



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN OF CAR FUEL LID COVER BREAKER FOR SAFETY PURPOSE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Mechanical Engineering Technology (Automotive Technology) with Honours

By

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2017



BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: Design of Car Fuel Lid Cover Breaker for Safety Purpose

SESI PENGAJIAN: 2017/18

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DEDICATION

This report is dedicated to my beloved family especially to my parent, Mr. Muhammad Hanafiah Bin Abu Bakar and Mrs. Haryati Binti Mohamed Haridi for their endless support and opinion when completing this report. Next, I would like to thank to my supervisor, Mr. Muhammad Zaidan Bin Abdul Manaf for guidance and encouragement while doing this project. Lastly, special thanks to my friend that has help me in giving their ideas and opinion for completing this final year project.

ABSTRACT

The Design of Car Fuel Lid Cover Breaker for Safety Purpose project is basically inspired by the Automatic Side Stand system where the system has been implement on the 2009 motorcycle brand Yamaha and model Ego. Nowadays, there are many petrol station users who ignore precaution safety when refueling at petrol pump. Most of safety precaution is to turn off the engine when refueling, turning off the cellphone, and not smoking when refueling. There are users of petrol stations that fail to follow the safety precaution at the petrol station and most things that users not aware such as is not to shut off the vehicle engine when refueling at petrol pump. This system is designed to teach the users petrol station about the importance of safety when refeuling. The system works when the vehicle is in static. When oil tweul are pulled to open the fuel lid cover , the sensor detects and immediately turns off the engine. In this writing, it will focus on fuel station users research, then launch the system by finding the best components for the project and prototyping and testing the project.

ABSTRAK

Projek *Design of Car Fuel Lid Cover Breaker for Safety Purpose* ini pada dasarnya diinspirasi daripada system *Automatic Side Stand* dimana system telah diguna pakai pada motorsikal jenama Yamaha model Ego keluaran tahun 2009. Pada masa kini , terdapat ramai pengguna stesen minyak yang mengabaikan langkah-langkah keselamatan semasa mengisi minyak kenderaan. Diantara langkah-langkah keselamatan ialah mematikan enjin ketika mengisi minyak, mematikan telefon bimbit, dan tidak merokok ketika mengisi minyak. Terdapat pengguna stesen minyak yang gagal mematuhi langkah-langkah keselamatan ketika berada di stesen minyak dan diantaranya adalah tidak mematikan enjin kenderaan ketika mengisi minyak kenderaan. Sistem ini diwujudkan bertujuan untuk mengajar kepada para pengguna stesen minyak tentang pentingnya keselamatan ketika mengisi minyak kenderaan. Sistem berfungsi ketika kenderaan dalam keadaan tidak bergerak. Apabila pencungkil minyak ditarik untuk pembukaan tempat pengisi minyak, pengesan akan mengesan dan segera mematikan enjin kenderaan. Di dalam penulisan ini, ia akan focus kepada kajian pengguna stesen minyak, kemudian melakar system dengan mencari komponen-komponen yang terbaik untuk projek dan akhirnya *Prototyping* dan pengujian kepada projek.

ACKNOWLEDGEMENT

Bismillahirrahmaanirrahim,

In the name of Allah S.W.T, the most compassionate and the most merciful.

Firstly, thanks to Allah S.W.T because giving me a good health and courage and strength to do this final year project.

Secondly, I would like to deeply express my gratitude and appreciation to my supervisor, En. Muhammad Zaidan Bin Abdul Manaf and my co-supervisor En Azman Bin Ibrahim for his guidance, support, encouragement and helping to finish my final year project.

I would like to extend my sincere to all my friends, who has assisted and share the ideas, indirectly easier for me to complete this project. I wish to extend to everyone who has helped directly or in completing this project. Finally, my deep gratitude goes to my beloved mother, father, and siblings for their blessing and prays.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

Malaysia has a high rate of accidents. The one of the accidents in Malaysia, are fire to a vehicle while refuelling at the petrol station. According to the Fire and Rescue Department of Malaysia (BOMBA), the fire comes from vehicle while refueling at the petrol station cause of an accident in Malaysia.

Nowadays, people are not aware of the safety precaution while refueling at a petrol station. At every petrol station, there are always highlight about safety precaution while refueling the fuel petrol, such as stop the engine, do not use a cell phone and another electronic device, do not smoke, and do not touch your car to discharge electrostatic. Lately news common happen fire while refueling the fuel petrol to the vehicle it is because usually laziness of people to stop the engine and did not care the safety precaution. In this same experience and prefer to prevent from the accident happen and presence creates a system when open the fuel tank case engine will stop automatically.

