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GUI development of solar energy flow for stand alone system / Muhamad Izzat Ab Halim.



**UNIVERSITI TEKNIKAL MALAYSIA  
MELAKA**

**FACULTY OF ELECTRICAL ENGINEERING**

**GUI development of Solar Energy Flow for Stand Alone System**

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**Bachelor of Electrical Engineering (Industrial Power)**

**June 2012**

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Date : 8<sup>th</sup> June 2012

**GUI DEVELOPMENT OF SOLAR ENERGY FLOW FOR STAND ALONE SYSTEM**

**MUHAMAD IZZAT BIN AB HALIM**

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

**Faculty of Electrical Engineering**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2012**

## STUDENT DECLARATION

I declare that this report entitle “*GUI development of Solar Energy Flow for Stand Alone 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.

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Date : 8<sup>th</sup> June 2012

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## **ABSTRACT**

Monitoring system of solar photovoltaic (PV) power systems is very essential for initial system evaluation, and continuous output optimization. There are many types of monitoring system and one of them is by using GUI (graphical user interface) system. This monitoring method is very simple and economic. The purpose of this project is to design software and hardware development for GUI standalone solar system. Stand alone solar system is the system that does not have a connection to electricity mains. The power generates needs to be buffer with battery, a charger controller may be incorporated in the system to avoid battery damage and inverter is required to change DC to AC. For the software development PIC microcontroller is used to integrate with Visual Basic 6.0 as GUI (graphic user interface) system. The RS232 will be used to communicate between VB and PIC controller. This monitoring system will collect data of current, voltage and power flow of the system. The data will be analysis for final result.

## ABSTRAK

Pemantauan sistem fotovoltaik solar (PV) adalah sangat penting untuk penilaian sistem awal dan pengoptimuman berterusan. Terdapat banyak cara untuk melakukan pemantauan terhadap sistem PV antaranya adalah menggunakan sistem GUI (penggunaan grafik antara muka). Hal ini adalah kerana penggunaan sistem ini adalah menjimatkan dan mudah. Tujuan ini adalah untuk mereka pembangunan perisian dan pengkakan untuk GUI bagi sistem solar sendiri. Sistem solar ini adalah sistem yang tidak mempunyai sambungan ke sesalur elektrik. Untuk menjanakan kuasa bahan yang diperlukan adalah bateri, pengecas controller berfungsi untuk mengelakkan kerosakan bateri dan penyongsang diperlukan untuk menukar DC ke AC. Mikro pengawal PIC pembangunan perisian pula digunakan untuk mengintergrasi Visual Basic sebagai GUI, sistem RS232 pula akan digunakan untuk menkomunikasikan VB dengan PIC. Sistem pemantauan ini akan digunakan untuk mengumpul data voltage aliran kuasa sistem. Data akan dianalisis untuk keputusan terakhir.

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**LIST OF SYMBOL**

$m$	-	Idealizing factor is Boltzmann's
$T_c$	-	absolute temperature of the cell
$e$	-	Electronic charge
$V$	-	Voltage imposed across cell
$I_o$	-	dark saturation current
$I_{dc}$	-	the current required by the inverter from the DC to keep rated to AC side
$V_{dc}$	-	the input voltage for the inverter delivered by the DC side

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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

GUI (Graphic User Interface) is very useful device that will allowed human to interact with computer and using computer to control the device. The user can design graphic control, label and text in order to represent action or the information to perform application system. The purpose of this project is to develop GUI development of Solar Energy Flow for Stand Alone System. Stand alone system is a system that generate electricity independently. In order to generate the electricity, the system requires battery, charger controller and inverter. However the weakness of this which is the variation in solar energy output due to weather and operation loses that can only be solve by monitoring the Photo Voltaic(PV) system performance[1]. In order to design the monitoring system the GUI application will be applied in this project, the GUI will monitoring the energy flow through the system consists of voltage and current of DC side.

