SOLAR CHARGING SYSTEM FOR BLUETOOTH SOLAR GRASS TRIMMER

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BLUETOOTH SOLAR GRASS TRIMMER

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STATEMENT OF AWARD FOR DEGREE

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SUPERVISOR'S DECLARATION

We hereby declare that we have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of degree of Bachelor of Engineering Technology in Energy & Environmental.

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Date: 10 JANUARY 2019

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries in which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

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ABSTRACT

Bluetooth Solar Grass Trimmer is a trimmer machine which can be controlled via RC Bluetooth through the smartphones and powered by the solar charging system. It provides a full command to control the moving direction of the trimmer that makes it easy to send start, stop and park commands. Additionally, a systematic photovoltaic (PV) solar system was built in together with the trimmer as the source of electricity to charge the batteries. The fabricating of Bluetooth Solar Grass Trimmer machine is primarily to reduce the electricity consumption and human workforce. Generally, energy storage that used in photovoltaic system application is lead acid battery and knowledge in battery state of charge (SOC) is important in effecting control and energy management. The objective in this project is to install the stand-alone of photovoltaic system as the battery charging system and estimating the battery state of charge based on the voltage value with variation on solar radiation. However, it is difficult to estimate the charging voltage with the variation in solar radiation and operating time of the trimmer as well as battery voltage state when a system of solar charging batteries was added. Therefore, the analysis was conduct and validate by using two estimation methods. The first method used is to determine the battery charging and discharging voltage at constant average solar radiation for 1 hour operating time. Then, the second method used to determine the battery state of charge (SOC) is by calculating the initial and final battery voltage by using interpolation method. The highest charging voltage obtained of the battery by using 30Watt solar module with no load condition was 12.23V, while the highest charging battery voltage with load connection was 11.66V respectively.

ABSTRAK

Pemotong rumput bluetooth berkuasa solar adalah mesin mudah alih yang boleh dikawal melalui RC Bluetooth menerusi telefon pintar dan dikuasakan oleh sistem pengecasan solar. Pergerakkan mesin tersebut boleh dikawal dan menjadikannya mudah untuk berhenti dan bergerak. Di samping itu, sistem solar telah digabungkan sebagai sumber elektrik untuk mengecas bateri. Tujuan utama mesin ini dihasilkan untuk mengurangkan penggunaan elektrik dan tenaga manusia. Secara umumnya, battery asid plumbum adalah komponen utama yang digunakan untuk menyimpan tenaga yang diperolah dari tenaga solar serta pengetahuan dalam keadaan sesebuah bateri amat penting untuk mengawal dan mengurus tenaga yang dihasilkan. Objektif projek ini adalah untuk memasang sistem fotovoltaik sebagai sistem pengecasan bateri dan menganggarkan keadaan bateri caj berdasarkan nilai voltan dan variasi radiasi yang diperoleh daripada matahari. Walau bagaimanapun, nilai voltan agak sukar untuk dianggarkan kerana kadar variasi daripada sinaran suria tidak tetap dan dipengaruhi oleh masa operasi serta keadaan voltan bateri apabila sistem bateri pengecasan solar telah ditambah. Oleh itu, analisis itu dilakukan dan mengesahkan dengan menggunakan dua kaedah anggaran. Kaedah pertama yang digunakan adalah menentukan pengisian dan pemangkasan voltan bateri pada sinaran suria purata tetap untuk masa operasi 1 jam. Kemudian, kaedah kedua yang digunakan untuk menentukan keadaan bateri caj adalah dengan mengira voltan bateri awal dan akhir dengan menggunakan kaedah interpolasi. Berdasarkan keputusan yang diperoleh, voltan pengecasan tertinggi yang diperolehi daripada bateri dengan menggunakan modul solar 30Watt tanpa syarat beban ialah 12.23V, manakala voltan bateri tertinggi dengan sambungan beban ialah 11.66V.

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LIST OF SYMBOLS

W	Watt
kW	Kilowatt
J	Joule
Cm	Centimeter
M	Meter
V	Voltage
A	Ampere
C	Coulomb
Min	Minute
%	Percentage

LIST OF ABBREVIATION

PV	Photovoltaic
AC	Alternating current
DC	Direct Current
PWM	Pulse Width Modulation
AH	Ampere-Hour
VE-30-36P	Venus Solar Panel
RC	Remote Control
RF	Radio Frequency
EDR	Enhanced Data Rated
SOC	State Of Charge
AGM	Absorbent Glass Mat
SLA	Sealed Lead Acid
kWh	Kilo Watt Hour
kHz	Kilohertz
GHz	Gigahertz
Mbps	Megabits Per Second

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF PROJECT

In the time where technology is merging with environmental awareness, consumers are looking for ways to contribute to the environment by using devices with eco-friendly technology in order to decrease the pollution and protect the nature. Pollution is manmade and might be seen in our own daily lives, a lot of specifically in our own homes. Traditional grass cutter machine are one of devices that contribute to the pollution especially air pollution as it require fuel for combustion. To relate this isues, this grasss trimmer is an alternative devices which provides the potential for automation that could facilitate massive process improvements and productivity.