Recently, a lot of news of car involve fire accident while refueling the petrol fuel. When an accident occurs, the new car or the old car was involve occurs fire during fill the petrol fuel. The one cause happen flammable because refueling while engine in running condition or not turn off the engine during refueling. The main idea of the project car fuel lid breaker is to educate of the user of vehicle and new implement system safety to the vehicle. The project function when the vehicle in static condition. When the user of vehicle open the fuel lid cover and sensor limit switch open, the circuit will detect and automatically shut

down the engine or cut off the engine. When the fuel lid cover closed , the sensor limit switch closed and the system operation back to normal.

1.2 Problem Statement

Most of the driver vehicle, when stop at the petrol station, most of the people are not aware with the safety precaution such as turn off the engine, do not use cell phone and another electronic device, do not smoke, and do not touch your car to discharge electrostatic. In every petrol station strictly highlight safety precaution, but the user still not aware.

The petrol station has a high risk of causing flammable. Hence, the fire occurs at the petrol station are due to the attitude of the drivers, where most of them are tend not to switch off the engine when refueling at a petrol station. If the petrol station fire explode, it may cause danger to other user of petrol station. From the statistic Fire and Rescue Department of Malaysia (BOMBA), the one accident in petrol station cause from fire explode while refueling.

Due to this situation, this study attempt to design car fuel lid cover breaker in order to make sure all drivers switch off the engine. It is because while refueling the petrol and engine still running, chances cause happen flammable is high. The idea is that when the drivers arrive at a petrol station, when they pull up till the switch to open cover fuel lid then sensor switch limit detect open of the cover fuel lid and the circuit detect automatic turn of the engine by disconnect the ignition switch. When the fuel lid cover closed and sensor switch limit detect, the system operation back as normal.

1.3 Objective

The objective of this study are :

- To study the behavior of driver during refueling at petrol station
- To design the system to turn off the engine automatically during refueling
- To verify the effectiveness on the system

1.4 Scope

The scope of this study are limited to the following aspects :

- For additional system car in automotive industry (safety purpose)
- The system applied when the car in static or not moving condition link with speedo meters.
- For new vehicle production

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will explain the literature review of the project. It start with fire accident due to engine ON, statistic accident in Malaysia, safety petrol fuel station, electrostatic discharge, automatic side stand, start-up the engine by using fingerprint, biometric, mechanism / system to auto shut-off engine, ignition switch, fuel pump, mechanical design process, product specification design (PDS), PDS checklist, concept selection method, concept screening, concept scoring, material selection , sensor switch selection, switch selection and summary result.

2.2 Fire Accident Due To Engine ‘ON’

2.2.1 Statistic Accident in Malaysia

From the reference the most accident fire in Malaysia such as fire inside or outside of factory building, fire inside or outside of office building, fire inside or outside of house building, fire inside or outside of school building, fire inside or outside of institution building, fire inside or outside of mall building, fire inside or outside of store building, fire inside or outside of assembly hall building, fire inside or outside of petrol station, fire inside or outside of hotel or hostel building, fire inside or outside of laundry, fire inside or outside of hospital or clinic building, and other. The one place can cause high risk happen fire is petrol station.

| JABATAN BOMBA DAN PENYELAMAT MALAYSIA | | | | | | | | | | | |
|---------------------------------------|----------------------------------|---|---|-----|-----|----------------|----|--|----------|--------------------------------------|----------|
| NEGERI : KESELURUHAN | | | | | | SEHINGGA APRIL | | | | | |
| BIL | JENIS PREMIS | BIL. BAHAYA KEBAKARAN SEK. 2 TAKSIRAN BAHAYA KEBAKARAN | | | | | | BIL. NOTIS MENGHAPUSKAN BAHAYA KEBAKARAN SEKSYAN 8 | | BIL. PERINTAH TUTUP SEKSYEN 13 | |
| | | A | B | C | D | E | F | BORANG A | BORANG B | BORANG C | BORANG D |
| 1 | Bangunan Kilang / Bengkel | 1 | 0 | 11 | 20 | 0 | 0 | 32 | 12 | 0 | 0 |
| 2 | Bangunan Pejabat | 1 | 1 | 22 | 10 | 1 | 0 | 35 | 0 | 0 | 0 |
| 3 | Bangunan Pejabat / Kediaman | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 |
| 4 | Bangunan Kediaman | 0 | 0 | 1 | 5 | 2 | 0 | 8 | 0 | 0 | 0 |
| 5 | Bangunan Sekolah | 0 | 0 | 26 | 11 | 0 | 0 | 37 | 0 | 0 | 0 |
| 6 | Bangunan Pengajian Tinggi / Inst | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | Pusat Membeli Belah / Kedai | 16 | 2 | 40 | 97 | 27 | 32 | 214 | 17 | 0 | 0 |
| 8 | Bangunan Stor | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | Bangunan Dewan Perhimpunan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | Stesyen Minyak | 0 | 0 | 1 | 1 | 0 | 1 | 3 | 0 | 0 | 0 |
| 11 | Bangunan Asrama / Hotel | 0 | 0 | 3 | 4 | 1 | 2 | 10 | 1 | 0 | 0 |
| 12 | Dobi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | Bangunan Hospital / Klinik | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | Pelbagai | 3 | 0 | 3 | 2 | 1 | 1 | 10 | 0 | 0 | 0 |
| JUMLAH | | 21 | 3 | 107 | 150 | 32 | 36 | 349 | 40 | 0 | 0 |

