SMALL SCALED, LOW-POWERED ELECTRIC CAR DRIVE MECHANISM

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This report is submitted in partial fulfillment of the requirements for the award of Bachelor of Electronic Engineering (Computer Engineering) With Honours

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I want to show my solitude to The God Almighty for giving me blessing, strength and time to complete this thesis. A special appreciation token and gratitude dedicated to my parents and family members. Lastly to my supervisor, my supporting colleagues and all UTeM's stuff and lectures who is involved.

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ABSTRACT

This project aims to develop a small scaled, low powered electric car drive mechanism that can be used to control the speed, direction of a direct current (DC) motor and have a feedback system for maintaining a constant speed of the motor in all condition. A conventional electric car drive mechanism uses mechanical component to operate. To be more specific, it uses electromechanical components in the control unit of the DC motor. The uses of this components make the overall circuit bulky and more complex because in standard package of electromechanical component, it is fairly bulky compared to electronic component. Furthermore, the circuit needs a higher input voltage to accommodate these components. This project will provide the necessity for the control unit to maintain the speed of the motor while an external pressure is applied to the motor that initially slows down the motor rotation. A sensor is used to detect the decreasing speed of the motor and a feedback system will tell the microcontroller to pump more power to the motor to regain the loss of speed and constantly maintain that speed. The objective of this project is to design an overall system that includes a control circuit and a feedback system to control the DC motor. The control circuit consists of microcontroller and several switches and light emitting diode (LED) and a sensor. The PIC is used because it can be programmed to meet certain conditions.

ABSTRAK

Projek ini bertujuan untuk membina sebuah sistem yang kecil, penggunaan kuasa yang rendah yang mimik kepada sistem mekanisma penggerakan bagi kereta berkuasa elektrik di mana sistem ini dapat digunakan untuk mengawal kelajuan, arah motor arus terus. Projek ini mempunyai sistem pengimbal balik di mana ia dapat mengekalkan kelajuan yang malar dalam semua keadaan. Sistem mekanisma penggerakan bagi kereta berkuasa elektrik yang biasa menggunakan komponen elektromekanikal untuk berfungsi. Penggunaan komponen ini membuatkan keseluruhan litar menjadi lebih kompleks dan besar berbanding dengan penggunaan komponen elektronik. Tambahan pula, litar itu akan memerlukan input kuasa yang tinggi untuk menampung komponen-komponen elektromekanikal ini. Projek ini akan memberikan keupayaan kepada unit pengawal untuk mengekalkan kelajuan motor apabila motor itu dikenakan tekanan luaran yang pada mulanya akan menurunkan kelajuan motor tersebut. Penderia akan mengesan penurunan kelajuan dan akan memberi isyarat kepada mikropengawal supaya memberikan kuasa yang lebih kepada motor untuk mengembalikan kelajuan pada keadaan asal. Objektif projek ini adalah untuk mereka-bentuk keseluruhan sistem yang mengandungi litar pengawal dan sistem pengimbal balik untuk mengawal motor. Litar pengawal mengandungi mikropengawal, beberapa suis dan lampu LED dan penderia. Mikropengawal digunakan kerana ia dapat diprogramkan mengikut ketetapan sesuatu syarat.

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DC	-	Direct Current
PIC	-	Peripheral Interface Controller
PWM	-	Pulse Width Modulation
LED	-	Light Emitting Diode
LCD	-	Liquid Crystal Display
ADC	-	Analog-Digital Converter
VSM	-	Virtual System Modelling
SMPS	-	Switch-Mode Power Supply
E	-	Enable
R/W	-	Read / Write
RS	-	Register Select
AC	-	Address Counter
DD RAM	-	Display Data RAM
PCB	-	Printed Circuit Board
ARES	-	Advanced Routing and Editing Software
FWD	-	Forward
REV	-	Reverse
ENA	-	Enable
IC	-	Integrated Circuit
RPM	-	Revolution per Minute
GPS	-	Global Positioning System

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This project aims to develop a small scaled, low powered electric car drive mechanism that can be used to control the speed, direction of a direct current (DC) motor and have a feedback system for maintaining a constant speed of the motor in all condition. It can be incorporated in several types of machinery such as automobile car namely small electric car and mini motorized motorcycle for kids or in small handy tools such as electric driller and many more. The difference from a conventional electric car drive mechanism is that this system uses fully electronic components as the control unit for DC motor. Microchip Peripheral Interface Controller (PIC) microcontroller will be used as the brain of this system.

