

DEVELOPMENT OF SEMI-AUTOMATIC SOLAR GATE SYSTEM
(MECHANICAL PART)

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A report submitted in partial fulfilment of the requirements for the award of
Diploma of Mechanical Engineering

Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

NOVEMBER 2008

SUPERVISOR'S DECLARATION

We hereby declare that we have checked this project and in our opinion this project is satisfactory in terms of scope and quality for the award of the Diploma of Mechanical Engineering

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis entitled "Development of Semi - Automatic Solar Gate System (Mechanical Part)" is my own research except as cited in the references. The thesis has not been accepted for any diploma and is not concurrently submitted in candidature of any other diploma.

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ACKNOWLEDGEMENTS

First of all, the deepest sense of gratitude to the God, who guide and gave me the strength and ability to complete this final year project. Infinite thanks I brace upon Him.

I would like to take this opportunity to express my gratitude and sincere appreciation to all those who gave me the possibility to complete this report. I am very grateful to my supervisor Mr.Shahmi bin Junoh @ Yacob for his patience, trust and supporting for guide me finished this project. I also sincerely thanks for the time spent proofreading and correcting my many mistakes.

I would like to acknowledge to all the staffs in Mechanical Laboratory, whom gave me permission to use the necessary tools in the laboratory and guide me the machine's operating system.

I would also like to express my deepest appreciation to my parents whom always support me and motivate me to complete this final year project.

My sincere appreciation also extends to all my colleagues, housemates, and friends whom had provided assistance at various occasions by support and ideas for this final year project.

Finally to individuals who has involved neither directly nor indirectly in succession of this thesis. Indeed I could never adequately express my indebtedness to all of them. Hope all of them stay continue support me and give confidence in my efforts in future. Thank you.

ABSTRACT

This thesis deals with the development of semi-automatic solar gate system (mechanical part). The objectives of this thesis are to design the mechanical part of gate system, fabricate the parts and assemble the parts together to complete the semi-automatic solar gate system. The thesis describes the methods of designing and fabricating the mechanical part of the gate system. There the many steps taken to design and fabricate the mechanical part of the gate system. The structural three-dimensional solid modelling of gate system was developed by using the SolidWorks engineering drawing software. The fabrication process also undergoes many steps such as material marking, cutting, drilling, welding, grinding and finalizing the gate system by painting. Other than that, it is explaining the procedure of testing where the mechanical part integrated with controller part to operate the mechanism of semi-automatic solar gate system. The results of testing the prototype also discussed in this thesis. Finally, the conclusion about this project and the recommendations for the future plan also attached together with this thesis.

ABSTRAK

Tesis ini membentangkan perkembangan pintu pagar separa automatik yang beroperasi dengan menggunakan tenaga solar. Objektif tesis ini ialah untuk mereka bentuk pintu pagar dan menghasilkan bahagian mekanikal modal pintu pagar separa automatik yang beroperasi dengan menggunakan tenaga solar. Tesis ini menerangkan cara-cara yang digunakan untuk mereka bentuk dan menghasilkan bahagian mekanikal pintu pagar ini. Pelbagai langkah telah diambil untuk menyiapkan projek ini. Lukisan struktur tiga dimensi bentuk pintu pagar ini telah direka dengan menggunakan perisian lukisan kejuruteraan yang dinamakan "*SolidWorks*". Proses penghasilan pintu pagar ini telah menjalani banyak proses tertentu seperti mengukur, menanda, memotong dan bahan mentah, membuat lubang, mencantumkan bahagian-bahagian tertentu, mengikir bahagian-bahagian yang terlebih semasa dicantumkan dan akhirnya mencatatkan pintu pagar supaya nampak menarik. Di samping itu, tesis ini juga mengandungi langkah pemeriksaan mekanikma operasi, di mana bahagian mekanikal dan bahagian pengawalan digabungkan supaya pintu pagar separa automatik dapat beroperasi dengan menggunakan tenaga solar. Hasil keputusan pemeriksaan dan perbincangan mengenai hasil keputusan turut disertakan dalam tesis ini. Akhir sekali, terdapat juga kesimpulan mengenai projek ini dan perkara-perkara yang boleh diperbaiki dalam projek ini di masa hadapan dalam tesis ini.

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LIST OF SYMBOLS

kg	Kilogram
V	Voltage
m	Meter
mm	Millimeter
Ø	Diameter

LIST OF ABBREVIATIONS

A-si	Amorphous silicon
AC	Alternative current
DC	Direct current
GMAW	Gas metal arc melding
MIG	Metal inert gas
SMAW	Shielded metal arc welding

CHAPTER 1

INTRODUCTION

The sole purpose of this project is to understand the fundamental knowledge of the semi-automatic solar gate fabricating process and its operating system.

