UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SMART LPG CYLINDER MONITORING SYSTEM FOR CONSUMER USE

This report is submitted in accordance with the requirement of the University Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours

by

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This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours. The member of the supervisory is as follow:

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Supervisor: En. Omar Bin Asaroon.

ABSTRAK

Produk sistem pemantuan pintar bagi tong gas adalah satu kajian penambahbaikan bagi produk sebelum ini. Produk sebelum ini hanya menggunakan analog tolok tekanan bagi memeriksa tekanan dalam tong gas. Sensor tekanan telah digunakan bagi menggantikan mekanisma yand telah digunakan bagi projek sebelum ini. Sensor tekanan yang digunakan akan menghantar data kepada system Arduino dan kemudian Arduino akan memproses data tersebut dan menukarnya kepada data digital dan isyarat lampu. Untuk isyarat lampu ia terbahagi kepada tiga iaitu merah, hijau dan biru. Warna merah mewakili tekanan rendah, warna hijau mewakili tekanan sederhana dan warna biru mewakili tekanan tinggi. Tong gas yang digunakan untuk eksperimen ini adalah petronas and berat gas adalah 14 kg. Projek ini dilakukan bagi membantu pengguna terutamanya suri rumah kerana suri rumah yang banyak menghabiskan masa memasak di rumah. Produk ini boleh membantu mereka untuk memeriksa tekanan didalam tong gas. Jadi, meraka boleh menganggar masa yang tinggal untuk mereka memasak sesuatu. Ia juga amat membantu semasa bulan puasa terutama ketika bersahur.

ABSTRACT

Smart LPG cylinder monitoring system is the product that had been improve from the previous product. The previous product had been used analogue pressure gauge to read the pressure inside the LPG cylinder. Pressure sensor had been used to replace the previous project mechanism. Pressure sensor function is to transmit the data from the LPG cylinder to the Arduino system and the system convert the data into the digital data and light signal. For the digital data, the Bar unit had been used. For the light signal, it had been divided into three type if light which are leg, green and blue. The red colour represent low pressure, the green colour represent medium pressure and the blue colour represent high pressure. The gas tank that have been used for experiment is Petronas LPG cylinder and the gas weight is 14 kg. This project had been made to help the user especially the housewife because usually they are the person that responsible for cooking. This product will help them to monitor the pressure inside the LPG cylinder. So, they can estimate the time left for cooking process. Its help when fasting month especially for “sahur”.

DEDICATION

This thesis writing is dedicated to my beloved late father Mohd Iqbal Dhilbir Bin Abdullah that always taught me to apply the knowledge for good things in daily life so it can benefit others in next time. Then, this thesis was also dedicated to my beloved mother Rahmah Binti Abu Hassan that give moral support to finish writing this thesis at the right time. Besides, to all my siblings that always support and sharing knowledge or experience about writing this thesis is really helpful to me during the process of writing this thesis.

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Then, I would like to send my gratitude to my friends that involve directly and indirectly. Without their knowledge and experience, the process of coding the system of Arduino, soldering process and drawing of the product can be unsuccessful. After that, I would like to express my gratitude to parents and siblings that support me spiritually throughout writing this thesis.

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LIST OF SYMBOLS

C_4H_{10}	-	Isobutane N-butane1 N-butane2
C_4H_{10}	-	Propane
MJ/m^3	-	Megajoule/meter^3
MJ/kg	-	Megajoule/kilogram
MJ/L	-	Megajoule/litre
C°	-	Celsius
kPa	-	kilopascal
m^3/L	-	Meter^3/litre
m^3/kg	-	Meter^3/kilogram
H_2O	-	water
T	-	Torque
L	-	Litre
kg	-	Kilogram
kg/m3	-	Kilogram/meter^3

