SOLAR HOME AUTOMATION SYSTEM
(ELECTRO-MECHANICAL PART)

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## ABSTRACT

This project is mainly concerned on development of solar home automation system for electro-mechanical part and integration. The main objective in this project is to give an experience and knowledge for student to make the project and activity successfully. The specific objective of to design the mechanical and electronic part of solar home automation system. This project as model to an application for a real house .This project involve the process of designing the circuit ,mechanical part ,functionality and the manufacturing costs for people using. The material using is solar panel, Perspex, electric components such as diode , battery, lamp, led and switch on/off. In this project have 3 main process .The first process is fabricate the electrical part, the second one process is fabricate the mechanical part and the last one is integrated electrical part and mechanical part. The electrical part need to make a circuit . To generate the electric by solar energy. Mechanical part to make model house. Lastly, two part need to integrate. The results can also significantly reduce the cost and time to market, and improve product reliability and customer confidence.

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## ABSTRAK

Project ini membangunkan Sistem Rumah Solar Automatik untuk bahagian elektro-mekanikal dan integrasi. Objektif utama projek ini ialah memberi pengalaman dan pengatahuan kepada pelajar membuat projek dengan jayanya. Manakala ,objektif spesifik pula ialah meraka bahagian mekanikal dan elektronik Sistem Rumah Solar Automatik . Projek ini sebagai contoh atau model kepada rumah yang sebenar. Projek ini disertai dengan proses mereka litar elektrik , bahagian mekanikal , fungsi , dan kos pembuatan untuk digunakan oleh orang. Bahan yang digunakan Panel Solar , Perspex , komponen elektronik seperti diod ,bateri ,lampu dan suis on /off. Terdapat 3 proses utama dalam projek ini. Proses pertama ialah membuat bahagian elektrik iaitu membuat litar elektik. Proses yang kedua pula membuat bahagian mekanikal dan proses terakhir pula ialah mengabungkan kedua-kedua bahagian tadi. Keputusan dari projek tadi bermakna mengurangkan kos dan masa untuk dipasarkan dan kebolehan produk dan keyakinan pelanggan.

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## LIST OF SYMBOLS AND ABBREVIATIONS

| | |
|---|---|
| GMAW | Gas metal arc welding |
| NiCd | Nickel-cadmium |
| PV | photovoltaic |
| V | Voltage |

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# CHAPTER 1

# INTRODUCTION

## 1.1 PROJECT SYNOPSIS

### 1.1.1 General Project Synopsis

The purpose of this project to Development of Home Solar Automation System, in this project we must know two basic engineering it is mechanical engineering and electric engineering. In this project ,the machine tools are mostly use to do to the metal cutting ,grinding and drilling . Welding also important to join inseperably every component of the product .This product also must know the basic of electrical. This project help consumer reduce their bill rate. As we known, the source our energy home is too expensive because of limited source. That why we must to find a new source easy to get and can renewable. This Project has 3 main part process development. There are mechanical process , where are we need made solar panel holder. The second process is electrical process ,in this process we need make a circuit for home electrical system.The last process is integration the two part , mechanical and electrical parts.

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### 1.1.2 Specific Project Synopsis

My project is to development of solar home automation (electro-mechanical part). This solar home automation is a model actual house. The house size is 50cm x 40cm x 25cm. This house using 24V solar panel .To know solar panel it function the bulb and led were install in the house and has a switch to on /off .The house can stand load 10 kg .Although the solar panel and the holder it weight not more then 5kg but the stability of house is important. The holder solar panel made from L shape steel. This holder was fix with house roof because when install the solar panel it's not slip down. In the circuit, rechargeable battery 24 V was using for save energy from solar panel and using when the night.

## 1.2 PROJECT BACKGROUND

At this moment, this product was available at market. home automation is all about transforming our existing home to an automated home to suite our living style, bring comfort and safety and the most important creating a peace of mind knowing that our house is secure while we are home or away and family and loved ones are safe and sound.

Using solar powered system, with minimal cost , we can transform our proposed home automation system fully automated , save energy and high utility bills.

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## 1.3 PROJECT OBJECTIVES

### 1.3.1 General Objective

Diploma final year project objective is to practice the knowledge and skill of the student that have been gathered before in solving problem using academic research, to born an engineer that have enough knowledge and skill. This project also important to train and increase the student capability to get knowledge, research, data gathering, analysis making and then solve a problem by research or scientific research.

### 1.3.2 Specific Project Objective.

The objectives of this project are:

I ) To design the mechanical part of solar home automation system.

II ) To fabricate the mechanical part of the system.

