

DESIGN AND DEVELOPMENT OF PORTABLE CHARGING STATION WITH SPORTS APPAREL

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**DESIGN AND DEVELOPMENT OF PORTABLE CHARGING STATION
WITH SPORT APPAREL**

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

by

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Design) (Hons.). The member of the supervisory committee is as follow:

.....

ABSTRAK

Tajuk untuk projek sarjana muda adalah mereka bentuk dan membangun pengecas mudah alih bersama peralatan sukan. Di dalam projek ini adalah untuk dibangunkan satu prototaip dimana peralatan suka disertakan dengan pengecas mudah alih. Membangunkan sumber tenaga baru yang disalurkan pada pengecas melalui suhu badan manusia yang bebas dan diserap oleh peranti yang dipanggil “Thermoelectric generator”. Mereka bentuk peralatan sukan melalui metodologi pembangunan produk yang dilakukan mengikut langkah yang telah ditetapkan. Projek ini menggunakan perisian “SolidWorks” untuk menterjemahkan rekabentuk terakhir prototaip dengan terperinci bersama ukuran yang betul serta kemas. Keputusan prototaip melalui eksperimen dilakukan bagi membolehkan prototaip berfungsi atau separa berfungsi. Langkah lain adalah melalui penilaian melalui keputusan eksperimen bersama teori yang diperolehi bagi mengetahui samada ia nya bersesuaian atau tidak.

ABSTRACT

The title of Projek Sarjana Muda is to design and develop portable charging station with sports equipment. This project is to develop a prototype that comes with equipment like portable chargers. Develop new energy sources that transmitted the energy to the charger from body temperature and be absorbed by a device called Thermoelectric Generator. Design the sports apparel through product development methodology that is done according to the steps prescribed. The project is using the SolidWorks software to interpret the final design prototype in detail with proper measurement. The results of the through experiments done to enable a working prototype. Another result gets from the comparison of theoretical and experimental result for future work.

DEDICATION

I would like to dedicate this report to my supportive supervisor, En Zulkeflee bin Abdullah in appreciation for his diligently support and contribution to aid me complete this report. This report is also dedicated to my beloved family and friends whom so understanding and support me throughout the entire project.

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LIST ABBREVIATIONS, SYMBOLS AND NOMENCLATURES

TEG	-	Thermoelectric Generator
PDMS	-	Polydimethylsiloxane
Li+	-	Lition
nW	-	nano Watt
°C	-	Celcius
ZT	-	Efficiency of Exhaust
Bi ₂ Te ₃	-	Bismuth Telluride
PbTe	-	Lead Telluride
SiGe	-	silicon Germanium
ΔV	-	Voltage different
n	-	Number of thermocouples
S	-	seebeck Coefficient
ΔT	-	Temperature different
Q	-	Heat
P	-	Electrical power

CHAPTER 1

INTRODUCTION

In this chapter, background of this study is described according to the title and project preview. Problem statement of this project and the project report organization are described clearly.

1.1 Background

Portable charging station is a solid state devices that can be used in where ever location. It contains an electrical energy which used to recharge the energy on the electronic devices. Nowadays, the portable charger can be seen all over the place. Variety of pattern and power of energy contain at the portable charger. For today used it's called as "power bank". Usually this portable charger need to recharge first before used to the electronic devices. Its surely can made the human life more comfortable and easier. Sport is one the activity that will combine the physical and mental to perform it. From this two different field, new ideas was came out which to combine a portable charging station and sport to become new device or sport cloth which can create new source of energy .

The Thermoelectric generator (TEG) used for converting human body heat energy to electrical energy. The proposed TEG was composed of a polydimethylsiloxane (PDMS) substrate and thermocouples. The use of PDMS provides flexibility to the TEG and low thermal conductivity that helps minimize losses in the effective heat flowing through the thermocouples. The proposed TEG was fabricated by simple dispenser printing for thermoelectric materials. The fabricated TEG was attached to the human body and generated electrical power of 50 nW when the temperature difference between the human body and ambient air was 7 °C.(Jo, Kim, Kim, Kim, & Kim, 2012).

Sports apparel that contributes in this device is back support. The back support was frequently used for support an operator in field of manufacturing. It's been used widely to maintain body posture to make sure an operator not easily collapse or faint. The back support will integrate with TEG and other component to absorb the heat from human body and convert it to electric energy that can used for charging an electronic devices.

This project studies about design and development of portable charging station that convert heat from human body to become electric energy. It will show the capability of heat that can generate the new power source according the product requirement. Furthermore, prototyping and analysis of the FOS and safety of this product can be implemented into this project to define whereas it's possible to generate new product that surely opens the innovation field.

