



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DESIGN AND MODELLING OF PORTABLE USB CHARGER
USING DC MOTOR**

This report submitted in accordance with requirement of the Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology
(JTKE) (Hons.)

by

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940410-01-6567

FACULTY OF ENGINEERING TECHNOLOGY

2016

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Portable USB Charger using DC Motor**

SESI PENGAJIAN: **2016/2017 Semester 1**

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I hereby, declared this report entitled “Portable USB Charger using DC Motor” is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

.....

(Project Supervisor)

ABSTRAK

Tujuan kajian ini adalah untuk membangunkan pengecas USB mudah alih yang menggunakan DC Motor. Dengan menggunakan pengecas ini, mana-mana peranti elektronik yang menggunakan USB sebagai sumber kuasa boleh dicas bila-bila masa dan di mana sahaja. DC Motor adalah komponen utama dalam reka bentuk. Ia menghasilkan elektrik apabila pemotongan medan magnet berlaku di dalamnya. Motor ini akan diputar menggunakan engkol tangan. Tenaga yang dihasilkan akan dikawal selia oleh pengatur voltan pada aras 5V. Tenaga yang dihasilkan akan digunakan untuk memberi kuasa kepada port USB dan boleh digunakan sebagai pengecas yang mudah alih. Tenaga yang dihasilkan juga boleh digunakan untuk mengecas bateri boleh dicas semula di dalam peranti ini. Projek ini adalah sangat berkesan dan boleh digunakan pada bila-bila masa, di mana sahaja termasuk keadaan kecemasan seperti banjir.

ABSTRACT

The purpose of the study is to develop a portable USB charger which using DC Motor. By using this charger, any electronic device that use USB as power supply can be charged anytime and anywhere. The DC Motor is the main components in the design. It produces electricity when the cutting of magnetic flux occurs inside it. The motor will be rotated using hand crank. The energy produces will be regulated by the voltage regulator at 5V. The energy produced then will be used to power up the USB port and can be use as portable charger. The energy produced also can be used to charge the rechargeable battery inside the device. The project is very effective and capable of being used at anytime, anywhere including emergency situation such as flood.

DEDICATION

To my beloved parents, my family, my teachers and my fellow friends, thank you for the support and help given to me on completing this thesis.

ACKNOWLEDGEMENT

Firstly, most thanks to Allah S.W.T for giving me the opportunity to complete this report “Projek Sarjana Muda” with a success after I went through a lot of obstacle with patience. I would also like to thanks my parent and my family for encouraging me throughout all the difficulties I had faced and keep supporting on my financial. Without their permission and blessing, I would not be able to further my study in this university and not able to do my degree project.

Not to forget, I would like to thank my supervisor, Puan Nurbahirah binti Norddin for guiding me in completing this project and report. She has taught me a lot of useful things and knowledges not only in theoretical but also practical. Furthermore, thanks to all lecturers and technicians that have guided me to get a good knowledge and experiences either in the class or in the lab session.

Besides, I would also like to thanks all my fellow friends including my friends under the same supervisor, Ida, Azni, and Nurul for sharing and comparing opinion on the report

Finally, I would like to thank anyone that has contributed either directly or indirectly, for giving me the support and help in order to make this project successful.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AC	-	Alternating Current
DC	-	Direct Current
V	-	Volts
A	-	Ampere
Li-ion	-	Lithium Ion
mAh	-	milliamperes-hours
USB	-	Universal Serial Bus
PSM	-	Project Sarjana Muda

CHAPTER 1

INTRODUCTION

1.0 Introduction

In this section, it basically explains the background of this project and explaining the objective, the scope, problem statement and project significant.

1.1 Project Background

In this modern era, electricity is one of the very important thing in our daily life. Electricity can be definite as the presence and flow of electric charge. It is use as energy to power up nearly everything around us. To use electricity, it need to be generated. Electricity can be produced by various way such as solar, nuclear, coal, fossil fuel. One of the most used concept to generate electric is cutting of magnetic flux. Such as dynamo and actuator.