## 1.2 Problem Statement

- i. The increasing of electricity bill and unable to manage power consumption
- ii. Difficult to do maintenance and troubleshooting
- iii. Unable to take measurement at difficult area
- iv. Unable to continuous monitoring system performance

## 1.3 Project Objective

The objectives of this project are:

- i. To study the graphical user interface of solar energy flow.
- ii. To develop hardware of solar system and software for the GUI.
- iii. To analysis voltage, current and power flow in the solar system.
- iv. To conclude that GUI can show the exact amount of energy produce, store and used.

## 1.4 Project Scope

This project is to generate the electricity by using solar system and required hardware and software development. The equipments for the hardware are solar panel, fuse, power inverter, and battery and charger controller in order to generate the electricity. This project is using Visual Basic as GUI interface. This software will be used for monitoring the current, voltage and power flow of the system. The PIC microcontroller also will be intergraded to the system. The integration between VB and PIC will be to use to monitor and control system. The type of PIC that will be used is PIC 16F877A.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

Solar energy has become important and widely used because of soaring fossil fuel gas and increased environmental pollution. There are many advantages by using solar energy like environment friendly, silent and required low maintenance, however there are also disadvantage of solar energy. Solar energy required high initial cost and the power produce depend on the weather. So, further study and research was developed in order to overcome this problem. In this chapter the latest journal research had been done to help development of this project.

#### **2.2 Development of Graphic User Interface (GUI)**

The GUI system will allowed human interact with computer and control the device. The GUI will provide user with special graphic or visual indicator, graphical icon, label or text to represent user the information and action available to the user. In order to meet the objective the GUI can be design by using two methods which are Visual Basic or MATLAB software that will be apply for monitoring performance standalone solar system.

### 2.2.1 Visual Basic (VB)

Microsoft Visual basic 6.0 is window programming language application of old Basic language. VB can be used to develop system in one package from the simples to complicated ones. Hence VB will be able to edit, write and test window applications. Besides that VB also include tool that can be use to write and compiles help file, active x control and even internet application. VB is most attractive software because it is the combination between graphic programming and code programming.

From the reference[2] show that VB had be used as GUI interface to collected data field of forest resource management. The VB had been used to replace the old tradition method manually record data using paper based sheet. The old method was not efficient method. They are using map made of paper and data were recorded on the paper. This method usually needs two people to work on the field to carry recording and measuring tool. One people will measure data and the other person will record the data. The data record maybe will less precision and the error may occur. Then the data will bring back to performing static analysis and further processing. At this stage the error can be occur due to human relate error when someone need to types all data and build up database. This method will give many disadvantage and the data will less precision, so in order to improve accuracy and efficiency the new method and technology have been introduce. The development of visual basic (VB)-application for data collection being installing on PDA will generate more efficient and accurate data collection. The system designed was divided into two control component include data analysis component or data entry and information component. The system designed in the log in window where two buttons will show up which link to data entry and query component. When the user enter data entry button the user can upload the plot map and input the plot information. Besides that to perform the necessary functionalities the database is built up with needed tables to aid the components of data entry and data inquiry. This reference show how the VB can become GUI for collecting data that can be applied in the stand alone solar system monitoring.

