RENEWABLE ENERGY POWERED AND MONITORING FOR URBANKIT SYSTEM

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Renewable Energy Powered and Monitoring for Urban kit System

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A report submitted in partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering (Industrial Power)

Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2016

I declare that this report entitle “Renewable Energy Powered and Monitoring for Urban kit System” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : …….

Name : MOHAMAD FIRDAUS BIN ABU

Date : ……..

To my beloved mother and father

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ABSTRACT

Nowadays, the increased concern on energy and development of renewable energy source is becoming more and more attractive issues. Renewable energy is a green technology for generating electricity for supplying in the systems. In previous decades, solar and wind power generation have been increased. Both of the energy flow and operation of solar energy and wind energy are capable to create a stand-alone system. Renewable energy as solar and wind has a big potential in contributing to generate electricity. Therefore, the project is conduct to solve the problem that involve in the Urbankit system that need supply electricity from the grid that may cause increasing electricity bill for the consumers. Then, for the use of renewable energy to powered the Urbankit system is to increase reliance of renewable energy in community and also want to increase the awareness of decreasing the greenhouse effect in environment and also for monitoring the efficiency of renewable energy that generate by wind and solar panels. For the main objective of this project is about to study and also design the hybrid renewable energy system using wind turbine and flexible solar panels. Then, the system also capable to monitor the voltage generate by the hybrid renewable energy system to the Urbankit. The Urbankit system also is able to control the level of irradiance supply to the Urbankit hydroponics plant. After that, the method that use to design the system is using manual calculation that studied from the book of designing standalone system and the alternative way is using standalone solar Online calculator. Other than that, the upgrading the Urbankit system is use creativity and own skills. For the significant outcome, the system will able to operate it self that using standalone system and also capable to control the irradiance level apply on the Urbankit plant. At the last of the project is need to testing the system, the testing that need to taking is about the performance of the standalone system supply to the Urbankit, the testing about the performance of the wind turbines and also the level of irradiance supply to the Urbankit plants. The overall studies are about full model of Urban Kit that powered by a standalone system with solar and wind turbine. The recorded result of this system is based on the value of the voltage from the solar and wind turbine.

ABSTRAK

Padamasakini, kebimbanganpeningkatanpadatenagadanpembangunansumbertenagabolehdiperbaharuimenjadiisu.lebihdanlebihmenarikTenagabolehdiperbaharuiadalahteknologihijauuntukmenjanaelektrikuntukmembekalkandalamsistem. Dalamdekad yang lalu, penjanaankuasa solar dananginтelahmeningkat.Kedua-duaalirantenagadanoperasitenaga solar dantenagaanginmampuuntukmewujudkansatusistem yang berdirisendiri.Tenagabolehdiperbaharuiseperti solar dananginmempunyaipotensibesardalammenyumbanguntukmenjanaelektrik.Olehitu, projekiniadalahmenjalankanuntukmenyelesaikanmasalah yang melibatkandalamsistemUrbankit yang memerlukanbekalanelektrikdari grid yang bolehmenyebabkanpeningkatanbilelektrikkepadapengguna.Kemudian, untukpenggunaantenagabolehdiperbaharuiuntukdikuasakansistemUrbankitiniadalahuntukmeningkatkanpergantungantenagabolehdiperbaharuidalammasyarakatdanjugamahumeningkatkankesedaranmengurangkankesanrumahhijaudalamalamsekitardanjugauntukmemantaukecekapantenagabolehdiperbaharui yang menjanadenganangindan panel solar.Untukobjektifutamaprojekinijugaakanmengkajidanmerekabentuksistemtenagabolehdiperbaharuihibrid yang menggunakanturbinanginfleksibeldan panel solar. Kemudian, sisteminijugamampuuntukmemantauvoltan yang dijanaolehsistemtenagabolehdiperbaharuihibridkepadaUrbankit.SistemUrbankitjugadapatmengawaltahapsinaranUrbankitbekalanhidroponikkepadatumbuhan.Selepasitu, kaedah yang digunakanuntukmerekabentuksistem yang menggunakanpengiraan manual yang dikajidarikitabmerekabentuksistem yang berdirisendiridancaraalternatifmenggunakankalkulator solar berdiri Online. Selaindaripadaitu, sisteminimeningkatkanUrbankitkreativitikegunaansendiridankemahiran.Untukhasil yang ketara, sistemakandapatmengendalikannyasendiri yang menggunakansistem yang berdirisendiridanjugamampuuntukmengawaltahapsinaranUrbankitmemohonpadatumbuhan. Padaakhirprojekiniadalahkeperluanuntukmengujisistem, ujian yang perlumengambilkira-kiraprestasibekalansistem yang berdirisendirikepadaUrbankit, thetestingmengenaiprestasiturbinangindanjugatahapbekalansinarankepadatumbuhanUrbank