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## 1.4 PROBLEM STATEMENT

This project is about how to reduce the costing for source at home. This project to shown solar energy is the best solution to solve high utility bills problem because solar energy can get at anyway .Solar energy source can get from the sun .Sun can sunrise every day at anyway in this world .This project are the first house using automation system in house .The example is when someone enter the house the lamp in house automatic will in immediately.

## 1.5 PROJECT SCOPE

The scopes for this project are:

I) Design of structure with given specification

II) Sketching and designing: sketching and designing using Solid Work software and DXP Portel Software.

Fabrication: fabricate and produce the holder for solar panel and electrical system circuit.

IV ) Made integration with home.

V ) Test the project .

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# CHAPTER 2

# LITERATURE REVIEW

## 2.1 INTRODUCTION

Solar energy is one of source can renewable. This energy can get to free. The world today , the energy undeniable will vanish forever such as fossil ,coal and other. This energy will empty so the method we can used wisely is using solar energy.

Solar energy very clean ,easy to get and no pollution occur. In this project , how solar can energy can use as source for house .

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## 2.2 BASIC COMPONENT

I ) Solar panel has two type :

- Solar photovoltaic modules use solar cells to convert light from the sun into electricity.
- Solar thermal collectors use the sun's energy to heat water or another fluid such as oil or antifreeze

II ) Solar panel Holder : Made from L shape steel. That shape in rectangular fit with size of solar panel.

III) Electric component : the electric component were using in this project is Zenith diode , Battery ,switch on/off and bulb.

## 2.2 HISTORY OF SOLAR ENERGY

Figure 2.1: Solar panel

Ancient Greeks and Romans saw great benefit in what we now refer to as passive solar design—the use of architecture to make use of the sun's capacity to light and heat indoor

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spaces. The Greek philosopher Socrates wrote, “In houses that look toward the south, the sun penetrates the portico in winter.” Romans advanced the art by covering south facing building openings with glass or mica to hold in the heat of the winter sun. Through calculated use of the sun’s energy, Greeks and Romans offset the need to burn wood that was often in short supply.

Auguste Mouchout, inventor of the first active solar motor, questioned the widespread belief that the fossil fuels powering the Industrial Revolution in the 19th century would never run out. “Eventually industry will no longer find in Europe the resources to satisfy its prodigious expansion. Coal will undoubtedly be used up. What will industry do then?” Mouchout asked prophetically.

In 1861, Mouchout developed a steam engine powered entirely by the sun. But its high costs coupled with the falling price of English coal doomed his invention to become a footnote in energy history.

Nevertheless, solar energy continued to intrigue and attract European scientists through the 19th century. Scientists developed large cone-shaped collectors that could boil ammonia to perform work like locomotion and refrigeration. France and England briefly hoped that solar energy could power their growing operations in the sunny colonies of Africa and East Asia.

In the United States, Swedish-born John Ericsson led efforts to harness solar power. He designed the “parabolic trough collector,” a technology which functions more than a hundred years later on the same basic design. Ericsson is best known for having conceived the USS Monitor, the armored ship integral to the U.S. Civil War.

Solar power could boast few major gains through the first half of the 20th century, though interest in a solar-powered civilization never completely disappeared. In fact, Albert Einstein was awarded the 1921 Nobel Prize in physics for his research on the photoelectric effect—a phenomenon central to the generation of electricity through solar cells.

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Some 50 years prior, William Grylls Adams had discovered that when light was shined upon selenium, the material shed electrons, thereby creating electricity.

In 1953, Bell Laboratories (now AT&T labs) scientists Gerald Pearson, Daryl Chapin and Calvin Fuller developed the first silicon solar cell capable of generating a measurable electric current. The New York Times reported the discovery as “the beginning of a new era, leading eventually to the realization of harnessing the almost limitless energy of the sun for the uses of civilization.”

In 1956, solar photovoltaic (PV) cells were far from economically practical. Electricity from solar cells ran about $300 per watt. (For comparison, current market rates for a watt of solar PV hover around $5.) The “Space Race” of the 1950s and 60s gave modest opportunity for progress in solar, as satellites and crafts used solar paneling for electricity.

It was not until October 17, 1973 that solar leapt to prominence in energy research. The Arab Oil Embargo demonstrated the degree to which the Western economy depended upon a cheap and reliable flow of oil. As oil prices nearly doubled over night, leaders became desperate to find a means of reducing this dependence. In addition to increasing automobile fuel economy standards and diversifying energy sources, the U.S. government invested heavily in the solar electric cell that Bell Laboratories had produced with such promise in 1953.

