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JUDUL: <u>DEVELOPMENT OF A MOTORIZED CUTTER (ELECTRO-MECHANICAL PART) AND INTEGRATION SYSTEM</u>

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DEVELOPMENT OF A MOTORIZED CUTTER (ELECTRO-MECHANICAL PART) AND INTEGRATION SYSTEM

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A report submitted in partial fulfilment of the requirement
for the award of the degree of
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SUPERVISOR'S DECLARATION

"I hereby declare that we have checked this project and in my opinion this project is satisfactory in terms of scope and quality for the award of the degree of Diploma of Mechanical Engineering"

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I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurently submitted for award of other degree.

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DEDICATION

To my beloved parents, Mr. Ismail Bin Ainuddin and Mdm. Noridah Binti Harun, other siblings, family and friends, without whom and his/her lifetime efforts in encouraging and supporting my pursuit of higher education in Mechanical Engineering. Not forgotten to all staff of Faculty of Mechanical Engineering form University Malaysia Pahang especially my supervisor, Mr. Shahmi Bin Junoh@Yacob for giving me this opportunity and providing conducive environment in completing this project.

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I would also like to wish my special thanks to my course mates who have inspired me and helped me throughout my project.

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ABSTRAC

A motorized cutter been designed to use in harvesting fresh fruit bunches especially during fruit season. The main reason for the motorized cutter been designed is to make it easier for the users or consumers operating the cutter without using high energy. The motorized cutter had been support with 24V DC motor, 24V rechargeable battery, cable and other electrical components. H-bridge concept being used in electrical circuit so that the motor rotor can rotate clockwise or anti clockwise when the push button is pressed.

ABSTRAK

Sebuah pemotong bermotor dibuat khas untuk digunakan ketika mengait buah yg sudah masak terutama pada musim buah. Tujuan utama pemotong bermotor ini direka untuk memudahkan para pengguna untuk mengait buah-buahan tanpa menggunakan tenaga yang tinggi. Pemotong bermotor ini dilengkapi dengan sistem elektrik dimana menggunakn 24V DC motor, 24V bateri caj, kabel dan juga komponen-komponen elektrik lain yang juga turut digunakan. Konsep H-bridge digunakan dalam litar elektrik bagi memudahkan motor berpusing mengikut lawan jam atau arah lawan jam apabila butang suis ditekan.

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LIST OF ABBREVIATION

MIG	**Metal Inert Gas**
DC	**Direct Current**
AC	**Alternating Current**
LED	**Light Emitting Diode**

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION FOR MOTORIZED CUTTER

A cutter for harvesting fresh fruit bunches and pruning fronds is easier to find in the current market nowadays. It has been used for a long time ago especially during fruit season such as rambutan season. Therefore with our modern technology, a new motorized cutter have been created so that make it easier to the farmer in collecting fruit bunches and pruning fronds. A motorized cutter was driven by (DC) motor when operating it. The other component uses in motorized cutter are battery, LED, resistor, cable and aluminium plate (motor casing).

1.1.1 INTRODUCTION TO DC MOTOR

A DC motor is an electric motor that runs on direct current (DC) electricity. A DC motor works by converting electric power into mechanical work. This is accomplished by forcing current through a coil and producing a magnetic field that spins the motor. The simplest DC motor is a single coil apparatus, used here to discuss the DC motor theory.

The voltage source forces voltage through the coil via sliding contacts or brushes that are connected to the DC source. These brushes are found on the end of the coil wires and make a temporary electrical connection with the voltage source. In this motor, the brushes will make a connection every 180 degrees and current will then flow through the coil wires. At 0 degrees, the brushes are in contact with the voltage source and current is flowing. The current that flows through wire segment C-D interacts with the magnetic field that is present and the result is an upward force on the segment.

The current that flows through segment A-B has the same interaction, but the force is in the downward direction. Both forces are of equal magnitude, but in opposing directions since the direction of current flow in the segments is reversed with respect to the magnetic field. At 180 degrees, the same phenomenon occurs, but segment A-B is forced up and C-D is forced down. At 90 and 270-degrees, the brushes are not in contact with the voltage source and no force is produced. In these two positions, the rotational kinetic energy of the motor keeps it spinning until the brushes regain contact.

The brushed DC motor generates torque directly from DC power supplied to the motor by using internal commutation, stationary permanent magnets, and rotating electrical magnets. Advantages of a brushed DC motor include low initial cost, high reliability, and simple control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses. Maintenance involves regularly replacing the brushes and springs which carry the electric current, as well as cleaning or replacing the commutator. These components are necessary for transferring electrical power from outside the motor to the spinning wire windings of the rotor inside the motor

Brushless DC motors use a rotating permanent magnet in the rotor, and stationary electrical magnets on the motor housing. A motor controller converts DC to AC. This design is simpler than that of brushed motors because it eliminates the complication of transferring power from outside the motor to the spinning rotor. Advantages of brushless motors include long life span, little or no maintenance, and high efficiency. Disadvantages include high initial cost, and more complicated motor speed controllers.

1.1.2 INTRODUCTION TO BATTERY

In electronics, a battery is a combination of two or more electrochemical cells which store chemical energy and make it available as electrical energy. Since its invention in 1800 by Alessandro Volta, the battery has become a common power source for many household and industrial applications, becoming a multibillion-dollar industry.

The name "battery" was coined by Benjamin Franklin for an arrangement of multiple Leyden jars (an early type of capacitor) after a battery of cannons. Common usage has evolved to include a single electrical cell in the definition.

1.1.3 INTRODUCTION TO CABLE

A cable is one or more wires or optical fibers bound together, typically in a common protective jacket or sheath. The individual wires or fibers inside the jacket may be covered or insulated. Combination cables may contain *both* electrical wires and optical fibers. Electrical wire is usually copper because of its excellent conductivity, but aluminium is sometimes used because it is lighter or costs less.

Electrical cables may be made flexible by stranding the wires. In this process, smaller individual wires are twisted or braided together to produce larger wires that are more flexible than solid wires of similar size. Bunching small wires before concentric stranding adds the most flexibility. A thin coat of a specific material (usually tin-which improved striping of rubber, or for low friction of moving conductors, but it could be silver, gold and another materials and of course the wire can be bare - with no coating material) on the individual wires.Tight lays during stranding makes the cable extensible (CBA - as in telephone handset cords).

Bundling the conductors and eliminating multi-layers ensures a uniform bend radius across each conductor. Pulling and compressing forces balance one another around the high-tensile center cord that provides the necessary inner stability. As a result the cable core remains stable even under maximum bending stress.

Cables can be securely fastened and organized, such as using cable trees with the aid of cable ties or cable lacing. Continuous-flex or flexible cables used in moving applications within cable carriers can be secured using strain relief devices or cable ties. Copper corrodes easily and so should be layered with Lacquer.

1.2 BACKGROUND OF THE PROJECT

A motorized cutter is specifically designed to allow us to do further study and have better understanding of flow mechanism during it operation when using 24V dc motor. This new designed of motorized cutter will have high capability in harvesting fresh fruit bunches. The blade is specifically design using patented C-sickle and support with saw cutting blade.

