SOLAR POWERED PLANT WATERING SYSTEM

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Especially dedicated to my beloved parents
En. Amirsharifuddin bin Sarudin and Pn. Emiwati bt Mayardi,
also my brothers and sister.
Thank u for all the support, love and prayers.

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ABSTRACT

Solar Powered Plant Watering System is a project that functions as an automatic plant watering system that uses solar energy rather then the power supply. It was invented after analyzing the normal process of watering plant is not effective and cause difficulty, time consuming and water inefficiency. This project is attempted to overcome all the problems. It consists of three main circuits, Solar Charging System, Soil Moisture Level Detector and Water Level Detector. Solar System is the circuit that will converts the solar energy received by solar panel to electrical energy which will be stored in a 12V rechargeable battery to provide power supply to the whole system. Soil Moisture Level Detector is the circuit that will control the watering process based from the soil moisture level. It will be connected to a water reservoir that will provide clean water using a pump. The water reservoir itself has a Water Level Detector that will give signals of the current water level to make sure there are always enough water sources.

ABSTRAK

Sistem Pengairan Tanaman Menggunakan Tenaga Solar ialah sebuah projek yang berfungsi sebagai satu sistem penyiraman tanaman secara automatik dengan menggunakan tenaga solar sebagai kuasa bekalan. Ia telah direka setelah membuat pemerhatian dan analisa penggunaan cara biasa untuk menyiram tananam yang tidak efektif dan menyukarkan selain penggunaan masa dan air yang banyak. Dengan adanya projek ini diharap masalah-masalah tadi dapat diatasi. Projek ini terdiri daripada tiga litar iaitu Sistem Mengecas Solar, Pengesan Kelembapan Tanah dan Pengesan Paras Air. Sistem Mengecas Solar adalah litar yang akan menukar tenaga solar yang dikumpul oleh panel solar kepada tenaga elektrik yang kemudian akan disimpan di dalam satu bateri cas semula 12V sebagai bekalan utama kepada seluruh sistem ini. Pengesan Kelembapan Tanah merupakan litar yang mengawal proses penyiraman bergantung kepada keadaan kelembapan tanah. Ia akan disambungkan kepada tangki air yang membekalkan air bersih melalui sebuah pam air. Tangki air itu juga dilengkapi dengan litar Pengesan Paras Air yang akan memaparkan tahap semasa air bagi memastikan bekalan air sentiasa mencukupi.

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LIST OF ABBREVIATION

LED - Light Emitter Diode

PV - Photovoltaic

PCB - Printed Circuit Board

IC - Integrated Circuit

DC - Direct Current

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CHAPTER I

INTRODUCTION

This chapter will give full view about Solar Powered Plant Watering System project with the details of the project introduction, problem statement, project objectives and scope of work. Besides, this chapter will explained briefly the whole process done in order to complete this project before clarifying the details on the next chapters.

1.1 PROJECT INTRODUCTION

This project functions as an automatic plant watering system that uses solar power. It consists of three main circuits, Solar System, Soil Moisture Level Detector and Water Level Detector. Solar System is the circuit that converts the solar energy to electrical energy to provide power supply to the whole system. Soil Moisture Level Detector is the circuit that will control the watering process based from the soil moisture level. It will be connected to a water reservoir that will provide clean water using a pump. The water reservoir itself has a Water Level Detector that will give signals of the current water level to make sure there are always enough water sources.

1.2 PROJECT OBJECTIVES

The objectives of doing this project is

i. To develop a solar charging circuit to power up the whole system
ii. To design and construct an automatic watering system
iii. To build soil moisture level detector using two pairs of probes.

1.3 PROBLEM STATEMENTS

The most common problem encountered in looking after plants are under/over watering. Most commercial systems work by either drip watering or watering at fixed periods via a programmable timer. Neither of these solutions is suitable if users wish to leave their plants unattended for long periods of time, as the watering needs of the plants will vary. Moreover, most automatic watering system uses electrical energy which cost consuming. Therefore, an automatic plant watering system that uses solar power is invented to overcome this problem.

1.4 SCOPES OF WORK

As a guideline, the project scopes of work include

i. A solar panel that will charge a 12V rechargeable battery
ii. Soil moisture level detector using two pairs of probes.
iii. Water reservoir with a water pump to provide water
iv. Water level detector consists of six LED each representing different level of water as a monitoring kit

1.5 METHODOLOGY

This project is created by combining three main circuits Solar System, Soil Moisture Level Detector and Water Level Detector. This project requires a lot of procedures from getting information on how each part functions, constructing the circuits and combining all three circuits with other parts like the solar panel, rechargeable battery and the water pump.

