Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF SMART LOARD BOARD TO CHECK THE FUNCTIONALITY OF RELAY

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Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours

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A project report submitted
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I declare that this project report entitled "Development of Smart Load Board Checker to Check the Functionality of Relay" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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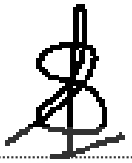
Signature	:	
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DEDICATION

This thesis is dedicated to:

To my beloved mother, Zuraina binti Zakaria, andfather, Mohd Azhar bin Md Hadzari,

My supervisor and co-supervisor that are exceptionally talented, Ts Wan Norhisyam bin Abd Rashid and Sir Faress Ezwan bin Mohd Sani @ Ariffin

And

My siblings and friends

ABSTRACT

Relays are electronic or electromechanical switches that are used to open and close circuits. Relays are used to control electrical circuits. It is work by activating contacts in one circuit and closing them in another. Nowadays, most of the industrial sectors are increasingly dependent on relays. Relays are now more widely used on machines used in the sector, and their functionality must also be taken into account so that no damage occurs. Therefore, this project is made to take into account and study the function of the relay, whether in good condition or otherwise. The relay functionality depends on the value of the current through it, which is in the range of 0.0416 A to 0.1 A if more or less it is not suitable for use and should be replaced. The human ability for relay damage detection is quite limited, as the damage cannot be seen with the naked eye. Due to that, the Arduino Microcontroller is used to connect the input along with the output to provide the test value of the relay. The LCD is used to display the required information, such as the state of the relay and the calculated current value. This smart load board uses a current sensor also known as acs712 to obtain the value of the current that can flow on the relay based on the value of the voltage used and the ohm value found on the relay. This test is used to inspect the automotive relay since it is relatively simple to inspect.

ABSTRAK

Relay adalah suis elektronik atau elektromekanik yang digunakan untuk membuka dan menutup litar. Relay digunakan untuk mengawal litar elektrik. Ianya berfungsi dengan mengaktifkan kenalan dalam satu litar dan menutupnya di rangkaian yang lain. Pada masa kini, sebahagian besar sektor perindustrian semakin bergantung pada relay. Relay kini lebih banyak digunakan pada mesin yang digunakan pada sektor tersebut, dan fungsinya juga harus dipertimbangkan agar tidak terjadi kerosakan. Oleh itu, projek ini dibuat untuk mengambil kira dan mengkaji fungsi relay, sama ada dalam keadaan baik atau sebaliknya. Keberfungsian relay bergantung pada nilai arus yang melaluinya, yang berada dalam julat 0.0416 A hingga 0.1 A jika lebih atau kurang ia tidak sesuai untuk digunakan dan harus diganti. Keupayaanmanusia untuk mengesan kerosakan relay agak terhad, kerana kerosakan tidak dapat dilihat dengan mata kasar. Oleh kerana itu, Arduino Microcontroller digunakan untuk menghubungkan input bersama dengan output untuk memberikan nilai ujian relay. LCD digunakan untuk memaparkan maklumat yang diperlukan, seperti keadaan relay dan nilai arus yang dikira. Papan beban pintar ini menggunakan sensor arus yang juga dikenali sebagai acs712 untuk mendapatkan nilai arus yang dapat mengalir pada relay berdasarkan nilai voltan yang digunakan dan nilai ohm yang terdapat pada geganti.Ujian ini digunakan untuk memeriksa relay automotif kerana agak mudah untuk diperiksa.