The design of patented C-sickle has been proven to give a higher cutting efficiency and at the same time minimizing the vibration transferred to the body of the operator. When the C-sickle been supported with saw cutting blade make it more easier to the user for harvesting fresh fruit just like using a saw and it is light when handling it.

The operation for motorized cutter been support with 24V dc motor can save time and energy when harvesting fruit. In the electrical circuit, we using H-bridge concept to connect the motor and the battery. When the push button is pressed, the motor will turn clockwise and pull the cable which has been connected with C-sickle and at the same time cut the fruit bunches. While when the push button is pressed for second time, the motor will turn anti clockwise and leave the cable and the C-sickle back at it initial position.

The motorized cutter also using light-emitting diode (LED) which is red and green LED. When the motorized cutter is operating, the red LED will turn on while when the cutter back at it own position or condition, the green LED will turn on. The main reason using different color LED during operating the cutter is to remind us that if there is any electrical current operating or not.

1.3 PROBLEM STATEMENTS

The cutter nowadays does not have dc motor and battery on their operation. It will took a long time to harvesting fresh fruit because it need to do manually when harvesting fresh fruit bunches by using our own energy. It will take a long time especially for a higher tree. The cutter which easy get in market have a higher in maintenance. When the cutter is been using for a period time, it will easy become malfunction or broken. For examples the blade peel of form the rod, the cable is not durable. So it need a lot of money to do maintenance.

1.4 OBJECTIVES

Objective to the project is firstly to produce an electrical circuit using suitable electrical components, develop and integrate it into the motorized cutter operation. Secondly, understand the operation of motorized cutter when supported by motor.

1.5 SCOPES

Literature review is been done on types of cutter which easy get in market nowadays, types of driven motor and also sheet metal for making motor casing. The motorized cutter is designed using engineering software like SolidWork to draw concepts design for conceptualization process and dimension of finalized concept to provide complete technical drawing. The finalized concept with technical drawing is fabricated using industrial machine and engineering tools. For example, aluminium using to make casing for 24V dc motor. Another software which been using is DXP Protel. DXP Protel been using in making electrical circuit. Examples of electrical components using in this project are battery, LED, motor, battery and push on button. H-bridge concept been using in making electrical circuit followed by solder process while joining method which is MIG welding being used to fabricate the casing with the cutter sing H-bridge concept for electrical circuit.

1.6 PROJECT ORGANIZATION

1.6.1 CHAPTER 2: LITERATURE REVIEW

Initial process of this project started with the literature study for the operation of motorized cutter to acquire better understanding of the importance and function of each part for motorized cutter. Each special component or design of the studied motorized cutter is listed to future use.

1.6.2 CHAPTER 3: METHODOLOGY

The following process is to determine the objective of the project and monitor the flow of the project. Required components in operating the motorized cutter is chosen based on the objectives. Each dimension of the component is defined using measuring instrument for determining the dimension of fabricated part to allow the component being assembled together. Function for each component have being identified and make it easier during assembly process and operating it.

1.6.3 CHAPTER 4: RESULT AND DISCUSSION

A new motorized cutter which using electrical systems during operation have been designed and built to identify the maximum load occur during harvesting rambutan fruit. Greatest challenge faced in this process when integrating the system and identifying the problems occur when the motorized cutter cannot be operated.

1.6.4 CHAPTER 5: CONCLUSION AND RECOMMENDATION

A new concept and design in operating the motorized cutter was built to improve the current product in market. Further investigation and recommendation for motorized cutter being identified and collect the data can be improved much better in future.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will provide detail description of literature review done regarding the project title of motorized cutter which is more focusing on their material in use and how it operating. In this literature review, we can see that there are lot types of motor in current market nowadays which can be use in this project. But each of electric motors has differences function and application. They also have their own advantages and disadvantages.

There are also variable types of sheet metal such as copper, aluminium, sheet and etc. Each of them has their own advantages and disadvantages. Same with cutters which also have variable types of it in current market nowadays and have different operation during handle it

2.2 TYPES OF MOTORIZED CUTTER

2.2.1 Wilkinsword Telescopic Universal Cutter

Figure 2.1: Wilkinsword Telescopic Universal Cutter

The Wilkinsword Telescopic Universal Cutter have a few advantages. A top pruner of this cutter is mounted on a lightweight telescopic steel pole that is capable of extending up to 4metres. The bypass blades function via a gear action giving 3 times more cutting power and operate through an integral pulley mechanism. The head can pivot through 240° and can lock at any angle.

2.2.2 Telescopic Tree Pruner

Figure 2.2: Telescopic Tree Pruner

Telescopic Tree Pruner is made using 65Mn high carbon alloy steel saw blade which durable when using it. The blade has 300mm and 2 sided teeth which allow smoothly cutting. It has ground universal pull cut saw blade. The Telescopic Tree Pruner are using double pulley with a 550lb. burst strength rope. Pulley is use in reducing the cutting efforts. It also use Teflon blade coating to reduces cutting friction and resists rust. The handles also can be adjustable. It just need to revolve the handles if want to release or lock the handles. The handles made form strong extendable handles and can be use for trimming branches up to 14’’ without a ladder. The connector made using strong ABS plastic which also durable and can be use for a long term. Overall length for this Telescopic Tree Pruner is 1800mm-2800mm.

2.2.3 Fiskars Pruner

Figure 2.3: Fiskars Pruner

Spare yourself the effort of climbing trees to reach far-off branches with this convenient and powerful Fiskars telescoping pruning tool. It uses plastic for body and handles. For the outer pole, it made from fiberglass while the inner pole is made from aluminum. The Fiskars pruner can be extending to a full 12 feet; 1-1/4-inch cutting capacity, allowing trimming upper branches from the safety and security of the ground. Its extremely includes with 15-inch sharp saw cutting blade with attachment which can be manipulated by pulling a rope or the pole's. The head can rotates through 240° for precise cutting angle. Overall length for Fiskars pruner is 95-inches long, for weight is 31 ounces and have lifetime warranty

2.3 TYPES OF MOTOR DRIVE

2.3.1 AC INDUCTION MOTOR (SHADED POLE)

A shaded-pole motor is a type of AC single-phase induction motor. As in other induction motors the rotating part is a squirrel-cage rotor. All single-phase motors require a means of producing a rotating magnetic field for starting. In the shaded-pole type, a part of the face of each field pole carries a copper ring called a shading coil. Currents in this coil delay the phase of magnetic flux in that part of the pole enough to provide a rotating field. The effect produces only a low starting torque compared to other classes of single-phase motors.

These motors have only one winding, no capacitor nor starting switch, making them economical and reliable. Because their starting torque is low they are best suited to driving fans or other loads that are easily started. Moreover, they are compatible with triac-based variable-speed controls, which often are used with fans. They are built in power sizes up to about 1/6 hp or 125 watts output. For larger motors, other designs offer better characteristics.

This photo is of a common C-frame motor. With the shading coils positioned as shown, this motor will start in a clockwise direction as viewed from the long shaft end.