1.2 Problem Statement

The exiting problem that have been discovered for the nowadays other alternative of power source. The heat from human body commonly not make sense. The waste heat of human can be one of the sources of energy that can help human for their life. The existing energy such as solar, water, and wind is the common use for life. It's also has their own weakness. For example, solar energy need to energise when the sun

appear same as wind. The heat of human can be generate sort of energy such as electric energy. The limitation of it can be reduce if the human active in their life.

For example, solar energy that believe will have huge long term benefit to global, has been found having a problem in consistency and reliability. If there is no sun, there is simply no power. Solar panels designed to generate electricity and the maintenance of system would be prohibitively expensive. Due to reliability, cost and low efficiency, most people unable to use it.

To solve for searching the new source of energy this human heat can be harvest using the suitable devices and method.

1.3 Objective

The objectives for this project are:

- a) To design a sport apparel (armband) for portable charging station.
- b) To develop first idea/ concept of portable charging station.

1.4 Scope

In order to make sure the project that was carried out will be achieved the objectives stated, which is to design and development of portable charging station with sports apparel , thus the scope of the study was proposed to make sure that the project flow will be easy, regular and well organized.

This project focuses on invention of portable charging station including design product, circuit design, fabrication process, and experimental of product. Moreover it will focus based on product design development.

1.5 Project structure

This report is dividing into five major chapters which are known as introduction, literature review, methodology, and expected value.

a) Chapter 1: Introduction

This chapter explains about the background of the project, problem statement, objective and scope of project.

b) Chapter 2: Literature review

This chapter explains and prove any information which is related to the project is being studied and summarized it. By following from past studies, research and book, it will show a path and guide for the project in the future.

c) Chapter 3: Methodology

This chapter describes an overview of the research method, research flow or methodology and how to conduct the research methods. It also shows the procedures and work flow of this project in detail start from the beginning to the end for Psm 2.

d) Chapter 4: Result and Discussion

Result and discussion is presented in the comprehensive way in this chapter.

e) Chapter 5: Conclusion and Future work

Determine the objective of the project and the future work for improvement the project

CHAPTER 2

LITERATURE REVIEW

Literature review is a process reviewing written and published knowledge on a topic which is included in the research through books, journal, and thesis and other that resources that can be applied which is related to rehabilitation device. This chapter also includes fact about the kinematics of lower extremity and the actual gait cycle used for this project.

2.1 Portable Charger

The traditional method of charging lithium-ion batteries is to apply constant current and constant voltage. Constant current is applied at the beginning of a typical full-charge cycle when the battery voltage is low. When the battery voltage rises to a specified limit, the charger switches to constant voltage and continues in that mode until the charging current declines to nearly zero (Contreras, 1926). At that time, the battery is fully charged. During the constant-voltage phase, current drops exponentially due to the sum of battery resistance and any resistance in series with the battery (much like charging a capacitor through a resistor). Because current drops exponentially, a complete, full charge takes a long time.

In this method the limit for charging current need not be as accurate as the limit for charging voltage. However, the voltage limit is critical: Higher voltage enables the

battery to store more energy, but excessive voltage damages the battery. Thus, typical Li+ chargers impose the voltage limit with accuracies better than 1%.

Even when charging at a constant high current (higher than 1C, where C is the battery capacity in ampere- hours), the constant-current charging time is small compared to the overall charging time. Constant-voltage mode, determined mostly by the battery's physical characteristics, takes most of the charging time. Thus, increasing the charging current has little effect on the overall charge time.(Design, Circuit, & Description, 2001)

2.2 Sport Apparel

Recent research has indicated that the sport business industry has been capable of generating more than \$210 billion per year in the United States (Shank, 2009) .In response to the tremendous growth, sport companies have been focusing on consumers' patterns of sport apparel consumption(Sporting goods manufacturers association Recreation market report,2006) .However, little attention has been given to as to whether decision-making styles are unique to each gender in purchasing sport apparel, even though this could be of great interest to marketers.

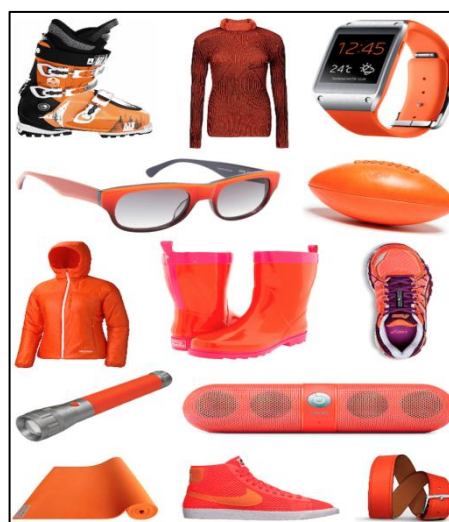


Figure 2.1: Type of Sport Apparel(Krzywinski S, 2002)