Table 2.1 show the statistic Fire and Rescue Department of Malaysia (BOMBA) in year 2012

2.2.2 Safety Petrol Fuel Station

The increase now days of the population, the number of the automobile also increase on the road. The population of use vehicle now days increase day by day. The increase of using a car also effect on increase usage of petrol fuel station for fuel the car petrol. In Malaysia, all the brand petrol station such as Petronas, Petron, Caltex ,BHPetrol, Shell and other are highlight usually the same safety precaution while filling the fuel.



Figure 2.1 brand petrol station in Malaysia

Petrol fuel station (PFS) is the one store that sells hazardous and flammable material in close of a rural and urban environment. For the safety measures that requires not be found similar at all petrol fuel station (PFS) smooth for the safety. The safety consciousness depending the occupational health and safety aspect that varies from industries to industries.

At every petrol station always highlight safety precaution while fill the fuel petrol, such as stop the engine, do not use or turn off cell phone, fill portable containers on the ground, never allow children to use pump and another electronic device, do not smoke, and do not touch your car to discharge electrostatic.

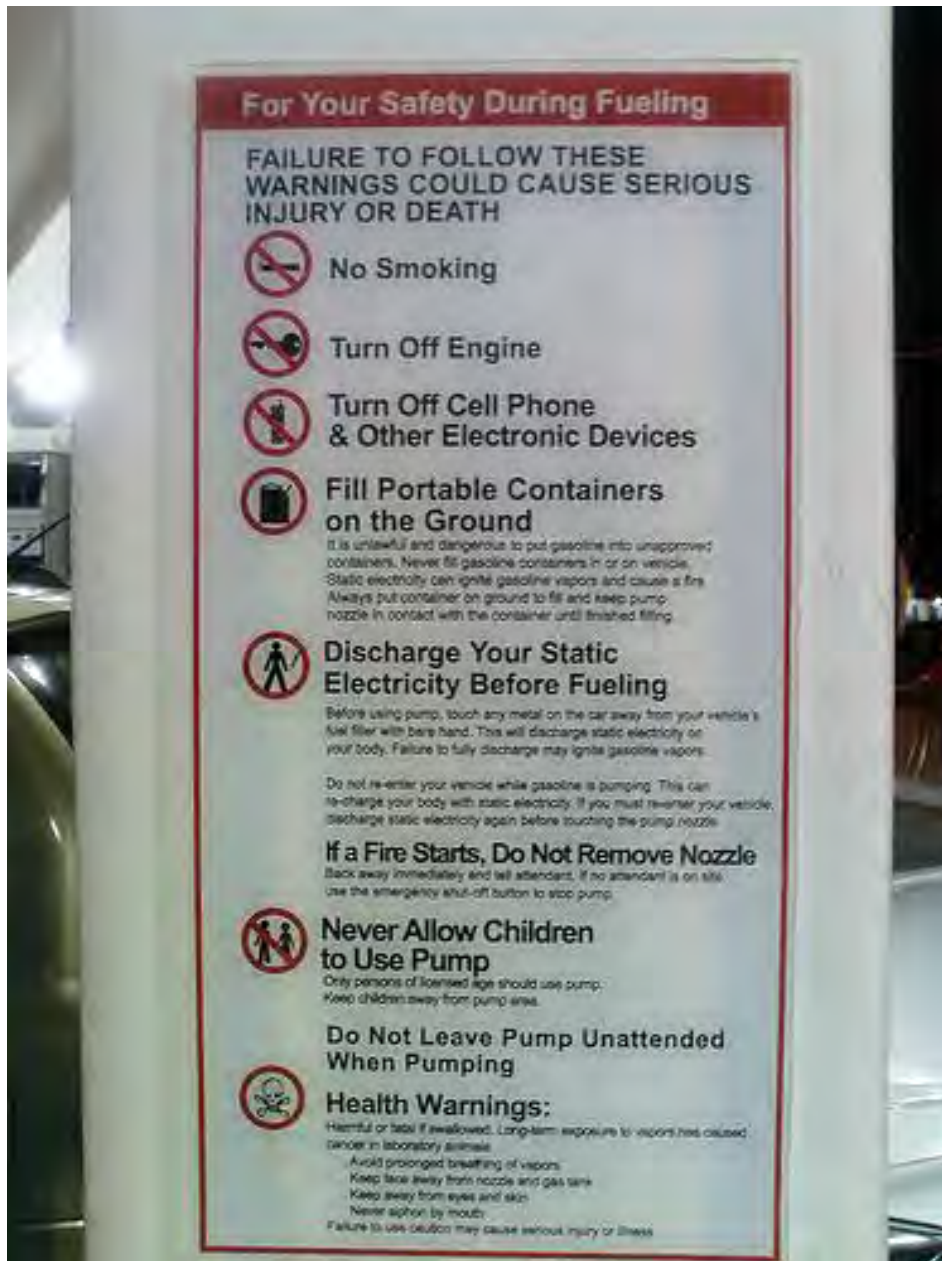


Figure 2.2 the safety precaution in petrol station

Fuel oil and gas is the source for the vehicle and it's offered refueling station that have combustion and explosion characteristics, serious casualties and economic losses often caused by fire. The fire risk while refuelling process to the vehicle.

| | Gasoline | Diesel |
|---------------------------------|--------------------|-----------|
| Composition | C5~C12 hydrocarbon | |
| Melting point (°C) | -90.5~-94.5 | -18 |
| Boiling Point (°C) | 40~205 | 282~338 |
| Relative density (water=1) | 0.7~0.8 | 0.82~0.86 |
| Relative vapour density (air=1) | 3~4 | |
| Vapour pressure (kPa) | 40.5~91.5 (37.8°C) | |
| Flash point (°C) | -58~10 | 45~55 |
| Ignition temperature (°C) | 250~530 | 257 |
| Explosive limit % (V/V) | 1.4~7.6 | 0.6~7.5 |

Table 2.2 the composition and physicochemical properties of the gasoline and diesel (Zhang,20014)

2.3 Previous Research

2.3.1 Electrostatic Discharge

