DC AC MOTORS SWITCHING CONTOLLER

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ABSTRACT

This project is about controlling the switching of DC and AC motors. The DC motor has large starting torque compare to AC motors and therefore they always used as starting motor to move the electric vehicle. On the other hand the AC motors is consider maintenance free and suitable for electric vehicle as well. It is common practise to put these motor in an electric vehicle. This project applied how to operate electric train. The speed of the train is varied by moving the voltage control on the transformer panel. The higher the voltage, the greater the speed. Some transformers provide at least two different voltage ranges. The lower range is used for light trains the higher range for heavier trains. The problem is how to switch ON and OFF both motors when is required. This project will switch ON DC motor first and after certain speed which is will set by user and without considering the load AC motor is ON automatically. If the speed is lower than set value the DC motor will still ON. Both motors are running simultaneously once the temperature reached at certain value (set by user). The motors back to normal sequence of operation temperature of both motor back to normal. The controller also controls the forward and reverse direction of the motors.

ABSTRAK

Projek ini bertujuan mengawal pergerakan suis diantara motor DC dan motor AC. Secara umumnya motor DC mempunyai daya tujahan permulaan yang kuat berbanding motor AC, oleh itu ia selalu digunakan untuk mengerakkan kenderaan electric. Selain itu motor AC juga boleh dianngap sebagai kurang penyelengaraan dan sesuai digunakan untuk kenederaan electrik secara umumnya. Projek ini diambil bagaimana keretapi electrik berfungsi. Kelajuan keretapi bergantung kepada voltan yang dikawal oleh panel transformer.Voltan yang tinggi menyebabkan keretapi bergerak denagn lebih laju. Sesetengah transformer menyediakan sekurang-kurangnya 2 perbezaan voltan. Voltan yang rendah digunakan untuk megerakkan keretapi yang ringgan manakala untuk voltan yang tinggi digunakan untuk mengerakkan keretapi yang berat. Masalah utama dalam project ini bagaimana untuk suis On dan Off kedua-dua apabila diperlukan. Projek ini akan suiskan motor DC dahulu dan selepas kelajuan yang tertentu yang mana ditentukan oleh pengguna tanpa mempertimbangkan beban motor AC akan juga akan On secara automatik. Jika kelajuan rendah dari apa yang ditetapkan motor DC masih On. Kedua motor akan bergerak serentak jika suhu sampai pada angka yang ditetapkan. Motor akan kembali kepada keadaan asal mengikut turutan jika suhu dipertimbangkan. Projek ini juga akan mengawal pergerakan kehadapan dan kebelakang motor.

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CHAPTER 1

INTRODUCTION

1.1 Overview

The DC drive is relatively simple and cheap (compared to induction motor drives). But DC motor itself is more expensive. Due to the numerous disadvantage of DC motor(especially maintenance), it is getting less popular, particularly in high power applications. For lower power applications the cost of DC motor plus drives is still economical. For servo application, DC drives is still popular because of good dynamic response and ease of control.

This project is about controlling the switching of DC and AC motors. The DC motors has large torque compare to AC motors and therefore they always used as starting motor to move the electric vehicle. On the other hand the AC motors is consider maintenance free and suitable for electrical vehicle. The problem is how to switch ON and OFF both motors when is required.

This project will switch ON DC motor first and after certain speed which is will set by user and without considering the load AC motor is ON automatically. If the speed is lower than set value the DC motor will still ON. Both motors are running simultaneously once the temperature reached at certain value (set by user). The motors back to normal sequence of operation temperature of both motor back to normal. The controller also controls the forward and reverse direction of the motors.

1.2 Objective

The objective of this project is to:

i. Develop and implement DC and AC switch logic motor controller with following specification:

   a) Control circuit to run first the DC motor after certain speed (set by user and regardless the load) of DC motor, the AC motor will on automatically.
   b) If the speed is lower than we set DC motor will still ON again and will be repeating.
   c) The both motor are running on the temperature reached at certain value (set by user) and no switching is allowed but switching is allowed when once the temperature of both motor back to normal. Temperature will be simulated using 2 switches.
   d) Based on condition a, b, and c possible switching state are 1)Switch motor DC to motor AC or 2)Motor AC to motor DC 3)Both motor will ON 4) Both are OFF.

e) Required to demonstrate the project by 1) DC motors which is corresponding to the DC motor 2) LED which is corresponding to AC motor.

ii. To built the controller base on logic integrated circuit.

1.3 Scope of Project

Among of the scope of project are:

i. DC and AC switching motor controller.

ii. DC motor control.

iii. Truth table.

iv. Logic circuit to control the motors.

v. Simulation of logic switching motor controller.

