UNIVERSITI TEKNIKAL MALAYSIA MELAKA

PSM TITLE

DEVELOPMENT OF EMERGENCY PACK FOR CAMPER BY USING ARDUINO

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronic Engineering Technology (Industrial Electronics) with Honours

By

NURUL SAQINAH BT ABDUL AZIZ
B071410704
920208015458

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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 Engineering Technology (Industrial Electronics) with Honours. The member of the supervisory is as follow:

……

PN. NORAIN BINTI RAHIM

ABSTRAK

Projek ini mengkhususkan mengenai pek kecemasan yang boleh digunakan dalam perkemahan. Dalam aplikasi ini, sistem navigasi yang terdiri daripada modul Sistem Penentududukan Global (GPS) dan Sistem Global untuk Komunikasi Mudah Alih (GSM) modul. GPS ialah sistem yang dapat mengesan lokasi sebenar. Oleh itu, maklumat dan lokasi sebenar akan menghantar mesej melalui telefon bimbit dengan menggunakan GSM. Walau bagaimanapun, modul GSM diaturcarakan untuk komunikasi secara satu arah yang hanya boleh menghantar mesej melalui Perkhidmatan Pesanan Ringkas (SMS) kepada penerima. Selain itu, dinamo 6V digunakan untuk menghasilkan tenaga elektrik yang dihasilkan oleh putaran dinamo dengan menggunakan tenaga angin. Elektrik yang dijana adalah 5V dan boleh digunakan untuk mengecas telefon bimbit melalui penyambung USB.

ABSTRACT

This project represent more detail about emergency pack which can be used for campers. In this application, the navigation system that consists of Global Positioning System (GPS) module and Global System for Mobile Communication (GSM) module. GPS is the system which can detect the actual location. Hence, the information and actual location will be sent message through mobile phone by using GSM. However, the GSM module is programmed for one way communication which only can sent a message thru Short Message Service (SMS) to people. Other than that, the 6V dynamo is used to generate electricity that generated by rotating the dynamo using wind energy. Electricity that has generate is 5V and can be used to charge a mobile phones via USB port.

DEDICATION

To my beloved parents and family. This thesis is dedicated to my dad, who showed me that the best sort of information to have is what is found out for its own purpose. It is likewise dedicated to my mom, who showed me that even the biggest assignment can be refined on the off chance that it is done with extra special care. They likewise helped me fiscally and bolstered all through completing this project report.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

GPS	-	Global System for Mobile Communication
GSM	-	Global System for Mobile Communication
TEC	-	Thermoelectric Coolers
DC	-	Direct Current
TEG	-	Thermoelectric Generator
USB	-	Universal Serial Bus
WECS	-	Wind Energy Conversion System
PSMG	-	Permanent Magnet Synchronous Generator
THD	-	Total Harmonic Distortion
PWM	-	Pulse Width Modulation
MPPT	-	Maximum Power Point Tracker
TSSC	-	Three-State Switching Cell
PFC	-	Power Factor Correction
BPM	-	Battery Power Modules
SOC	-	State-Of-Charges
CCM	-	Continuous Conduction Mode
DCM	-	Discontinuous Conduction Mode
RL	-	Load Resistance
RPM	-	Malaysian Ringgit
LED	-	Light Emitting Diodes
HSF	-	Heat sink/Fan
MBps	-	Megabytes Per Second
>	-	More than
τ	-	Torque

CHAPTER 1
INTRODUCTION

This chapter consists of project background, problem statement, objectives, scope of project, significant of project outline that define and give brief overview about development of emergency pack for camper using heat and wind energy.

1.1 Project Background

Electronic gadgets of the present age are power hungry. All gadget's battery is exhausted after a long journey. Tablets, laptops, portable speakers and other similar electronics are in common frequent use and need their battery to stay functional. Extensive use these electronic devices causes the battery life to decrease and the battery can drain out in a fasters and in shorter spell. Without an energy, these smart and cool devices are worthless. But modern technology advancements have revolutionized their life, including new trends to keep one stress-free and battery full. It is the current status or charging limit of a battery at the time of plug-in. Nowadays the common man is more concerned with the battery strength of his cellphone, same goes to campers. Therefore, the use of power bank in the solution of this problem. Campers use power bank as a power supply that can be used to supply an electric energy to their electronic devices. Besides, they also bring a small generator and extra batteries to generate or as an extra supply if need.

The present power bank that always used by campers is solar power bank. These types of solar banks are an advantage for the people who don't have access to electrical supplies for long period of time. Solar power banks can normally fuel smartphones but sometimes they are also capable of charging the tablets, depending

on the requirement as its engine is too weak to supply too much. But, using this solar power bank, it just working at a place that receives the maximum sunlight and need to place the solar pack with plates facing upwards. It could take a few hours to completely charge it with receives good light density [1].