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V	-	Voltage
%	-	Percentage
Hz	-	Hertz
A	-	Ampere
k	-	Kilo
m	-	Mili
M	-	Mega
cm	-	Centimeter
°C	-	Celcius

LIST OF ABBREVIATIONS

PLC	-	Programmable Logic Controller
LED	-	Light Emitting Diode
OL	-	Over Limit
IC	-	Integrated Circuit
PCB	-	Printed Circuit Board
TCC	-	Time Current Characteristic
IDMT	-	Inverse Definite Minimum Time
DC	-	Direct Current
AC	-	Alternating Current
Tx	-	Transmitter
Rx	-	Receiver
PTE	-	Potential Trust Exponent
WPT	-	Wireless Power Transfer
LCD	-	Liquid Crystal Display
PWM	-	Pulse Width Modulation
NC	-	Normally Close
NO	-	Normally Open
COM	-	Common
MCU	-	Microcontroller unit
VSS	-	Virtual Switching System
VCC	-	Voltage Common Collector
VEE	-	Voltage Common Emitter

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CHAPTER 1

INTRODUCTION

1.1 Background

In recent years, the use of relays in the manufacturing field has grown significantly, with relays already being used in most machinery. The most common forms of relays include electromechanical, solid-state, and reed relays. Electromechanical relays make use of an electromagnetic coil and a physically moveable contact. When the coil receives current, it generates a magnetic field that draws a moving touch or the frame. The coil's magnetic field is lost as it lacks momentum, and the spring removes the link. Solid-state relays are mechanical solid-state components that have no moving parts and are thus more reliable over time. An electromagnetic coil and a reed switch are used in the reed relays. The switch is made up of two metal blades, also known as reeds, screened in a tube packed with inert gas. A relay is a system that enables a current to be transmitted with the least amount of resistance possible. Relays are widely used as switches in electrical circuits, which can link two points of a circuit with different potentials.

This project is more focused on a smartboard load that is intended to test the relay's functionality. The functionality of a relay is important in determining if it is in good or poor working order. The relay functionality can be determined when there is no current or no voltage can pass through it. Several failures are due to the length of time that a relay is in use, particularly when the relay is switching very low signal levels or when the relay is not used very much and oxidation forms on the contacts, but these are generally rare. The basic component used in this project is an Arduino microcontroller, which can build a smart load board checker.

1.2 Statement of the Purpose

The aim of this study is to look at how a relay works on a circuit board in terms of mechanical properties. This research was used to identify the most used relay in industry. Then, it can identify the current value to determine where the relay is working or not. Lastly, it will produce a beep if the current is low as an indication that the relay is broken.

1.3 Problem Statement

The inability of the relay to function will have a greater impact on some people especially when any project or electronic equipment that uses relay. Like other electronic components, relays can also be damaged. There are have problems to detect the functionality of relay in nowadays. Secondly, it has no display current value for relay to determine the value of current in the relay can get. Finally, it also has no indicator to give hint if there are relay in good condition or not in good condition.

1.4 Objective

The main purpose of doing this research is to innovate a smart load board to check the level functionality of relay. Here are the specifically objective of this research:

a) To design a smart load board checker to detect the malfunctioned of relay.

b) To detect the value of current to determine the functionality of relay.

c) To give a beep sound if the current low as a hint that the relay is broken.

1.5 Scope of Project

The scope of this project are as follows:

a) It is use Arduino Uno as a microcontroller.

b) If put the relay it will display the value of current in relay on LCD.

c) It will be using buzzer to give a hint for the broken relay.

1.6 Summary

This project focuses on the relay's functioning. This report is divided into five chapters based on the objectives stated above. First, a brief introduction to the study context, issue statements, aims, and scopes. The second chapter gives a study of the literature evaluation of current methodologies embrace and other advances that have been realized in the previous attempt. In the meantime, the advantage and disadvantages of comparison will be discussed. After that, it will be detailed in this chapter three the approach established for the components and the representation approach to employ. Here can also be a brief description of the project. The fourth chapter will cover the models that were developed and the data that was gathered as a result, as well as data tabulation and project analysis. Finally, the main result, as well as the work completed in this research, as well as areas for future research, are described in Chapter 5.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The relay control system was today's fundamental kind of electric control in the machining and countless others. In this chapter an overview of the background of the functionality of relays from the source which is the newspapers, article and another source of this project which is related. This article focuses on the functioning of electromechanical relays and contact relays. The type of contact relay and to check the functionality of an electromechanical relay in deeper will be further discussed in this chapter. Additionally, many kinds of tools are utilized to evaluate the relay functioning based on the article.