1.4 Problem Statement

This project is about controlling the switching of DC and AC motors. The DC motor has large starting torque compare to AC motors and therefore they always used as starting motor to move the electric vehicle. On the other hand the AC motors is consider maintenance free and suitable for electric vehicle as well. It is common practice to put these motor in an electric vehicle. The problem is how to switch ON and OFF both motors when is required.

1.5 Thesis Organization

For this thesis consists of 5 chapter altogether. Chapter 1 explain about the actual concept which is guide to development DC AC motor controller switching. Other than that is contains objective and scope of this project. Chapter 2 is literature review, chapter 3 about the project methodology, it is about the flow of this project, step to follow and. also the how it’s manage. Chapter 4 present the result and lastly conclusions for chapter 5.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, the researcher reviews articles and past research about the implementation of switch DC to AC controller via method which is logic circuit or integrated circuit, second using computer programming and lastly using microcontroller.

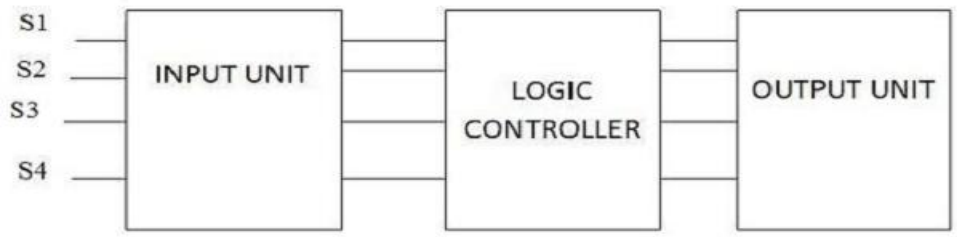
2.2 LOGIC CIRCUIT /INTEGRATED CIRCUIT

A logic gates is a circuit which uses digital signals as its inputs and outputs. What makes a circuit a gate is that each output depends entirely on the signals applied at the inputs. If these input signals change, then the output signal may also change. Digital

circuits which use logic gates are usually arranged so that a logic 1 appears at an output only for some definite combination of input signals - for this reason these circuits are sometimes called combinational logic circuits. In theory, we could make i.c.s for each and every possible combination of input signals to produce a 1 output, but this would be wasteful of resources. In practice, what is done is to make i.c.s which accomplish a few standard logic operations. From these standard logic i.c.s any combinational logic circuit can be built up. The microprocessor is an extension of this idea - a circuit which can perform virtually any logic function.

The action of a standard combinational logic circuit, or of any circuit made up from these units, can be described in two ways. One way is by the use of a truth table. A truth table shows what output can be expected from each possible combination of inputs, so that the action of the circuit can be readily checked. Another method of describing the action of a circuit is by Boolean Algebra. This method is much more concise but less easy for the raw beginner to interpret, so both methods always be used together in this book. Boolean algebra, incidentally, was invented long before modern computers. It is named after George Boole (1815-1864) who devised it as a method of turning logical statements into algebraic expressions. Little use was made of this work until Shannon found in 1938 that Boolean algebra could be used to analysis relay circuits which carried out the sort of switching operations we now refer to as 'AND' and 'OR' gates.