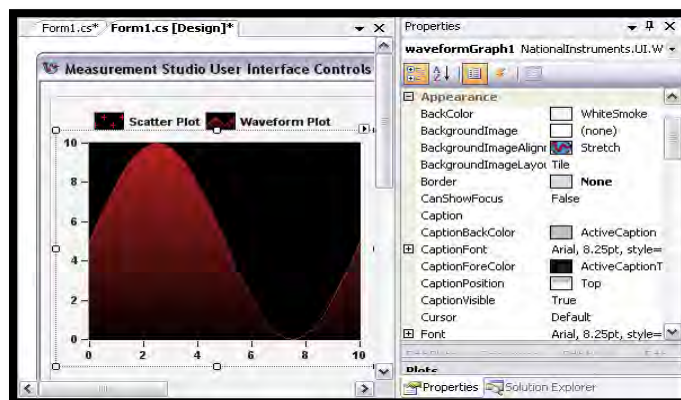


Figure 2.1: VB GUI

## 2.2.2 MATLAB

MATLAB (matrix laboratory) is the most popular software for engineering student. MATLAB represent with an interactive numerical computation environment, matrix computation, graphics, programming, toolboxes and other. MATLAB has many advantages to user because it is very easy, inexpensive software and fast numerical algorithms. The MATLAB software also include GUI that will be able to design PV stand alone system.

From the reference [3] shown that the MATLAB had been used for GUI development for PV hybrid design. With MATLAB the user can select the system type, load profile and select the location then software will calculate and the result will carry all necessary information such as sizing of battery, PV and all other components. The MATLAB software also can provide powerful analysis tool that will able user to check the result and make decision. The analysis can show in 2 method which are by graphic and data table of the result. Besides that with MATLAB the comparative between monitoring and simulation can be done. As the result the losses of the system can be determine by the error percentage between monitoring and simulation. The example of the MATLAB as shown in Figure 2.2

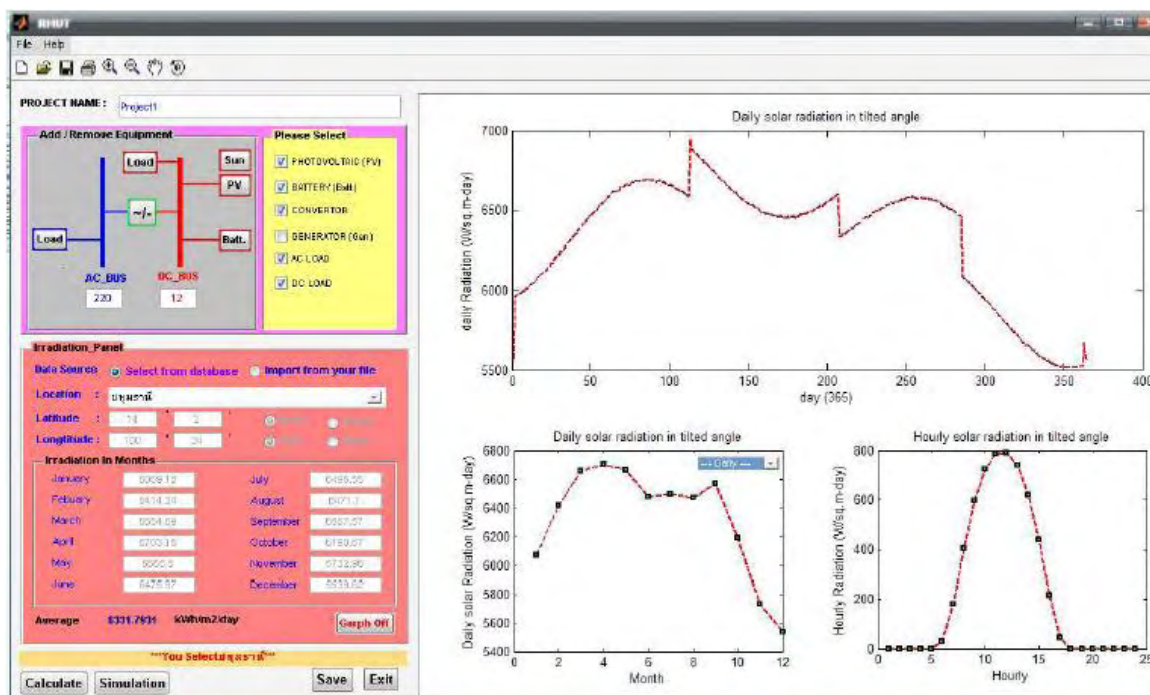


Figure 2.2: MATLAB GUI

## 2.3 Component of Standalone Solar System

This project consist of five main part; PV module, charger Controller, inverter, batteries and monitoring system. PV modules will convert sunlight into electric energy. The PV solar will act as supply to the system and electric produce will flow through charger controller and inverter. The battery will function as the storage system and back up in the case the sunlight not available. The whole power flow will be monitor by monitoring system. This system used VB as its GUI. The stand alone system was illustrated as figure 2.3.