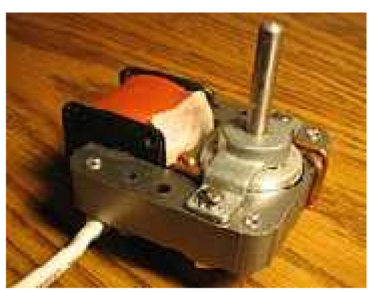


Figure 2.4: Small shaded-pole motor

2.3.2 AC INDUCTION MOTOR

An induction motor (IM) is a type of asynchronous AC motor where power is supplied to the rotating device by means of electromagnetic induction. Other commonly used name is squirrel cage motor due to the fact that the rotor bars with short circuit rings resemble a squirrel cage (hamster wheel).

An electric motor converts electrical power to mechanical power in its rotor (rotating part). There are several ways to supply power to the rotor. In a DC motor this power is supplied to the armature directly from a DC source, while in an AC motor this power is induced in the rotating device. An induction motor is sometimes called a rotating transformer because the stator (stationary part) is essentially the primary side of the transformer and the rotor (rotating part) is the secondary side. Induction motors are widely used, especially polyphase induction motors, which are frequently used in industrial drives.

Induction motors are now the preferred choice for industrial motors due to their rugged construction, absence of brushes (which are required in most DC motors) and the ability to control the speed of the motor.

Figure 2.5: Ac Induction Motor

2.3.3 AC SYNCHRONOUS MOTOR

A synchronous electric motor is an AC motor distinguished by a rotor spinning with coils passing magnets at the same rate as the alternating current and resulting magnetic field which drives it. Another way of saying this is that it has zero slip under usual operating conditions. Contrast this with an induction motor, which must slip in order to produce torque

Sometimes a synchronous motor is used, not to drive a load, but to improve the power factor on the local grid it's connected to. It does this by providing reactive power to, or consuming reactive power from the grid. In this case the synchronous motor is called a Synchronous condenser. Electrical power plants almost always use synchronous generators because it's very important to keep the frequency constant at which the generator is connected. Low power applications include positioning machines, where high precision is required, and robot actuators. Mains synchronous motors are used for electric clocks.

Figure 2.6: Ac Synchronous motor

2.3.4 STEPPER DC MOTOR

A stepper motor (or step motor) is a brushless, synchronous electric motor that can divide a full rotation into a large number of steps. The motor's position can be controlled precisely, without any feedback mechanism (see open loop control). Stepper motors are similar to switched reluctance motors, which are very large stepping motors with a reduced pole count, and generally are closed-loop commutated.

Stepper motors operate differently from normal DC motors, which rotate when voltage is applied to their terminals. Stepper motors, on the other hand, effectively have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are energized by an external control circuit, such as a microcontroller. To make the motor shaft turn, first one electromagnet is given power, which makes the gear's teeth magnetically attracted to the electromagnet's teeth. When the gear's teeth are thus aligned to the first electromagnet, they are slightly offset from the next electromagnet. So when the next electromagnet is turned on and the first is turned off, the gear rotates slightly to align with the next one, and from there the process is repeated. Each of those slight rotations is called a "step." In that way, the motor can be turned to a precise angle.

Figure 2.7: Stepper dc motor

2.3.5 BRUSHED DC MOTOR

The DC motor is a rotating electric machine designed to operate from source of direct voltage. The basic type is a permanent magnet DC motor. The stator of a permanent magnet DC motor is composed of two or more permanent magnet pole pieces. The rotor is composed of windings that are connected to a mechanical commutator. The opposite polarities of the energized winding and the stator magnet attract and the rotor will rotate until it is aligned with the stator. Just as the rotor reaches alignment, the brushes move across the commutator contacts and energize the next winding.

Two other types of DC motors are series wound and shunt wound DC motors. These motors also use a similar rotor with brushes and a commutator. However, the stator uses windings instead of permanent magnets. The basic principle is still the same. A series wound DC motor has the stator windings in series with the rotor. A shunt wound DC motor has the stator windings in parallel with the rotor winding. A series wound motor is also called a universal motor. It is universal in the sense that it will run equally well using either an AC or a DC voltage source.

DC motors are controlled by an H-bridge consisting of four power switches. They enable you to adjust the motor voltage and polarity using the Pulse Width Modulation (PWM) technique. Thus speed and direction of the motor can be controlled.

Figure 2.8: Brushed dc motor

Table 2.1: COMPARISONS TYPES OF MOTOR [1]

Type	**Advantages**	**Disadvantages**	**Typical Application**	**Typical Drive**
AC Induction (Shaded Pole)	-Least expensive -Long life -High power	-Rotation slips from frequency -Low starting torque	Fans	Uni/Poly-phase AC
AC Induction (split-phase capacitor)	-High power -High starting torque	Rotation slips from frequency	Appliances	Uni/Poly-phase AC
AC Synchronous	Rotation in-sync with freq long-life (alternator)	More expensive	-Clocks -Audio turntables -Tape drives	Uni/Poly-phase AC
Stepper DC	-Precision positioning -High holding torque	-Slow speed -Requires a controller	Positioning in printers and floppy drives	Multiphase DC
Brushed DC electric motor	-Low initial cost -Simple speed control	-High maintenance (brushes) -Low lifespan	-Treadmill exercisers -Automotive starters	Direct (PWM)

2.4 TYPES OF SHEET METAL (FOR MOTOR CASING)

2.4.1 COPPER

Copper is a chemical element with the symbol and atomic number 29. It is a ductile metal with excellent electrical conductivity. Copper is rather supple in its pure state and has a pinkish luster which is (beside gold) unusual for metals, which are normally silvery white. It is used as a heat conductor, an electrical conductor, as a building material and as a constituent of various metal alloys. Copper is an essential trace nutrient to all high plants and animals. In animals, including humans, it is found primarily in the bloodstream, as a co-factor in various enzymes and in copper-based pigments. However, in sufficient amounts, copper can be poisonous and even fatal to organisms.

Copper has played a significant part in the history of mankind, which has used the easily accessible uncompounded metal for thousands of years. Evidence has been preserved from several early civilizations of the use of copper. In the roman era, copper was principally mined on Cyprus, hence the origin of the name of the metal as Cyprium, "metal of Cyprus", later shortened to Cuprum. A number of countries, such as Chile and the United States, still have sizable reserves of the metal which are extracted through large open pit mines. However, like tin, there may be insufficient reserves to sustain current rates of consumption. High demand relative to supply caused a price spike in the 2000s. Copper has a significant presence as a decorative metal art. It can also be used as an anti-germ surface that can add to the anti-bacterial and antimicrobial features of buildings such as hospitals

2.4.2 ALUMINIUM

Aluminium is a silvery white and ductile member of the boron group of chemical elements. It has the symbol **Al**; its atomic number is 13. It is not soluble in water under normal circumstances. Aluminium is the most abundant metal in the Earth's crust, and the third most abundant element therein, after oxygen and silicon. It makes up about 8% by weight of the Earth’s solid surface. Aluminium is too reactive chemically to occur in nature as the free metal. Instead, it is found combined in over 270 different minerals. The chief source of aluminium is bauxite ore.

Aluminium is remarkable for its ability to resist corrosion (due to the phenomenon of passivation) and its low density. Structural components made from aluminium and its alloys are vital to the aerospace industry and very important in other areas of transportation and building. Its reactive nature makes it useful as a catalyst or additive in chemical mixtures, including being used in ammonium nitrate explosives to enhance blast power.

