DEVELOP CONTROL ALGORITHM PIC FOR MULTISOURCE DC MOTOR

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"I hereby declare that I have read this report and in my opinion this report is sufficient in terms scope and quality for the award of Bachelor of Electronic Engineering (Industrial Electronic) With Honours"

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ABSTRACT

This project aims to create control algorithm PIC for multisource DC Motor. Nowadays, increasing oil prices due to oil depletion, global warming and the introduction of compulsory standard gas emissions in cities have had a tremendous impact on the development of new transportations technologies. In this project use control algorithm PIC for multisource DC motor. PIC 16F877A microcontroller had been chosen to control the multisource DC motor. The main task of the system is to maintain the power source to drive the DC motor. The controller determines three basic operation input condition such as pedal offset (PO) and power duration load (PD) are determined by measuring motor speed over a long period of time, and battery capacity (BC).

ABSTRAK

Projek ini bertujuan untuk mewujudkan kawalan algoritma PIC untuk multisource DC Motor. Pada masa kini, kenaikan harga minyak disebabkan oleh kekurangan minyak, pemanasan global dan pengenalan wajib pelepasan gas standard di bandar-bandar telah memberi kesan yang besar kepada pembangunan pengangkutan teknologi baru. Dalam projek ini menggunakan algoritma kawalan PIC untuk multisource DC motor. PIC 16F877A mikropengawal telah dipilih untuk mengawal multisource DC motor. Tugas utama sistem ini adalah untuk mengekalkan sumber kuasa untuk memacu motor DC. Pengawal ini menentukan tiga keadaan input operasi asas seperti pedal mengimbangi (PO) dan beban tempoh kuasa (PD) ditentukan dengan mengukur kelajuan motor dalam tempoh masa yang panjang, dan kapasiti bateri (BC)

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CHAPTER 1

INTRODUCTION

This chapter will discuss about the overview of the project, problem statement, objectives, project scope and thesis outline.

1.1 Overview

High oil prices have the potential of retarding the growth of an economy in particular if it is a net oil-importing country. Increasing oil prices squeeze income and demand, present an inflationary threat and cause serious fiscal consequences. Nowadays, increasing oil prices due to oil depletion, global warming and the introduction of compulsory standard gas emissions in cities have had a tremendous impact on the development of new transportations technologies. In hybrid electric vehicles (HEVs), renewable energy is a new option for improving vehicle efficiency and is economical with lower toxic gas emission. To achieve the same power and density energy as a combustion engine, fuel cell (FC) with batteries and super capacitor (SC) are combined to provide additional power rapidly during high demand and to overcome the FC start time. It also can travel distance and speed same like combustion engine.

In many Asian countries, scooters and three-wheeled vehicles are notably popular and are a cheaper form of transportation. They are often used in the cities to travel short distances and avoid traffic jams. These vehicles have capacity of 2-5kW from an internal combustion engine (ICE). Recently, due consumers concern for the environment, small HEVs have been introduced with a power system and no longer use an ICE. This study focused on Energy Management System (EMS) in which a control strategy is developed to provide light vehicle load demand or to optimize the system energy.

Power sharing and hybridization of FC, battery and SC show that controls strategies play a vital role in improving vehicle performance and efficiency. It coordinates the power sources to secure the electrical flow of the system. Power electronics such as dc/dc converter and inverter has become a major study of HEV for improving power conditioning system. A light energy vehicle (LEV) system like electric scooter has also become an interesting system. The EMS system and controlling in wheel motor is the concerned of this project. In Malaysia, LEV vehicles such as motorcycles or scooter are widely used for personal transportation such as to office, shopping and schools. Unlike in Europe, USA or Japan, such transportations are used as recreation. It is estimated that half of the vehicle are used to travel 20km below per day and half of them may travel more than 30km per day, vehicle powered by battery can be used without any refueling stop.

The electric vehicle can be recharged at home as well. There are about 5 million motorcycles in Malaysia are using subsidized rate of petrol RON 95. The subsidy for RON95 is RM2.26 per liter while RON97 is RM2.51 per liter. If average one motorcycle uses half liter petrol per day, the government spends approximately RM3 million each day. However, the selling of motorcycle is expanding each year at nearly 200,000 units with increment 5% per year. Thus, subsidization does not help to improve living quality due to toxic emission in the city. The increase of oil price forces the government to find other alternative way of transportation or to face double of subsidization for next 10 years.