Electric motor is an electrical machine that converts electrical energy to mechanical energy, while the conversion of mechanical energy to electrical energy is done by electric generator. The source of the mechanical energy and varies from hand crank to internal combustion engine. The generator is divided in to two types, producing dc voltage, and ac voltage. But the research will be focused on motor that produced dc voltage.

Nowadays, there are lots of electronics devices around us. All of these devices are created to make our lives easier. Electronic devices vary from telecommunication systems, entertainment, calculation, and even cigarettes are available in electronics. But all these electronics devices have one common thing; all of them require electricity to work. Hence, most of these electronics devices are equipped with batteries. But, as the device is being used, the energy stored inside the battery will run out. In the event of an emergency where electric sources are limited, the electronic device can hardly operate.

Mainly, all of these electronic devices are using electric supply from home such as an electric socket. Nowadays, all the electric sockets at home use 230V to supply electricity for the household. But when there is no electricity available at home, these electronics simply cannot function. Therefore, an alternative power source is needed.

1.2 Problem Statement

The creation of electronic devices such as mobile phones makes our lives easier, but their batteries will run out of charge and need to be recharged. In the event of an emergency such as a natural disaster where electrical sources are limited, they can play a role in life-or-death situations. It can also make the situation worse without electricity. For example, when smartphones are out of battery, the user loses connection and cannot call for help. Therefore, we need something to recharge these devices without the source of electricity. This charger also needs to be small, portable, and can be used in any condition.

Cikgu 'unsung hero' di SK Manek Urai Lama

RAZIATUL HANUM A. RAJAK
23 JANUARI 2015



SHAH ALAM - Tindakan seorang guru di Sekolah Kebangsaan Manek Urai Lama di Kuala Krai yang menghantar pesanan ringkas kepada pasukan penyelamat kemudian menutup telefon bimbitnya bagi menjimatkan bateri mampu menyelamatkan nyawa ratusan mangsa banjir yang terperangkap di sekolah itu.

Ketua Penerangan Umno Kelantan, Datuk Md Alwi Che Ahmad berkongsi cerita tersebut ketika menjadi panel pada Wacana Sinar Harian siri ke-34, Kelantan Pasca Banjir: Bicara Hati ke Hati Pas, Umno Bangunkan Semula Kelantan yang berlangsung di Auditorium Kompleks Kumpulan Media Karangraf, semalam.

Ketika kejadian pada 25 Disember lalu, pelbagai maklumat tersebar di aplikasi WhatsApp dan laman sosial mengaitkan sekolah berkenaan.

Namun, kata Md Alwi, bantuan yang dihantar pihak berkuasa tidak dapat sampai ke lokasi pada malam kejadian tersebut.

"Misalnya SK Manek Urai Lama yang tersebar WhatsAapp kata 200 orang mati...runtuh. Sebenarnya pada malam 25 Disember itu, Datuk Mustafa (Pengerusi Jawatankuasa Bencana Banjir Kelantan, Datuk Seri Mustapa Mohamed) ketika itu masih di Mekah dan saya menghubungi Panglima Angkatan Tentera sebab ramai wakil rakyat dah minta tolong.

"(Selepas) Itulah helikopter pergi (ke sekolah), Untuk makluman di sekolah itu, mereka berpindah dari tingkat satu ke tingkat empat. Bayangkan mereka di sana dari 24 Disember hingga 26 Disember. Kita hantar helikopter dan bot tapi tak boleh masuk," ceritanya.

Mengimbas kembali situasi itu, beliau menyebut tentang seorang guru yang tidak diceritakan jasanya.

"Ada seorang cikgu...dia memang 'unsung hero'. Telefon bimbitnya masih mempunyai bateri jadi, dia SMS kemudian dia tutup telefon untuk jimat bateri. SMS dia lah sebenarnya yang datang meminta tolong.