Research on solar and all the components used in each circuit is very important in order to understand the process and details on how this three circuit operate in individuals and when it is combined. Based on all information gathered, all three circuits have different function but receiving the same power supply from a rechargeable battery which is charge by solar panel. Function of each circuit is explained with the help of block diagram to clearly illustrate how all circuits process flow is.

1.6 REPORT STRUCTURE

This thesis contained five chapters that will explain in detail about the whole process of this project. The first chapter is an introduction which simply gives illustration and ideas on what this project is all about and it contained of objectives, problem statement, scope of work and methodology of project.

The second chapter will discuss on literature review that will gives information that is related with this project. Basically this chapter is concentrating on any previous project that has the similarity with Solar Powered Plant Watering System. Besides, there are also information on solar power, solar panel and plant watering.

The third chapter will concentrate on the research methodology which is the explaining of the three circuits Solar Charging System, Soil Moisture Level Detector and Water Level Detector. Every facts and information is explained clearly to give the full understanding on how each parts of this project works.

The fourth chapter is explaining on results and discussion about the whole project. Each parts of this project will be discussed and how it works and relates to each other is clarified with more figures included. There will be hardware implementation and system operation.

The last chapter is the conclusion and suggestion. This chapter will conclude according to the achievement and information obtains in completing the whole process of this project. Besides, suggestion will be given to give opinion on how this project will be improve and to increase its performance in the future

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter discuss on the overall project theory and concept. The purpose of this is to explain the perspective and method that is used in previous research or projects and to classify how much this project relate with those research and theory. Moreover, this chapter will show the theory and concept used to solve the project problem. Theoretical understanding is very important as a guide in doing any kind of research.

2.2 SOLAR POWER

Solar power is the technology of obtaining usable energy from the light of the sun. Solar energy has been used in many traditional technologies for centuries and has come into widespread use where other power supplies are absent, such as in remote locations and in space. Solar energy is currently used in a number of applications which are heat (hot water, building heat, cooking), electricity generation (photovoltaics, heat engines) and desalination of seawater.

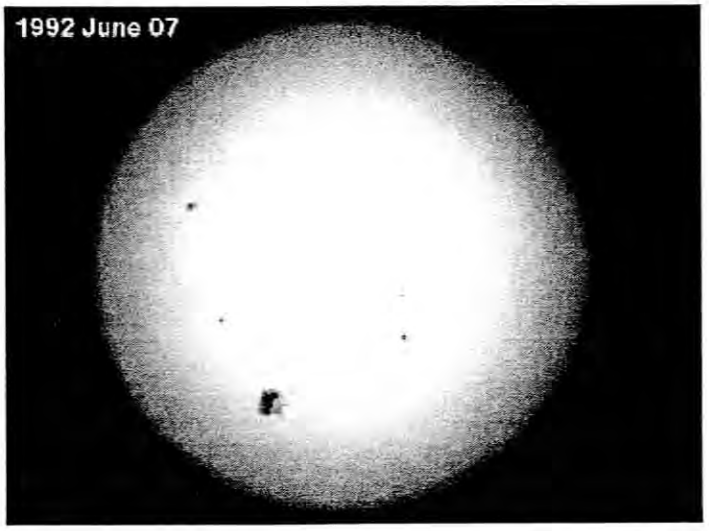

Figure 2.1: At the equator, the sun provides approximately 1000 watts per square meter on earth's surface.

2.2.1 Energy from The Sun

Solar radiation reaches the earth's upper atmosphere at a rate of 1366 watts per square meter (W/m^2). The first map in Figure 2.2 shows how the solar energy varies in different latitudes.