2.2 Related Research to Investigate the Functionality of the Relay

2.2.1 How to Troubleshoot Mechanical Relays by David Peterson (2020)

Given the critical nature of relays in control system architecture, it must be advantageous to develop simple, effective troubleshooting procedures. Extra time spent identifying faulty components is costly and unproductive, especially when simple procedures for troubleshooting and repairing equipment are available. Mechanical and solid -state relays are popular control system components that are frequently at fault. Although problems can likely be caused by other components, investigating the most common components first will speed up troubleshooting.

2.2.1.1 Causes Relay Failure

A surge in voltage to either the coil or the contacts cause relay damage. The coils of a mechanical relay will begin to overheat, melting the resistive wire covering. An arc between the coil and the contacts, or between sets of contacts, may generate an extraordinarily high voltage spike to cause immediate failure in many circumstances. An electrical failure produced by an excessive number of switching operations is the other cause of failure. Corrosive corrosion will cause the low resistance plating to deteriorate, resulting in increased resistance. It will occur at a faster rate at higher voltages. It may also be a highly costly failure if the relays are located within a PLC or other digital control device. The higher-than-normal voltage loss might result in black stains on the contact pads, as well as excessive heat. This is not to be confused with the mechanical failure of damaged pieces that may occur in mechanical relays.

Nominal Voltage	Coil Resistance
AC Operated	
6 VAC 50/60 Hz	5.4 Ohms
12 VAC 50/60 Hz	21.2 Ohms
24 VAC 50/60 Hz	84.5 Ohms
120 VAC 50/60 Hz	2220 Ohms
220-230 VAC 50/60 Hz	7360 Ohms
240 VAC 50/60 Hz	9120 Ohms
DC Operated	
6 VDC	24 Ohms
12 VDC	96 Ohms
24 VDC	388 Ohms
48 VDC	1550 Ohms
110-125 VDC	7340 Ohms

Figure 2.1 shows a multimeter 383 ohm of coil resistance. This datasheet shows that the relay is stated to have 388 ohms. (This one is almost perfect)

2.2.1.2 Testing Input Coils

The resistance of a relay's coil is measured to see whether it is higher or lower than it should be. To begin, disconnect one of the wires from the socket's terminal, or remove the relay totally from the socket. Measure the resistance of the coil using an ohmmeter, accounting for three distinct values. If the reading is OL, it signifies the value is outside of the meter's measuring range, or the coil is open. Because the indicator LED is in parallel with the coil, it may continue to light. The LED may turn on even if the coil is defective. Failure is also indicated by a value of less than roughly 5 ohms. The wire insulation has most likely been melted, and the number of wire turns has been drastically decreased, resulting in a 'shorted' coil. Due to the increased load current, an input fuse or breaker was most likely triggered in this situation. If this is the case, look for shorted coils rather than open wires to investigate. Finally, the number might be somewhere between 100 and 1000 ohms, making it more difficult to determine than a straightforward immediate measurement. To compare the value, you will need access to a datasheet or a known functioning identical relay. If the coil's resistance is lower than the datasheet or a known excellent value, the number of turns has likely been lowered, and there is insufficient inductance to create the magnetic field necessary to switch the contacts.

2.2.1.3 Testing Output Contacts

Move on to the contact terminals of the relay to continue testing when the coil is working. First, measure the resistance between the common terminal and the usually closed terminal using an ohmmeter. You may also check the typically open terminal if a manual toggle switch is supplied. One of two values will most likely be used as resistance. The resistance between the common and typically closed terminals of a working relay should be less than a fraction of an ohm. A datasheet will show you the precise amount and tolerance to anticipate, although 0.05 ohms, or 50 milliohms. Before making a decision, make sure you check your