Therefore, as a student of mechanical engineering of University Malaysia Pahang, this project given me interest and exposes me the field of manufacturing engineering as a part of mechanical engineering.

The importance of improving manufacturing processes grows each year. Manufacturing production is central to any other manufacturing enterprise. One of the important factors in improving manufacturing and developing automated production system is through knowledge of manufacturing production processes, including data about the processes and conditions under which the processes are carried out.

The design and fabrication of small prototype of a semi-automatic solar gate system is a baby step to develop larger and complex design of gate fabrication with unique operating principles.

1.1 Project Synopsis

The design and fabrication the mechanical part of a semi-automatic solar gate system requires the finished gate system to operate faster. The use of light weight material is applied in order to enhance the gate system's capability and performance as well as to reduce the cost of the project.

1.2 Objective of the Final Year Project

1.2.1 General Objective

This final year project is part of the required subjects to be taken during the Diploma in Mechanical Engineering course. This is done during the final semester before advancing into the industrial training program. Therefore, it is vital to complete this project in order to receive a final grade depending on the effort put in.

The final year project is also to give the students the individual ability and confidence to complete a task with under less supervision of lecturers. With this, students can learn problem solving skills in areas of designing, analysis, fabrication and testing as well learn to do a complete formatted report which is important for future thesis writing.

1.2.2 Specific Objective

There are two specific objectives for this final year project, which are:-

- i. To design the mechanical part of a semi-automatic solar gate system.
- ii. To fabricate the designed mechanical part of the system.

These objectives must be fulfilled to complete this project.

1.3 Scope of Work

Finishing the prototype of semi-automatic solar gate system requires precise scope of work to be followed. This project title is new as well as the knowledge for this project is not entirely answered in the subjects taken during this diploma course. Therefore, the manufacturing knowledge applied is the extension of statics, dynamics, solid mechanics and manufacturing technology detailing in the aspects and scope of designing and fabricating a gate system. Likewise, unique scope of work should be determined to achieve the purpose and goal of the project.

These scopes are:

- i. Literature review on the knowledge of design analysis of gate system.
- ii. Design the mechanical part of the system using theoretical and practical approach.
- iii. Fabricate the mechanical part of the system using welding skill.
- iv. Test designed and fabricated mechanical part of the system together with controller part to complete the operating system of semi-automatic solar gate system.

Only with these scopes, total effectiveness can take place to satisfyingly complete this title of final year project.

1.4 Project Planning

To start this project, a thoroughly research of literature review is done with the means of the internet, books, available published articles and materials that is related to the title and supervisor's guidance. This is continuing progress until sufficient knowledge is attained to complete the project.

In the first week, an appointment with the supervisor is done to manage the schedule of weekly meeting. The purpose is to inform the supervisor on the progress of the project and guided by supervisor to resolve difficulty.

Briefing based on the introduction and next task of the project is given by the supervisor in the first week.

Designing phase starts of by sketching few designs and models using manual sketch on A4 papers. Then, analyse the designs and choose an appropriate design to finalize. Next, propose the design to the supervisor. After that, convert the design to the three dimensional drawing using SolidWorks software. After done a deep research on gate system and the material used propose the appropriate material types and specification to the supervisor.

The preparation of mid-presentation of the project is next. Before presenting, the supervisor will see through the presentation slides and comment on corrections to be made. Then, the presentation on the knowledge attained and instilled in the design phase is presented to the panel of three judges. It takes four weeks to design and alteration is done.

Following up, is the survey for the materials needed and purchasing the suitable materials. The modification is done on the design so as the model will operate better. Once receive the materials, start the fabrication of mechanical part of the system. This would take about two weeks to complete.

Once welding process starts, complete the welding parts by parts. Then, assembly of the parts will be next and then testing. Modifications or add-ons, and some trials will be done until it operates for about the period of one week. Results are jotted done during this time trials.

After that, the final report writing and presentation will be the last task to be accomplished during the week thirteen. The supervisor will review the final presentation and revise the mistakes to be amended. The final presentation then again will be presented to three panels. A draft report would then be submitted to the supervisor to be point out the flaws. Corrections are done and the real final report is handed over as a completion of the final year project.

1.5 Thesis Organization

In chapter two, I will go through the literature review of the gate system. This chapter will discuss about the reviewing study about the semi-automatic solar gate system.

