



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DEVELOPMENT OF SMART LOADBOARD CHECKER**

**TO INVESTIGATE THE LIFESPAN OF RELAY**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Industrial Electronic) with Honours.

by  
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Sesi Pengajian: 2020

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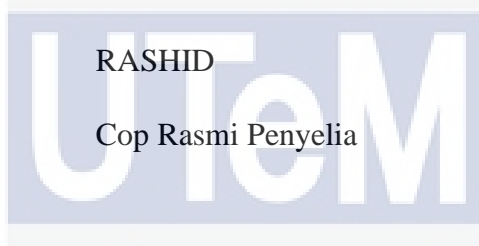
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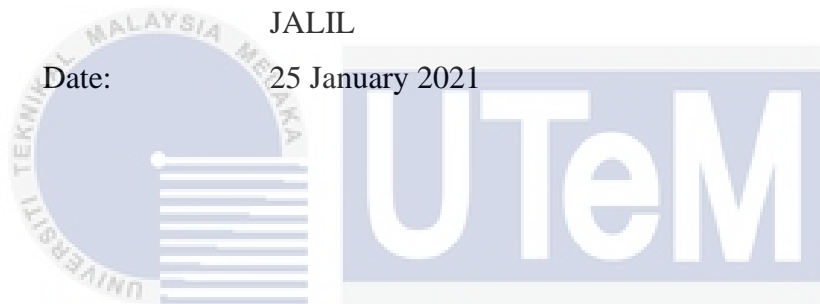


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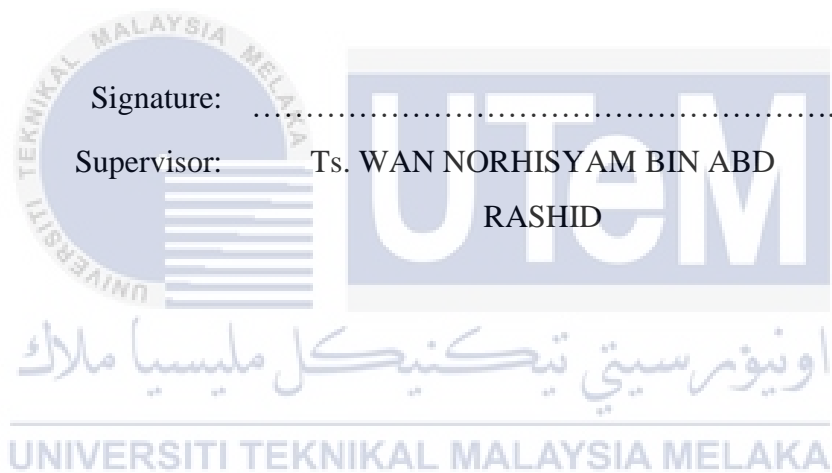


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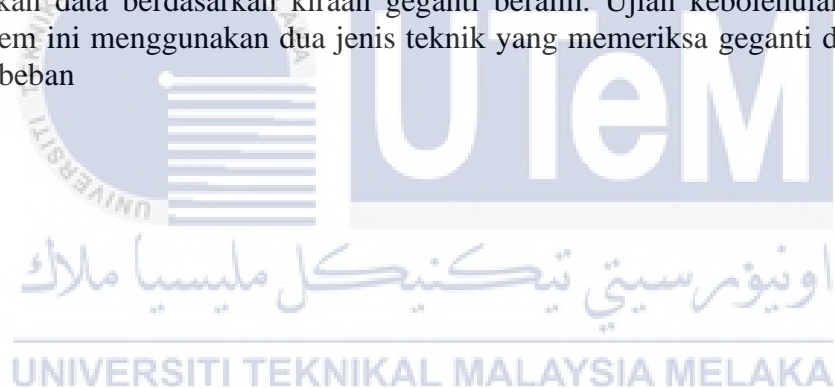
## APPROVAL

