Faculty of Electrical and Electronic Engineering Technology

Development of Gas Leakage Detector with SMS Alert system Using GSM Module and Arduino

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Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

2023

Development of Gas Leakage Detector with SMS Alert system Using GSM Module and Arduino

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A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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2023

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FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

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Tajuk Projek : Development of Gas Leakage Detector with SMS Alert system Using GSM Module and Arduino

Sesi Pengajian : 2022/2023

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I approve that this Bachelor Degree Project 2 (PSM2) report entitled "Development of Gas Leakage Detector with SMS Alert system Using GSM Module and Arduino" is sufficient for submission.

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APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours.

Signature :

Supervisor Name : Dr A.K.M Zakir Hossain

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DEDICATION

To my beloved mother, SITI FATIMAH BINTI YAHAYA, my family, my fellow lecturer and my fellow friends.

ABSTRACT

The use of LPG gas is very widespread in industrial use as well as at home. Therefore, safety should also be taken seriously because LPG gas is flammable and explodes, causing property destruction and loss of life. The rate of accidents of explosions and fires of LPG is increasing from year to year. Therefore, the use of gas leak alarm is very relevant to reduce the occurrence of accidents caused by gas leakage. The goal of this project is to detect the presence of hazardous gases such as LPG and the ability to reduce the rate of gas entry into a space as well as provide warnings in the form of short messages to customers' mobile phones. When this procedure occurs, the MQ6 gas sensor will detect the presence of LPG gas and send a signal to the Arduino to process the data. Next, the alarm siren is immediately activated, the gas valve is closed and the fan is turned on automatically to reduce the presence of gas in a room. In addition, a warning message will also be sent by the GSM SIM900D to the customer's mobile phone about a gas leak that occurred and the LCD will display a reading of the situation when the incident occurred. The results and analysis of this project have been carried out and shown in the report.

ABSTRAK

Penggunaan gas LPG adalah sangat meluas dalam kegunaan industri mahupun di rumah. Justeru, keselamatan juga harus dipandang sirius disebabkan gas LPG ini bersifat mudah terbakar dan meletop hingga menyebabkan kemusnahan harta benda dan meragut nyawa. Kadar berlakunya kemalangan letupan dan kebakaran gas LPG ini semakin meningkat dari tahun ke tahun. Oleh itu, penggunaan penggera kebocoran gas adalah sangat relevan bagi mengurangkan berlakunya kemalangan yang disebabkan oleh kebocoran gas. Matlamat projek ini adalah untuk mengesan kehadiran gas berbahaya seperti LPG dan keupayaan untuk mengurangkan kadar kemasukkan gas ke dalam sesuatu ruangan serta memberi amaran dalam bentuk mesej ringkas ke telefon bimbit pelanggan. Apabila prosedur ini berlaku, sensor gas MQ6 akan mengesan kehadiran gas LPG dan menghantar isyarat kepada Arduino untuk memproses data. Seterusnya, siren penggera segera diaktifkan, injap gas ditutup dan kipas dihidupkan secara automatik bagi mengurangkan kehadiran gas di dalam sesuatu ruangan. Di samping itu, mesej amaran juga akan dihantar oleh GSM SIM900D ke telefon bimbit pelanggan mengenai kebocoran gas yang berlaku dan LCD akan memaparkan bacaan situasi ketika kejadian tersebut berlaku. Hasil dan analisis tentang projek ini telah dijalankan dan ditunjukkan dalam laporan.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Dr A.K.M Zakir Hossain, for his precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) and my family for the financial support which enables me to accomplish the project. Not forgetting my fellow colleague for the willingness of sharing his thoughts and ideas regarding the project.

My gratitude is extended to my parents and relatives for their prayers and thoughts through my studies.

Finally, I'd like to express my gratitude to all of my co-workers and classmates, as well as faculty members and those who aren't named here, for their cooperation and assistance.

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V	-	Voltage
PPM	-	Parts-per-million
LPG	-	Liquidfied gas petroleum
GSM	-	Global system for mobile communication
SMS	-	Short message service
LED	-	Light-emitting diode
LCD	-	Liquid crystal display

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CHAPTER 1

INTRODUCTION

1.1 Background

Liquefied Petroleum Gas, or LPG, is a blend of gas streams that includes Butane and Propane. LPG is formed through the usage of fossil resources, where it is extracted from gasoline or natural gas streams as they erupt from the earth, or are generated during the distillation of fuel.[1]

