LPG Gas Detection Mechanism Using MQ6 Sensor and NodeMCU

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Abstract - In the modern era, liquefied petroleum gas (LPG) leakage is extremely dangerous. It is also a crucial source of energy for industries, residences, automobiles, and other devices. Installing LPG leakage detectors in vulnerable and residential areas is one way to prevent risks. The main purpose of this project is to design a microcontroller-based LPG leakage detection and response system. The system uses a MQ-6 gas sensor to find LPG leaks and notifies the user of the leakage using a GSM-module through SMS or mail. Therefore, this project invokes detection of gas leakage therebysuccessfully shutting the system down. It prevents accidents.

Keywords —Internet of things, microcontroller, sensor, Liquefied Petroleum Gas (LPG), leakage, detection, notify and fire/explosion prevention.

I. INTRODUCTION

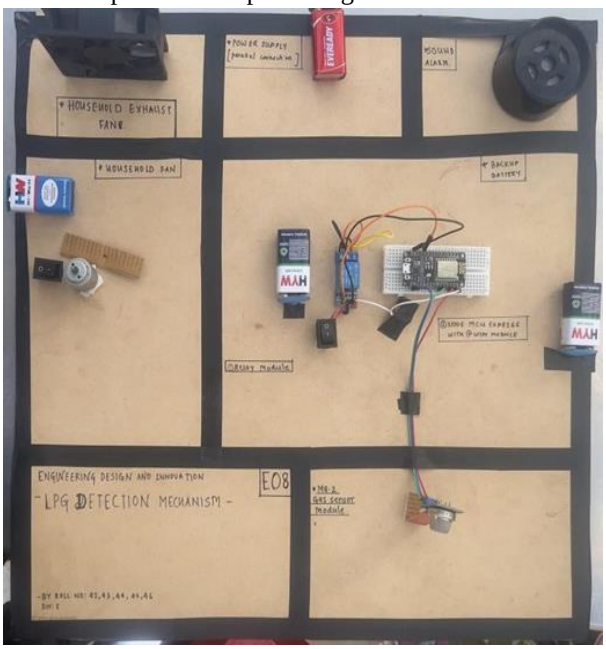
LPG (Liquefied Petroleum Gas) is widely used as a fuel source for domestic and industrial applications. However, it poses a significant safety risk if leaks occur. Therefore, the development of a reliable and cost-effective LPG gas detection system is crucial. In this paper, we present an LPG gas detection sensor (MQ6) and its integration with Node MCU, an open-source platform that enables the sensor to sendan alert email to the owner while cutting off the electricity andturning on an exhaust fan and buzzer in case of gas leaks.

II. LPG GAS DETECTION SENSOR (MQ6)

The MQ6 gas sensor is a highly sensitive and low-cost gas sensor that can detect LPG gas concentration levels. It works by measuring changes in the resistance of the sensing materialdue to the presence of LPG gas. The sensor is equipped witha heating element that ensures stable and rapid response to gasleaks.

III. INTEGRATION WITH NODE MCU

The Node MCU is an open-source platform that integrates a microcontroller, Wi-Fi module, and USB-Serial converter ona single board. In this project, the Node MCU wasprogrammed to read the output from the MQ6 gas sensor andsend an alert email to the owner in case of gas leaks. The Node MCU was also programmed to cut off the electricity and turnon the exhaust fan and buzzer to prevent the spread of gas.



Overview of the Final Project

IV.METHODOLOGY

Data Acquisition: In this stage, comprehensive information was gathered about the various mechanical components required for the project. A meticulous analysis was conducted to determine the circuit design, and connections between the different components were established. Detailed research was

carried out on individual components to ensurea good understanding of their properties.

Researching Previous Projects: The team extensively studied published and patented projects as well as various research papers to gain a better understanding of the optimal combination of components for the project. This stage allowed the team to build on prior work and incorporate innovative ideas to design an effective solution.

Circuit Designation: The team meticulously examined the working of various components in combination with each other to ensure compatibility with the overall project. The goal was to ensure that the components worked together seamlessly and effectively, while also meeting the specific requirements of the project.

Optimization: To minimize costs and maximize efficiency, various components of the project were optimized. The teamfocused on refining the project to ensure optimal performance and enhance its overall functionality.

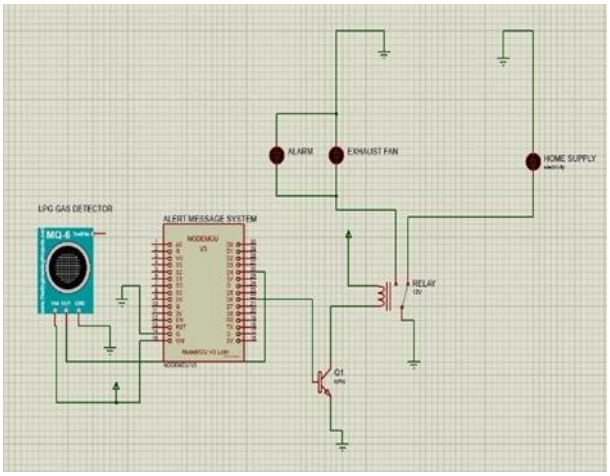
Testing and Evaluation: Once the circuit design was decided, the team tested it under real-life conditions. This stage allowed the team to identify any necessary changes required to improve the circuit design. Through rigorous testing and evaluation, the project was refined to ensure that it functioned optimally under all circumstances.