The hope in the 1970s was that through massive investment in subsidies and research, solar photovoltaic costs could drop precipitously and eventually become competitive with fossil fuels.[3]

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## 2.3 METHOD JOINING OF WELDING PROCESS

### 2.3.1 Basic Theory of Metal Inert Gas (MIG) Welding

Figure 2.2: Gas metal arc welding (GMAW)

**Gas metal arc welding (GMAW)**, sometimes referred to by its subtypes **metal inert gas (MIG) welding** or **metal active gas (MAG) welding**, is a semi-automatic or automatic arc welding process in which a continuous and consumable wire electrode and a shielding gas are fed through a welding gun. A constant voltage, direct current power source is most commonly used with GMAW, but constant current systems, as well as alternating current, can be used. There are four primary methods of metal transfer in GMAW, called globular, short-circuiting, spray, and pulsed-spray, each of which has distinct properties and corresponding advantages and limitations.

Originally developed for welding aluminum and other non-ferrous materials in the 1940s, GMAW was soon applied to steels because it allowed for lower welding time compared to other welding processes. The cost of inert gas limited its use in steels until several years later, when the use of semi-inert gases such as carbon dioxide became common. Further developments during the 1950s and 1960s gave the process more versatility and as a result, it became a highly used industrial process. Today, GMAW is

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the most common industrial welding process, preferred for its versatility, speed and the relative ease of adapting the process to robotic automation. The automobile industry in particular uses GMAW welding almost exclusively. Unlike welding processes that do not employ a shielding gas, such as shielded metal arc welding, it is rarely used outdoors or in other areas of air volatility. A related process, flux cored arc welding, often does not utilize a shielding gas, instead employing a hollow electrode wire that is filled with flux on the inside.

### 2.3.2 The Advantages of MIG Welding

- High productivity, because based on this machine the consumer no need to stop their work to change rods or chip and brush the weld frequently.
- Easy to learn and makes great –looking welds.
- Can weld stainless steel ,mild steel
- This welding process also can be weld in all position.

### 2.3.3 The Disadvantages of MIG Welding

- Costs money of consumable ,such as tips and nozzle
- Is not worth a dang on paint , rust ,or dirty surfaces
- Not good for thick steel , because it does not get proper penetration.

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### 2.3.4 Operation of MIG Welding

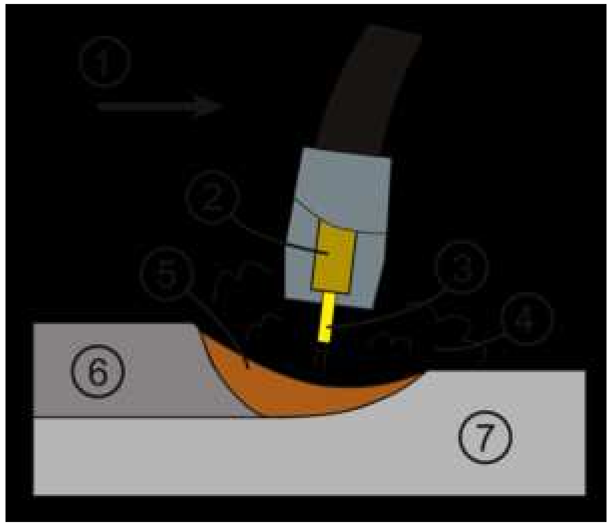


Figure 2.3: MIG welding Process

The basic technique for GMAW is quite simple, since the electrode is fed automatically through the torch. By contrast, in gas tungsten arc welding, the welder must handle a welding torch in one hand and a separate filler wire in the other, and in shielded metal arc welding, the operator must frequently chip off slag and change welding electrodes. GMAW requires only that the operator guide the welding gun with proper position and orientation along the area being welded. Keeping a consistent contact tip-to-work distance (the *stickout* distance) is important, because a long stickout distance can cause the electrode to overheat and will also waste shielding gas. Stickout distance varies for different GMAW weld processes and applications. For short-circuit transfer, the stickout is generally 1/4 inch to 1/2 inch, for spray transfer the stickout is generally 1/2 inch. The position of the end of the contact tip to the gas nozzle are related to the stickout distance and also varies with transfer type and application. The orientation of the gun is also important—it should be held so as to bisect the angle between the workpieces; that is, at 45 degrees for a fillet weld and 90 degrees for welding a flat surface. The travel angle or lead angle is the angle of the torch with respect to the direction of travel, and it should generally remain approximately vertical.