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



## ABSTRAK

Geganti adalah suis yang secara elektromekanik atau elektronik untuk membuka dan menutup litar. Geganti mengawal satu litar elektrik melalui pembukaan dan penutupan kenalan yang lain. Sejak kebelakangan ini, penggunaan geganti telah berkembang dengan ketara di sektor perindustrian. Sektor industri menggunakan lebih banyak geganti pada mesin yang terdapat di kilang dan ketahanan mesin juga bergantung pada jangka hayat geganti. Oleh itu, analisis ini digunakan untuk mengkaji jangka hayat geganti untuk memastikan ketahanannya. Jangka hayat geganti pada dasarnya bergantung pada geganti kenalan. Semakin banyak pergerakan relay kenalan semakin kurang jangka hayat kerana geganti sesentuh akan menjadi lebih nipis. Keupayaan manusia untuk mengesan kerosakan pada geganti adalah terhad. Ini kerana kerosakan pada geganti tidak dapat dilihat dengan mata kasar. Mikrokontroler Arduino adalah otak utama projek yang akan dihubungkan antara semua peranti input dan output. EEPROM digunakan untuk menyimpan data untuk sistem ini. Kitaran untuk menghidupkan dan mematikan geganti akan dibaca oleh mikrokontroler dan paparan pada paparan LCD. Pembacaan kitaran hayat geganti dapat diketahui dengan menghasilkan papan beban pintar ini. Dengan menggunakan perisian LabVIEW, kitaran kiraan geganti jugak dapat ditampikan yang menunjukkan data berdasarkan kiraan geganti beralih. Ujian kebolehlungan geganti dalam sistem ini menggunakan dua jenis teknik yang memeriksa geganti dengan beban dan tanpa beban



## ABSTRACT

Relays are switches, which open and close the circuit electromechanically or electronically. Relays control one electrical circuit by opening contacts and closing them in another. In recent times, the use of relays has expanded significantly in the industrial sector. The industrial sector uses more relays in the machines available at the factory and the durability of a machine also depends on the life of a relay. Therefore, this analysis is used to study the life span of a relay to ensure its durability. A relay's lifespan depends essentially on the contact relay. The more movement of the contact relay the less the lifespan because the contact relays will become thinner. The human ability to detect damage to a relay is limited. This is because damage to a relay is not visible to the naked eye. Arduino UNO microcontroller is the major component as a brain of the project that will interface between all input and output devices. EEPROM is used to store the data for this system. The cycle for switching on and off a relay will be read by the Arduino UNO microcontroller and display on an LCD. The lifecycle readings of a relay can be known by generating this smart load board. By using LabVIEW software, the relay count cycle can also be displayed which shows the data based on the switching relay count. Testing relay test in this paper using 2 kinds of techniques that were checking the relay with load and checking relay without load.



## DEDICATION

This thesis is dedicated to:

My beloved parent

Sarina Binti Sentol

My talented supervisor

Ts. Wan Norhisyam Bin Abd Rashid



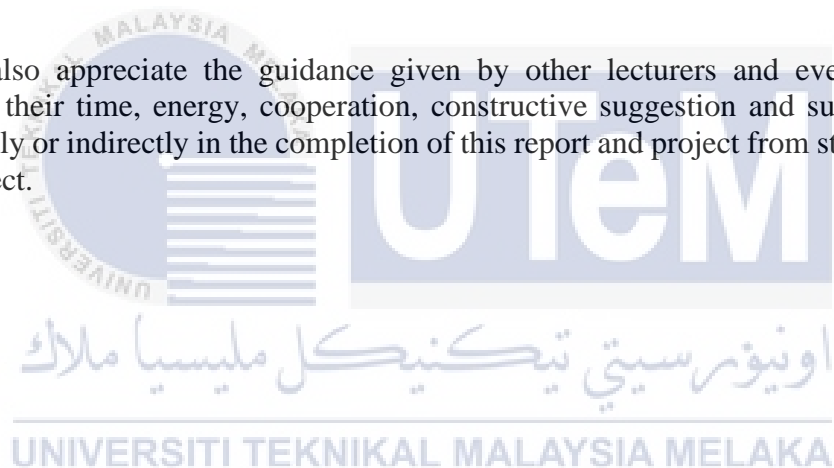


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Firstly, thanks to Allah SWT for providing me with good health and huge courage and strength to complete this project from the beginning to the end. I have tried my best and give my full commitment to do this project by myself without giving up. Secondly, I want to express my sincere thanks to my project supervisor Mr. Wan Norhisyam Bin Abd Rashid for the give support and inspiration, for his kindness, dedication, and his insight to carry out this thesis.