it.Kajiankeseluruhanpenuhtentangitu model Urban Kit dikuasakanolehsistem yang berdiri sendiri dengan solar dan angin turbin. Hasilnya direkodkan sistem ini adalah berdasarkan kepada nilai voltan dari solar dan angin turbin.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

1.1.1 The Urban Kit System That to Upgrading

Nowadays, agriculture technology is has various type and method. To plant a tree or vegetable without using any of soil it called hydroponic. Hydroponic is a method of planting only use water, mineral, and nutrient solution that dissolve entire nutrient it in the water. The previous technology is using Urban Kit system for planting. The Urban Kit system is a technology that can plant a vegetable in an area which is very limited and small placement like terraced houses, link houses, condominium, apartment, flat and etc. Besides that, the basic operation of the Urban Kit is use the water from the aquarium tank to watering the hydroponic plant. The water is always circulated and flow to the aquarium. This system is use the power from the grid to power up the system. For this Urban Kit, the plant also needs to place under the sun to give irradiance supply to the plant. So that, the new idea about the Urban Kit system is use standalone system to power up system and also capable to applied indoor for planting. The basic idea to support standalone system is using flexible solar panel and wind turbine. Then, the growth light will be used in the indoor system to replacement to the sun. Therefore, to upgrading the Urbankit system that support by the standalone system is need to consider factor of environment and all the equipment need to be use in the system. The factors that need to be consider is explain below.

Figure 1.1: The Urban Kit System

Wind power can be produce from air moving from breeze. From the air moving, it can rotate wind turbine by the air moving through the wind turbine blade. During the sun heats the land, air above also warms and rises up. Cold air then replaces the rising air. This creates the winds that we feel most days. Air tends to warm at a faster rate over land because the land retains its heat. Then, over the sea the air warms more slowly as heated by the sun and slowly cooled by the cold water. This phenomenon is called breeze that always happen near to the sea. The breeze can happen during night and day that called sea breeze and land breeze.