V.RESULTS AND DISCUSSIONS

User satisfaction: The user testing showed that the small businessmen (using LPG in their shops) were satisfied withthe circuit and found it efficient for detecting the gas. They appreciated the ability to search and appreciated our initiative of working for a social cause. Some of them suggested some improvisations. We considered their ideas and added those ideas into our project.

The functional testing showed that all features and functionalities of the platform were working as intended, including the buzzer alarm, brushless exhaust fan, mail system and cutting off the electricity supply.

The usability testing showed that the circuit was easy toinstall and efficient. People found it as a good and comparatively cheaper product for gas detecting.



Circuit Diagram

VI.PROCEDURE

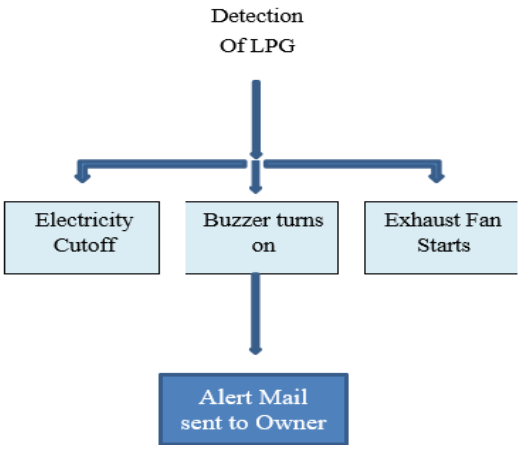
LPG Gas Detection Mechanism consists of 3 segments withtotal of 5blocks

Detection of LPG: This is a crucial process where the LPG isdetected by the MQ 6 sensor. The SnO2 filament in the sensor is highly sensitive, and its conductivity increases when exposed to a flammable gas like LPG, allowing for determination of gas concentration by measuring the change in conductance or resistance. This sensor then relays the signal to themicrocontroller.

Electricity Cutoff: This is done using relay module which will get the signal from the from the microcontroller which gets its signal from the sensor. The relay module then cutoff the electricity.

Buzzer turns on: As soon as the electricity is cutoff the relay module completes the circuit with the parallel power source provided to the buzzer which switches it on.

Exhaust Fan Starts: Similar to the buzzer mechanism. Alert Mail is sent to owner: As soon as the above mechanism starts a prewritten mail is sent to the owner viathe Wi-Fi which I utilized by the ESP chip present in the Node MCU.



VII.FUTURE SCOPE

LPG can be dangerous if not handled correctly, and gas leaks can be hazardous, leading to explosions or fires. Therefore, gas detecting sensors have become very important. Here are some of the future scopes:

1. Smart Home Integration: LPG gas detecting sensors will become an essential part of home automation systems, since they will detect gas leak and notify the owner about it. It will prevent accidents to a large extent.
2. Machine Learning: Machine learning algorithmswill be used to analyze data collected by LPG gas detecting sensors. This will enable the sensors to learn from past data and identify patterns of LPG gas leaks, enabling early detection and prevention of potential accidents. This can be very useful in the near future.
3. Compact Design: LPG gas detecting sensors will become more compact and easier to install, allowing for wider adoption by homeowners. They will be integrated into LPG cylinders or gas stoves, making them more accessible and user-friendly.

In conclusion, the future of LPG gas detecting sensors for domestic use is promising. With advancements in technology, gas detecting sensors will become more intelligent, compact, and affordable, ensuring the safety of domestic environments and preventing accidents caused by LPG gas leaks.

VIII.CONCLUSION

The evidence is clear: Since all the people in today's world go to work on a daily basis, it makes it impossible to check on appliances at home especially LPG cylinders, Electric circuits etc. This system focuses on cost friendly, user-friendly way to prevent gas leakage and explosions in domestic usage. It enables to incentivize workers jobwho are job deprived due to the leakage and system malfunctions. Therefore, this detector can solely prevent and ensure safety.

IX.ACKNOWLEDGMENT

Following the successful sample trials of the LPG gas detector, we are glad to have achieved our target on time, all thanks to the extraordinary efforts put forth by our team members. We would like to extend our heartfelt gratitude to our team of developers, who worked tirelessly to bring our vision to life. Their expertise, dedication, and resolute commitment were the driving force behind the success of ourproject.

We would also like to express our sincere appreciation to the students at our college who played an integral role in the testing and evaluation of the platform. Their invaluable feedback and suggestions played a pivotal role in enhancing the platform and ensuring it met the needs and requirements of the student community.

Furthermore, we would like to acknowledge and appreciate the unwavering support and guidance our esteemed teachers and college staff provided throughout the project. Their vast experience and expertise proved invaluable in helping usovercome obstacles and achieve our goals.

In conclusion, we extend our heartfelt thanks to all those whocontributed to the success of the LPG gas detector project. Without their unwavering support and contributions, this platform would not have been possible, and we are truly grateful for their invaluable involvement.

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