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## TABLE OF CONTENTS

	<b>PAGE</b>
ABSTRAK	vi
ABSTRACT	vii
DEDICATION	viii
ACKNOWLEDGEMENTS	ix
TABLE OF CONTENTS	x
LIST OF TABLES	xiv
LIST OF FIGURES	xv
LIST OF APPENDICES	xviii
LIST OF SYMBOLS	xix
LIST OF ABBREVIATIONS	xx
<b>CHAPTER 1 INTRODUCTION</b>	<b>1</b>
1.1 Introduction	1
1.2 Statement of the Purpose	2
1.3 Problem Statement	2
1.4 Research Objective	3
1.5 Scope of Research	3
1.6 Summary	4
<b>CHAPTER 2 LITERATURE REVIEW</b>	<b>5</b>
2.1 Introduction	5
2.2 Related Research to Investigate the Lifespan of the Relay	5
2.2.1 A Review on Protective Relay's Development and Trends by Hamid Bentarzi and Abdelkader Abdelmoumene (2014)	5

2.2.2	Life Prediction of Electromagnetic Relay Focused on Bayesian Method by Jiang Wenman et al. (2018)	8
2.2.3	Effect of electrical load on contact welding failure of silver tin oxide material used in DC electromechanical relays by Xu Zhang et al. (2019)	9
2.2.4	Theoretical and Industrial Studies on the Electromechanical Relay by M Vinod et al. (2018)	12
2.2.5	Implementation of PhotoMOS Relay for ATE Application by Cheok Yong Seng et al. (2018)	13
2.2.5.1	Electromechanical Relay	14
2.2.5.2	Solid state / PhotoMOS relay	15
2.2.6	Bringing Insight into the Analysis of Relay Life-Test Failures by S.J.Hobday BEng	16
2.2.7	Arcing Failure of RoHS Complaint Electromagnetic Relay by Robert Donald Boettcher (2012)	18
2.3	Contact Materials	19
2.3.1	Common Contact Material Features	21
2.3.2	On Switching Contact Depending on Load Range	22
2.4	Journal	23
<b>CHAPTER 3      METHODOLOGY</b>		<b>26</b>
3.1	Introduction	26
3.2	Project Flow	26
3.3	Planning	27
3.4	Research	30
3.5	Design	30
3.5.1	Development of Automatic Switching Relay Circuit	30
3.6	Implementation	31
3.6.1	Hardware Implementation	32

3.6.1.1	Arduino UNO Microcontroller	32
3.6.1.2	Liquid Crystal Display (LCD) Module	33
3.6.1.3	Relay	34
3.6.2	Software Configuration	35
3.6.2.1	Arduino IDE	35
3.6.2.2	Proteus	36
3.6.2.3	Data Acquisition System (DAQ)	37
3.7	Preliminary Result	38
3.8	Summary	38
<b>CHAPTER 4</b>	<b>RESULT AND DISCUSSION</b>	<b>39</b>
4.1	Introduction	39
4.2	Project Hardware Layout	39
4.2.1	Schematic Layout	39
4.2.2	Component Layout	40
4.2.3	Hardware Setup	41
4.3	Project Software Layout	42
4.3.1	Arduino UNO Code Development	42
4.3.2	Automatically Switching Relay Code Development	43
4.3.3	LabVIEW Software	45
4.4	Result	46
4.4.1	Hardware result	47
4.4.1.1	Test lifespan Relay with load and without load	47
4.4.1.2	The Comparison of two types of relay brands lifespans	49
4.4.2	Software Result	51
<b>CHAPTER 5</b>	<b>CONCLUSION AND FUTURE WORK</b>	<b>53</b>