Aluminium is a soft, durable, lightweight, malleable metal with appearance ranging from silvery to dull grey, depending on the surface roughness. Aluminium is nonmagnetic and nonsparking. It is also insoluble in alcohol, though it can be soluble in water in certain forms. The yield strength of pure aluminium is 7–11 MPa, while aluminium alloys have yield strengths ranging from 200 MPa to 600 MPa. Aluminium has about one-third the density and stiffness of steel. It is ductile, and easily machined, cast, and extruded.

Corrosion resistance can be excellent due to a thin surface layer of aluminium oxide that forms when the metal is exposed to air, effectively preventing further oxidation. The strongest aluminium alloys are less corrosion resistant due to galvanic reactions with alloyed copper. This corrosion resistance is also often greatly reduced when many aqueous salts are present however, particularly in the presence of dissimilar metals.

Aluminium is a good thermal and electrical conductor, by weight better than copper. Aluminium is capable of being a superconductor, with a superconducting critical temperature of 1.2 kelvin and a critical magnetic field of about 100 gauss.

Table 2.2: COMPARISONS BETWEEN COPPER AND ALUMINIUM

ASPECTS	ALUMINIUM	COPPER
WEIGHT	LIGHT	HEAVY
CONDUCTOR	GOOD	EXCELLENT
PRICE	CHEAP	EXPENSIVE
APPLICATION	MORE TO MECHANICAL PARTS	MORE TO ELECTRONIC COMPONENTS
FORM TO SHAPE	EASY	HARD

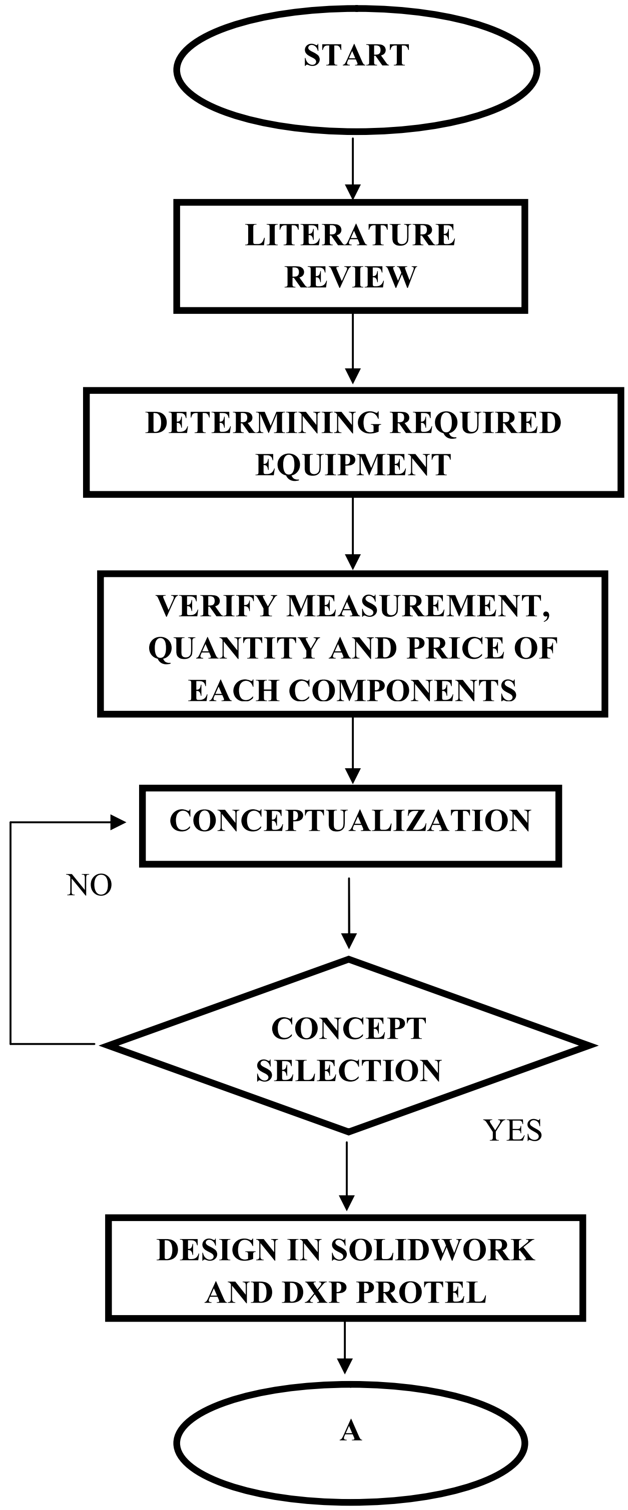
CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter will provide detail explanation on the methodology of carrying out this project from the beginning to the end. Title was given by the supervisor in the beginning of this semester including objectives and scopes of the project. Since the title is “Motorized cutter (Electro-Mechanical Part)”, a detail related literature review was done and important information were acquired and explained in previous chapter. Since the title given was motorized cutter, rough ideas of the required components were listed and measurement of each components were also defined accordingly. Sketches of conceptualization was done and only one of the concept was selected and which most possible to fulfill targeted objectives. Process selection of material is not based on material properties instead based on material dimension suitability according to the concept sketches and later fabricated using industrial machine based on the technical drawing of the selected concept. A test run was carried out for motorized cutter which have been design and fabricated between electrical and mechanical part and minor alteration was done to improve the performance.