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However, the desirable angle changes somewhat depending on the type of shielding gas used—with pure inert gases, the bottom of the torch is out often slightly in front of the upper section, while the opposite is true when the welding atmosphere is carbon dioxide.[1]

## 2.4 Threaded Fastener

Bolts screw and nuts are among the most commonly used threaded fasteners. Numerous standards and specifications (including thread dimensions, dimensional tolerances, strength and the quality of the material used to make these fasteners) are described. Bolts and screw may be secured with nuts, or they may be self tapping is particularly effective and economical in plastic products where fastening does not required a tapped hole or nut. If the joint is to be subjected to vibration (such as an aircraft, engines, and machinery) several especially designed nuts and lock washers are available. They increase the frictional resistance in tensional direction and so inhibit any vibration of the fasteners.[1]

Figure 2.4: bolt and nut

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## 2.5 Drill Machine

A **drill** (from Dutch *Drillen*) is a tool with a rotating drill bit used for drilling holes in various materials. Drills are commonly used in woodworking, metalworking, and construction and DIY.

The drill bit is gripped by a chuck at one end of the drill, and is pressed against the target material and rotated. The tip of the drill bit does the work of cutting into the target material, either slicing off thin shavings (twist drills or auger bits), grinding off small particles (oil drilling), or crushing and removing pieces of the work piece (SDS masonry drill).

### 2.5.1 History

The earliest drills were **bow drills** which date back to the ancient **Harappans** and **Egyptians**. The **drill press** as a machine tool evolved from the bow drill and is many centuries old. It was powered by various power sources over the centuries, such as human effort, **water wheels**, and **windmills**, often with the use of **belts**. With the coming of the electric motor in the late 19th century, there was a great rush to power machine tools with such motors, and drills were among them. The invention of the first electric drill is credited to Mr. Arthur James Arnot and William Blanch Brain, in 1889, at **Melbourne**, Australia. Wilhelm Fein invented the portable electric drill in 1895, at **Stuttgart**, Germany. In 1917, **Black & Decker** patented a trigger-like switch mounted on a pistol-grip handle.

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### 2.5.2 Types

There are many types of drills: some powered manually, others using electricity or compressed air as the motive power, and a minority driven by an internal combustion engine (for example, earth drilling augers). Drills with a percussive action (such as hammer drills, jackhammers or pneumatic drills) are usually used in hard materials such as masonry (brick, concrete and stone) or rock. Drilling rigs are used to bore holes in the earth to obtain water or oil. An oil well, water well, or holes for geothermal heating are created with large drill rigs up to a hundred feet high. Some types of hand-held drills are also used to drive screws. Some small appliances may be drill-powered, such as small pumps, grinders, etc. [3]

a) Hand Tool

A variety of hand-powered drills have been employed over the centuries. Here are a few, starting with approximately the oldest:

- Bow drill
- Brace and bit
- Gimlet
- Breast drill, also known as "eggbeater" drill
- Push drill, a tool using a spiral ratchet mechanism
- Pin chuck, a small hand-held jewellers drill

Figure 2.5: Hand drill

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b) Cordless drill

A cordless drill is a type of electric drill which uses rechargeable batteries. These drills are available with similar features to an AC mains-powered drill. They are available in the hammer drill configuration and most also have a clutch setting which allows them to be used for driving screws. Also available now are Right Angle Drills, which allow a worker to drive screws in a tight space. These are currently less useful than the corded version however, as one of the main functions is drilling holes through joist and studs to run electrical and plumbing. While recent battery innovation allows significantly more drilling, the large diameter holes required (typically 1/2"-1" or larger) drain current cordless drills quickly.

For continuous use, a worker will have one or more spare battery packs charging while drilling, so that he or she can quickly swap them, instead of having to wait an hour or more for recharging, although there are now Rapid Charge Batteries that can charge in 10-15 minutes.

Early cordless drills started with interchangeable 7.2 V battery packs, and over the year's available battery voltages have increased, with 18 V drills being most common, and 24V drills are available. This allows these tools to produce as much torque as some mains-powered drills. The drawback of most current models is the use of nickel-cadmium (NiCd) batteries, which have limited life, self-discharging and eventually internally short circuiting due to dendrite growth. This severely limits battery life, and poses a hazardous materials disposal problem. A lot of drill manufacturers, including DeWalt, Ryobi, and RIDGID, are now using lithium ion batteries. The main advantages are very short charging time, longer life, and lighter battery weights. Instead of charging a tool for an hour to get 20 minutes of use, 20 minutes of charge can run the tool for an hour. Lithium-ion batteries also have a constant discharge rate. The power output remains constant until the battery is depleted, something that nickel-cadmium batteries also lack, and which makes the tool much more versatile. Lithium-ion batteries also hold a charge for a significantly longer time than nickel-cadmium batteries, about two years if not used, vs. 1 to 4 months for a nickel-cadmium battery.

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The handles of cordless drills are usually made from polymorph which is easy and quick to mold to a comfortable shape for holding. The main body of the drill is usually made from polythene as it is able to withstand the high temperatures which the drill reaches.[3]


Figure 2.6: Cordless drill

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