Therefore, this emergency pack is developing to easier the campers so that they can use this device to charging their electronic devices. By using nature energy which is heat and wind, campers don't need to worry about to get a power supply when they are in the tropics. While, when users use wind as recharging element, they need to attach a small fan and place it at windy area. It could take a few hours to completely charge it, but make sure it receives enough density of those heat or wind element.

1.2 Problem Statement

The ideas for this project is to help a camper when they need a power storage/recharge their electronic devices. There is no power supply in the Tropics that can be uses to charge an electronics device. Electronic devices is one type of the technology nowadays. The problem is, almost every person nowadays can't live without technologies. If there is no supply, therefore all the technologies devices will not function if power stored in those devices are all finish, and it would be more difficult to the normal person.

Furthermore, people nowadays are live in technologies, and technologies is a need to them in everywhere. It more difficult when in the emergency case where all the power storage is not functioning/out of power, and need to recharge it. Therefore, with this emergency pack, campers can use it to charge their devices. Besides, this emergency pack is use a nature element to generate an electrical energy and suitable for those who love nature.

1.3 Objective

Basically, objectives will explain the outcomes that needed to be achieved at the end of the project. The purpose of objectives is to keep the project in the right path and well defined. The main objectives of this project are listed as below:

a. To develop emergency pack by using wind energy.
b. To develop a portable emergency pack for camper.

For the first objective, this project is use nature element which can be used to generate an electrical energy. By using this nature element, users will not to be worried about to find a power supply when travelling. This element also not hazarded to environment. For the second objective, the project the focus to campers who always do outdoor activities and more to in the tropics. At there, the power supply is doesn't exist and need to bring supply bank or generator to generate an electricity. Therefore, with this project, it will easier to them to generate an electric energy and give a power supply to them.

1.4 Project Scope

This project will focus in designing a device where can generate and store an electrical energy for campers. The device is friendly with the nature and ease the campers to use it. In this project, the scope is limits in use wind energy to generate an electrical energy. For wind energy power generation, the vertical wind is use to rotate a small fan and at the same time the dynamo will also rotated to generate an electrical energy. The electric generated produces depend on the amount of wind flow. Then the electrical energy will store and can be used to camper to charge an electronic devices.

CHAPTER 2
LITERATURE REVIEW

This chapter consists of past related research, hardware overview, and software overview that related and used in this project of development of emergency pack for camper using heat and wind energy.

2.1 Past Related Product and Research

Past related research section consists of project researched that was related with this project. These sections cover the past product that related with this project. The product related in this project such electric generator using dynamo, study about power bank and how it stores a power, GPS, GSM, Arduino Uno, and other components that use in this project.

2.1.1 Make a Dynamo to Charge Your Phone

From this research conference state that a dynamo is an electric generator made from coils of wires that are made to turn in a permanent magnetic field by way of a commutator. Essentially any electric DC motor with a permanent magnet can become a dynamo. Rather than applying current to the motor to cause it to spin, the shaft of the motor can be turned to generate a current.

Voltaic System's battery packs will take charge from solar panels, AC adapters, USB ports, even other battery packs. It also charges from

kinetic power sources like hand-cranked in Figure 2.1 or bike driven dynamos.

Figure 2.1: Hand-cranked system for charging application

The 12V 50:1 DC gear motor is used. The reason for gearing 50:1 ratio is the motor don't have to crank at 3000 revolutions per minute (RPM) to generate power need. Therefore, the motor rated at certain voltages then give the RPM for those voltages; but sometimes well current rating is produced. If a 12V DC motor turns at 100 RPM and draws 100mA of current, it's consuming about 1.2W of power. When used as a dynamo, the expectation of watt generated is close to 1W when motor is turned at 100RPM. Normally, for hand cranked application use 60-120 RPM rate of motor, while for bike driven application use higher RPM ratings.

Figure 2.2: Equipment used

The output results are depends on a way of motor shaft is turned. The voltage across the terminal is measured while turning the motor in the desired direction. In Figure 2.3 the battery terminal is labelled to positive and negative and the turned shaft direction is marked to clockwise or anticlockwise (CW or CCW).

Figure 2.3: Battery with label

If motor connected directly to any battery, the dynamo will spin. To prevent this from happened, the diode should be blocked. This is because, the V15 battery already has one built in. Therefore, to charge the battery, the diode should be connected in series from motor's positive terminal to the lead that connected to battery's positive terminal. In here, schottky diodes are recommended to use, because the lower feed-forward voltage adds just a touch to the overall efficiency. Then, the motor's negative terminal is connected to the lead that connected to the battery's negative terminal or ground terminal.