3.2 OVERALL METHODOLOGY



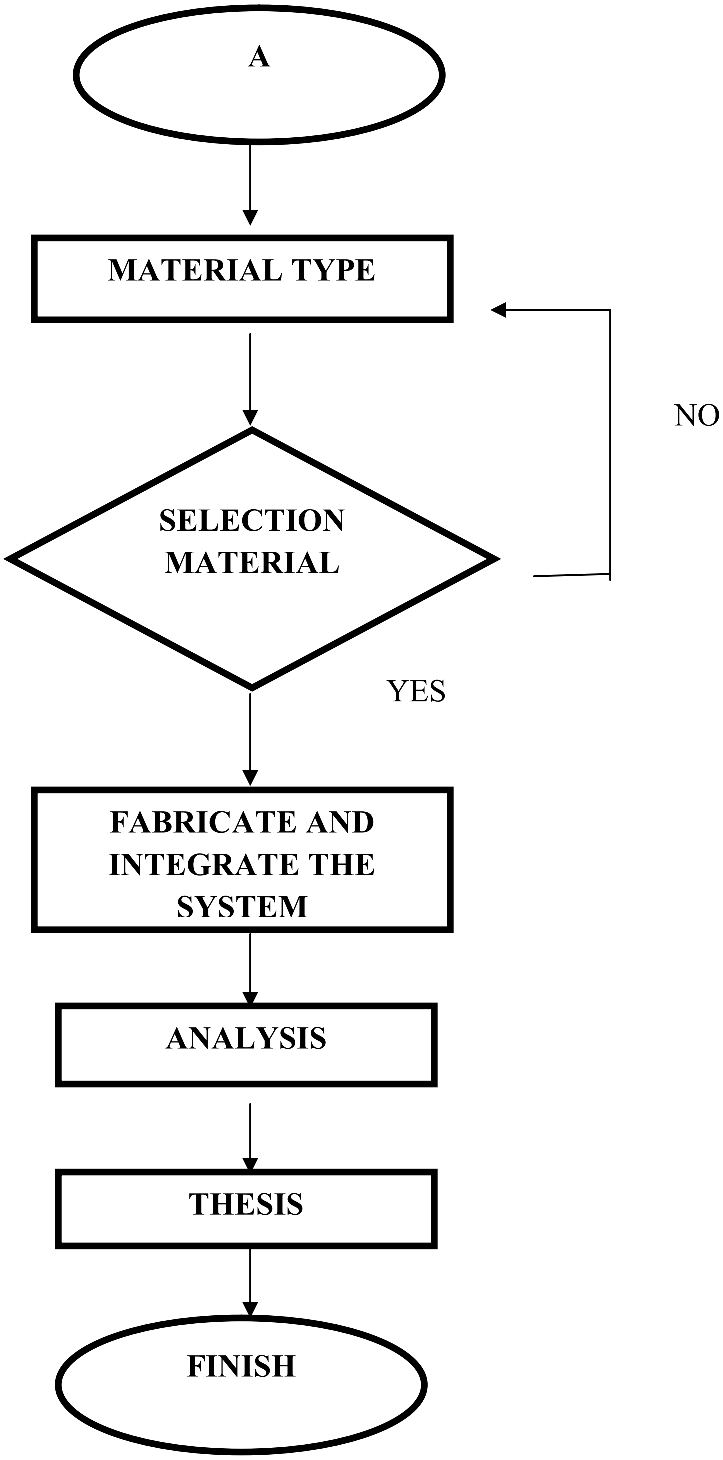


Figure 3.1: Flowchart of overall methodology

From the flow chart above, this project started with the literature review or defines the product and research about the title. The main important of the project is determination is the objective. Then, study and make a lot of research on types of motor and cutter in market. These tasks have been done through research on the internet, magazines, from public areas and others sources

.

Then the information has been collect and gather, after that, the project will be continuing with the design process. In this stage, the knowledge and lessons that have studied will be applied in sketching. The manual sketching is on the A4 it is to make a suitable design for the project. A design for electrical circuit and motor casing been made using sketching and finally transfer into engineering drawing by using Solidwork and DXP Protel software.

After all the drawing finished, the drawing was used as a reference for the next process, which is fabrication stage for motor casing. This process is consists fabricate the cutter with the motor casing by following all the dimension using various type of manufacturing process. The manufacturing process included in this process is welding by using MIG, cutting, grinding, drilling and others. For the electrical part, all the electrical components being solider and connected together based on the sketch drawing.

Integration stage has been implementing after electrical and mechanical part for cutter has been combined together. The testing is run to gathered information about the capability cutter during operation. During the testing, if problem occur, the process step back to previous process, and try to correct it back.

Then, all the process mentioned above is done; all the material for report writing is gathered. The report writing process will be guided by the UMP final year project report writing. This process also, preparation for presentation slides for the final presentation for this project. The project ended after the submission of the report and the slide presentation has been present.

3.3 GANTT CHART

ACTIVITIES	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Understand project scopes																
Collect data																
Build flow chart																
Build Gantt chart																
Sketch circuit and motor casing																
Draw in Solidwork and DXP Protel																
Progress presentation																
Fabrication																
Integration system																
Finalize project																
Analysis																
Thesis																
Final presentation																

Table 3.1: Gantt chart

3.4 PROCESS INVOLVED IN PROJECT

3.4.1 MOTOR CASING

Several processes have been used to fabricate the motor casing. The fabrication process starts from dimensioning the raw material until it is finish as a desired product. The processes that involved are including:

a) Measuring: Measuring the material into dimension needed.
b) Marking: All measured materials need to be marked to give precise dimension.
c) Cutting: Cutting the material into part according to dimension needed.
d) Joining: Materials joined by the method of welding
e) Drilling: Marked holes are then drilled to make holes for joining it with another part.
f) Finishing: Any rough surface cause by welding spark were grind to give smooth and safe surface.
g) Spraying: Using black spray color to the whole product.

3.4.2 PROCESS IN MAKING MOTOR CASING

The fabrication processes was started with measuring the material into the required dimension needed. The measuring process done to the aluminium plate and mark it based on the dimensions according to its length needed. All the measuring and marking process is done by using steel ruler, measuring tape, and steel marker. Before measuring process, the types of material identification is needed to make sure all part can be assembling with the correct way.

Then, after measuring and marking process, the marked material goes to next process, cutting. The aluminium plate being cut by using the vertical bend saw. Before proceeding with this process, safety measurement had been carried out by wearing Personal Protective Equipment (PPE) such as goggle and hand glove. These safety measurements are so important in order to prevent the projectile spatter from the process.

Then the aluminium plate that had been cut will drill at the several locations to make the holes for wire to connect between motor and controller part. Drilling machines was used during this process for joint the parts.

The aluminium plate that had been drill and cut to the required size is bending to make it like a casing box. The vice and the hammer will used for this process.

Then, the material that had been drilled, grinded and cut will be ready to be joining with using the welding. The joining process was carried out by using the Gas Metal Arc welding or formerly known as (MIG) Metal Inert Gas. Before started the process, the out put of the processes had been setup to make sure it will satisfy and suitable with the material used. Before proceeding with this process, safety measurement had been carried out by wearing Personal Protective Equipment (PPE) such as face shield, hand gloves and so on.

All the material that had been weld was grinded to give smooth surface from the sharp edge and weld spark that will make dangerous when handling the material. The hand grinder was used for this process.

After all the process had been done, the last process is spraying the product to make it look more smooth and beautiful. Before that the whole product must be brush by using the sand paper to ensure it from dirt and rust. The whole product will spray with the black color.

3.4.3 PROCEDURE IN MAKING MOTOR CASING (PICTURE)

Cutting process using vertical bendsaw

Drilling process using drill machine to make a hole

Bending process using hammer to bend the plate

Joining process using welding method

Figure 3.2: Process involve in making motor casing

3.4.4 ELECTRICAL CIRCUIT

a) Checking : checking voltage all the electrical components with multimeter

b) Solder : solder all the electrical components on the bread board

c) Using H-bridge Concept

3.4.4.1 SOLDERING PROCESS

Soldering is a process in which two or more metal items are joined together by melting and flowing a filler metal into the joint, the filler metal having a relatively low melting point. Soft soldering is characterized by the melting point of the filler metal, which is below 400 °C (800 °F). The filler metal used in the process is called solder.

Soldering is distinguished from brazing by use of a lower melting-temperature filler metal; it is distinguished from welding by the base metals not being melted during the joining process. In a soldering process, heat is applied to the parts to be joined, causing the solder to melt and be drawn into the joint by capillary action and to bond to the materials to be joined by wetting action. After the metal cools, the resulting joints are not as strong as the base metal, but have adequate strength, electrical conductivity, and water-tightness for many uses.