LIST OF ABBREVIATIONS

LPG	Liquefied petroleum gas
SIRIM	Standard and Industrial Research Institute of Malaysia
USB	Universal Serial Bus
PMW	Pulse-Width Modulation
AREF	Analog References
LED	Light Emitting Diode
IC	Integrated Circuit
CATIA	computer-aided three-dimensional interactive application
RGB	Red, green and blue

CHAPTER 1

INTRODUCTION

1.1 Introduction

LPG cylinder have been used widely in every house in Malaysia. They are no longer use the traditional method which are use wood, charcoal and kerosene. LPG are more economical, environmentally friendly, faster cooking and easy to use. LPG pressure regulator is a device that use to decrease the pressure by change the phase of LPG from liquid to gas. Pressure regulator is a dynamic open valve that takes a high varying inlet pressure and converts it to a nearly constant and lower desired outlet pressure.

However the gas regulator that usually used do not alarm the user when the gas inside the cylinder is about to decreased or empty. It's difficult the user to guess the amount of gas that inside the cylinder. Many difficulty situation will be occur such as when the user want to cook at night or in the special event and the gas in the cylinder is empty, they need to find the LPG cylinder to continue their work. This situation consume a lot of time and can affect their job.(Tobergte & Curtis, 2013)

A new device will be invented by applying sensor on the gas regulator for the problem solution. This project will be focusing on the pressure regulator on the LPG gas regulator by applying sensor which is Arduino. Arduino is an open-source

electronics platform based on easy-to-use hardware and software. Arduino is the system that used to monitor the movement needle on the pressure gauge to alarm the people by various type of colour or sound. From the colour or sound the user can alert or know about the amount that remain inside the cylinder. The design of the project will be focused on the objective which is design the Arduino coding that suitable for this applications. Smart LPG cylinder monitoring system is a name of the device project to solve the gas regulator problem when faced with the sudden empty LPG cylinder. This device is suitable for all LPG cylinder that used for home appliance.

1.2 Problem Statement

Almost all house use gas regulator on the LPG cylinder as the intermediaries between the gas stove and the LPG cylinder. Its function as dynamic open valve that takes a high varying inlet pressure and converts it to a nearly constant and lower desired outlet pressure. The gas always run out will been used without warning the user and it can cause the problem to the user. The user need to replace to the new LPG cylinder to continue their work. For example, if the gas run out in the middle of the night and all the groceries shop are close, they cannot continue cooking.

1.3 Objective

Based on the problems as mentioned above, the objectives to this project are:

1. To design the gas regulator that can be monitor.
2. To do a simulation on the result using Arduino software.
3. To fabricate the prototype of the actual product.

1.4 Scope

To fulfilling the objectives for this project, several scopes have been determined:

1. Designing the product concept based on the Arduino system and shape that suitable to use.

2. Produce the product by installing the Arduino circuit and sensor on the LPG gas regulator for monitoring purpose.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Pressure gauge for the Liquefied petroleum gas (LPG) have been used widely in the industry for the cooking application. It function is to measure the pressure of the gas inside the LPG cylinder. Usually the pressure inside the LPG cylinder will be measure in bars and pressure gauge just use in industry and not for home usage. Liquefied petroleum gas (LPG) is a flammable mixture of hydrocarbon gases that used in heating appliances and is one of the important source of energy for many homes and businesses in Malaysia. In Malaysia, LPG is often used in homes cooking. This energy sources is usually supplied using gas cylinders. In Malaysia, there are a few type of gas cylinder for cooking. For the household the size of the LPG cylinder is 12, 14 and 16 kilogram (Kg) and for the industry the LPG cylinder is 50 kg.

LPG exists in a Liquid-vapour equilibrium state in a cylinder. The LPG never 100% filled in the cylinder. Usually its takes about 85% of the space in the container. It is because the remaining space which is 15% is used for the vapour phase of the LPG. The more evaporation in the cylinder, more vapour gets generated. Due to the limited space for vapour, it will increase the pressure inside the cylinder.