The LPG does not pollute the earth or water because it is a gas, but it may pollute the air. The LPG is frequently delivered in pressured steel tanks since it drains because its heating rate is below cellar temperature. fast at normal temperatures and pressures. The LPG also has no color and no odor.[2] But even so, LPG carries an odorant for safety precaution if there is a gas leak that may be easily detected. Unlike natural gas, the LPG is denser than air, so it will stream along with surfaces and slip into the low district like underground bunkers. Besides, there are two critical factors linked with LPG and the primary is the chance of a detonation if the LPG and vapor mixture is within detonation bounds and combustion.[3] Next, hypoxia is the second factor that occurs when LPG substitutes air resulting in a fall in oxygen concentration. Gas leakage has recently been a hot topic, and it is one of the leading causes of fires.[1], [4] This project is designed to detect any LPG leaks and notify the user of the problem. The user will receive an SMS alert. This initiative will help to reduce the probability of spontaneous combustions it guides premature sensing devices before the gas intensification reaches an unsafe level.[3]

1.2 Problem Statement

Liquefied Natural Gas (LPG) is almost like a natural gas commonly used all over the world[2]. In a home or hotel, LPG is utilized for cooking and it also is utilized in several gas-related industries.[5] Although the method for installing an LPG-based system is highly strict, there is no way to ensure that the system would not leak. Even though humans have some flaws. Humans are unable to indicate the existence of biogas as instantly as sensors. As a result, the installation of a gas sensing system is necessary for legit controlling the volatile substance. In some situations, gas leaks can produce fires that devastate people's belongings and cause catastrophic injury or death due to the massive volume of the fire because of the delayed received notification about the fire by the fire station. The existing devices on the market serve as gas detectors since they only detect gases and sound an alarm[4]. However, even if the sensor is activated while the user is away from home or premises, they will be unaware that a gas leak has occurred.

As a result, this project will be able to fix the problem. This is because the project "Development of Gas Leakage Detector with SMS Alert System Using GSM Module and Arduino" can detect the presence of LPG and provide more reliable information by sending an SMS alert to the owner[1].

1.3 Project Objective

The study's aim is:

1. To construct a technique for identifying the appearance of LPG.
2. To design and simulate the prototype of the proposed LPG detector.
3. To benchmark the results with the current trends.

1.4 Scope of Project

a) The project scope is to develop a technique for detecting natural gas appearances. It may help to prevent fires and explosions caused by the leakage of gas and it also may identify the leakage of gases in their early stages. The main aim of this project will be exclusively on the building and it is capable of detecting LPG gas. The sensor used in this project could trace any type of combustible gas, especially LPG. This project used a microcontroller of Arduino UNO as the CPU that analyzed the sensor's data before sending it to the GSM module where it will communicate with the user by sending an SMS alert while applying safety procedures to decrease the presence of LPG gases in the building.

Chapter 1 (Introduction) - Background, Problem Statement, Objective, Scope Of Project.

Chapter 2 (Literature review) - Introduction, Previous Project Research, Comparison Previous Research Paper, Summary.

Chapter 3 (Methodology) – Introduction, Methodology, Flow Chart, Block Diagram, Hardware Implemantation, Software Project, Summary.

Chapter 4 (Results and analysis) – Introduction, Results, Discussion, Summary.

Chapter 5 (Conclusion and recommendation) – Conclusion.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This initiative aims to identify any LPG spills in manufacturing or household utensils. With ongoing research moving toward the benefits of lowering the rate of gas leakages, the lack of a system to monitor and manage gas leakages in households has become a significant problem[2]. This chapter evaluates many attempts at solving a similar problem. Different studies have attempted various techniques to eliminate the issue described before, and some of the strategies used have been assessed. Following a study of what many researchers have done, a brilliant potential solution will be built based on some of the elements used by other researchers.

Since then, many methods and equipment have been created to measure, analyze, and notify the leaking of various gases such as LPG. As a result, an efficient strategy to monitor and regulate LPG leakage which might be utilized for household purposes is required.

2.2 Previous Project Research.

This chapter will provide a review of previous research and existing projects that have been created using reference sources and guidelines such as journals, the internet, article writing, blogs, and scientific studies to gain an understanding of project design, conception, and any information that may be useful in improving the project. Several researchers have built and innovated projects with different concepts and designs. This chapter also covers the research that is relevant to this project.

2.2.1 A SECURITY ALERT SYSTEM USING GSM FOR GAS LEAKAGE.

LPG is a volatile group of chemical gases used as gasoline in a wide variety of uses due to its beneficial features. Unfortunately, since gases are denser than air and do not diffuse easily, there is a serious issue with their spilling into the environment. Gas leakage into the air might also result in an explosion. To avoid this problem, the hazardous gas detection approach for recognizing highly hazardous leakage employs multiple devices. Whenever a toxic chemical is spotted, these devices generally emit an audio warning to notify authorities.

