

DEVELOPMENT OF AN AUTOMATED SOLAR PHOTOVOLTAIC TRACKING SYSTEM



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SEPTEMBER 2006

Acknowledgement

In the name of ALLAH SWT, The Most Beneficent, The Most Merciful. It is with the deepest sense of gratitude to the Almighty ALLAH who gives us the strength and ability to complete this project.

We express our deepest appreciation to the Institute of Research, Development and Consultancy (IRDC) for the full funding and giving all the necessary help for this research project. We would like to express deep appreciation to the Faculty of Electrical Engineering , Faculty of Applied Sciences and Faculty of Mechanical Engineering for all the help and support given to us. We also express appreciation to the Maintenance Office for providing the much needed laboratory space and filed site.

In addition, we express appreciation to all person and departments who have contributed in many ways towards the achievement of this project.

Last but not least, we express our deepest appreciation to our research assistant Muhamad Rizwan Yahya@Yahir for his hard and consistent work, and to our project student Mohd Farid Mohd Hatta for all his help.

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Abstract

This research involves the design and development of a prototype product code-named *Solt 2A* is a system that tracks the position of the sun automatically across the celestial vault in two axes. This kind of system is typically used in a solar photovoltaic (PV) system in terrestrial applications as well as extra-terrestrial applications such as spaceships and satellite systems to provide electrical power. It is designed and fabricated due to two main problems: a) Malaysia is located in the equator, thus the solar altitude crosses the zenith and the azimuth reverses direction; and b) Malaysia has a space programme that requires the use of solar PV power for its space satellites and probably later-on spaceship technology. These main problems require the use of a two axes solar tracking system. In addition, so far, Malaysia has not implemented such power-tracking systems. Thus *Solt 2A* has been designed and fabricated to address these problems. *Solt 2A* uses a combination of electro-mechanical devices with an element of programming ingenuity and intelligence. Basically *Solt 2A* measures solar irradiance at four points and makes comparisons in terms of the intensity received. These data are then analysed and processed by the microcontroller before being sent to a DC motor system that ensures the maximum amount of solar irradiance received on the PV panels. Thus *Solt 2A* is a system that maximises the power output of the PV panels to obtain the highest power output at all times. With the technical know-how and proven prototype, Malaysia can look into joining the small and limited but niche pool of expertise in this area. This will not only give immediate socio-economic impact to the population, but will give an upgrade to Malaysia as a country with expertise in the area. In addition, Malaysia has committed interest in upgrading and modernising her defense systems, and with further testing and improvement, *Solt 2A* system can be further upgraded to reach a commercial stage. This will definitely be of commercial interest to the country.

1. Introduction

1.1 Overview of solar photovoltaic system applications in Malaysia

At the time of writing, the estimated total installed capacity is about 3 MWp as of the year 2005. The largest user of PV technology is for rural electrification by the MORD, with about 66% share of the total installed capacity. This is followed by telecommunications and related power applications at 16%. Third is the new addition, the grid-connected PV systems at about 1.5%. However, with the government's plans for higher percentage of rural electrification, the residential PV portion is expected to increase further, especially when the Government has plans to electrify all schools. This seems to offer a greater option in using PV technology in these rural areas via stand-alone, hybrid or localised grid-interactive power systems. Actual detailed figures are not available, but the cost of the installed PV systems for these applications averages at about USD22 per Wp. This Malaysian figure appears to be within the higher end of the range of values quoted by established publications for off-grid applications at about USD14 to 22 per Wp (Strong and Scheller, 1993) or about USD12 to 25 per Wp (IEA-PVPS, 2004). In addition, it must be noted that these applications have been for remote areas only and costs for using other types of power would have been higher in the longer run. The popular periods of warranty normally offered was ten years on the modules, and from three to five years on the batteries.

Presently, a governmental energy policy research body called the Pusat Tenaga Malaysia (PTM) is the national body that is responsible for energy issues in the country.

A summary of the major PV applications in Malaysia is shown in the following table.