Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF USB SOLAR TECHNOLOGY BASED SMART HOME GARDENING USING ARDUINO SYSTEM

THIAGU A/L DEWARAS

Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

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A project report submitted

in partial fulfillment of the requirements for the degree of

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Tajuk Projek: Development Of USB Solar Technology Based Smart Home Gardening Using Arduino System.

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I declare that this project report entitled “Development Of USB Solar Technology Based Smart Home Gardening Using Arduino System” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in the candidature of any other degree.

Signature : 

Student Name : THIAGU A/L DEWARAS

Date : 11/1/2022

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours.

Signature : 

Supervisor Name : Dr.Adam Wong Yoon Khang

Date : 1/3/2022

Signature :

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DEDICATION

Thanks to my family and friends for the moral support.

ABSTRACT

In the current era, renewable energy sources such as solar energy will be the most important energy in future. Solar PV technology will be the major renewable source. Besides that, in modern world, Universal Serial Bus (USB) technology is widely used to charge our devices and connect our devices to another device. Direct solar PV supply will cause unstable supply to a system. Therefore, a simple USB hub device using solar PWM controller will be the aim of the project. Besides that, people who have an interest in gardening are always busy with their daily life will abandon the basic care on the plant so by implementing the IoT technology a smart home gardening system which able to monitor the growth of plants will be developed. Besides that, an android application will be designed so that users can observe the parameters of the plant anytime and anywhere. There are three main aspects of methodology which are the hardware, software, and flow process. For hardware, this system will use an Arduino UNO Wi-Fi as a microcontroller to control the input and output of the system. The soil moisture sensor, ultrasonic sensor, and voltage are the inputs while for the USB solar system there will be a solar PV panel, PWM charge controller, and battery. Arduino software is used to program the system. All this data will be sent to the Google Firebase server and data will be logged. Users can monitor the system through the android application named SOLAR SMART PLANT. The data analysis will be based on the battery backup time and solar voltage during sunny and cloudy weather. For plants, the growth and amount of water consumed were taken. Finally, the USB solar PV system performs the analysis well, and the implementation of IoT can prove that this gardening system performs well in every aspect based on the analysis done.

ABSTRAK

Pada era semasa, sumber tenaga boleh diperbaharui seperti tenaga suria akan menjadi tenaga terpenting di masa depan. Teknologi PV solar akan menjadi sumber utama yang boleh diperbaharui. Selain itu, dalam dunia moden teknologi Universal Serial Bus (USB) banyak digunakan untuk mengecas peranti kami dan menyambungkan peranti kami ke peranti lain. Bekalan PV solar langsung akan menyebabkan bekalan tidak stabil ke sistem. Oleh itu, peranti hab USB sederhana yang menggunakan pengawal PWM solar akan menjadi tujuan projek. Selain itu, orang yang berminat untuk berkebun selalu sibuk dengan kehidupan seharian mereka akan meninggalkan penjagaan asas pada tanaman sehingga dengan menerapkan teknologi IoT sistem berkebun rumah pintar yang dapat memantau pertumbuhan tanaman akan dikembangkan. Selain itu, aplikasi android akan dirancang agar pengguna dapat melihat parameter tanaman kapan saja dan di mana saja. Terdapat tiga aspek utama dalam metodologi iaitu perkakasan, perisian, dan proses aliran. Untuk perkakasan sistem ini akan menggunakan Arduino UNO Wi-Fi sebagai mikrokontroler untuk mengawal input dan output sistem. Sensor kelembapan tanah, sensor ultrasonik dan voltan adalah input sementara untuk sistem suria USB akan ada panel PV solar, pengawal cas PWM dan bateri. Perisian Arduino digunakan untuk memprogram sistem. Semua data ini akan dihantar ke pelayan Google Firebase dan data akan dicatat. Pengguna dapat memantau sistem melalui aplikasi android yang diberi nama SOLAR SMART PLANT. Analisis data akan berdasarkan pada masa sandaran bateri dan voltan suria semasa cuaca cerah dan mendung. Untuk tanaman pertumbuhan dan jumlah air yang digunakan diambil. Akhirnya, sistem PV solar USB melakukan analisis dengan baik dan pelaksanaan IoT dapat membuktikan sistem berkebun ini berfungsi dengan baik dalam setiap aspek berdasarkan analisis yang dilakukan..

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$$I = \frac{P}{V}$$

$$T = \frac{Ah}{I}$$

$$\text{Total Load Current } (I) = \quad = \frac{\text{Total Watts}}{\text{Voltage}}$$

$$\text{Battery backup time} = \frac{\text{Battery AH}}{\text{Total Load Current}}$$

LIST OF ABBREVIATIONS

A	-	Ampere
ADC	-	Analogue to digital converter
A	-	Alternating current
DC	-	Direct current
DC-DC-		Direct current – direct current
ESP	-	Espressif
GPIO	-	General-purpose input/output
IoT	-	Internet of Things
12C	-	Serial Communication protocol
IDE	-	Integrated development environment
LCD	-	Liquid Crystal Display
MPPT	-	Maximum power point tracker
MCU	-	Microcontroller Unit
MIT	-	Massachusetts Institute of Technology
NC	-	Normally close
NO	-	Normal open
PIC	-	Peripheral Interface Controller
PV	-	Photovoltaic
PWM	-	Pulse Width Modulation
PCB	-	Phone Charging Box
SPI	-	Serial Peripheral Interface

USB - Universal Serial Bus

UART - Universal asynchronous receiver-transmitter

VCC - Voltage common Collector

WI-FI - Wireless fidelity

W - Watts

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

As we know the sun provides us with more energy than we could ever use. There are many advantages of solar power that we can see in the long term. By using solar panels, we can harvest the energy and the energy will be converted into electrical energy which can use to power the smart home gardening system. Besides that, USB technology was purposed in this project because nowadays USBs are widely used in many devices which makes it the user easy to connect to the smart home gardening system [1].

