UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF HARDWARE IN ENERGY HARVESTING FROM BURNING PROCESS VIA IOT BASED SYSTEM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunication) with Honours.

by

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930414-08-6109

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY

2018

Universiti Teknikal Malaysia Melaka

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **DEVELOPMENT OF HARDWARE IN ENERGY HARVESTING FROM BURNING PROCESS VIA IoT BASED SYSTEM**

SESI PENGAJIAN: **2018/19 Semester 1**

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APPROVAL

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

…….

Mdm. Rahaini Binti Mohd Said

(Project Supervisor)

…….

Sir. Shamsul Fakhar Bin Abd Gani

(Project Co - Supervisor)

ABSTRAK

Pada masa kini, pembakaran terbuka, bencana seperti banjir dan gangguan elektrik menjadi agak biasa yang di kawasan luar bandar dengan kadar yang membimbangkan. Oleh itu satu projek dicadangkan untuk menangani masalah ini dan bertujuan untuk mewujudkan mekanisme pembakaran yang terkawal dan berkesan mengurangkan bahan berbahaya yang dikeluarkan dari pembakaran dan mencipta teknik penuaian baru menggunakan tenaga biomas seperti ranting, daun, kayu, kertas dan arang dan pada masa yang sama menuai tenaga dari tenaga haba yang dibebaskan. Selain itu, produk ini menjanjikan banyak dari segi aplikasinya di mana memenuhi keperluan komuniti semasa bencana terutamanya semasa gangguan banjir atau kuasa di mana elektrik adalah keperluan untuk kesejahteraan penduduk di seluruh dunia. Di samping itu bukan sahaja menyediakan bekalan elektrik semasa bencana, penemuan ini boleh digunakan untuk alat elektronik semasa aktiviti luar seperti berkhemah dengan menghapuskan untuk membawa bahan bakar gas sepanjang aktiviti luar. Produk ini boleh muncul sebagai kaedah baru untuk menuai tenaga kerana kos penjana termoelektrik modul yang digunakan dalam produk ini menghasilkan tenaga murah berbanding dengan kaedah penuaian sedia ada seperti panel solar, turbin air atau turbin stim. Projek ini juga akan mengumpulkan data yang berharga seperti suhu, asap, voltan, dan berat bahan buangan. Ini dimungkinkan dengan menggunakan modul WiFi ESP bersama Arduino Uno yang akan melaksanakan pemprosesan yang diperlukan untuk membolehkan operasi ini berlaku. Selepas memeriksa jenis bahan arang yang berbeza dipilih sebagai bahan terbaik untuk pelepasan kuasa. Untuk membuktikan analisis regresi kenyataan ini telah dijalankan dan garis regresi linear dihasilkan.

ABSTRACT

Nowadays, open burning, disasters such as floods and power outage tends to be a relatively common eye soring experience that is often practiced in rural area in an alarming rate. Therefore a project was proposed to counter this issue and aims to recreate a controlled burning mechanism which effectively reduce the harmful substances that is emitted from the burning and to recreate a new harvesting technique using biomass energy such as twigs, leaves, wood, paper and charcoal emitted from the burning and simultaneously harvest the energy from this heat energy that is released. In addition this product promises a lot in terms of its application whereby it serve the community need during disaster especially during flood or power outages whereby electricity is a necessity for well-being of population around the world. In addition not only providing electricity during disaster this invention can charge your electronic gadgets during outdoor activities such as camping and the plus point here is by eliminating to carry gas fuel along during outdoor activities In addition this product can be emerge as new method to harvest energy as the cost of the thermoelectric generator module used in this product to produce the energy is cheap than the existing harvesting method such as solar panel, water turbine or steam turbine. Furthermore, this project will also collect valuable data and information such as temperature, smoke, voltage, current and weight of the waste material. This is made possible by using a ESP WiFi module alongside Arduino Uno which will perform the processing that is necessary to allow this operation to occur. After examining different type of material charcoal was selected as the best material for power emission. In order to prove this statement regression analysis was conducted and linear regression line was produced.

DEDICATION

To my beloved parents,

Gurdir Singh and Ranjit kaur

All my lectures, especially Rahaini Binti Mohd Said and friends

ACKNOWLEDGEMENT

First and foremost, I would like to take this opportunity to express my appreciation to those who helped me to complete my project. I would like to thank my supervisor Rahaini Binti Mohd Said and co-supervisor Shamsul Fakhar Bin Abd Gani from Electronic and Computer Engineering Technology Department in UTeM for the significant guidance, patience and suggestion to make sure that my project achievable. I have gain a lot of information and knowledge from both of my lectures along this project.

Furthermore, I would like to thank my beloved parents for their motivation and financial support along this project. Lastly but not least, I would to like to thank my friends and everyone that had been supporting and helping me during the progress of my project.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

TEG	-	Thermoelectric Generator
μ-TEG	-	Micro Thermoelectric Generator
DC	-	Direct current
ANN	-	Artificial neural network
MPPT	-	Maximum power point tracking algorithm
PV	-	Photovoltaic
K	-	Kelvin
LCD	-	Liquid-crystal display
UPS	-	Uninterruptible power supplY
VR-BESS	-	Voltage Regulator- Battery Energy Storage System
PCM	-	Phase change material
HTTP	-	Hypertext Transfer Protocol
HTML	-	Hypertext Markup Language
PHP	-	Hypertext Preprocessor
GPIO	-	General Purpose Input Output
SSID	-	Service set identifier
IoT	-	Internet of Things
USB	-	Universal Serial Bus
I/O	-	Input/ Output
ICSP	-	In-circuit serial programming
EEPROM	-	Electrically erasable programmable read-only memory
SRAM	-	Static random-access memory
PWM	-	Pulse Width Modulation

