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Intelligent Life Saver System with Gas Leakage

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Abstract: *Home fires have been occurring regularly, posing an increasing hazard to human lives and property in recent years. Due to its significant flammability, LPG can burn even some distance from the leak. Most fire incidents are brought on by a poor-quality rubber tube or when the regulator is left on. Even after the regulator is turned off, gas continues to flow from the regulator to the burner. Gas leaks happen if the knob is accidentally turned on. This article discusses the detection, monitoring, and control system for LPG leakage. A relay DC motor automatically controls the stove knob. The GSM (Global System for Mobile Communications) module in this system also warns the owner through SMS.*

Keywords: CNG, LPG, MQ Gas sensor, Microcontroller;

I. INTRODUCTION

An intelligent lifesaver system with gas leakage detection is a state-of-the-art safety solution designed to protect people and properties from the dangers of gas leaks. This system employs advanced sensors and automated control units to detect the presence of hazardous gases and initiate appropriate responses to ensure the safety of occupants.

The core components include gas sensors, control units, alarms, ventilation systems, automated evacuation plans, and emergency response mechanisms. These components work together to provide a comprehensive and reliable safety solution that detects gas leaks and activates an immediate response.The intelligent life saver system with gas leakage detection can be installed in homes, commercial buildings, and industrial facilities, providing a versatile and effective safety solution for various applications. With its automated controls and advanced monitoring capabilities, this system can help prevent gas leaks from causing accidents, property damage, or even loss of life.

Explosions of domestic LPG inflict harm to both people and property. Accidents with LPG are now increasingly prevalent. LPG leaking is the primary cause of these catastrophes. When we neglect to close the primary regulator valve, LPG leaks occur. This is what causes mishaps of this nature. Some corrective actions are already in place, such as sending a message to the fire station and the owner when a leak is discovered. The other corrective procedure is activating an exhaust fan when a leak is discovered. The first technique suggested has the drawback that no control action is done, requires further human interaction, and puts people in danger. The second approach has the drawback that because it involves the AC, an imminent explosion would result if the exhaust fan wiring is improper. All of the methods mentioned above involve merely detection and no actual control.

We suggested a system that would perform both detection and control actions in order to address these types of drawbacks. Upon LPG leak detection, the suggested system initiates an automated control action. This automatic control action shuts off the air conditioning while opening the kitchen windows.

II. LITERATURE SURVEY

LPG measurement, detection, and booking system. This method demonstrated how to use a gas sensor to detect a leak and automatically request a new cylinder by sending a message to the agency. However, no action was taken to stop an accident in the event of a leak. [1] A tiered monitoring and warning system for LPG leaks was suggested. A system that detects LPG gas leaks and produces the results in audio and visual forms while also alerting people through SMS (SMS). However, it lacked a mechanism for automatic prevention. [2] An affordable gas leakage detector's design and implementation were suggested. A system that informs people about low and excessive gas leakage levels by sending the proper audio-visual warning signals. The system's development cost was considerably lower than the price of commercially available gas detectors on the market. [3] A system for monitoring and managing LPG was suggested. In

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this system, a relay-driven DC motor controls the stove knob automatically. In addition, they suggested that when the gas level falls below the typical cylinder weight, the cylinder should automatically be rebooked. However, there were no gas leak detection or fire accident prevention provisions. [4]

IOT-based gas leak detection, intelligent alerting, and prediction. This system found a gas leak, warned the user, and foresaw potential leaks. However, there were no plans to stop and remove the gas leak. [5]

The notion of multi-robot intelligence known as SR (swarm robotics) has been put out by Belkacem Khadi et al. [6] in an effort that is motivated by nature and the observation of swarms of ants, flocks of birds, schools of fish, and swarms of bees. In SR, a group of robots is called SI (swarm intelligence) if they complete a job using an intellectual method. This passive networking system involves each robot in the group interacting with the others and the environment outside. This topic focuses on constructing numerous basic robots, their physical characteristics, and their manipulative behaviour. The structure and algorithm of swarm robots are tested using a variety of simulation platforms.

A study on incorporating two distinct robot types, including an explorer robot and a carrier robot, was proposed by R. Imtiaz et al. There are four robots in this configuration: one master robot, also known as an explorer robot, who serves as the leader, and three slave robots, also known as carrier robots. The explorer robot follows the complete path that has been put up to get to the goal and instructs the carrying robots on the journey. Carrier robots go along the road as directed by master robots. As a result, any task may be accomplished more quickly and effectively. Each robot has a Zigbee module, a communication tool for robots to communicate.