In chapter three, I will go through the methodology of the project. This chapter will discuss more about the fabrication process of the project. It's includes the materials and method of fabrication.

In chapter four, I will discuss about the results and discussion. These will base on the testing of the system and the operating mechanism of semi-automatic solar gate system.

In chapter five, I will conclude the project. This chapter also includes the summary of the project and recommendation for future project.

CHAPTER 2

LITERATURE REVIEW

The title design and fabrication of a semi-automatic solar gate system requires an amount of good understanding on the knowledge of this gate operating system. Therefore, executing a research is necessary to obtain all the information available and related to this topic. The information or literature reviews obtained are essentially valuable to assist in the fabrication and specification of this final year project. With this ground established, the project can be accomplished with guidance and assertiveness in achieving the target mark.

2.1 Definition

2.1.1 Gate

Gate is a point of entry to a space enclosed by walls, or an opening in a fence. Larger gates can be used for a whole building, such as a castle or fortified town, or the actual doors that block entry through the gatehouse.

In ancient and medieval times, gatehouses of cities and castles were heavily defended and fortified to prevent breaching of the gates. Often the gate would consist of several pairs of doors and iron grates along a tunnel through the gatehouse. The top of the tunnel commonly had murder holes to allow defenders to attack invaders trying to breach the inner doors. Drawbridges were common in conjunction with gates to facilitate passing the moat; moats were often used to increase the effective height of the walls. ^[5]

2.1.2 Solar Panel

Solar panels are special devices that harvest the sun's light and turn it into energy that can be used for a lots of things. They are also referred to as active solar power producers. The solar panel is made of a lot of solar cells. These solar cells, also known as photovoltaic cells are arranged on the panel's surface in a grid like pattern. During the day if exposed to sunlight these solar cells will collect the energy that comes from the sun and transform it into electrical power that is stored in special batteries attached to the solar panel.

Solar panels are usually made of crystalline silicon that is used for the microprocessor industry and of gallium arsenide which is used only for making the solar cells. Modern solar cells are recently made of amorphous silicon alloy and this is why you might find them under the name of A-si. Using the amorphous silicon technology in building up a solar panel will make the new product be more durable, thinner than the older ones and more efficient.

Solar panels are not used only by regular people for day to day activities; they are also used in space for the solar projects. These solar panels are made up of gallium arsenide through the molecular beam epitaxy process. P-n junction diodes are implemented to the solar cells included in those solar panels making the whole system working at higher standards that we could ever imagine. Due to the high costs that are involved for building such a great solar panel they are not rentable for the everyday activities. ^[5]

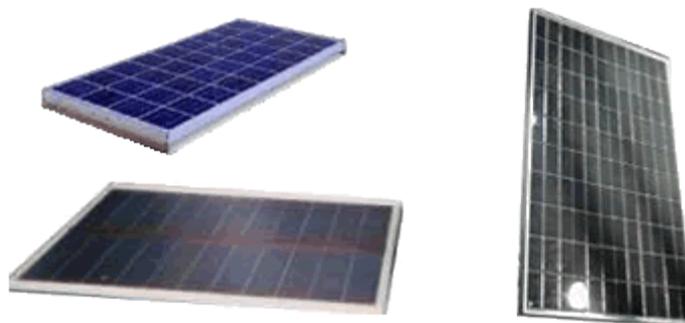


Figure 2.1 : Solar Panels

2.1.2.1 The Three Types of Solar Panels

A. Monocrystalline solar panels

The most efficient and expensive solar panels are made with Monocrystalline cells. These solar cells use very pure silicon and involve a complicated crystal growth process. Long silicon rods are produced which are cut into slices of .2 to .4 mm thick discs or wafers which are then processed into individual cells that are wired together in the solar panel.

B. Polycrystalline solar panels

Often called Multi-crystalline, solar panels made with Polycrystalline cells are a little less expensive & slightly less efficient than Monocrystalline cells because the cells are not grown in single crystals but in a large block of many crystals. This is what gives them that striking shattered glass appearance. Like Monocrystalline cells, they are also then sliced into wafers to produce the individual cells that make up the solar panel.

C. Amorphous solar panels

These are not really crystals, but a thin layer of silicon deposited on a base material such as metal or glass to create the solar panel. These Amorphous solar panels are much cheaper, but their energy efficiency is also much less so more square footage is required to produce the same amount of power as the Monocrystalline or Polycrystalline type of solar panel. Amorphous solar panels can even be made into long sheets of roofing material to cover large areas of a south facing roof surface. ^[9]