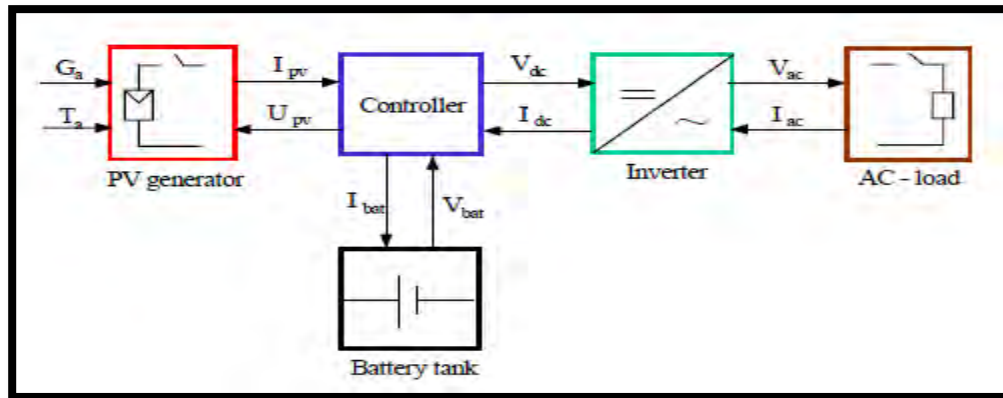


Figure 2.3: Stand Alone Solar System Component

### 2.3.1 PV Module

PV module will convert solar energy to electrical energy. PV module will function as the supply to the system. The PV Module consist of collection individual silicon cells that that able to generate electricity from sunlight which positive on one side (backside) and negative on the other (towards the sun). When the surface of the thin silicon wafers was strike by the photon, the electric will produce through the system, the electrons will knocked loose from the atoms in the semiconductor material, creating electron-hole pairs. Then if electrical conductors are then connect to the positive and negative sides an electrical circuit will form, electric current  $I_{ph}$  (photocurrent) will form by the electrons that been captured [4]. The PV module will generate the DC electricity and will be used to charge batteries at the charger controller. The losses are the main problem occurs at this level. The output power cannot perform maximum power due to load miss match or sunlight obstruction by dust accumulation and shading. This shading may damage the shaded cells due to overheating and limits the module current from series connected cells to the minimum current from the shaded cell [1]. If prevent action is not taken by disconnected the load from system the current difference will be dissipated in the shaded cells and PV cells will damage due to hot sport.



Figure 2.4: PV module

### 2.3.1.1 Basic Type of Common Solar

There are 3 basic type of common solar; panel mono crystalline silicon solar cells, polycrystalline silicon solar cells and amorphous silicon solar cells.

i. Mono Crystalline silicon

The mono crystalline solar panel was made in mono crystalline cell. It element contain pure silicon and involve complicated crystal growth process. The silicon was cut into slice about of 0.2 to 0.4 mm thick discs or wafers and then all the individual silicon were combine and wired together in the solar panel. The mono crystalline silicon will produce most efficient method compare to other but the disadvantage is, it was too expensive.

ii. Polycrystalline solar panels

The polycrystalline solar panels were made with Polycrystalline cell. Not like mono crystalline the cell are in the large block of many crystal and not grown in single crystals which allow them striking shattered glass appearance. Like Mono crystalline cells, Polycrystalline cell are also sliced into wafers and then all the individual silicon were combine and wired together in the solar panel. The benefit of Polycrystalline