Work on the use of S-bots in disaster management has been proposed by Mohd. Daneel Khan, et al [8]. Swarm intelligence enables more precise and practical collaborative work to complete a specific job. When many buildings collapse, and many people are trapped underneath the building swarm during earthquakes, humans find it difficult to go to such sites and rescue people. Birds in a swarm may be employed to learn about the environment and convey information so that people can make informed judgments. It is also utilized to find a safe spot and to provide a precise route.

Gas leakage may be discovered using a gas sensor, according to Abhishek, P. Bharath, and colleagues [9]. When a small amount of gas is brought close to the sensor, it utilizesIoT to notify the user of the leakage.

According to P. M. Vidya, S. Abinaya, G. G. Rajeswari, N. Guna, et al. [10], gas sensors can detect leaks. Based on the significant gas loss from the container, Kavitha B et al. [11] created an alerting system Fig. 3 displays the suggested system's circuit diagram for the industry.

When the gas leaks constantly at a specific volume, Kalpesh Gupta et al. [12] have created an automated window opening mechanism.

III. PROPOSED SYSTEM

Fig. 3.1 displays the suggested system's block diagram.

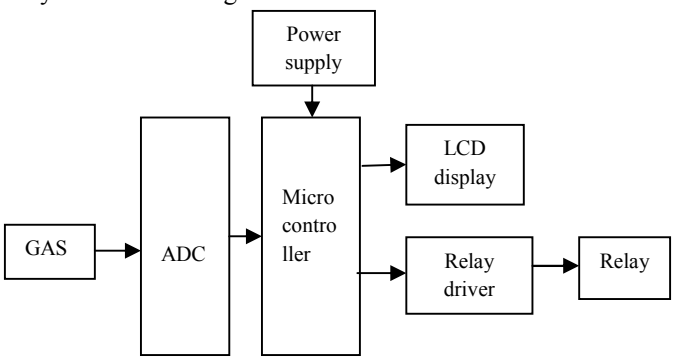

Fig.2. Block Diagram of the proposed system

Our gadget solves the issue of no automatic mechanism to stop LPG and CNG-related home tragedies. Our gadget is made up of three primary components:

- Detection System
- Prevention System
- Alerting System

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This component's LCD and gas sensor continuously track the gas concentration. A revolutionary type of gas valve that we will develop is the foundation of the Prevention System. Although it will have the same appearance as our current standard valves, a stepper motor will be attached to its control knob to allow for automated and manual control. Additionally, these components will be connected to the Microcontroller, which will control the entire apparatus. The alerting system uses a GSM modem to SMS an alarm message to the user if there is a gas leak; the gas sensor in the detection system will continually check for it and send a signal to the Microcontroller, which will then sound the alarm and turn off the gas supply using a stepper motor. Last, but not least, the Microcontroller will employ a GSM module to send an SMS alerting the owner of the occurrence.

Fig. 3 displays the proposed system's circuit diagram.

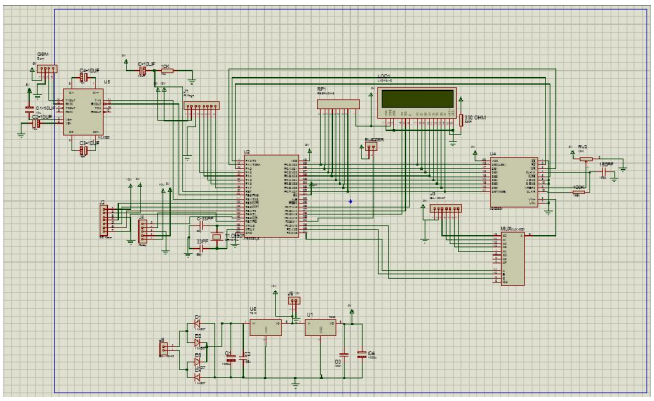

Fig.3. Circuit diagram

Two sensors have been used: a temperature sensor and a gas sensor. The IC 4051 is attached to this sensor. The multiplexer IC is CD 4051. These ICs are used to establish the order of two sensors. A quad bilateral switch called the CD4051 is designed to transmit or multiplex analogue or digital signals. The following are applications for CD 4051:

- Analog signal switching/multiplexing
- Signal gating
- Squelch control
- Chopper
- Modulator/Demodulator
- Commutating switch
- Digital signal switching/multiplexing
- CMOS logic implementation
- Analog-to-digital/digital-to-analog conversion

The ADC0804 receives the multiplexer's output. Using an ADC, analogue input is converted to digital. With three-state outputs and a modified potentiometric ladder, the ADC080X series of successive-approximation CMOS 8-bit A/D converters is designed to communicate with the 8080A control bus. These converters appear as memory or I/O ports to the CPU. Consequently, no logic interface is required. 8951 microcontrollers are interfaced with the output of the ADC0804. The 8951 microcontrollersis given an 11.0592MHz crystal. This Microcontroller has a bit size of 16. The Microcontroller's software will determine how to produce interrupts and then determine how to operate relays. It is the system's brain, managing all inputs and the actions to be executed at the output.

Relays are used to manage a device's ON/OFF functionality. Transistor-driven relays are used. They are utilizing the SPDT relay. Transistor BC 548 is employed to carry out the relay's switching action. Unlike transistors, which can only switch DC, relays can switch AC and DC. The linked appliances that need to be controlled are on the opposite side of the relay. The reset circuit gives the Microcontroller the necessary starting pulse to begin the function from scratch.

This circuit, an MQ-6 sensor was used to look for gas leaks. The MQ-6 sensor, mounted into a plastic and stainless-steel net crust, consists of a tin dioxide (SnO2) sensitive layer, a measuring electrode, a heater, and a micro AL2O3 ceramic tube. For sensitive components, the heater provides the optimal working environment. The gas sensor output is

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transmitted to the IC1 microprocessor (ATMEL 89S52), which displays the gas leaking on the relevant coded LCD and issues another command to the relay driver circuit.

IV. RESULTS

The results of the proposed system are discussed in this section. The experimental setup of the proposed system is shown in Fig.4.

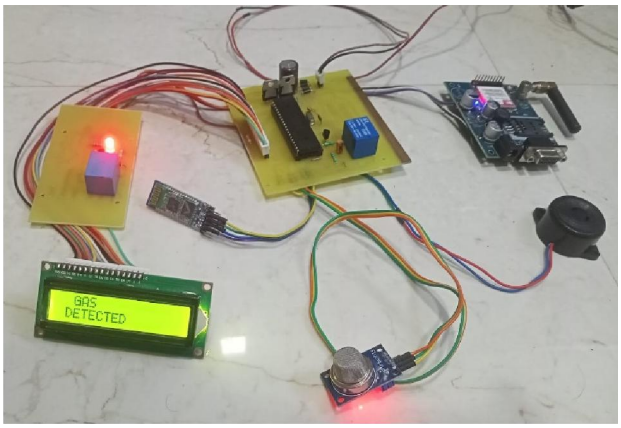

Fig.4. Experimental setup of the proposed system

The proposed system is developed using Microcontroller 89c51. The gas sensor is connected to the controller via GPIO pins. LCD module is connected to the system to display the results. The GSM module sends the message to the authority when gas is detected. The test cases of the system are explained below.

Case I: LCD shows only GAS LEAKAGE DETECTION SYSTEM when gas is not detected in Fig.5.

Fig.5. Output when no gas detected

Case II: LCD shows as GAS DETECTED when gas is detected in Fig.6.

Fig.5. Output when gas detected

The system performs as per requirement. There is no delay in the detection and display.

V. CONCLUSION

An intelligent life-saving system with gas leakage detection may be created by combining gas sensors with microcontrollers like the 89c51. This system can deliver a solid and trustworthy response for identifying and dealing with gas leaks, potentially saving lives and avoiding property damage. Data from the gas sensors may be gathered and processed by the 89c51 Microcontroller to ascertain whether a gas leak is occurring. The Microcontroller can then sound an alert and, if required, contact emergency personnel. On the other hand, the gas sensors are in charge of identifying the presence of dangerous gases in the environment. These sensors may detect methane, propane, carbon monoxide, and other gases, among many more. An intelligent lifesaver system with gas leakage detection may offer

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precise and dependable monitoring of the environment and warn occupants of possible threats in realtime by combining the 89c51 microprocessor with gas sensors.

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