

**DESIGNING AND CONSTRUCTING PORTABLE USB CHARGER
USING DC MOTOR AND BATTERY**

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**BACHELOR OF ELECTRICAL ENGINEERING TECHNOLOGY
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND CONSTRUCTING PORTABLE USB

CHARGER USING DC MOTOR AND BATTERY

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

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Tajuk: Design and constructing portable USB charger using dc motor and battery

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DECLARATION

I hereby, declared this report entitled “Portable USB charger using DC motor and battery” is the results of my own research except the references that already stated.

Signature : 

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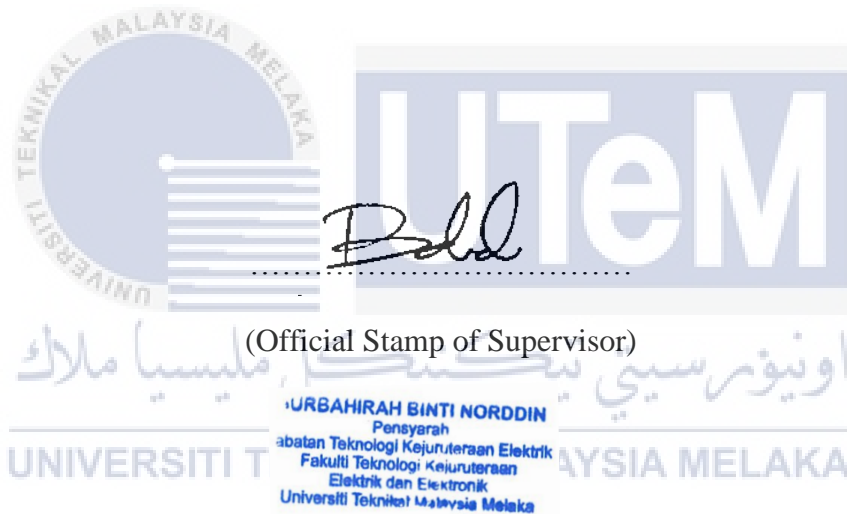
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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of supervisor is as follows:

(Signature of Supervisor)



DEDICATION

It feels so blessed and thankful for me to my beloved parents, my family, my supervisor, my lecturers and my fellow friends. Thank you for all the supports, helps and guide me physically or mentally on complementing this project.



ABSTRACT

This Portable USB Charger is inspired by a few groups of ranger whom needs a backup power supply during their exploration of the wood to keep their equipment does not run out of battery. There are various types of power bank in current market right now, which their product providing a big capacity of the battery so that they can last longer but there are the least amount of power bank that can be charged in emergency situations. Thus, the objectives of this project is to design and construct a portable power bank that use a DC motor to recharge the internal battery of the power bank anytime, anywhere and it can also be charged by an external power source just like usual power bank nowadays. This project has a several layers of method to do which is designing the case with Solidwork software, run the circuit simulation by using Multisim software before proceeding with the hardware part which is the circuit connection. In conclusion, the use of a DC motor as a generator to recharge the power bank is a brilliant and effective ways so that it will help a lot in an emergency situation.

ABSTRAK

Pengecas USB Mudah Alih ini diinspirasi oleh beberapa kumpulan renjer hutan yang memerlukan sokongan bekalan kuasa ketika sedang mengeksplor hutan untuk memastikan segala barangan keperluannya tidak kehabisan kuasa. Kini terdapat pelbagai jenis bank kuasa mudah alih yang terdapat dipasaran yang memberikan kapasiti bateri dalam yang besar supaya ia dapat bertahan lebih lama namun tidak banyak bank kuasa mudah alih yang boleh dicas ketika situasi kecemasan. Maka, objektif bagi projek ini ialah mereka bentuk dan mencipta sebuah pengecas USB mudah alih yang menggunakan motor arus terus untuk mengecas bateri dalaman bila-bila masa dan dimana-mana sahaja, ianya juga menyokong system pengecasan bateri dalam dengan menggunakan sumber kuasa luar seperti bank tenaga mudah alih yang telah berada dipasaran sekarang. Projek ini mempunyai beberapa lapisan metodologi dalam pembikinannya iaitu mereka bentuk bekas luarannya dengan menggunakan perisian Solidwork, menjalankan simulasi litar dengan menggunakan perisian Multisim sebelum menyambung kerja perkakasan iaitu penyambungan litar. Sebagai konklusi, penggunaan motor arus terus dalam projek ini merupakan cara yang sangat berkesan untuk mengecas semula bateri dalam bank kuasa mudah alih jadi ia akan memudahkan perkara ketika berlakunya situasi kecemasan.