The main purpose of the leak detection device is to consistently trace leakage of gas in the air by implementing an MQ5 gas sensor, which has numerous benefits such as a long lifetime, cheap cost, reliability, and high sensitivity to LPG. In addition, the MQ5 gas sensor has an enhanced combustion awareness. The sensitivity of the gas sensor enhances when volatile gases are found within the surroundings and the resistance of the sensor varies in proportion to the combustible gas concentration[3]. Once the volume of gas in the air achieves a certain proportion, the audiovisual alarm, which comprises an LED and a buzzer is activated and the GSM module will transmit a message to the subscriber. When there is a gas leak, the GSM module is utilized to deliver brief messages. Every cell phone address can be added, whereby an SMS with the above text should always be despatched. Even though the subscriber was never at home, this wireless module is designed to remind them and in the event of a crisis, a digital sound siren is generated to advise individuals at the residence[3]. The detector is intended to communicate with a microcontroller and evaluate leakage in the air on an ongoing basis, gives the microcontroller these facts, which then sends an SMS to the customer and activates the LED, Buzzer, and the notification will be shown on the screen. The LPC2148 controller is applied in this project, and its major role is to send a message via the GSM module even though the user is never at home, they would be reminded when the percentage of gas in the air surpasses the safety standards[3]. This

item was intended to power on the LED and engage the buzzer to alert the residents and show the message on the LCD that was connected to the controller. The GSM modem is controlled using AT instructions. The protection circuit is safe since it has an exhaust fan and does not create a spark. A driving circuit is built using a relay to command the extractor fan and when the gas consolidation is over the allowable limits, the operator activates the exhaust system, which exhausts the gases, and is interfaced to the LPC2148 microcontroller[3]. When the gas leakage surpasses a specific level, the system software developed in Embedded C language may receive data from the sensor, transfer the data, and send a message to the user's phone, as well as activate LEDs and buzzers to immediately inform the guests at home and display the notification on an LCD monitor. It is employed in numerous sectors due to its low power consumption, ease of use, and dependability.

The entire system was introduced and tested by applying a small supply of LPG just next to the sensor system. If somehow the gas volume in the environment surpasses the legal standard, the major contributor is the verbal alert which sends a Text to the subscriber via a GSM modem to notify users at residence to develop a solution. Finally, we can use this device to notify consumers if a gas leakage exceeds a specific level by delivering a signal and activating the alarm, and implementing appropriate precautions to stop the gas leakage.

2.2.2 GSM-BASED GAS LEAKAGE DETECTION SYSTEM.

LPG is an extremely combustible gas made primarily of gaseous fuels. that is extensively equipment used mostly for heat generation. In this circumstance, gas leak security systems become critical, since they aid in the prevention of gas leakage incidents[4]. In the literature, an implanted sensor used to monitor and notify harmful gasses was presented, in which the sensor has already been turned on instantly whereas gas consolidation is higher than the usual threshold. This study presents a low-cost, high-

accuracy system that not only detects gas leaks but also alerts and shuts down major power and gas supply, as well as sending an SMS[4]. The GSM module sends the subscriber an SMS as an alarm. MQ-6 has been utilized to offer a high-accuracy gas sensor.

The system's functioning is broken into three basic phases. Throughout the first process, the gas detector MQ-6 senses gaseous escape. This detects gas and uses ADC where the information is sent to the microcontroller[4]. It transmits an activation signal to any external devices it is connected to. Many tasks were completed in the final step, including the activation of the buzzer and the display of a message on the screen, as well as the activation of the GSM module, which sent a warning SMS to the user. As a result of the stepper motor driving the affiliated stepper motor, the main power and gas supplies are turned off. Finally, when the gas leak has been repaired, with the aid of the reset button, the system was effectively halted and the entire system progressed to the first step. An electronic device that monitors gas emergence is the MQ6 detector. Once the gas device monitors a gas appearance, the microcontroller automatically addresses the data sent to the GSM to inform the subscriber by sending a message via SMS to their handphone[4]. One SIM card is required for the GSM module. This module can take any network SIM card and, like mobile phones, has a unique identifying number. These modules are powered by a 12V DC source and have the ability to send SMS and audio messages. The microcontroller memory stores these SMS or voice messages. The stepper motor is powered by a 12V DC external source and its main function is to turn off the electricity and the gas furnish. The main power supply is turned off by a single motor where when the motor turns 60 degrees, it is linked to the main control in this mode, the electricity has been cut off instantly. The major gas flow will be shut off by the other generator. The main gas knob is physically attached to a stepper motor, such that when the motor turns 180 degrees, the knob closes automatically. At 434 MHz, an RF communication system using ASK with a receiver[4].