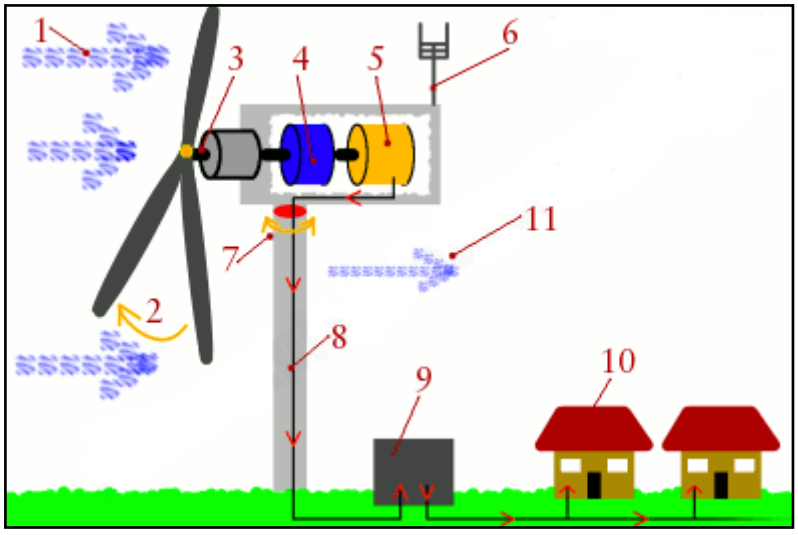

Figure 1.2: Wind Turbine Concept

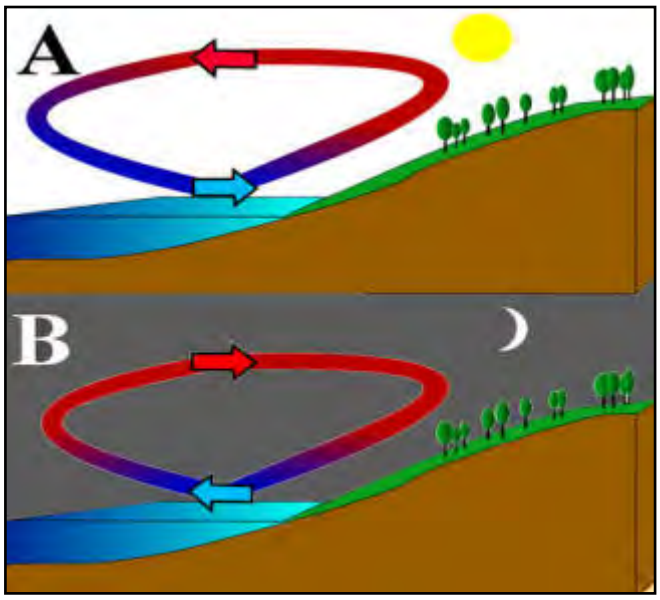

Figure 1.3: Breeze Concept

Malaysia is a country that placed near by the sea, so it has been a good potential to build wind turbine power station around the Malaysia. From the observation about the condition of Malaysia that has enough wind to rotate the wind turbine. Others option can be taken to build wind turbine is wind turbine can be built at sea because don not have enough space on land. Today, many of researchers from the entire world try to find any alternative energy which is safe, friendly, renewal and useful in our daily life. So that wind energy is a one of the best decision to use in Malaysia among the others renewable energy after solar energy. Besides that, wind is a one of the alternative energy to generate electricity if it use in genius method and creatively to create a lot of energy from the wind to support human being. The wind turbine can be built by the own. With the basic skill about the mechanical function of the wind turbine and some knowledge about to store electricity, people can build their own wind turbine that can place it at home.

Nowadays, solar is a one of the source that can be converts the sun light to electricity using solar panels. Solar panel is devices that convert sun light into electricity by through some process in a solar panel. The basic operation of solar panel is like operation of diode that only operates when electron from p-silicon moves to n-silicon hole. The movement of the electron cause the electricity flow from positive terminal to negative terminal and electron flow from negative terminal to positive terminal. A solar panel is a collection of solar cells. Many of small solar cells spread over a larger area can work together to provide

enough power to be useful. The more intensity of light that hits a cell, the more electricity is produces. Solar panel refers to a panel build to absorb the sun's ray as a source of energy generating electricity. A photovoltaic module is a packaged, connected assembly of typically 6x10 solar cells. Then, solar photovoltaic panels contribute solar array of photovoltaic system.

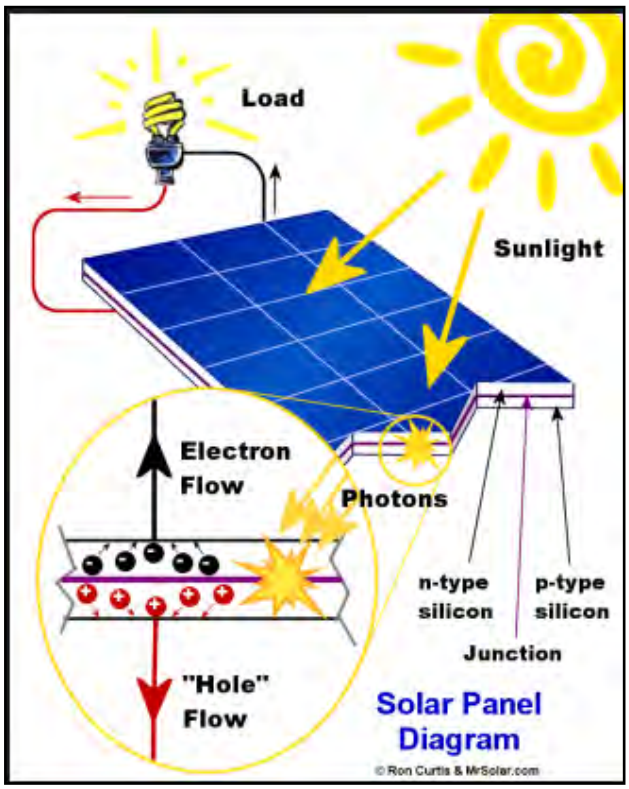

Figure 1.4: Solar panel operation

A photovoltaic module is able to produce electricity from the frequency of light. The other concept is separate the light into deference wavelength range and light emission on the different cell.