1.2 PROJECT SYNOPSIS

Briefly, this project criteria is all about simplicity and practicality. The standard drive mechanism of an electric car usually is bulky and uses lots of space because it uses mechanical devices that are usually big. Here is where the simplicity of this project comes. The simplicity is in the usage of hardware for this system that just consists of several electronic devices that replace the traditional mechanical devices such as relays and motorize attenuator. So this project is about designing and developing a low powered electric car drive mechanism by using microcontroller unit to control the direction and as well as the speed of the wheel.

The motor will be driven by a pulse width modulation (PWM) that works by switching the power supplied to the motor on and off very rapidly. The system also has a reverse function that alternate the motor direction backward. A light emitting diode (LED) will be used to indicate the forward or reverse state of the motor. The system also has a feedback sub system that will maintain the speed of the wheel in different ground condition such as standard flat ground or hill climbing. A liquid crystal display (LCD) is used to display the speed of the motor.

1.3 PROJECT OBJECTIVE

The objectives of this project are:

i) To design an overall system that includes a control circuit and a feedback system to control the DC motor. The control circuit consists of microcontroller and several switches and Light Emitting Diodes.

ii) Implementation of a less complex circuitry for the DC motor into the system plus developing a sensor system that can properly detect the current speed of the DC motor.

iii) To design an indication system to properly indicate several state of the DC motor.

iv) To develop a system to display the current speed of the DC motor on a LCD.

1.4 PROBLEM STATEMENT

In today's conventional electric car drive mechanism, it uses mechanical component to operate. To be more specific, it uses electromechanical components in the control unit of the DC motor.

The use of electromechanical components make the overall circuit bulky and more complex because in standard package of electromechanical component, it is fairly bulky compared to electronic component. Furthermore, the circuit needs a higher input voltage to accommodate these components.

The conventional control unit of the DC motor consumes a lot of space and can not be implement in other type of machine. While with a small control unit, we can use it in other small machinery such as compact electric drill, children motorized motorcycle or even a small, specific function electric car such as motorized wheel chair, cart at the golf court and many more.

The use of electromechanical component will make the lifespan of the device short as the electromechanical uses movement to operate and with movement comes friction and friction is one of the cause of component defect.

1.5 SCOPES OF WORK

This project has a broad aspect of application. So to simplify and maintain the objectives of this project, the scope of work has been narrowed down to these 5 elements. First is to design the drive mechanism to control the speed and rotation of the DC motor. The control mechanism of the motor can be a switch button, a potentiometer and many more. The interface between the PIC and the DC motor is an H-Bridge with several optocoupler and transistor.

Secondly, to design an indicator system to indicates the state of the DC motor. The system will incorporated several LED corresponding to each of every states of the motor namely forward, reverse, increased and decreased speed state.

Then a sensor system is developed. A sensor is used to detect the current rotational speed of the DC motor and the sensor will feedback a signal to the PIC and it will pump up more power to the motor to maintain the speed.

After finish designing all the hardware parts, the source code is created to interface all hardware components. The PIC will receive input signal from the switches and from that will transmit a signal to control the DC motor. The source code will be in assembly language.

Lastly, the overall system is constructed and programmed.

1.6 THESIS OUTLINE

Chapter 1 - presents an overview of project, the aim and objectives of the project, problem statement, scope of project and thesis outline.