"Nasib baik bomba ada kenderaan amfibia bomba, pada malamnya, kenderaan ini sampai ke sekolah tapi bukan SK Manek Urai Lama, sekolah yang sebelah lagi. Sebab elektrik dah putus dan tak dapat nak beri 'signal', dia hanya dengar bunyi enjin bot.

"Kemudian dia hubungi kita balik. Alhamdulillah pagi esoknya, barulah helikopter dapat masuk dan Tan Sri Panglima Tentera Darat sendiri turun dengan tali bawa makanan dan air kepada mereka," katanya.

25 Disember lalu, Sinar Harian melaporkan lebih 400 mangsa banjir yang terpaksa mendiami tingkat tiga SK Manek Urai Lama berikutan air menenggelamkan sehingga tingkat dua bangunan berkenaan, dilaporkan selamat.

Figure 1.1: Sinar Harian Newspaper article 23 January 2015

From Figure 1.1 which show Sinar Harian Newspaper article on 23 January 2015, it states that a teacher able to save more than 400 lives of flood victim that had occupied the third floor to take cover. All he did was constantly turn on and off his phones to save battery. If his phones are out of battery, he cannot call for help, thus all the 400 lives at that place are in danger. Hence, in order to prevent this from happen again, a device need to be designed to be able to charge phones at anywhere and anytime.

1.3 Objectives

The aim of the project is to design and modelling the portable USB charger using DC Motor. This general objective can be broken down into two more specific objectives that would together achieve the overall aim of this project as follows:

- a) To design the electrical circuit for generating and transferring of energy from DC Motor to USB device including power bank.
- b) To modelling portable Universal-Serial Bus(USB) Charger casing based of certain criteria.

1.4 Scope

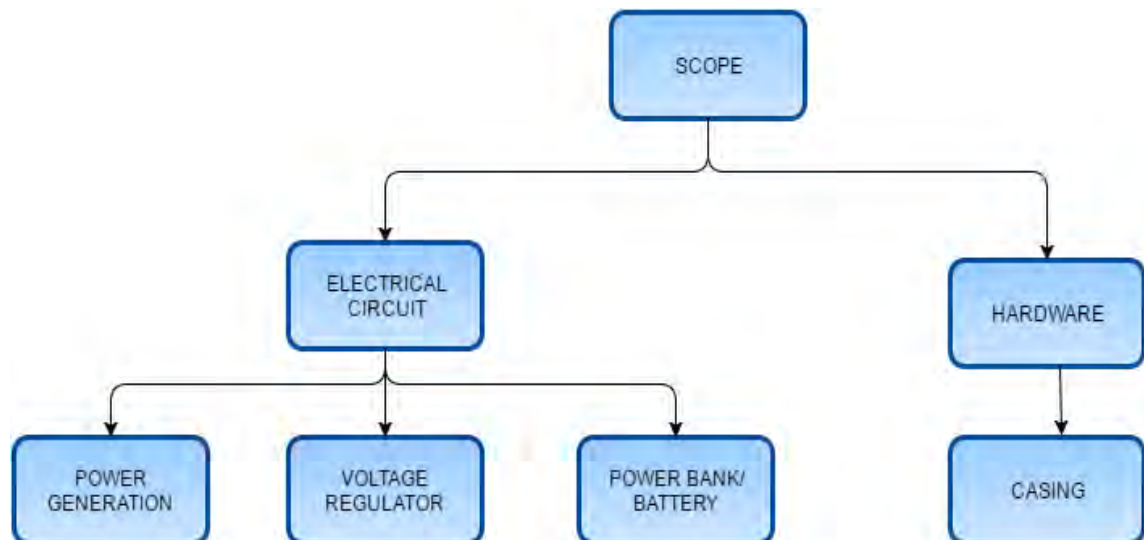


Figure 1.2: Scope flowchart

From the Figure 1.2, the scope will be divided into 2 main item which is electrical circuit and the hardware of portable USB charger. For the electrical circuit, it is broken down to three main components which is the power generation which is using DC motor, voltage regulator, and power bank which consist of battery inside. For the hardware part, is focused to the casing. The shape of the casing is designed in such way all component can be fitted inside.