In order to meet the consumer's requirement such as power, longer travel distance and reliability, EMS and available stored energy system in which a battery is used as the primary source of energy, while the SC is used as the auxiliary energy source and the FC is used as an extended energy source for high demand load. In addition of multi sources, the battery can be charged at home. Thus, the control strategy in the EMS plays an important role either enhances the storage capacity or changes the energy sources as required. The system will be successfully operated when the controller to control the system is suitable for this project.

In this project use control algorithm PIC for multisource DC motor. PIC 16F877A microcontroller had been chosen to control the multisource DC motor. The main task of the system is to maintain the power source to drive the DC motor. The controller determines three basic operation input condition such as pedal offset (PO) and power duration load (PD) are determined by measuring motor speed over a long period of time, and battery capacity (BC).

1.2 Problem Statement

If there is a mistake in coding it can cause components to be connected to the microprocessor may not work. So it should find the suitable program to design the microprocessor.

1.3 Objectives

There are some objectives of this final year project that need to be achieved due to the following aspects below:

- To develop control algorithm PIC for multisource energy management system.
- To produce basic PWM to drive DC motor.

1.4 Scope of Project

Since the project about control algorithm PIC for multisource energy management system at software part, so, this projects focus on the following properties below:

- To develop the energy management system(EMS) as a control strategy to provide electric vehicle load demand the systems energy through PIC
- PIC manages to control energy management system (EMS) and available stored energy.

1.5 Report Outline

In this thesis, there are five chapters involved to control algorithm PIC for multi source energy management system. First and foremost, it is Chapter 1. This chapter will discuss briefly about the project introduction that consist of objectives, problems statements, scopes of project and report outline in order to conduct the project. Next, the thesis is continued with Chapter 2. This chapter contains the literature review on the past research and some theoretical concepts applied in this project. It contains the collection information of the project in order to complete the whole project. Then, Chapter 3 focus on the methodology used in order to complete this project to design software. In this chapter, there is flow chart to explain the procedures of designing the software and the simulation. Next, the detail description about experimental setup is discussed too. In Chapter 4, results consist of two parts which are simulation and experimental results. Several comparisons include the theoretical, simulation and experimental setup will be discussed in this chapter too. Last but not least, a summary of project control algorithm PIC for multisource energy management system is discussed as well as the recommendation is provided for future work in this chapter. The conclusion that will be done includes the whole chapters.

CHAPTER 2

LITERATURE REVIEW

This chapter contains the literature review on the past research and it contains the collection information of the project in order to complete the whole project.

2.1 Background

In Malaysia, scooters and three wheeled vehicles are noticeable popular and are a cheaper form of transportation. They are often used in the cities to travel short distances and avoid traffic jams. These vehicles have capacity of 2-5kW from an internal combustion engine. Then, due the consumers concern to environment, light electric vehicle will be introduced using control algorithm PIC for multisource DC motor. The multisource of the system consist battery, fuel and super capacitor. A battery is used as the primary source of energy, while the fuel cell is used as an extended energy source for a high demand load and super capacitor as the auxiliary energy source. The light electric vehicle tends to use the battery as the primary energy source, to use the super capacitor minimally and to avoid the use of the fuel as an energy resource unless the demand is high. This concept is ideal for light electric vehicle because the battery can be charged at home. On the other hand, the energy management system play an important role, either enhances the storage capacity or changes the energy source as required.

The closed loop driving system for the EMS of the light electric vehicle, where the multisource are attached to the EMS to best selection of energy source before linked to the motor drive. In the EMS, these power sources are controlled by switches which the control system is based on the control algorithm. The system control strategy counts on the pedal acceleration which measured current energy, battery capacity and continuous high speed energy constraint.