Figure 2.4: USB connection for power input

Refer to Figure 2.4, for power input, V15 use a micro USB connector. One of the spare micro USB cable is modified to connect from the dynamo. The positive output of the motor is connected to positive lead on the modified cable. Then the negative output of motor to negative lead on the modified cable as well. It is hard to give a dynamo a whirl; therefore, rig up the geared crank system [2].

2.1.2 Power converter for vertical wind energy conversion system

From this research, the wind energy conversion system (WECS) is based on permanent magnet generator coupled to a vertical-axis turbine. Wind turbines are machines that convert kinetic energy from wind to mechanical energy, in order to generate electricity through an energy transformation process. Wind turbines are classified into two general types: Horizontal axis turbines and vertical axis turbines. A horizontal axis machine has its blades rotating on a parallel axis to the ground. In the other hand, a vertical axis machine has its blades rotating on a perpendicular axis to the ground. There are several designs available for both turbine types, each having different advantages and disadvantages. Horizontal axis turbines are the most used because of its technical domain; however, in

urban environments, where winds are turbulent, the vertical-axis turbines have a good performance. The Darrieus turbine, H-Darrieus turbine, Savonius turbine and Hunt turbine are examples of vertical axis machines.

Some of the principal advantages using vertical axis technology are: [3] Uses wind regardless its direction, high torque, can be installed under other wind turbines or onto buildings top, and low mechanical force applied to its support structure. With low rotation speed, they present low audible noise, this feature is very important, since they are usually installed onto buildings and residences top. Looking forward to improved efficiency in low rotation machines is used a permanent magnet synchronous generator (PSMG). This generator has a neodymium imam that produces a high magnetic flux in a small physic space, making it compact equipment. The main advantages of using PSMG are: High reliability; High efficiency; and it do not require external excitation current.

Figure 2.5 presents the oldest topology for wind power battery charging, that still widely used by manufacturers of small wind generators. As can be seen, PMSG is connected directly to batteries through a three-phase rectifier without using any control system. Although this topology is simple and robust, but some problems must be observed: Reduced battery life due to over-voltage and over-current, losses increase due to not extraction of maximum power available and the serious one, non-energy transfer when generated voltage is below battery voltage , only over a range of wind speed for the effective generation.

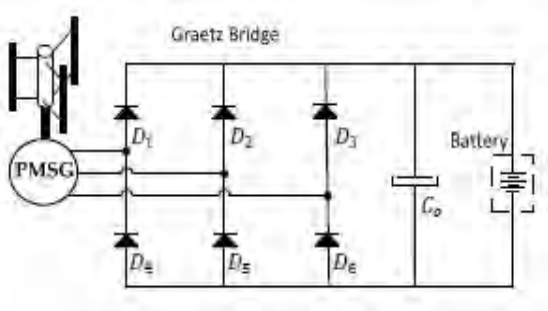

Figure 2.5: Three-phase rectifier Graetz bridge type

One of the options to solve some problems found in previous topology is to add an intermediate dc-dc power conversion stage, as shown in Figure 2.6. This additional stage allows the variation of the rectifier's output voltage as it's possible to extend the useful life of the battery bank and allows the use of MPPT techniques to maximize the energy extracted from the wind [4]. Despite the low cost of such solution, it produces a high total harmonic distortion (THD) in the generator phases. Such high THD implies an additional heating of the generator, which leads a significant drop in their efficiency, as well as produces audible noise which might hinder its use in urban environment.

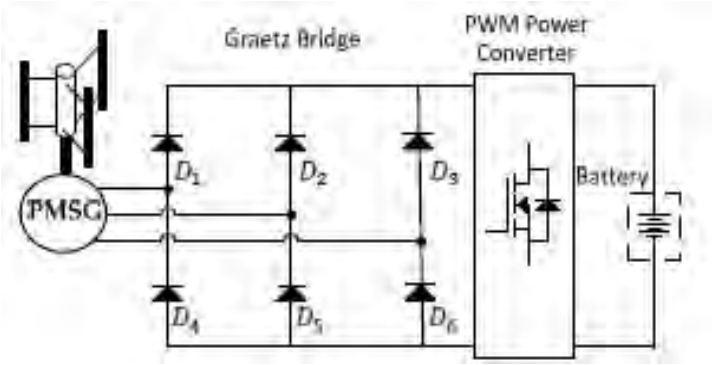

Figure 2.6: Graetz bridge with buck converter

In this section some simulation results, looking to validate the controller, are presented. Figure 2.7 shows the rectifier input current waveforms (ILa, ILb and ILc). The THD obtained is about 1.4%, enough to mitigate audible noise. Also, this improvement in THD, when compared to a conventional Graetz bridge rectifier, represents a reduction of 10% generator conduction losses, which is important, considering that keeping the generator temperature low is a difficult task [5].