In this project soldering is being using in assembling electronic components to printed circuit boards (PCBs)

Figure 3.3: Soldering Components

3.4.4.2 H-BRIDGE CONCEPT

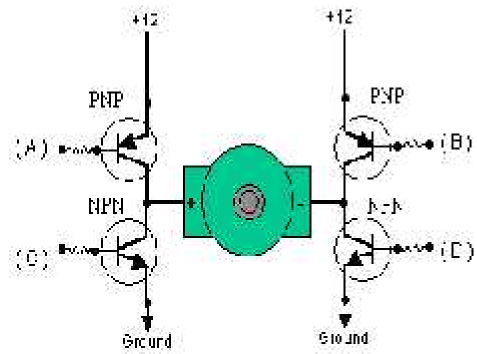


Figure 3.4: H-bridge concept

H-bridge concept is being able to control the direction a motor was going (forward or backward). It can be achieved by managing current flow through circuit elements called transistors. The formation looks like an H and that's where it gets the name H-Bridge. The picture illustrates the 4 base cases that we can get out of the simple version of an H-Bridge. The two cases that interest us are when A & D are both 1 and when B & C are both 1. When A & D are 1 current from the battery will flow from point A through the motor to D's ground. However for the case when B & C are both 1, current will flow in the opposite direction from B through the motor to C's ground.

3.4.5 PROCESS IN MAKING ELETRICAL CIRCUIT

All the electrical components such as LED, push on button and jumper being solder on the bread board based on the electric circuit sketching. Than it connected together with the battery and 24V dc motor.

3.4.6 PROCEDURE IN MAKING ELECTRICAL CIRCUIT (PICTURE)

Solder all the electrical components on PCB's board

Solder the wire from the PCB's board with the push button. Than put the PCB's board inside the controller box

Figure 3.5: Procedure in making electrical circuit (picture)

3.5 MANUFACTURING PROCESS INVOLVED

3.5.1 METAL INERT GAS (MIG) WELDING

MIG (Metal Inert Gas) or as it even is called GMAW (Gas Metal Arc Welding) uses an aluminum alloy wire as a combined electrode and filler material. The filler metal is added continuously and welding without filler-material is therefore not possible. Since all welding parameters are controlled by the welding machine, the process is also called semi-automatic welding.

The MIG-process uses a direct current power source, with the electrode positive (DC, EP). By using a positive electrode, the oxide layer is efficiently removed from the aluminum surface, which is essential for avoiding lack of fusion and oxide inclusions. The metal is transferred from the filler wire to the weld bead by magnetic forces as small droplets, spray transfer. This gives a deep penetration capability of the process and makes it possible to weld in all positions. It is important for the quality of the weld that the spray transfer is obtained.

In this project MIG welding being used to connect the aluminium motor casing with the rod cutter

3.5.2 DRILLING MACHINES

A drill is a tool with a rotating drill bit used for drilling holes in various materials. Drills are commonly used in woodworking, metalworking, 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 workpiece.

Speed change is achieved by manually moving a belt across a stepped pulley arrangement. Some drill presses add a third stepped pulley to increase the speed range. Modern drill presses can, however, use a variable-speed motor in conjunction with the stepped-pulley system; a few older drill presses, on the other hand, have a sort of traction-based continuously variable transmission for wide ranges of chuck speeds instead, which can be changed while the machine is running.

Drill presses are often used for miscellaneous workshop tasks such as sanding, honing or polishing, by mounting sanding drums, honing wheels and various other rotating accessories in the chuck. This can be dangerous on many presses, where the chuck arbor is held in the spindle purely by the friction of a Morse taper instead of being held securely by a drawbar.

In this project, drilling process is being used to make a hole for connected between the motor, controller part and battery.

3.5.3 VERTICAL BANDSAW

Vertical bendsaws, also known as contour saws, perform metal removal jobs that save time and material. Large sheets and bars of material can be cut to any size or shape without creating too many chips in a short period of time. Most materials, from wood and plastics to aluminum and steel, can be cut by using vertical bendsaw.

In this project, vertical bendsaw being using to cut aluminium plate to make a casing since it can cut at any angle and size.

3.6 PROCESSES (PICTURE)

Figure 3.6: Measuring process

Figure 3.7: Cutting process (vertical bendsaw)

Figure 3.8: Bending process

Figure 3.9: Grinding process

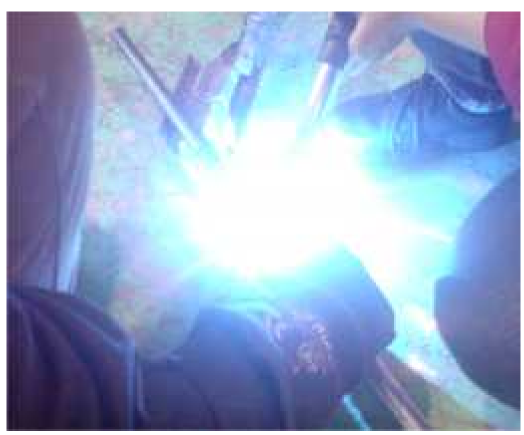


Figure 3.10: Welding process

Figure 3.11: Drilling process

Figure 3.12: Spraying process

CHAPTER 4

RESULT AND DISCUSSION

4.1 ASPECT IN DESIGN

4.1.1 MOTOR CASING

The design for motor casing must be compliance to several aspects. The design consideration must be done carefully so the design can be fabricated and the parts are all functioning. The aspects that must be considered in designing the dining chair are including:

a) Strength: Must have certain strength to ensure that it can load 24V dc motor weight.
b) Safety: Giving the safety for the user.
c) Material: Availability of material is one of aspects that have been considered.
d) Light: Must light in weight when connected with the rod cutter

4.1.2 ELECTRICAL CIRCUIT

The design for electrical circuit motor casing must be compliance to several aspects. The aspects that must be considered including:

a) Safety : Giving the safety for the users (no electrical shock when operating it)
b) H-bridge : Using H-bridge concept to ensure motor turn clockwise and anti clockwise

4.2 DRAWING

The drawing process will be divided into two categories, which are including:

a) Sketching: All the ideas for making the motor casing and electric circuit will be sketch on the paper first to ensure that idea selection and be made after this.

b) SolidWork software: The sketching idea in hand manual sketch will be change in 3D using SolidWork.