2.2.1 FUNCTIONAL DIAGRAM CIRCUIT:



INPUT
S1:Forward Direction
S2:Reverse Direction
S3:Temperature
S4:Speed

Output
DC motor
AC motor

2.3 COMPUTER PROGRAMMING

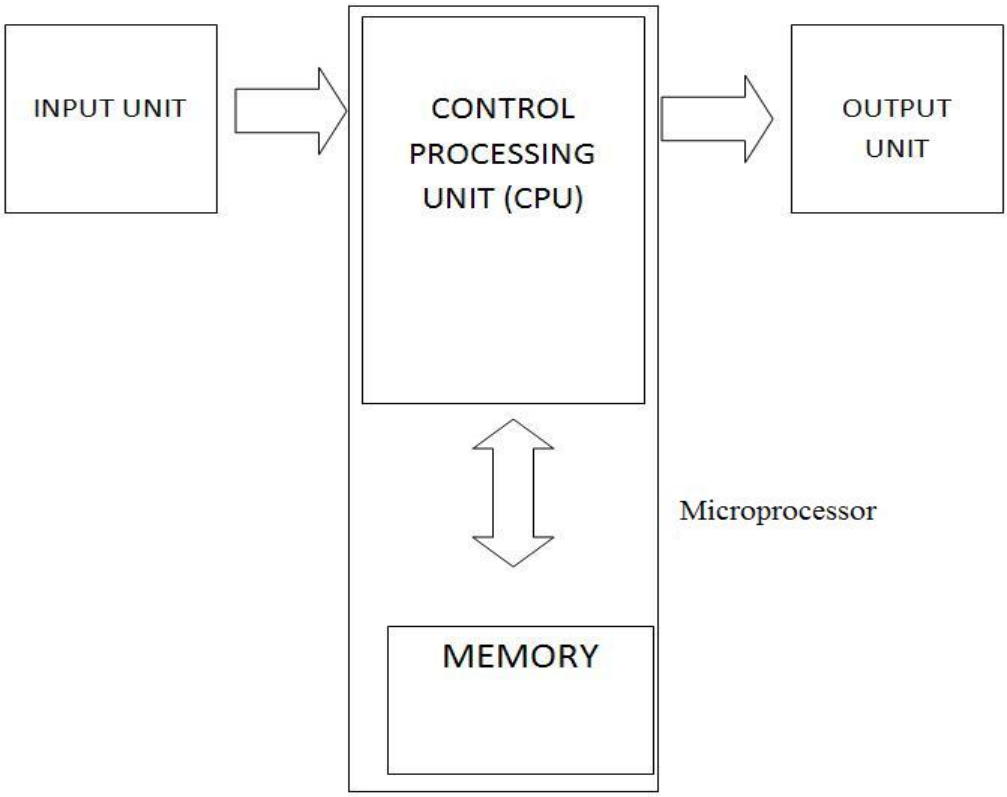
Computer programs (also software programs, or just programs) are instructions for a computer. A computer requires programs to function. Moreover, a computer program does not run unless its instructions are executed by a central processor however, a program may communicate an algorithm to people without running. Computer programs are usually executable programs or the source code from which executable programs are derived (e.g., compiled).

Computer source code is often written by professional computer programmers. Source code is written in a programming language that usually follows one of two main paradigms, imperative or declarative programming. Source code may be converted into an executable file (sometimes called an executable program or a binary) by a compiler. Alternatively, computer programs may be executed by a central processing unit with the aid of an interpreter, or may be embedded directly into hardware.

Computer programs may be categorized along functional lines: system software and application software. And many computer programs may run simultaneously on a single computer, a process known as multitasking.

Computer programming is the iterative process of writing or editing source code. Editing source code involves testing, analyzing, and refining, and sometimes coordinating with other programmers on a jointly developed program. A person who practices this skill is referred to as a computer programmer or software developer. The sometimes lengthy process of computer programming is usually referred to as software development. The term software engineering is becoming popular as the process is seen as an engineering discipline.

2.3.1 FUNCTIONAL DIAGRAM PC:



2.4 MICROCONTROLLER

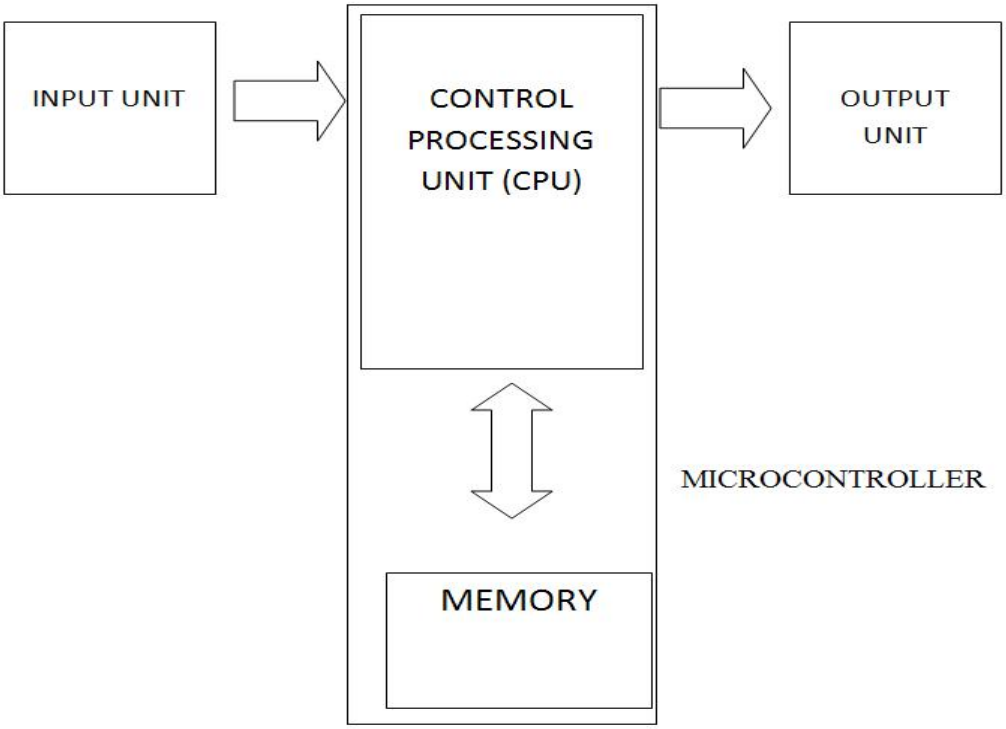
A microcontroller is a highly integrated chip which performs controlling functions. A microcontroller, or embedded controller, is similar to a microprocessor as used in a personal computer, but with a great deal of additional functionality combined onto the same monolithic semiconductor substrate. Microcontrollers, sometimes referred

to as one-chip microcomputers, are used to control a wide range of electrical and mechanical appliances.