So at the end of the process the solar panel will generate energy from the sun light energy and convert to electric energy. Then, the energy is able to store in battery, the process need solar charge controller to store energy generate from solar panel before store it into battery.

Flexible solar panels are lightweight and versatile. It is particularly useful if need a portable solution. Flexible, able to roll and folding/fordable solar panel use amorphous

technologies. Besides that, with no glass they are less fragile and lighter than rigid, frame panels, and perform well under low light condition.

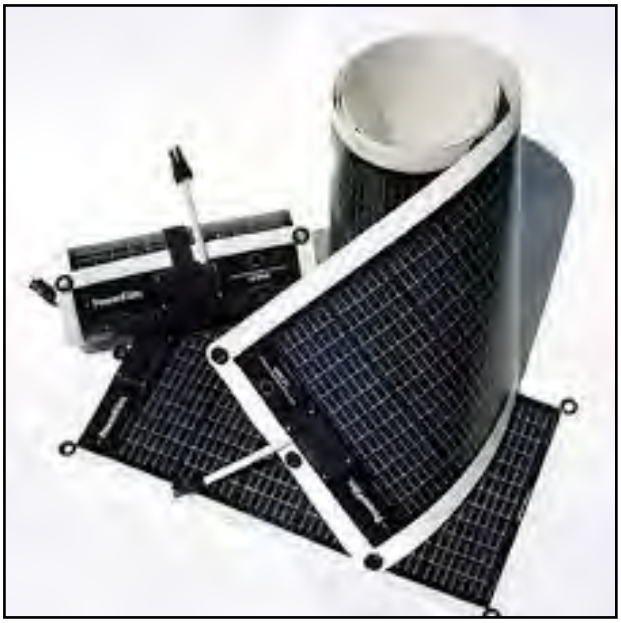

Figure 1.5: Flexible solar panel

Solar panel is only generating power from conversion of sun light beam to electricity, but solar panel cannot store the power from the solar panel. So, to store the power battery is needed for the storage. But, from the solar panel it cannot direct connect to the battery because the solar panel will be a load for the battery. The solution to store the energy is via solar charger controller. Solar charge controller also knows as charge regulator. Therefore, the charger controller is basically a voltage and current regulator to keep battery from over charging and discharging to the solar panels. Basically the solar charger controller is operating to regulate voltage and current generate from solar panel to the battery. So, without using solar charge controller will cause damage to the battery. Besides that, battery also need round 14V until 14.5 V to fully charge.

Figure 1.6: One type of solar charger controller

Basically, the charged controller is no needing for the small system with only supplies little power from the solar panels to the system, such as 1 Watt to 5 Watt panels.