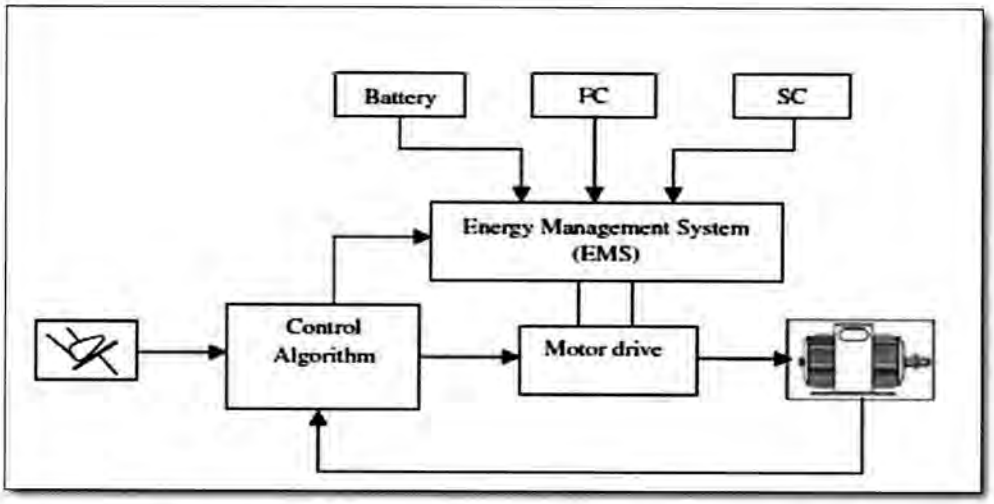

Figure 2.1: Multiple power sources in a closed loop motor drive system for drive system for light electric vehicle.

In this project use control algorithm PIC for multisource DC motor. PIC 16F877A microcontroller had been chosen to control the multisource DC motor. The main task of the system is to maintain the power source to drive the DC motor. The controller determines three basic operation input condition such as pedal offset (PO) and power duration load (PD) are determined by measuring motor speed over a long period of time, and battery capacity (BC).

2.2 The difference between electric, solar and hybrid car.

2.2.1 Electric car

Electric car use technology that is designed to decrease the use of gasoline fuel for powering car engines. Electric cars are totally electric, meaning they must be plugged in and charged and that the range of the car is only as far as the charge. At the turn of the twentieth century, most cars actually were electric. The car ran quietly and efficiently, and had reasonably good ranges. For a variety of reasons, the internal combustion engine powered by gasoline overtook electric cars in popularity. The electric car faded from public popularity until the late 1960s, when concerns about a growing oil crisis and emissions drove several companies to manufacture electric cars again, albeit on a small scale. Modern electric cars are comparable to gasoline powered ones in term of speed and many of them have long ranges which can be increased at charging stations along the way. Electric car also non-polluting and can be powered using clean energy such as wind or hydropower.

2.2.2 Hybrid car

Hybrid car also use technology that is designed to decrease the use of gasoline fuel for powering car engines. Hybrid cars use a mixture of gas and electric power to create gas efficient partially electric car with a less limited range. Manu car manufacturers are including hybrids in their line up to cater to people who would like the clean energy of an electric car without the difficulties of managing charging and range. A hybrid car has a conventional gasoline engine and a bank of rechargeable batteries that charge while the car is running. When the driver makes limited demands on the cars power such as driving around town or idling at spotlight, the car runs on the stored electricity in the batteries. When the driver demands burst of energy or is driving at sustained high speeds, the gasoline engine kicks in. a hybrid car is more ecologically sound choice than a conventional gasoline powered car but still carries environment issues.

2.2.3 Solar car

Solar car are different only in the fuel that makes them run. They are called solar energy cars for the reason that they use sunlight for fuel. The concept of driving a car with zero harmful emissions, one that is very quiet and is very low maintenance and does not need an expensive fuel source has been the ideal inventors for a long time. Solar car need sunlight to run. Most solar energy devices depend upon photovoltaic technology to convert sunlight to electricity. Solar cells are made up of a pure form of silicon. These solar cells can convert up to twenty percent of the sunlight hitting them into electricity. This electricity is channelled to and used by the electric motor of the car if it is running. When the car is not running the current is used to charge a battery pack.

2.3 Energy Storage element

2.3.1 Batteries

A battery is a device that transforms chemical energy into electric energy. All batteries have three basic components in each cell such as anode, a cathode, and an anode and their properties relate directly to their individual chemistries. Batteries are broadly classified into primary and secondary.