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LIST OF SYMBOLS

V	-	Voltage
A	-	Ampere
m	-	Meter
F	-	Farad
H	-	Henry
°C	-	Degree Celsius
Hz	-	Hertz
G	-	Gram



LIST OF ABBREVIATIONS

DC	-	Direct Current
AC	-	Alternative Current
mAh	-	milliamps per hour
USB	-	Universal serial bus
RPM	-	Rotation per minute
LCD	-	Liquid-crystal display
μF	-	micro-Farad
μH	-	micro-Henry
kHz	-	kilo-Hertz
EMF	-	Electromagnetic force



CHAPTER 1

INTRODUCTION

1.0 Introduction

This section will point out the work flow and the background of backup power supply for USB user by using dc motor as a generator and internal lithium battery. The objective of this project are listed by countering the problem statement of this project which is the objective is to provide or to create a rechargeable portable USB charger or power bank with dual mode of charging itself which are directly charge by using electrical supply and also by using dc motor as a generator.

1.1 Project Background

Universal Serial Bus or well known as USB is a technology used to connect the computer with other external equipment or also used as an input or output port for most electronic devices. The use of USB is very common nowadays and it comes along with the development of modern gadget. Most of the people live with the gadget to fulfil or perform their daily life routine in order to make their task easier and smooth but the gadget is limited by its internal capacity of energy. When the battery is running out, the user need to recharge the gadget to continue performing their task.

Next, electricity is one form of various energy that exist in real life. Electricity is made of flowing electric charge called electron from point to another point. Electricity is a need nowadays to perform daily task such as running the electrical machine or lighting the house. However, the electricity is something that can be generate or produce by certain source such as nuclear, fossil fuel, coal and solar. The most way that been used to generate electricity is when there is change in magnetic flux through the coil. It is related to Faraday's first law.

Electric generator and electric motor is a same concept hardware part with a different function of its own. Electric generator is a part where the transformation of mechanical energy to electrical energy occurred while electric motor is a part where the transformation of electrical energy to mechanical energy. Basically, generator can be divide into two types which is ac

generator and dc generator. Both ac and dc generator have their own specific types to use base on different situations. As this project highlighting the use of USB, so we will concentrate on dc voltage only.

The gadget or electronic devices commonly used a battery to supply energy to keep the device operate optimally. The USB is use as the output or input port for the device to connect with other device and mainly as a charging connector. When it came to an emergency situation such as lost in the wood and natural disaster, people will seek for any electrical energy backup supply to avoid their stuff from running out of battery. This is why we need to produce and prepare another choice of power source.

1.2 Problem Statement

As gadget is compulsory nowadays, people always look for backup supply to ensure their things alive to do their daily task such as cell phone. Based on (Peslak, 2011) there are 82% American adults whom own a cell phone according to a report by Pew Internet and 27% of college students own a cell phone according to a survey finished by Ball State.

As an alternative why of backup supply, people commonly use a power bank to charge the phone. However, the power bank itself will run out of battery after several time of use. When it came to an emergency situation like natural disaster, this project will take part in this situation to produce a rechargeable power bank by using dc motor as a generator and also can be charge directly from electric power supply. It helps people to charge their stuff easily and unfortunately will help people to contact with other to get help or something else.

1.3 Objective

This project's target is to develop a portable USB charger or power bank using dc motor with LCD as an indicator of battery capacity. There are three main objectives for this project, here are the objectives:

- i. To study the power generate by using dc motor.

- ii. To create the electrical circuit from energy generated by dc motor to internal battery then to user by USB female port.
- iii. To design and create the casing for the power bank based on the size of internal component and comfortable to hold.

1.4 Scope

The scope for this project can be divided into 2 major parts which is electrical circuit and design. The electrical circuit is focus on how the electrical is connected and from dc motor until the USB port for the output and for the design, it will focus on the drawing of the casing by using Solid Work software and 3D printing.