   DXP Protel software: The sketching idea in hand manual sketch will be change in real electrical circuit

4.3 SPECIFICATION FOR MOTOR

- Voltage: 24V DC
- Rated current: 4A
- Rated torque: 11N.m
- Rated speed: 23rpm
- Diameter: 1.57‘ and long 3"
- Shaft diameter: 0.3744 x 0.748‘
- Ratio: 185.4:1
- Amps: 0.8
- H.P.: 1/175

4.4 SPECIFICATION FOR ALUMINIUM (CASING MOTOR)

- Dimension 130mm x 35mm x 35mm

4.5 SKECTHING DRAWING

4.5.1 MOTOR CASING

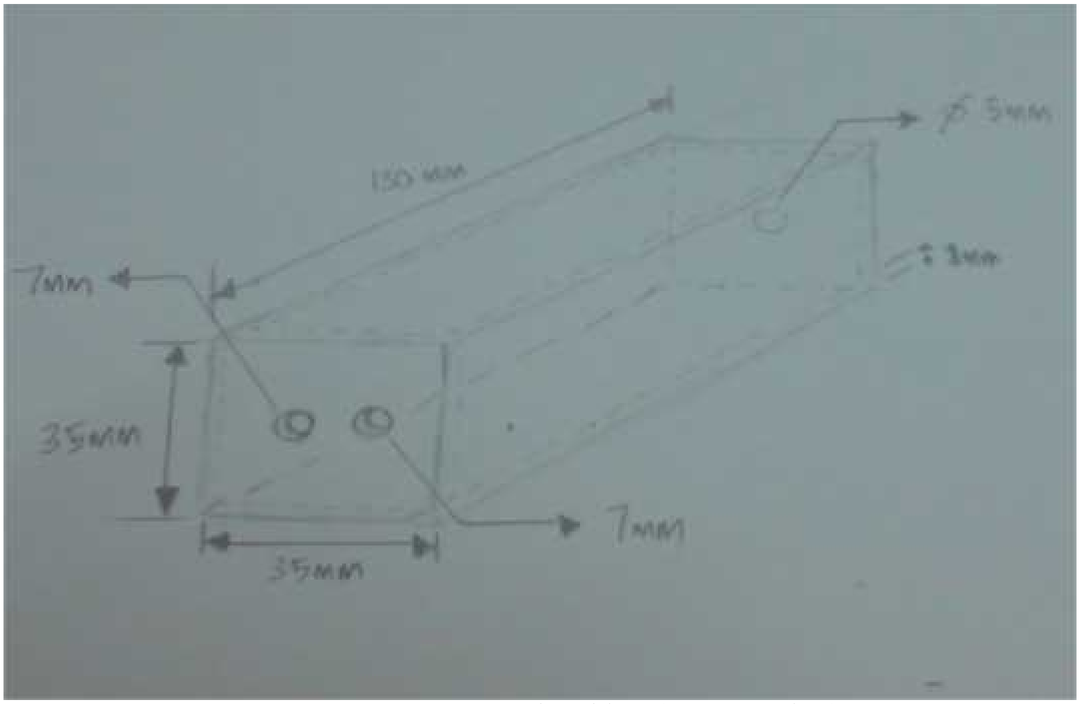


Figure 4.1: Sketching (motor casing)

4.5.2 ELECTRICAL CIRCUIT

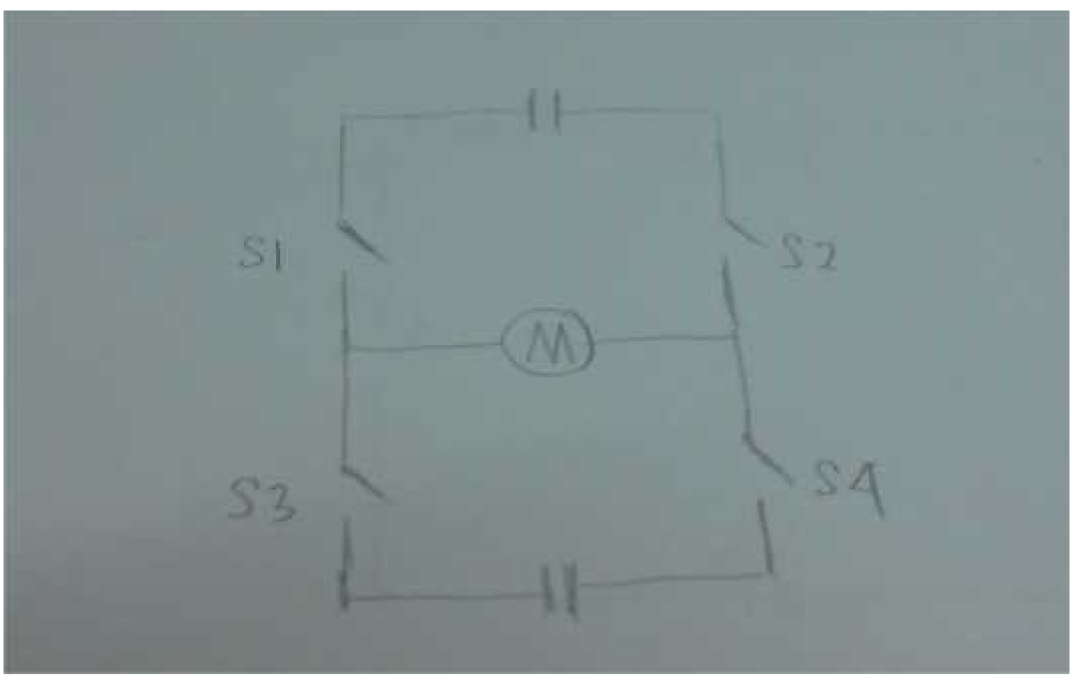


Figure 4.2: Sketching (electrical circuit)