1.5 Project Significant

In the end of the project, the portable USB charger using DC Motor is successfully constructed and demonstrated. From the project testing and demonstration, the portable USB charger is able to generate electricity and able to provide energy to electronic devices by using USB port.

1.6 Thesis Outline

This thesis consists of five chapter. Chapter 1 are the introduction that consist of the element necessary to get to know to this project such as problem statement, objectives and scope. Chapter 2 are literature review, which contain previous research and the material used in this thesis. Chapter 3 is methodology, which explain the method used in this thesis. Chapter 4 is result and analysis. All the data and result obtained during experiment and testing will be presented and analyzed. Last chapter is chapter 5 which is the conclusion. This chapter will conclude the thesis and contain problem faced during research and suggestion for future research.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In this literature review section, it comprises from the journal on the internet, paper proceedings and research, books and lectures. The literature review includes the cases investigation of the project that may be arise to overcome the problem and also gives a powerful knowledge on the fundamentals of the project.

2.1 Electrical Machine

Electrical machine can be classified into two types which is electrical motor and electrical generator. Electrical motor is a machine that convert electrical energy into mechanical energy. In this machine, a force is induced in a conductor that has a current going through it and placed in a magnetic field. The other one is electrical generator that converts mechanical energy into electrical energy. For the generator, an EMF(voltage) is induced in a conductor if it moves through a magnetic field. This machine can be classified further into two types which is AC machine and DC machine. In this project, we are focusing on the DC machine. Hence, it also can be called as DC motor or DC generator.

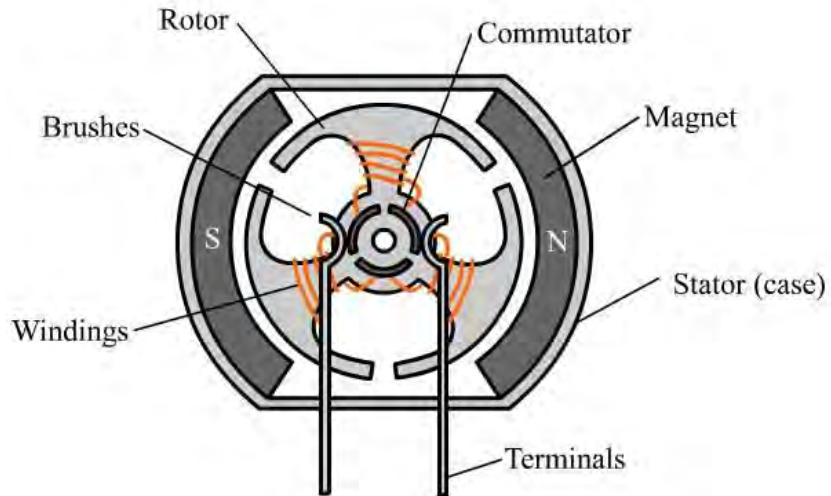


Figure 2.1: Cross section of DC Motor

Figure 2.1 shows important parts inside the DC Motor. There are several important components inside the motor. The components are rotor, stator, winding, air gap, brushes, and commutator.

2.1.1 Rotor



Figure 2.2: Rotor

Figure 2.2 shows a rotor inside electrical motor. Rotor is the moving part inside electric motor which will turn shaft to convey the mechanical power. The rotor generally has conductors laid into it which convey currents that interface with the magnetic field of the stator to produce the force that will turn the shaft. Notwithstanding, a few rotors convey permanent magnets, while the stator holds the conductors.

2.1.2 Stator



Figure 2.3: Stator

Figure 2.3 shows stator inside electrical motor. A stator is a stationary component of the motor's electromagnetic circuit and ordinarily comprises of either permanent magnets or windings. The stator core are comprised of numerous thin metal sheets, also known as lamination. The lamination are utilized to lessen energy losses that would come about if a solid core were utilized.