Chapter 2 - covers the literature review on the Background Study, Current Similar Products with Disadvantages and Overview of Microcontroller.

Chapter 3 - describes methodology, the hardware and software development, the technique to use LCD display.

Chapter 4 - presents the results from simulation and analysis of the project.

Chapter 5 - the conclusion and the suggestion for future improvement of project.

1.7 METHODOLOGY

The methodology for this project is divided into six phases. First phase is literature review. This phase consists of study on the project circuit as well as the main components involve. The advantages and the disadvantages of the components also will be analyzed and studied.

Second phase is about designing the hardware of the project. In this phase, all the related hardware such as the control switch, motor driver and feedback system will be designed to meet the objectives. The hardware will be tested in a suitable software such as Proteus.

The third phase is to develop the source code and compile it using a compiler such as MPLAB or other software. The source code will be in assembly language as this is the machine language and it fits best for programming a PIC microcontroller.

Then after designing the hardware and creating the source code, the hardware and source code will be combined and simulated in Proteus to assure that the coding is properly decoded by the PIC and all the hardware components are interfacing correctly with each other.

After simulation comes the construction and assembly of the actual hardware of this project. The construction is done on the breadboard first with several testing criteria must be met in order to verify that the hardware is working in real time. After the circuit had been tested and has met its objective specifications, it will then be implemented on the printed circuit board.

The final phase in this methodology part is the result and analysis. All the important data that had been found out during the project will be gathered so that the analysis towards the project can be made.

The flowchart about the methodology is shown in Figure 1.7.1 and the details about the project methodology part will be explained in Chapter 3.

Flowchart

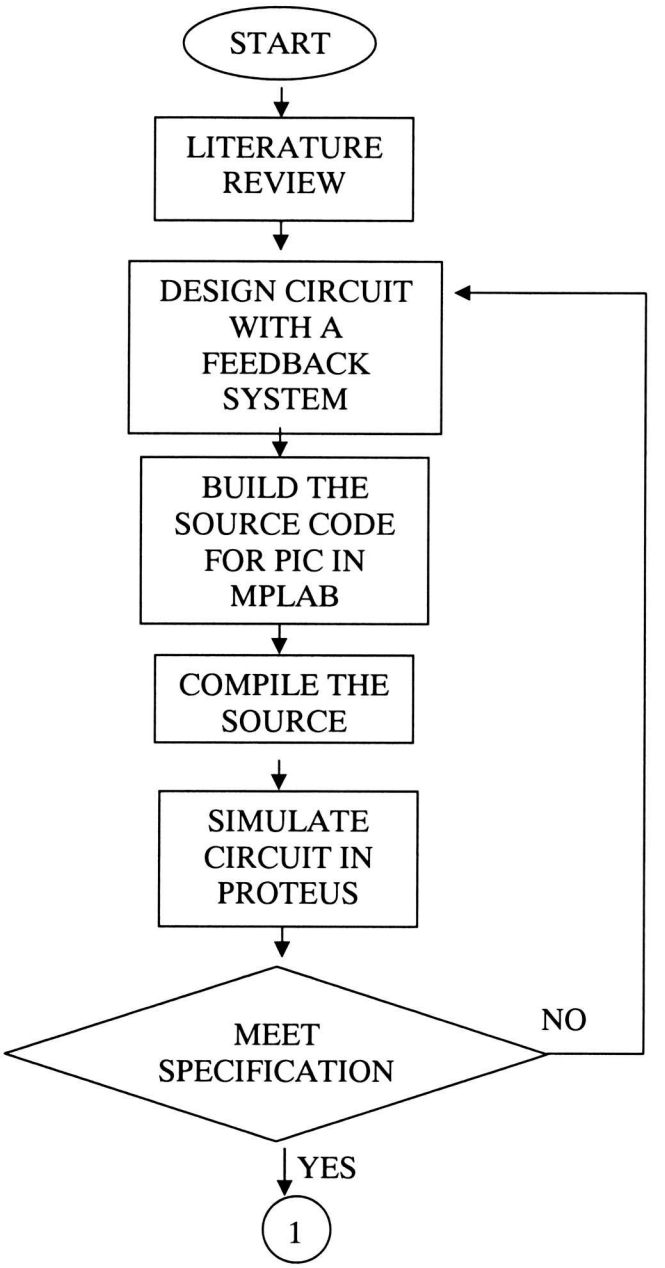

Figure 1.7.1 : The Methodology of this Project (continue next page)