4.6 FINALIZED DESIGN

4.6.1 SOLIDWORK DRAWING

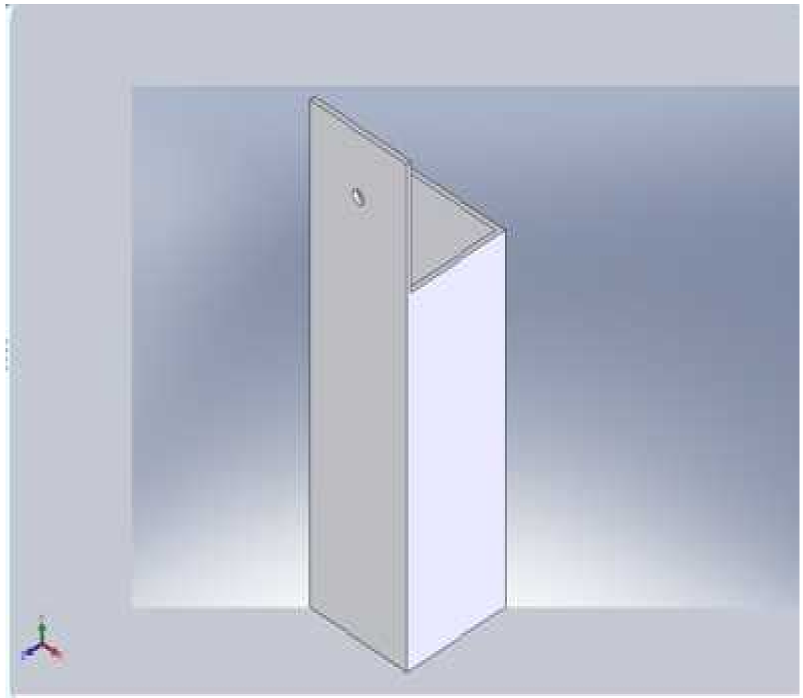


Figure 4.3: Solidwork for motor casing

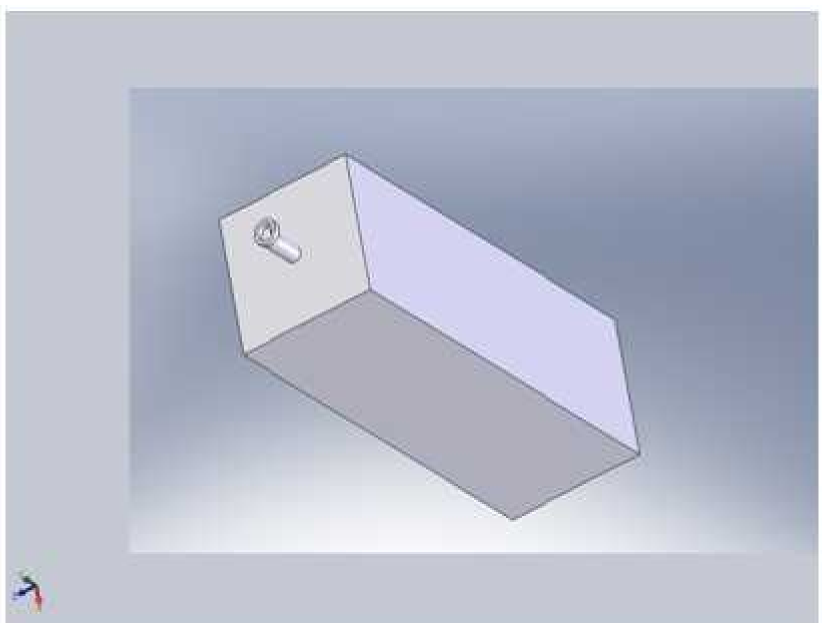


Figure 4.4: Solidwork for motor casing with motor inside it

4.6.2 DXP PROTEL CIRCUIT

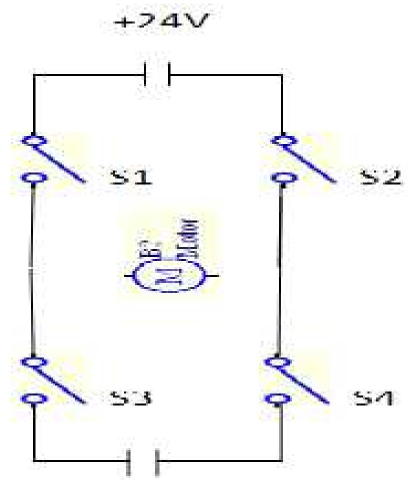


Figure 4.5: DXP Protel circuit

4.7 THE WHOLE PRODUCT PREVIEW

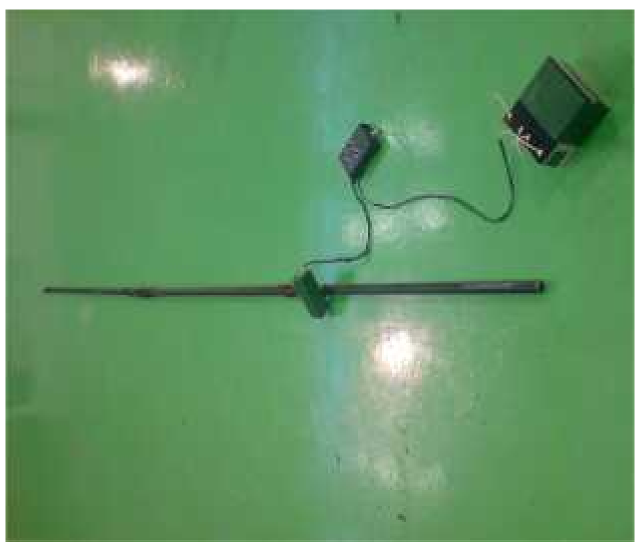


Figure 4.6: The whole product preview

4.8 TESTING OF THE PRODUCT (PICTURE)

Figure: 4.7: Testing of the motorized cutter (picture)

4.9 RESULTS

As a result, the motorized cutter success and finish being fabricate and integration of system have been done based on the time. From the testing that has been made, there are a few problems on the product such as:

1. Cable can not be attached with the rotor motor using welding method

The cable can not be attached together with the rotor motor using welding method because the cable easy to burn out

2. The LED burn out and cannot be use because the current is too high

The LED can not support the current that flow in the motorized cutter operation because the current is too high and need to be support with high resistance

3. The battery is too heavy and need to carry everywhere when operating

The battery is too heavy and need to carry everywhere make it more difficult to the users when using it

4. Need 2 person when operating it

It need 2 person in one time to handle the motorized cutter since it have two part to be handle which is the cutter and the controller part

4.10 DISCUSSION FOR THE RESULTS

For the future recommendation, a few things can be done to improve the product become better such as:

1. Use more durable cable

Using more durable cable which is not easy to burn out when welding it together with the rotor motor

2. Use high resistance to support LED

Since LED is easy to burn out, high resistance can be used to support the LED

3. Make a casing box or a beg for battery

Since the battery is too big and heavy, a casing box can be made or put the battery inside the beg

4. Join any solid material with the rotor to make it more long and easier when the motor rotating the cable

Since the rotor is too short and difficult for the rotor to support the cable when rotating it, the rotor can be join together with any solid material to make it more long.

CHAPTER 5

CONCLUSION & FUTURE RECOMMENDATTION

5.1 INTRODUCTION

This chapter is about problems the project encounter before, during and after the project. This chapter also will discuss about the conclusion of the project. Problem that will be discussed here is the entire problem encountered in every task in the project. The problem encountered during literature review is mainly about the difficulty to get the material to be used in this project. The problem is like, limited resources to get the relevant material such as books and internet connection problem. The problem also comes from the material itself such as many non relevant literature reviews about the project title.

5.2 PROJECT PROBLEMS

a) Designing and sketching

Many problems come at this stage. The problems came during decision making to select the best criteria that need for the project.. During this period many design have been sketched but to pick one design that have all the criteria needed by the specification is hard. After a design is selected, another problem encountered is dimensioning the design. After several searching and discussion with the supervisor the problem is solved.

b) Material selection and budget

Another problem encountered during design process is material selection for the system, these happen because, the project budget is disclose. The material selection also hard to done because no specific information about available material at the market. Another problem during material selection is the status of person in charge on buying the material and how to buy the material

.

c) Fabrication and integration work

Students need to given more time to finish fabricating and integration work because of limited amount of machines.

d) Material and electrical components preparation

The material and electrical components in lab is not available for making my project and to order the material at market take a long period time to arrive. As an alternative I need to buy my own self all the material and electric components to start the fabrication and integration process while waiting the material needed is arriving.

e) Lab machine and equipments

The amount of machines in lab is not enough to use for the whole student PTA and PSM to do the project in the same time. And the some lab equipment is malfunction. Then the amount of protective equipments is less to use.

5.3 CONCLUSION

In general, the project achieves objectives however some objectives are ignored due to the time frame. Overall perception of the project carried out was good. The project was completed on schedule despite being started late because of some confusion. If more time and good budget is given the project will be complete successfully.

5.4 RECOMMENDATION

a) The planning of the project must be done before the project started, it is because to avoid the problem when to start the fabrication and can be done in a shorter time.
b) More time given to the project
c) Having a good time management can guaranty that any of students task to complete in a good ways.

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APPENDIX

PLAYAR

SOLDER SUCKER

WIRE

SOLDER WIRE

SOLDER IRON

PUSH ON BUTTON