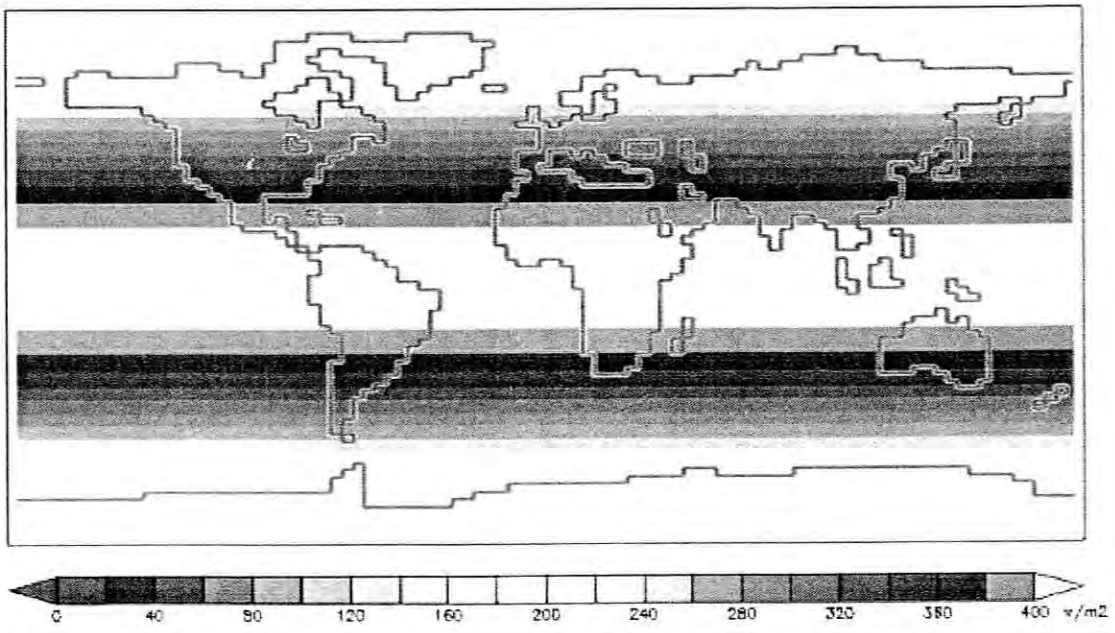

Figure 2.2: Theoretical annual mean insolation, at the top of Earth's atmosphere.

While traveling through the atmosphere 6% of the incoming solar radiation (insolation) is reflected and 16% is absorbed resulting in a peak irradiance at the equator of 1,020 W/m². Average atmospheric conditions (clouds, dust, pollutants) further reduce insolation by 20% through reflection and 3% through absorption. Atmospheric conditions not only reduce the quantity of insolation reaching the earth's surface but also affect the quality of insolation by diffusing incoming light and altering its spectrum.

The second map in Figure 2.3 shows the average global irradiance calculated from satellite data collected from 1991 to 1993. For example, in North America the average insolation at ground level over an entire year (including nights and periods of cloudy weather) lies between 125 and 375 W/m² (3 to 9 kWh/m²/day). This represents the available power, and not the delivered power. At present, photovoltaic panels typically convert about 15% of incident sunlight into electricity; therefore, a solar panel in the contiguous United States on average delivers 19 to 56 W/m² or 0.45 - 1.35 (kW·h/m²)/day.