Primary batteries are the most common and are designed as single use batteries, to be discarded or recycled after they run out. They have very high impedance which translates into long life energy storage for low current loads. The most frequently used batteries are carbon-zinc, alkaline, silver oxide, zinc air, and some lithium metal batteries

Secondary batteries are designed to be recharged and can be recharged up to 1,000 times depending on the usage and battery type. Very deep discharges result in a shorter cycle life, whereas shorter discharges result in long cycle life for most of these batteries. The charge time varies from 1 to 12 hours, depending upon battery condition, Depth of Discharge (DoD), and other factors. Commonly available secondary batteries are Nickel-Cadmium, lead-acid, Nickel-Metal Hydride, some lithium metal, and Li-ion batteries. Some of the limitations posed by secondary batteries are limited life, limited power capability, low energy-efficiency, and disposal concerns.

2.3.2 Fuel Cells

Like a battery, a fuel cell uses stored chemical energy to generate power. Unlike batteries, its energy storage system is separate from the power generator. It produces electricity from an external fuel supply as opposed to the limited internal energy storage capacity of a battery.

A typical fuel cell requires a large amount of extraneous control equipment like fuel pumps, cooling systems, fuel tanks, and re-circulators that make them impractical for portable applications. New developments like the small direct methanol fuel cell (DMFC) can do away with a large amount of the extraneous systems. Fuel cells range in size from hand-held systems to megawatt power stations. Most large fuel cells operate at high temperatures (200 °C to 1000 °C); the proton-exchange membrane fuel cell (PEMFC) may be able to operate at room temperature.

Fuel cells operate most efficiently over a narrow range of performance parameters and at elevated temperature, rapidly becoming inefficient under high power demands. Fuel cells will be used in tandem with either batteries or super capacitors to provide a high-energy, high-power combination. Use of catalyst metals, such as platinum, makes fuel cells an expensive proposition.

2.3.3 Super capacitors

Super capacitors are very high surface area activated carbon capacitors that use a molecule-thin layer of electrolyte, rather than a manufactured sheet of material, as the dielectric to separate charge. The super capacitor resembles a regular capacitor except that it offers very high capacitance in a small package. Energy storage is by means of static charge rather than of an electro-chemical process inherent to the battery. Super capacitors rely on the separation of charge at an electrified interface that is measured in fractions of a nanometre, compared with micrometers for most polymer film capacitors.

In super capacitors, the solution between the electrodes contains ions from a salt that is added to an appropriate solvent. The operating voltage is controlled by the breakdown voltages of the solvents with aqueous electrolytes (1.1 V) and organic electrolytes (2.5 to 3 V).

There are three types of electrode materials suitable for the super capacitor. They are: high surface area activated carbons, metal oxide, and conducting polymers. The high surface electrode material, also called Double Layer Capacitor (DLC), is least costly to manufacture and is the most common. It stores the energy in the double layer formed near the carbon electrode surface.

The lifetime of super capacitors is virtually indefinite and their energy efficiency rarely falls below 90% when they are kept within their design limits. Their power density is higher than that of batteries while their energy density is generally lower. However, unlike batteries, almost all of this energy is available in a reversible process.

Property	**Super capacitors**	**Fuel Cells**	**Batteries**
Charge/Discharge Time	Milliseconds to Seconds	Typically 10 to 300 hrs. Instant charge (refuel).	1 to 10 hrs
Operating Temperature	-40 to +85 °C	+25 to +90 °C	-20 to +65 °C
Operating Voltage	2.3V - 2.75V/cell	0.6 V / cell	1.25 to 4.2 V / cell
Capacitance	100 mF to > 2F	N/A	N/A
Life	30,000+ hrs average	1500 to 10,000 hrs	150 to 1500 cycles
Weight	1 g to 2 g	20 g to over 5 kg	1 g to over 10 kg
Power Density	10 to 100 kW/kg	0.001 to 0.1 kW/kg	0.005 to 0.4 kW/kg
Energy Density	1 to 5 Wh/kg	300 to 3000 Wh/kg	8 to 600 Wh/kg
Pulse Load	Up to 100 A	Up to 150 mA / cm^2	Up to 5 A

Table 1: Comparison property: super capacitor, fuel cell and battery.

CHAPTER 3

PROJECT METHODOLOGY

This chapter will introduce about methodology used in order used in order to complete this project that involve develop control algorithm PIC for multisource DC Motor. In this chapter, there a flowchart to explain the overall system.

3.1 Flow Chart of Project

According to the figure 6, flow chart shows there are a few processes need to be implemented in order to produce the project of control algorithm PIC for multisource DC motor design. Any item that has been made in this project is described step by step. This methodology is useful as guidelines and to make sure the project is running on systematically.