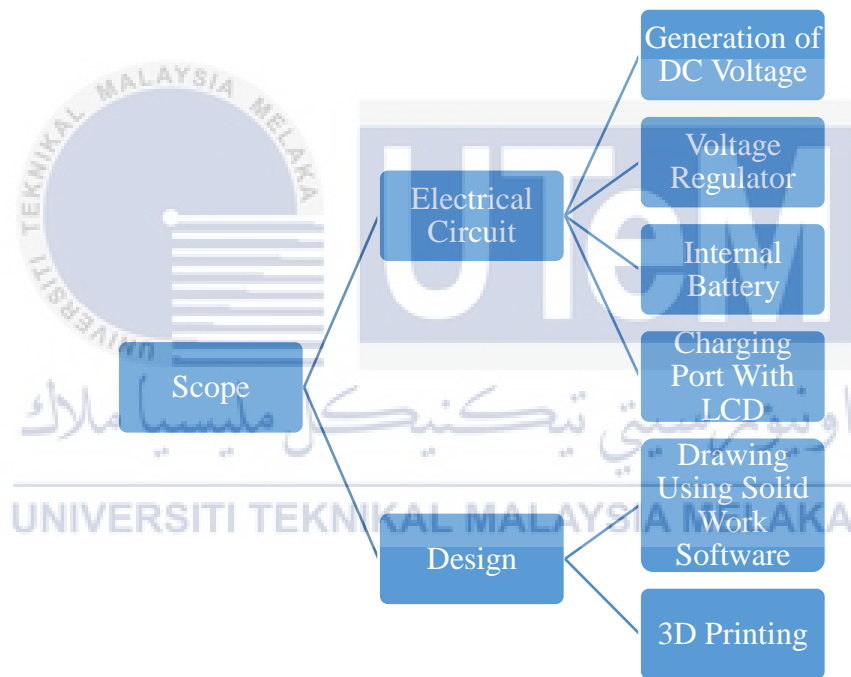


Figure 1.1 Parts of scope

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

As for literature review, it will explain the basic knowledge that may give a solution for this project to make sure it will success and safe to use. It is also a cumulative information that have been taken from previous journal, research and article that related to this project.

2.1 Electrical Machine

Electrical machine is device that use electromagnetic force. Basically, electrical machine can be separate into two part which is electrical motor and electrical generator. Based on (Chapman, 2012) electrical motor is converting the electrical energy to mechanical energy while electrical generator is vice versa of electrical motor. This project will focus more on electrical generator. Electrical generator can produce both ac voltage and dc voltage base on requirement of user.

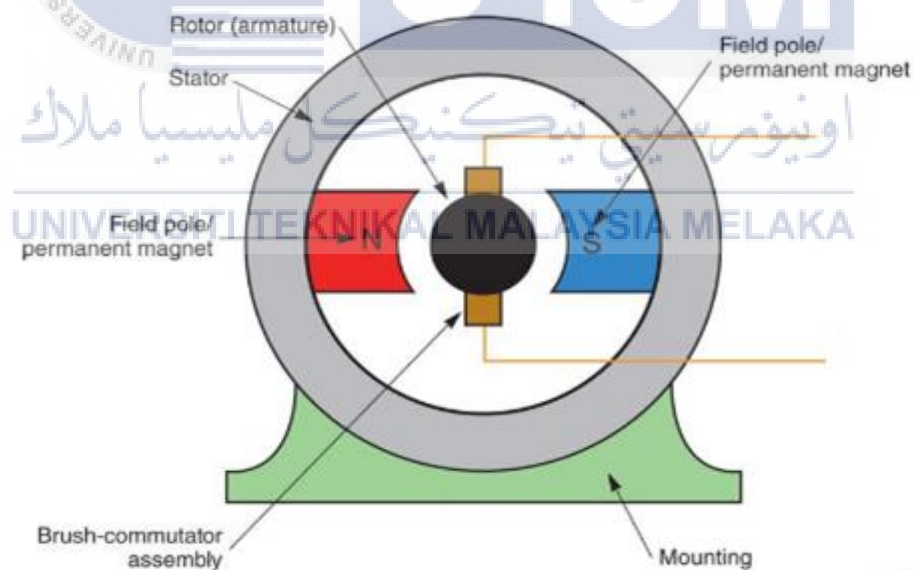


Figure 2.01 Parts of DC motor

DC motor is made of various main part which is permanent magnet, rotor, stator, winding, brush and commutator. All of these component contribute in producing dc voltage or acting as dc motor.

