

SOLAR BICYCLE

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## **ABSTRACT**

There are many types of bicycle in the world such as normal bicycle that people need to paddle for it to move, motorized bicycle that uses fuel as its prime power and electric bicycle that can only be sufficient for an hour. Because of some weaknesses in the existence system, the idea of a solar bicycle came in mind. The idea is to make the bicycle last longer and can be automatically recharge when the bicycle is not in use by the renewable solar energy. The concept of the solar energy is that a high torque motor will be put on the bicycle which will be generated by the solar energy. The solar energy will be absorbed by the portable solar panel to generate the power. The power that had been absorbed by the panel can be used directly by the motor if the power matches the power requirement. If not, the motor will use the power from a battery. When the bicycle was not in use during the day, the solar panel will charge the battery. The system will make bicycle operate more efficiently.

## ABSTRAK

Terdapat banyak jenis basikal di dunia seperti basikal biasa yang memerlukan seseorang untuk mengayuh basikal itu bg menggerakkan basikal tersebut, basikal bermotor yang menggunakan bahan bakar sebagai sumber tenaga dan basikal elektrik yang hanya boleh bertahan cukup untuk satu jam. Kerana beberapa kelemahan dalam sistem yang sedia ada, idea basikal suria muncul dalam fikiran. Ideanya adalah untuk membuat basikal bertahan lebih lama dan boleh mengisi semula secara automatik ketika basikal adalah tidak digunakan oleh tenaga suria. Konsep tenaga ini adalah motor yang mempunyai daya yang tinggi akan ditempatkan di basikal yang akan memperoleh kuasa dari tenaga matahari. Tenaga matahari akan diserap oleh panel suria mudah alih untuk menghasilkan kuasa elektrik. Kekuatan yang telah diserap oleh panel yang boleh digunakan secara langsung oleh motor jika kuasa sesuai dengan keperluan kuasa. Jika tidak, motor akan menggunakan kuasa dari bateri. Ketika basikal itu tidak digunakan pada siang hari, panel suria akan mengisi bateri. Sistem akan membuat basikal beroperasi secara lebih efisien.

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Chapter Overview**

This chapter will discuss about the main idea of this project and to get a larger picture on what is the problem in the current technologies, what that I want to achieve in this project and the area that will cover on this project. This chapter is divided into some categories that are project background to describe the reasons to do this project, problem statement to inform about the problem or weakness of the existing technology, objective to make sure what actually this project must achieve and scope of this project to specify what will be used in this project.

## **1.2 Background**

There will be a big area at the UMP campus Kuala Pahang when it is fully built and operates. So students need a vehicle to move from one side to another. In state of using car or motorcycle that are costly, student will be prefer to used bicycle as their vehicle. There several types of bicycle that can be chosen such as paddle bicycle, motorized bicycle and electric bicycle. But there are some weaknesses about that type of bicycle. To overcome the weakness this project will develop a better bicycle.

Because of Malaysia is located in the equator area, this project will make used the energy of the sun that rarely used in Malaysia to generate the bicycle.

## **1.3 Problem Statement**

As what had been mention earlier, there are several types of bicycle that can be categories that is paddle bicycle, motorized bicycle, and electric bicycle. The weakness of the bicycle make people do not like to used bicycle.

First, paddle bicycle need a lot of energy to paddle the bicycle. The user will surely be tired after used the bicycle. This will not suitable for student to use to go to the class because they will be tired when they are in the class and will lost their concentration while hearing the lecture.

Next, motorize bicycle that used fuel as it prime mover. The bicycle use fuel that is costly. As a student, their allowance is limited and only can be used for their study material and for their food to survive at the campus. Besides that, motorize bicycle will make pollution that can be very bad for our environment especially in this period that global warming happen to the earth.



Lastly, electric bicycle that generate by battery can be only be sufficient for about an hour. The user needs to find power supply to recharge the battery or else they need to paddle the bicycle that used more energy compare to the normal bicycle because of the weight.

#### **1.4 Objective**

To overcome the problem and the weakness, this project need to do some research and studying to develop better technology. To make it success there are several thing that we need to know such as what will be the prime mover, how to stored it and the advantages of this new vehicle. In that case, these are the list of the objective to be conduct before continue to proceed on this project:

- To develop a vehicle that use renewable energy, environmentally friendly and cheap.
- To develop an electrical bicycle that can charge the battery when it is not in used.
- To develop low speed bicycle, but for a longer distance.

## **1.5 Scope of the project**

This project is consists of two part that is hardware and software. The hardware will be the bicycle and the software is the program of the controller to control the operation of the bicycle. To be more specific about this project, there will be using several things that are:

- Use solar energy to recharge the battery.
- Use PIC Microcontroller for charging system.
- Use high torque motor to drive the bicycle.

## **CHAPTER 2**

### **LITERATURE REVIEW AND THEORY**

#### **2.1 Chapter Overview**

In order to perform this project, literature review has been made from various sources like journal, books, article and others. This chapter includes all important studies which have been done previously by other research work. It is importance to do the literature review before doing the project because we can implement if there are information that related to this project.

The most important thing before starting the project we must clearly understand about the topic that we want to do. So by doing the literature review we can gain knowledge to make sure we fully understand and can complete the project.