The implementation of IoT in the modern world has brought new improvements for people and made life easy. In this project, an IoT system will be proposed as smart home gardening. By applying the concept of IoT we can make the sensors communicate with each other This system will monitor the plant growth through the sensors and all the parameters such as water level, soil moisture, and height of the plant are sent to the cloud server. Using this system, users can monitor the system anywhere around the world through their android application and can maintain the plants in their garden without any hassle. A simple android application from MIT app inventor can help any user to monitor the parameters of the plants[2].

1.2 Problem Statement

Solar panel unit is the main energy source which is used for conversion of sunlight into electricity. The solar cell produces direct power which always fluctuates with the intensity of the sunlight. When the solar PV panel unit is connected directly to the system will cause an unstable supply to the smart home gardening system. The second problem was people who have an interest in gardening are always busy with their daily routines neglects the basic care of the plant and u unexpected weather condition will cause the growth of the plant to decrease. Home gardeners are unable to observe the parameters of the smart home gardening system such as soil moisture level, water tank level, and plants growth.

1.3 Project Objective

Several objectives must be achieved:

a.) To develop a simple USB hub device using a solar PWM controller for a stable power supply.

b) To develop a smart home gardening using Arduino system which monitors the growth of the plant.

c) To design an android application which able to observe parameters of the plant.

1.4 Scope of Project

The scope of this project are as follows:

a.) USB port will be the main hub to connect the smart home gardening system and observe the plant parameters in the android application.

b.) Solar PV system generates electricity, and the energy will be stored in the lithium battery pack

c.) PWM solar charger regulates the voltage and current coming from the solar panel.

d.) Develop a home-based automated system that has sensors to monitor the soil moisture and measure the growth of the plants.

1.5 Summary

In chapter 1 the background of the project was explained. The problem statement and objectives of the project are listed to set a proper benchmark to reach and solve the problem. Finally, this chapter also covers the scope of the project which is related to the project.

Chapter 2 discusses the related research done by researchers based on the project implementation. The comparison was done between the projects and the identified method used.

Chapter 3 gives an overview of the methodology of the project. The design specification and process flow of the project are explained.

In chapter 4 the results and data analysis are analyzed and discussed in detail. Finally, chapter 5 discusses the main idea and the project output that has been achieved the objectives of the project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter gives an overview regarding several topics about the previous work and literature study which are related to this project. The studies will be based on the system related to the project title. The proposed project focuses on the Solar PV system, solar charger controller, and smart home gardening system.

2.2 Solar Photovoltaic Technology

In the proposed project, a solar photovoltaic system is used as the main power source to operate the smart home gardening system. Based on the journal paper author by [3] Solar PV technologies are the most valuable type of renewable energy source because it has less carbon emission, are silent, and is reliable for a sunny location like our country. Besides that, the solar PV system has a charger controller which able to maintain the receiving power from the solar panel and also increase the life span of the battery [4]. Here are the more previous studies related to the system.

2.2.1 Solar Technology-based USB Hub

The journal by [1] shows the development and operational advantages of portable solar-powered phone charge boxes for mobile users. In this research, the solar-powered PCB consists of a 15W photovoltaic solar cell connected to a 20A, 12/24V (auto) solar charging and discharging controller unit. The solar charging and discharging controller unit enable the solar cell to supply power to load via the controller through which the connected battery is charged and allows energy retained in the 12V, 18 AH DC battery to supply power to the

loads (USB Hub and A.C Sockets) during the day and at sunset. The USB hub will have a few output ports which able to slot any device by using a USB cable. Figure 2.1 below shows the block diagram of the project which includes the main hardware such as Solar panel, charge controller, inverter, and battery

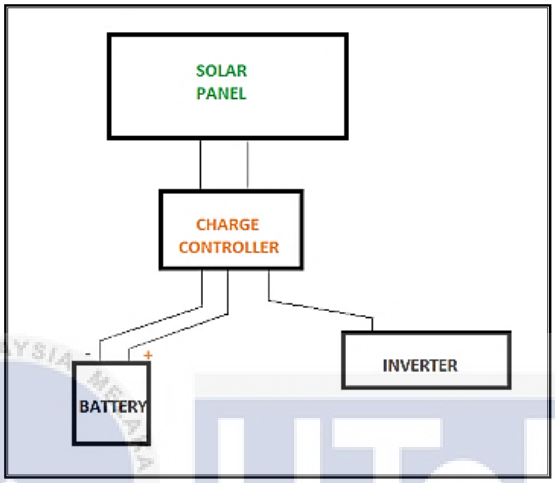

Figure 2.1 Block diagram of phone charging box. [1]

In another journal paper, by [5] shows the development of a power bank mobile using solar panel-based microcontroller ATMEGA 328. This project uses a 5V solar panel that functions as a power source generator. The electrical source will keep the charge in the battery. The Arduino Uno which has Atmega 328 was programmed to display the voltage value in the LCD. Once the battery is full the battery is connected to the USB port. In this development, the USB type used is a single port. Figure 2.2 below shows the valid testing was done and the USB port shows an indicator light.

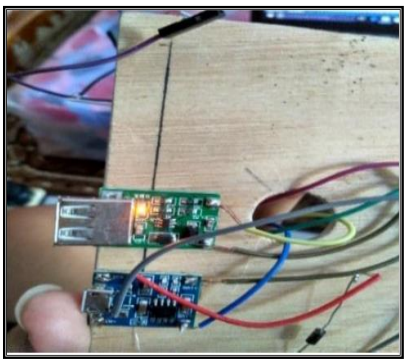

Figure 2.2 Single USB port [5]