As to move towards industrial revolution 4.0, all kind of transportation devices or tools are going under autonomous system (Davis, 2018). The design objective is to build a grass trimmer with portable, durable, easy to operate and maintain. It also aims to design self-powered trimmers with use of renewable energy which is solar energy as power source. The trimmer can be control by smartphones via Bluetooth through Arduino RC controller application. The use of cable tie as the cutting blade such a way to achieve efficient trimming pattern where it requires less torque power for the motor to spin the blade. Also, this grass trimmer can reduce the manpower as it only required a person to control it through smartphones.

In addition, the body design compartment of the Bluetooth Solar Grass Trimmer is fabricate by considering on a few main factor in which to achieve a more efficient in moving, less noisy and suitable to enter in small industries that consist of less scale area such as home area, garden and playground. As the sources of electricity, the main components that includes in solar charging system are 12-volt battery, PWM solar charge controller and 30Watt solar panel. The use of solar energy for battery charging system is primarily to reduce the cost, reduces pollution and achieved towards green technology.

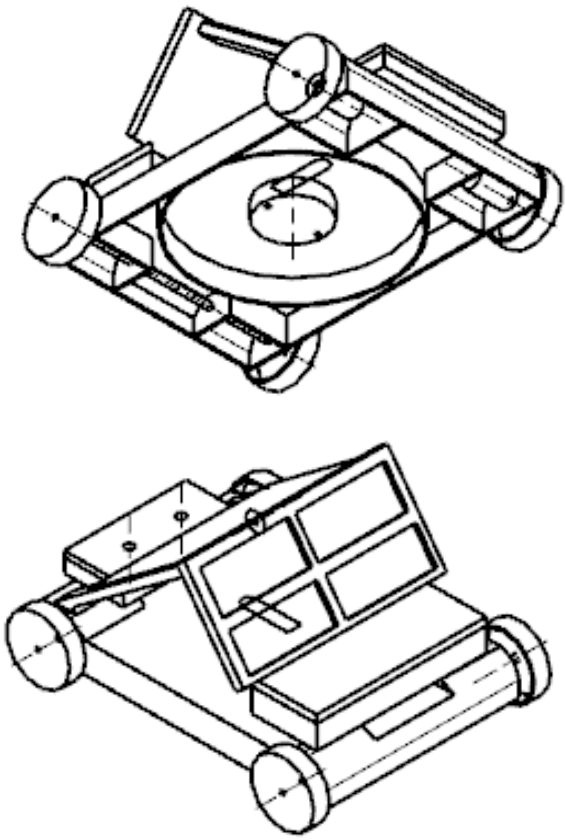

Figure 1.1: Body design of Bluetooth Solar Grass Trimmer

1.2 PROBLEM STATEMENT

In the time where technology is merging with environmental awareness, consumers are looking for ways to contribute for reducing the cause of pollution. By switching towards green technology, the implementation of Bluetooth solar grass trimmer as grass cutting tools is more environmental friendly compared to old grass cutting devices which use fuel for internal combustion of engine. In addition, the present technology that commonly used in industry which is traditional grass cutting machines is inconvenience due to heavy body compartment and required manpower to handle.

Bluetooth Solar Grass Trimmer is a sufficient machine as the power can be produces from solar energy. The addition of solar charging system as the energy sources from photovoltaic module is a systematic ways to reduce energy consumption. However, there are a few important parameters that must be measure based on the requirement of solar PV system. It was difficult to estimate the amount of charging voltage by considering the variation in solar radiation as well as the battery voltage state. In addition, the combination of the system for the battery charging by using solar panel and the operating time of the devices during running is also varies which depending on the solar radiation and the load consumption.

Therefore, in response to this problem, the analysis was conduct and validate by using two estimation methods which are estimation of battery state of charge (SOC) and analyzing the battery charging voltage at constant average solar radiation.

1.3 PROJECT OBJECTIVES

The objectives of the project are as follows:

i. To fabricate a bluetooth solar grass trimmer that easy to handle.
ii. To program a bluetooth solar grass trimmer which can driven by the motor driver and be able to communicate with the Bluetooth HC-05.
iii. To power the bluetooth solar grass trimmer with the solar panel system.

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