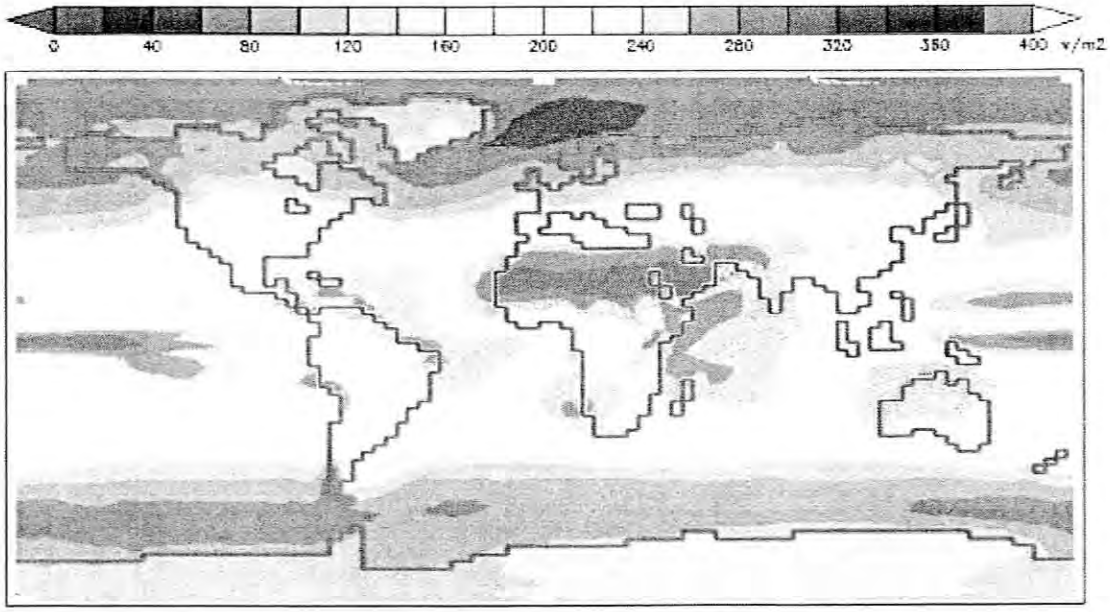

Figure 2.3: Theoretical annual mean insolation at the surface on a horizontal square meter.

The dark disks in Figure 2.4 are an example of the land areas that, if covered with 8% efficient solar panels, would produce slightly more energy in the form of electricity than the total world primary energy supply in 2003. While average insolation and power offer insight into solar power's potential on a regional scale, locally relevant conditions are of primary importance to the potential of a specific site.

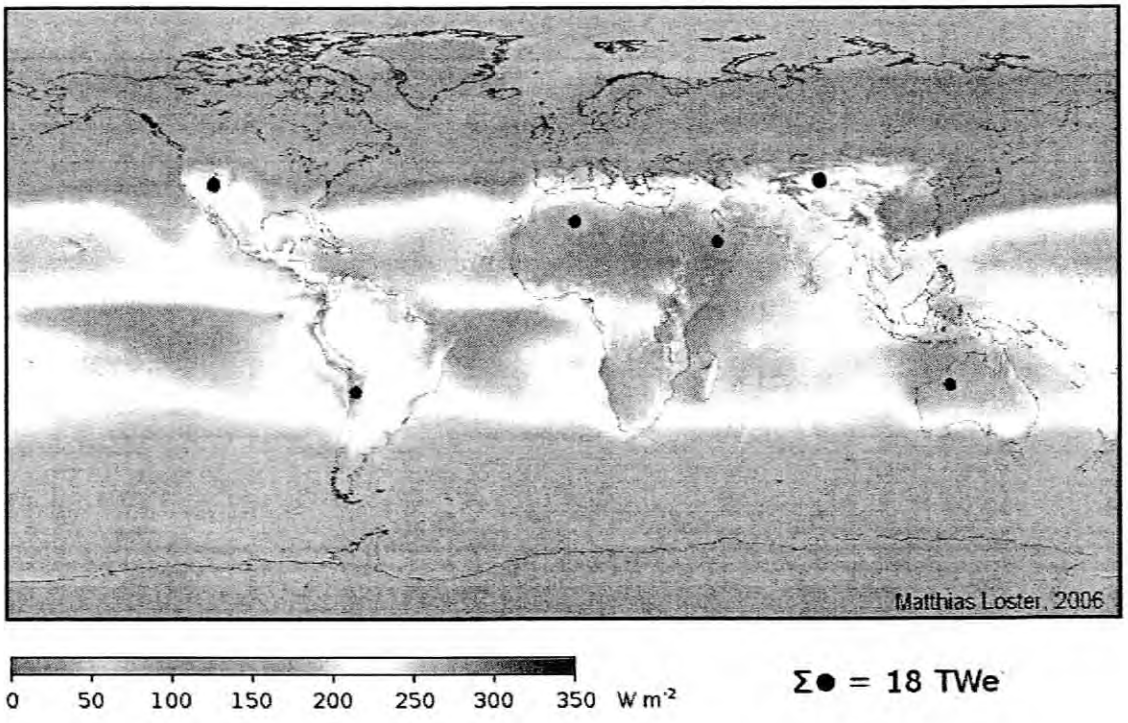

Figure 2.4: Map of global solar energy resources.

In Figure 2.4, the colors show the average available solar energy on the surface during 1991 to 1993. For comparison, the dark disks represent the land area required to supply the primary energy demand in the year 2010 using currently available technology (i.e. with a conversion efficiency of 8%).

After passing through the earth's atmosphere, most of the sun's energy is in the form of visible and infrared radiations. Plants use solar energy to create chemical energy through photosynthesis. Humans regularly use this energy burning wood or fossil fuels, or when simply eating the plants.