leakage to provide safety in the kitchen and make it easier for elderly and disabled individuals to undertake their daily culinary tasks and operate the LPG gas stove from a remote location inside the home. Although the main components used in the smart gas leakage detection system are also reviewed to provide an insight into the newer technological concepts [18-21].

II. MICROCONTROLLER

The microcontroller is the main part of the smart gas sensing technology which controls the entire system. The 8051 and Arduino microcontrollers are frequently used in the system. 8051 microcontroller uses embedded 'C' programming language and Arduino uses Arduino programming language respectively. These microcontrollers can be easily integrated with other components through programming [22-25].

III. GAS SENSORS

A transducer that senses a gas's molecules often makes up a gas sensor. As an output, it produces electrical signals whose amplitudes are proportional to the gas concentration. There are two different types of gas sensors that are used to detect gas leakage; such as the MQ-6 gas sensor, and the MQ-2 gas sensor [16,17].

A. LPG Sensor

The ideal sensor to find a dangerous LPG leak in our home, at a gas station, surrounding a storage tank, or even inside a vehicle that operates on LPG gas is an LPG sensor. This unit can easily be linked into an alarm circuit or unit to sound a warning or provide a visual indicator of the LPG concentration. The sensor has a quick response time and great sensitivity. As the concentration of the target combustible gas grows, the sensor's conductivity rises as well.

Changes in conductivity are converted to the output signal of gas concentration using a straightforward electrical circuit. The MQ-6 gas sensor, which is used to detect toxic gases and has a high sensitivity to LPG as well as reaction to Natural gas, is depicted in Figure 1.

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Fig 1:- LPG gas sensor, adopted from [2]

B. Combustible Gas Sensor

SnO_2, the sensitive material for the MQ-2 gas sensor, exhibits a decreased conductivity in clean air. As the concentration of the target combustible gases rises, the sensor's conductivity rises as well. A simple electrical circuit converts the change in conductivity into the output signal of gas concentration. Figure 2 depicts the MQ-2 gas sensor, which is sensitive to natural gas as well as propane and butane. A sensor is a low-cost option that may be utilized for a variety of applications. It can be used to detect various flammable gases, including methane.

Fig 2:- Combustible gas sensor, adopted from [2]

IV. IR PROXIMITY SENSOR

To identify a vessel, IR proximity sensors are used. It produces light at the source, which is then reflected by the sensor. A tiny potentiometer located on the IR proximity sensor module can be utilized to change the sensitivity of the IR proximity sensor.

V. GSM MODULE

The primary responsibility of the Global System for Mobile (GSM) module is to deliver a gas leakage detection message to the already set cell number to confirm gas leakage. The microcontroller receives a signal from the MQ6 sensor when it is activated, and according to pre-programmed instructions, sends the activation signal to the GSM module. Once the GSM module is turned ON, the microcontroller will begin sending notifications of gas leaks to the user's mobile number. The MQ6 sensor won't stop delivering messages until it detects an LPG leak.

VI. CONCLUSION

From the above review, it is concluded that researchers have investigated the smart and automated gas stove which provides safety and minimizes gas waste by saving money. The generally used components in these systems are the motor, GSM, and buzzer unit are all controlled by a microcontroller that runs the entire system; which decreased the amount of human involvement and LPG waste. The sensors used can able to detect a wide range of gases, including LPG and propane. In comparison to manual approaches, this technology offers quick reaction rates and allows for the speedier dissemination of important situations Before using this system to detect different gases, the sensors and the critical level of the relevant gas must be determined. Apart from the above functions, the smart gas stove can be equipped with a microcontroller that transmits an active signal to other connected external devices to provide additional safety to the user in the home or any other industry using LPG gas. When a gas leak is discovered, the microcontroller sends a signal to the door-opening device so that door will open automatically, and simultaneously gas valve will be closed automatically.

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