2.1.1 Stator

Stator is a motionless part in electric motor or electric generator that help in produce a rotating magnetic field. Despite the stator is static, it is come along with stator frame. Stator can be divided into three parts which is stator core, winding and frame. Commonly, stator is made of iron or steel and there is a hollow cylindrical core at the center. Based on (B. Gardel, 2011) the induced current in the stator may prompt overheating of the motor and producing energy losses that should be used to generate a magnetic field, this is why laminated sheets are used instead of a whole big iron core because it can reduce the unwanted current called as eddy current. The core of the stator is built to back up the stator winding structure. The permanent magnet that attached to stator is use to supply magnetic field inside stator area.

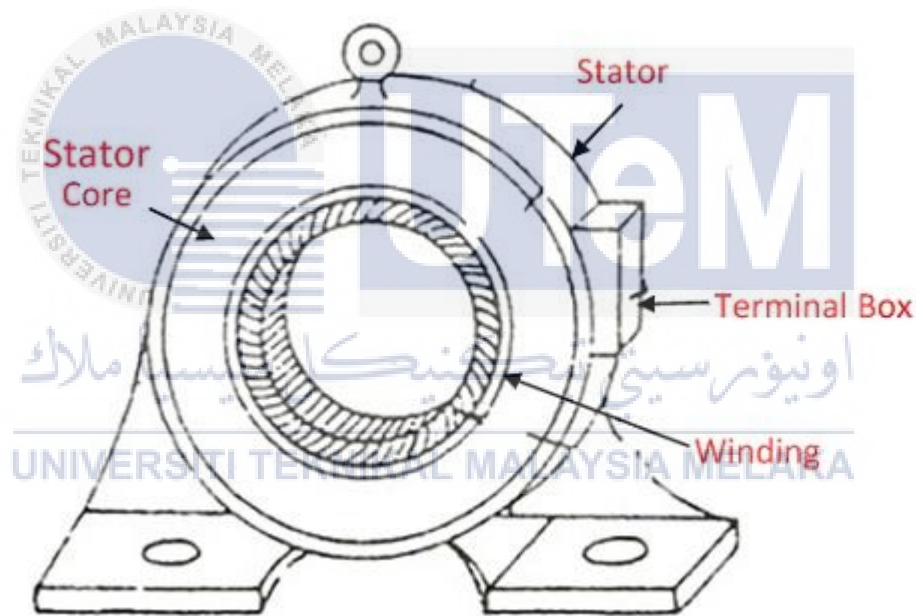


Figure 2.02 Parts of stator

2.1.2 Rotor

Rotor or also known as armature core is spinning part in this dc motor where it is located inside the stator. There are two types of rotor that commonly used nowadays which is squirrel cage and wound rotor. As for this dc motor, we only use wound rotor that contain cylindrical

laminated core with the slots cut into the cylindrical core. Rotor's main part is slot, winding, commutator and shaft.

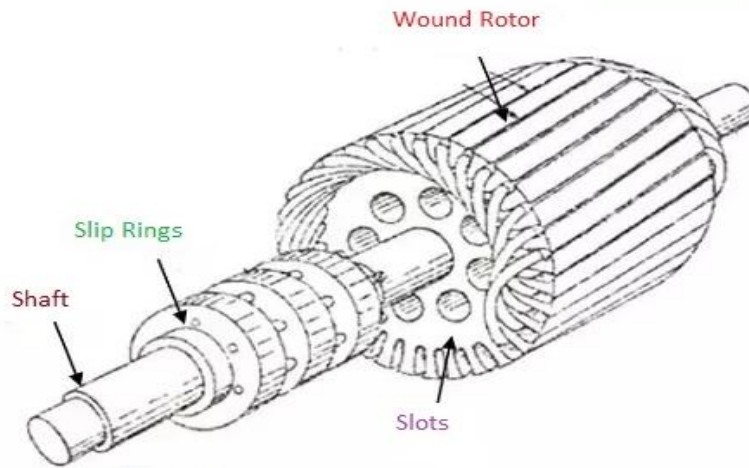


Figure 2.03 Wound rotor's part

2.1.3 Working Principle of Stator and Rotor

As rotor and stator is a compulsory part in every type of electrical generator and motor, their working principle is very important and we need to know on how it can produce current or functioning as motor. The basic theory that related to these both component is Faraday's First Law. The law stated that the current and electromotive force is induced if the closed loop of inductor is placed in the varying magnetic field. When the rotor is being moved, circling inside the stator, the winding of the armature will cut the magnetic field from the permanent magnet inside the stator and produce a magnetic flux. The magnetic flux that occurred will induce current or electromagnetic force inside the armature's winding and go through the commutator. Based on (Keream et al., 2018) the generation of torque and EMF is led by electromagnetic interaction.