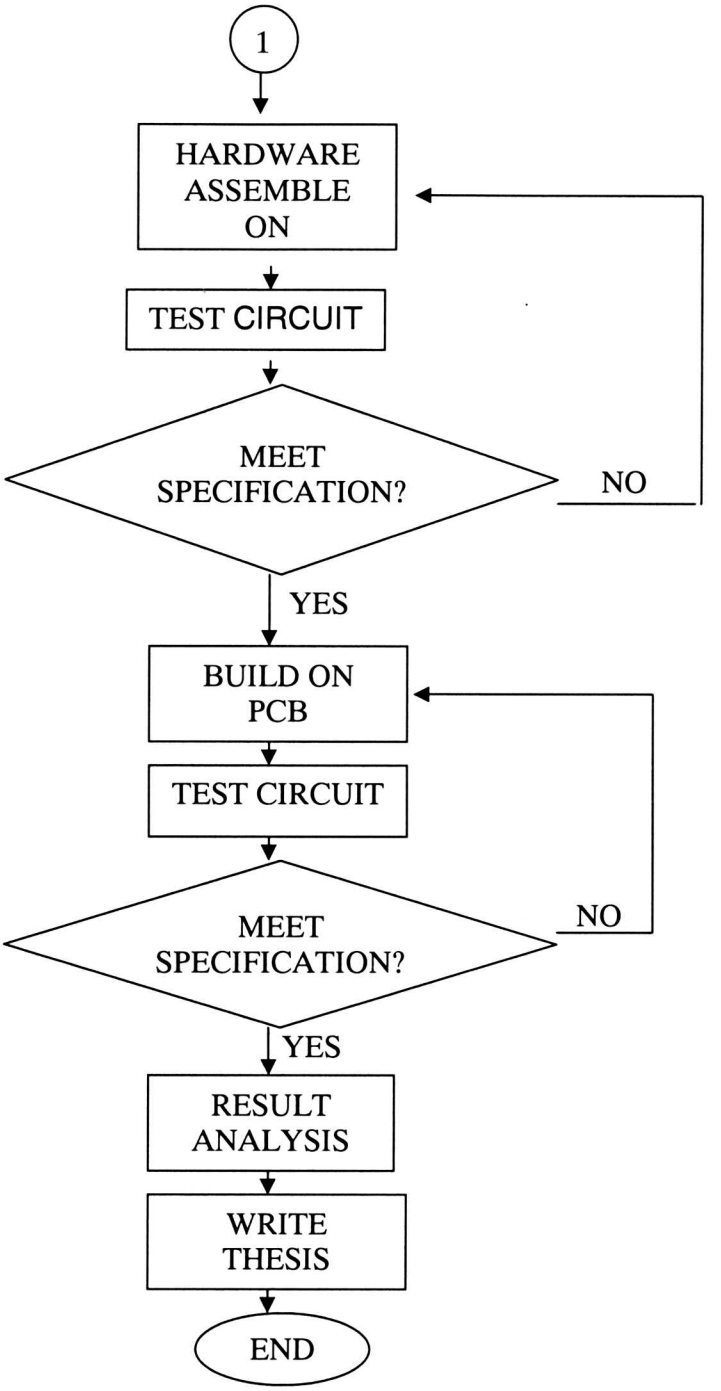

Figure 1.7.1 : The Methodology of this Project