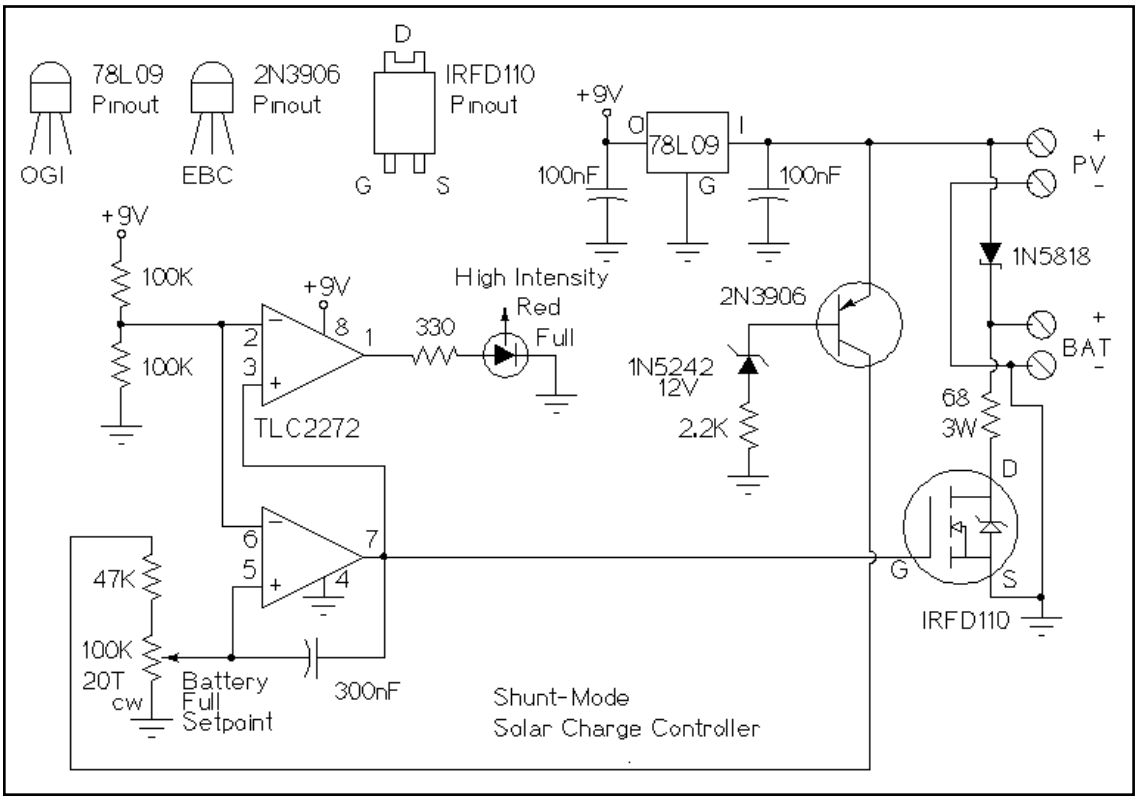

Figure 1.7: Basic operation circuit.

Therefore, the by refer the manual of the charger controller the function is for overload protection, short circuit protection, reverse discharging protection, reverse

polarity protection, protection from lighting strike, under voltage protection and overcharging protection. Then, the solar charger controller has LED indicator. The LED indicator is to indicate the charging status of the battery. The lighting is shown in charging mode and when LED turn off means the charging is stopped.

LED disk light is Light Emitting Diode that is a simple semiconductor that blocks electrical current from flow. The LED only allows electrical current flow in one direction. Besides that, strip light is used in accent lighting, backlighting, task lighting, decorative lighting and etc. LED disk light is designed for indoor and outdoor condition and also to build with waterproof condition. Then, strip light also in flexible condition that able be used with any condition of the place. Most of the strip light use in computer lighting, costume lights, toy, work lighting, display ambient lighting, alcove lighting and etc.

Figure 1.8: LED disk light

Inverter is needed to convert the DC power supply to AC Power. This is because the not all equipment uses DC supply and also not all equipment use AC supply to power up the equipment. So, the power inverter is important for standalone system. Most of the power inverter use power electronic equipment to convert the type of supply from AC to DC or to AC to DC. In the inverter, the important component that use for convert DC to AC is MOSFET, IGBT and etc. the main function for the components is for switching process in high speed to simulate the AC wave form.

Figure 1.9: DC to AC inverter

So, all the equipment and all basic information is state in the description above is need to be use and consider to make sure the system is able to operate properly and the system running at the best conditions.

1.2 Problem Statement

The standalone hybrid system is built to support the Urban Kit**.** The best solution is using flexible solar panel and wind turbine as the renewable or green energy supply sources. This is because the available Urban Kit system used the supply from grid that sometime lack of accessibility especially in rural areas. Besides that, the monitoring for the standalone system also needs to make sure the system in optimize condition.

In action to choose the type of renewable energy that is suitable to be used for this project. The wind energy can be used to generate electricity that has good potential for keep the environment clean during energy is generate. In action to realize the green environment, wind energy is a way to help reduce the greenhouse gas compare then other sources of electricity such as hydro, coal, gas plants, and other renewable energy that can be used to produce electricity.

The purpose of this project is about development a standalone system that use wind turbine consist of DC motor as a generator of the wind turbine and use flexible solar panel as the main electricity supply. This project has been developer because the wind energy has a high potential and the small wind energy and solar panel require the detail