SPI	-	Serial Peripheral Interface
LED	-	Light emitting diode
TTL	-	Time to live
MCU	-	Micro Controller Unit
TCP/IP	-	Transmission Control Protocol/Internet Protocol
PCB	-	Printed Circuit Board
GND	-	Ground
VCC	-	Power Supply
RX	-	Receive Data
TX	-	Transmit Data

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CHAPTER 1

INTRODUCTION

1.0 Background

Since from the past century, electricity becomes a necessary source of living needed by humans. Hence, energy plays a vital role at focal point of our lives and protecting us whereby it enhances wellbeing, encounters environmental change and generate income. About a large portion of the planet needs electricity during disaster or power outages whereby electricity is a necessity for well-being of population around the world. With a smart and innovate design, this product promises a lot, not only providing electricity during disaster this invention can charge your electronic gadgets during outdoor activities such as camping and the plus point here is by eliminating to carry gas fuel along during outdoor activities. In addition carrying gas fuel is a major problems especially during camping whereby it can spill and ruin your trip if you are not careful. Moreover, fuel can start adding up pretty expensive if you regularly go camping. Therefore, by using this product as long you have a biomass energy such as leaves, twigs, wood, paper and charcoal around you this product can provide you with a power source for phones, radio, light and more. There's a creating enthusiasm for greener, more secure practical power sources to battle the developing danger of an unnatural weather change and other ecological issues. Sun, wind, water, biomass, waves and tides, and the glow of the soil, all give different choices to non-practical power source

Next, this product also reserve power whereby this product come with a rechargeable battery whereby you can fully charge prior to leaving on your trip and it also help pretty good way during disaster's or other emergencies whereby it can sustain and provide electricity to the victims even without fire. In addition this product

can be emerge as new method to harvest energy as the cost of the module used in this product to produce the energy is cheap than the existing harvesting method such as solar panel or water turbine.

Therefore, the wasted heat energy that are released from the burning could be used again or recycled in other alternative form that is electrical energy form. This device has the capability to convert the DC voltage to AC voltage whereby it can be used for higher voltage appliances (AC voltage products) by only using the burning method in the form of wasted heat energy. By using this new harvesting method, it will be able to convert wasted heat energy into electricity, reduce smoke emission and improve the air quality in the output while simultaneously providing users with capability to use appliances that uses AC voltage. This project solves these problems by converting a fraction of the fire's thermal energy into electricity, enabling reductions in emissions and a corresponding improvement in health and living conditions.

This project comprises with three different application to monitor the system based on wireless technology which comprises data transmission from one point to another. Basically, the aim of this project is to collect data such AC voltage, AC current, DC voltage, DC current, Power and the temperature. Furthermore, a cloud or server will created to store all the data via three different ways of Internet of Things (IOT) which are Android app, Wi-Fi hotspot using ESP module and software pc base interface (GUI). Essentially, a circuit board will be created using Arduino, ESP module, relay, temperature sensor and all the required sensors for this project. Moreover, a weight sensor is added which will convert a load or force acting on it into an electronic signal. This electronic signal can be a voltage change, current change or frequency change depending on the type of load cell and circuitry used because different weight have different reading of data.

1.1 Problem Statement

Essentially, there are many existing method for harvesting energy such as solar panel and water turbine but due to its cost it has been a vital problem to all whereby it

is costly to implement the method. Hence, it is necessary and inevitable to combat this ever growing problem of harvesting energy existing method and come up with a proper solution in terms of its cost of implementation for the well-being of our civilization in the 21st century. Thusly, a venture was proposed to recreate a new harvesting technique using biomass source such as twigs, leaves, wood, paper and charcoal emitted from the burning and simultaneously harvest the energy from this heat energy that is released. In addition this product promises a lot in terms of its application whereby it serve the community need during disaster especially during flood as shown in figure 1.1.1 and 1.1.2 or power outages whereby electricity is a necessity for well-being of population around the world. Around the globe, 1.3 billion individuals need access to power. In excess of 600 million are in sub-Saharan Africa, and in excess of 300 million are in India alone. Hence, giving electric energy to these unserved publics will cause a huge bounce sought after in the coming decades. India has guaranteed to put an accentuation on sustainable wellsprings of vitality; there are programs in Africa to make "small scale grids" utilizing renewables. In any case, as power producing limit unavoidably develops ever bigger, India and alternate nations of the creating scene won't have the capacity to dodge the expanded utilization of non-renewable energy sources particularly coal. Figure 1.1.3 shows, country which don't have access to electricity whereby India marks as the largest population that does not have access to electricity. Besides that, figure 1.1.4 demonstrates the percentage of people in Africa do not have access to electricity especially in rural areas. Below are some figures which shows the disaster strikes to countries such as India and Africa when populations does not have access to electricity. As a result of absence of access to power and present day vitality sources, individuals around the globe, particularly in provincial groups, battle to break out of the cycle of destitution. Reliable energy get to engages impressive financial advantages, empowering shops and organizations to remain open longer, giving groups access to better medicinal services, and giving youngsters household lighting for after-school study time. Hence this product will be a great use for them whenever the electricity is not available in those 3rd world countries. This can ideally be used as an inverter to regenerate back the power for a temporary period of time.