5.1	Introduction	53
5.2	Conclusion	53
5.3	Recommendation for Future Work	54
<b>REFERENCES</b>		<b>55</b>



## LIST OF TABLES

TABLE	TITLE	PAGE
Table 2. 1	Comparison of the respective protective relays	7
Table 2. 2	Comparison of the values estimated for 10 electromagnetic relays	9
Table 2. 3	Common contact material features	21
Table 2. 4	On switching contact depending on load range	22
Table 2. 5	Journal study for checker lifespan of relay	23
Table 3. 1	Arduino UNO Microcontroller specifications	32
Table 3. 2	Pinout of 16X2 LCD modules	33
Table 3. 3	Pin configurations of relay	34
Table 4. 1	Table for testing relay with load and without load	48
Table 4. 2	Lifespan of Songle Relay and HKE Relay	50

## LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2. 1	The different eras for protective relays.	6
Figure 2. 2	Lifetime contact electrical for a few capacitances	10
Figure 2. 3	SEM image for anode surface after electrical endurance test that welded after 242,913 cycles at $C = 0\text{mF}$	11
Figure 2. 4	SEM images of anode surface after electrical endurance test that welded after 25,764 cycles at $C = 2.5\text{mF}$	11
Figure 2. 5	Electromechanical relay's construction and operation	12
Figure 2. 6	Concept of an electromagnetic relays	14
Figure 2. 7	PhotoMOS relay's concept	15
Figure 2. 8	Flow for the experiment test	16
Figure 2. 9	Simple technique for CR measurement	17
Figure 2. 10	Block diagram for the life-test measurement	17
Figure 2. 11	Fully automatic circuit for test relay	18
Figure 2. 12	Failure sensing circuit connection	19
Figure 2. 13	Relay contact positions	20
Figure 3. 1	Project flow	27
Figure 3. 2	Project flowcharts	28

Figure 3. 3	Block diagrams for the project	29
Figure 3. 4	Project overviews	31
Figure 3. 5	Model Arduino UNO	32
Figure 3. 6	16x2 LCD module	33
Figure 3. 7	Symbol and pins configuration relay	34
Figure 3. 8	Arduino IDE software	35
Figure 3. 9	Proteus software	36
Figure 3. 10	DAQ- unit configuration	37
Figure 3. 11	Schematic circuit of automation switching relay	38
Figure 4. 1	The schematic diagram for the checker lifespan of relay	40
Figure 4. 2	Breadboard layout for the checker lifespan of relay.	40
Figure 4. 3	Image form the outside component and inside component	41
Figure 4. 4	Arduino IDE software version 1.6.13	43
Figure 4. 5	Coding for the automatically switching relay	44
Figure 4. 6	Block diagram of the process in LabVIEW Software	45
Figure 4. 7	Front panel for the process in LabVIEW Software	46
Figure 4. 8	Circuit for test relay with load	47
Figure 4. 9	Hardware for test relay without load	48
Figure 4. 10	Difference value between theoretical and measurement with load and without load	49
Figure 4. 11	Different of measurement value and theoretical value of Songle relay and HKE relay	50



Figure 4. 12 Block diagram to display the count

51

Figure 4. 13 Front panel to display the value cycles

52



## LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix 1	Datasheet Songle Relay	57
Appendix 2	Datasheet HKE Relay	59
Appendix 3	Coding of Checking Lifespan Relay using Arduino IDE Software	60
Appendix 4	Gantt Chart	62



## LIST OF SYMBOLS

m	-	Milli
F	-	Farad
B	-	Beta
a	-	Alpha
C	-	Load resistance
CR	-	Contact resistance



## LIST OF ABBREVIATIONS

LCD	Liquid Crystal Display
LED	Light-Emitting Diode
GPS	Global Positioning System
SEM	Scanning Electron Microscope
DC	Direct Current
AC	Alternating Current
ATE	Automatic Test Equipment
NC	Normally Close
NO	Normally Open
DSP	Digital Signal Processing
ADC	Analogue to Digital Converter
PLD	Programmable Logic Devices
RoHS	Hazardous Substance Retention Devices
IDE	Integrated Development Environment

# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

Nowadays, the use of relay has expanded significantly in the industrial sector and mostly they are use relay in their machines. There are two types of relay is an electromechanical relay and solid-state relay are most used in the industry. An electromechanical relay has lower resistance when switching on the current. This assumes that the enclosure and the surrounding area is enough for an electromechanical relay cooling, while solid state relay requires additional power supply to protect the circuit (Zach Wendt, 2017). The most significant and frequently electrical relay form is the electromechanical relay method. Relays were also switching, which open and close the circuits electronically or electromechanically. Relay regulates the opening with one electrical system and closes contacts for the other.