Since they were first introduced, microcontrollers have evolved to the point where they can be used for increasingly complex applications. Some microcontrollers in use today are also programmable, expanding the number of applications in which they can be used. A modern microcontroller is basically a low-cost computer adapted to provide rapid solutions to external events after intensive computation. The microcontroller senses the happening of external events through signals received at input ports and transmits responses to the events through output ports. Modern microcontrollers are found in nearly every facet of modern life. More and more consumer and commercial products, such as for example but not limited to, appliances, telecommunications devices, automobiles, security systems, full-house instant hot water heaters, thermostats, and the like are being controlled by these integrated circuit microcontrollers.

Generally, a microcontroller has a standard hardware design that is customized for a particular implementation by programming the firmware for a specific application. Microcontrollers combine relatively inexpensive, generic hardware with specialized firmware to provide cost-effective custom designs for many different applications.

2.4.1 FUNCTIONAL DIAGRAM MICROCONTROLLER



CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will discuss on the methods that will be used to ensure the project could achieve the objective and scope of the project. Thus, all the methods need to be done as in in schedule so that this project could be complete within the time. There are several steps to be applied in designing a dc ac motor control switching.

Firstly before start this project we have classified a certain behavior and sensor as a input to the circuit sensor. Among of the behavior and sensor is the direction of motor have forward and reverse. Speed and temperature as a sensor that control the moving of motor. From this explanation we state 4 every each sensor have own characteristics that must be follow for this project. For this part we go to step by step flown the process of this project.

3.2 UNDERSTAND THE CONTROLLER BEHAVIOUR

For the motor that use consist 2 motors DC and AC but AC we substitute using LED because the scope of AC is very wide and connection is very complicated and need much time to spend. Only use DC motor and for the rotation just forward and reverse. For forward direction follow the clock wise and the reverse direction follow anti clock wise. From this direction we can distinguish the direction of motor.

3.2.1 FORWARD AND REVERSE DIRECTION

For the direction part have provided 2 button or switch to control the movement and easy to control among forward and reverse. For the forward direction just press the button forward we label as a logic 1 as active. For the reverse direction same with the instruction with forward direction just press the reverse button and known as a logic 0.With 2 button it become easy to control the direction of motor.

3.3 UNDERSTAND THE SENSOR BEHAVIOUR

For the sensor which is state previously consist of temperature and speed. Every each sensor have certain function that must be follow to run this motor. Actually for this project we apply from the electrical transport like train. Normally the motion or

movement of train depend on the temperature and speed, from this knowledge we apply as a sensor to this motor.

3.3.1 TEMPERATURE AND SPEED SENSOR

Sensor of this motor we divide into 2 and every each sensor have own function that fixed. For temperature sensor state 2 condition here, first known as a normal temperature. Normal temperature here around 30-60 Celsius and label as a logic 0 and the high temperature around 60-90 Celsius and label as a logic 1. From this partition can know which temperature that need to control the motor and also the difference using normal temperature and high temperature. Speed sensor also have 2 part which is below set speed and above set speed. Set speed can be change and can be adjust. Logic 0 as a below set speed and logic 1 as a above set speed.

3.4 TRUTH TABLE

As well as a standard Boolean Expression, the input and output information of any Logic Gate or circuit can be plotted into a table to give a visual representation of the switching function of the system and this is commonly called a Truth Table. Logic gate truth tables shows each possible input to the gate or circuit and the resultant output depending upon the combination of the input.

For this part we have build the actual truth table base on this project consist 2 which is forward and reverse. From this truth table can see the all sensor base on logic that state previously.

3.4.1 FORWARD

AC	DC	TEMP	FORWARD	REVERSE	SPEED
0	**0**	**X**	**0**	**0**	**0**
0	**1**	**0**	**1**	**0**	**0**
1	**0**	**0**	**1**	**0**	**1**
1	**1**	**1**	**1**	**0**	**X**

3.4.2 REVERSE

AC	DC	TEMP	FORWARD	REVERSE	SPEED
0	**0**	**X**	**0**	**0**	**0**
0	**1**	**0**	**0**	**1**	**0**
1	**0**	**0**	**0**	**1**	**1**
1	**1**	**1**	**0**	**1**	**X**

3.5 SIMULATION

After got the truth table from forward and reverse compile to become 1 truth table like below It is easiest to do simulate using 1 truth table. Software that using to simulate is Max + plus II.