A review of the article was performed to identify studies that relevant to the topic. The search to find material that related to the topic is categories as solar panel, solar charger, battery, motor, electric bicycle and speed control.

## 2.2 Literature review

### 2.2.1 Solar panel

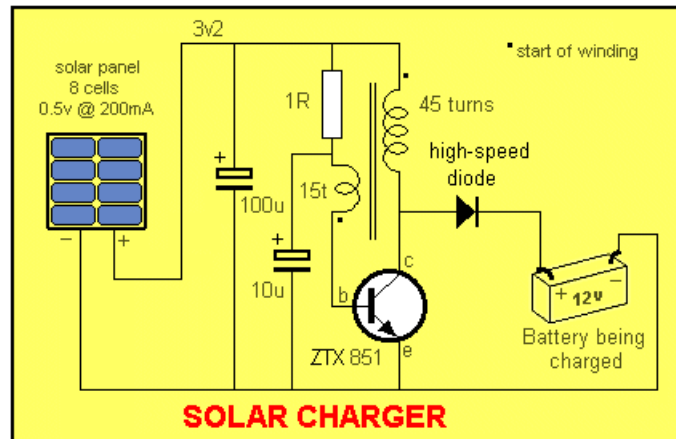


**Figure 2.1:** solar panel

A photovoltaic module or photovoltaic panel is a packaged interconnected assembly of photovoltaic cells, also known as solar cells. The photovoltaic module, known more commonly as the solar panel, is then used as a component in a larger photovoltaic system to offer electricity for commercial and residential applications [20].

The primary difficulty with solar power and indeed with its cousin wind power has been one of efficiency. There is more than enough energy hitting the earth in the form of solar radiation to meet power needs of our species. Estimates indicate that there is four times as much wind energy available for our use as the species uses every year. Solar power is even more dramatic, the sun showers the planet with more energy every day than we use in a year. So the difficulty has never been the availability of sun and wind, they are readily available [21].

### 2.2.2 Solar charger



**Figure 2.2:** Circuit diagram for solar charger.

Solar battery chargers are an inexpensive, environmentally friendly, and convenient way to make sure your batteries are always fully charged and ready to go all the time. The problem with charging a battery from a solar panel is the SUN. It does not shine all the time and clouds get in the way. Our eyes adjust to the variations in the strength of the sun but a solar panel behaves differently. As soon as the sun loses its intensity, the output from a solar panel drops enormously. Not only does the output current fall, but the output voltage also decreases. Many of the solar panels drop to below the 13.6v needed to charge a 12v battery and as soon as this occurs, the charging current drops to ZERO. This means they become useless as soon as the brightness of the sun goes away [16].

### 2.2.3 Battery

Given the current market, lead-acid is the only viable battery technology for electric vehicle conversion. The following is a list of criteria to use in selecting an electric vehicle battery [4][19]:

1, **Voltage.** Batteries are available in both 6V and 12V units. Most standard, wet-cell, golf cart batteries are 6V units. Most sealed batteries are 12V units.

2. **Amp-hour rating.** The capacity of a battery is rated in amp-hours. This rating must be specified with a given discharge rate.

3. **Discharge rate.** The discharge rate of a battery is the minimum length of time during which the battery must be discharged in order to meet the specified amp-hour rating.

4, **Watt-hour rating.** The watt-hour rating is a true indication of the energy capacity of a battery, Like the amp-hour rating, this rating must be specified with a discharge rate. The watt-hour rating of a battery is the amp-hour rating multiplied by the specified voltage of the battery.

5. **Energy density.** Energy density is the energy capacity of the battery, in watthours, divided by the weight of the battery, in kilograms. This is a critical factor in selecting an electric vehicle battery-the amount of energy a battery carries per unit weight.

6. **Cycle-life.** Cycle-life is the number of times a battery can be fully discharged before replacement. However, in most real applications, a lead-acid battery will exceed its specified cycle-life, since the battery will not be fully discharged every time it is used

### 2.2.4 Motor

The main characteristic of Brushless DC Machines is that they may be controlled to give wide constant power speed ranges because the Motor Voltage may be held constant at Maximum Bus Voltage over the Constant Power Range. In this condition the machine exhibits a leading power factor and with suitable control leads to low switching losses in the Inverter when in the High Speed Region-The Machine has the lowest size and weight of any of the main contenders. The disadvantage is the need for Permanent Magnets with Unity Recoil Permeability and Suitable Containment Sleeve Technology both of which have now been solved effectively. In this type of machine the main losses are in the Stator Iron and a number of factors are important in reducing this [22].

### 2.2.5 Electric bicycle



**Figure 2.3:** Electric bicycle

The basic configuration of an electric bicycle drive consists of a controller that controls the power flow from the battery to the electric motor. This power flow acts in parallel with the power delivered by the rider via the pedal of the bike. The rider of an E-bike can choose to rely on the motor completely, pedal and use the motor at the same time or pedal only (use as a conventional bicycle).

### **2.2.6 Speed control**

As considering on the measurement results from the system, the noise effect of PWM control method, and the characteristics of the dc motor, it is expected that we could control the speed of the dc motor stably and highly efficiently [1]. In ordinary times the dc motor is driven by change of a transmission in this system and as the speed of it decreases due to the overload, the load induction unit works automatically to accelerate it with the maximum efficiency of the system. The speed of the dc motor, therefore, can be regulated.