This project focuses on developing and understanding of the smart load board checker to investigate lifespan of relay. A significant characteristic to consider when selecting a relay for an application is the lifespans of the relay. Relay lifespans can be determined by relay cycles but it more accurate by the resistance of relay contacts. One relay cycle was known as the relay open and close operation. There was a slight spark between them most time the relay contacts turn on, which creates very faster current surges it through conducting wire. If the relay switches rapidly or high current loads it will short the contact lifespan of the relay. There a few of problem that faced by the Testhub company. This project was proposed when the lecturer visit the production line at the Testhub company. Firstly,

the problem was relay have an operational lifespan. It can analyse the count of switching the relay that can detect by the microcontroller.

Furthermore, the mechanical relay will cease to function properly or even stop working completely after the relays have exceeded their operational life as specified by the manufacturer. Then, it must require highly experience engineer to detect which relay was damage. The human capability to knowing the damage of the relay has been limited. This is because the human eye was unable to see anything that was too tiny and a close section. The monitoring system can display what is the condition of the relay. Count of relay reading will still be the same if damage to relay occurs that is will display in the LCD. In the current economic situation, higher cost for check the lifespans of the relay will make difficult for the human to detect the damage. It also will affect the downtime productivity. For this project, the basic component that uses is Arduino microcontroller that can create a smart load board checker.

## **1.2 Statement of the Purpose**

The purpose of the research is to investigate the effect of relay damage on the mechanical properties such as contact relay. This analysis also uses two approaches to define the lifespan relay with load and without load. Secondly, the comparison of two types of the relay brands lifespans that were Songle relay and HKE relay.

## **1.3 Problem Statement**

The damage of relays can cause the problems to human when any project that uses relay such as student engineering learning or in the industrial. Relays have moving parts and

their action causes wear and discomfort that can ultimately lead to relay failure. There are three problems of the project have defined. Firstly, the mechanical relay will cease to function properly or even stop working completely after the relays have exceeded their operating life as specified by the manufacturer. Besides that, rapidly relay switching, or high current loads can shorten relay contact life. This because the relay has an operating lifespan. Sometimes the relay is difficult to figure out how many times it can be used. Then, this will impact the IC semiconductor test and could trigger a quality problem unintentionally. Lastly, it took a highly experienced engineer to detect the breakdown of the relay. High cost of machine to checker relay lifespan in market also the reasons to make this project.

#### **1.4 Research Objective**

The main objective of this research is to implement a systematic and effective methodology to detect the lifespans of relay with reasonable accuracy. The main objectives were specifically as follows:

1. To design and implement of a digital smart load board checker to identify the damage of the relay.
2. To analyses the count of lifespan switching contact relay.
3. To create low-cost relay lifespan checker.

#### **1.5 Scope of Research**

1. Using one indicator connected the relay to identify the damage of the relay.
2. By turn on and turn off continuously of the relay will display the cycle count on the LCD display and the LabVIEW software.
3. Using Arduino Microcontroller as the brain to check the lifespan relay.

## 1.6 Summary

This project focuses on lifespans of the relay. Based on the objectives previously, this report consists of five chapters. Initially, a brief introduction to the research background, problem statements, goals, and scopes. Next chapter provides a review of the literature review of existing methods embrace and different advance that have been actualized in the past venture. The comparison in terms of advantage and disadvantage will be discussed in the interim. After that, the establishes out the methodology that has been developed for the components and portrayal method that wanted to use will be clarified in this chapter three. A brief of the project's outline stream may also appear here. Chapter four will discuss about the models developed and information of the result, including data tabulation and project analysis. Finally, chapter five describes the main result as well as the work accomplished in this research and suggests areas for future work.