Electrostatic discharge (ESD) is an electrical flow suddenly between two electrical imposed objects caused by contact, electrical breakdown, or dielectric fraction. Static electric convergence can be caused by tribocharging or electrostatic induction. ESD occurs when objects are charged differently closely or when the dielectric between them breaks, often resulting in visible sparks.

ESD can make a great electric splash (lightning, with the accompanying thunder sound, is a large-scale ESD event), but also a less dramatic form that may not be seen or heard, but still large enough to cause damage to sensitive electronic devices. Sparks require field strength above 40 kV / cm in the air, as happened in the lightning strike. Other forms of ESD include the release of corona from the sharp electrode and the release of the brush from the blunt electrode.

ESDs can cause various major harmful effects in the industry, including gas, fuel steam and coal dust explosion, as well as failure of solid state electronic components such as integrated circuits. This can experience permanent damage when subjected to high

voltage. Electronic manufacturers therefore set up static-free electrostatic protective areas, using measures to prevent charging, such as avoiding extremely expensive materials and static static steps such as basic human workers, providing antistatic devices, and controlling humidity.

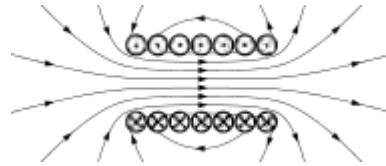


Figure 2.3 show electrostatic mechanism

2.3.2 Spark

Spark is triggered when the electric field strength exceeds about 4-30 kV/cm - the air dielectric strength field. This can cause rapid rise in the number of electrons and free ions in the air, while causing the air to suddenly become an electrical conductor in a process called fraction dielectric.

2.3.3 Human Body and Electrostatic Discharge

As we known, cause fire in petrol station happen of create of small spark or microwave can cause fire. US-based Petroleum Equipment Institute (PEI) executive vice-president Robert Renkes said it was static electricity from a person's body that causes sparks when it comes into contact with the petrol pump, that creates fires. Human body also have a balance of positive and negative charge. By nature, all matter must have a balance of charge.