UNIVERSITI MALAYSIA PAHANG

BORANG PENGESAHAN STATUS TESIS ◆

JUDUL: DESIGN AND FABRICATE OF A MOTORIZED CUTTER FOR MECHANICAL PART

SESI PENGAJIAN: 2007/2008

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DESIGN AND FABRICATE OF A MOTORIZED CUTTER FOR MECHANICAL PART

MAIZATUL MASTURA BINTI MUHAMMAD NAZRI

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

Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

NOVEMBER 2008

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"

Signature:

Name of Supervisor: En Shami B. Junoh@yacob

Date:

STUDENT'S DECLARATION

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.

Signature:
Name: Maizatul Mastura Binti Muhammad Nazri
ID Number: MB06031
Date:

DEDICATION

To my parent, friends, without whom and his/her lifetime efforts, my pursuit of higher education would not have been possible and I would not have had the chance to study for a mechanical course

Also to my supervisor, Mr. Shahmi B. Junoh@Yacob and other Mechanical staff, without whose wise suggestions, helpful guidance and direct assistance, it could have neither got off the ground nor ever been completed.

ACKNOWLEDGEMENTS

This project was conducted under the supervision of Mr. Shahmi Bin Junoh@Yacob in University Malaysia Pahang formerly known as KUKTEM. I am very grateful to him for his patience and his constructive comments that enriched this research project. His time and efforts have been a great contribution during the preparation of this thesis that cannot be forgotten for ever. I would like to thank to lecturers and technicians in faculty of Mechanical Engineering for their valuable comments and sharing time and knowledge on this research project during the project was carried out. I also gratefully acknowledge the assistance of everybody who helped in the execution of this project in UMP. I also thank to all Mechanical students for their friendship and help when thinking through problems and for sharing their knowledge of experimental apparatus and computer systems. Finally, I thank my family for their continuous support and confidence in my efforts.

ABSTRACT

Cutter is a common tool used in various cutting shape for a variety purposes. In this project, the improvement of cutter which is design and fabricate of a motorized cutter for mechanical part then integrate the system using a 24V DC motor to operate the system so it can cut the fruit brunches easily without using our own energy too much. This cutter can lift up until 3.5 m and above according the user height and it not too heavy to carry it because it weight is 2.2 kg including the electro-mechanical part. This cutter also safe to used because of the C-sickle is weld properly and tied with aluminum plate together with bolt and nut so it cannot easily falling down to the ground which is can get hurt. The design of this product is suitable with the electro-mechanical part and can work together. The operating for this system is control by the controller to moving the motor spindle. When press the ON button the motor spindle will move clockwise direction then roll the rope while it attract top rod which is it will through the hole until the spring retract is finish. Then, when press the OFF button, the motor spindle will released the rope and the spring will extend back to it normal position. However, this cutter needs to be handled by two persons because one person needs to hold the battery and the controller and the other person will hold the rod. Hence, this motorized cutter can help people to harvesting fruit bunches easily and also can used it in a long term.

ABSTRAK

Pemotong ialah peralatan yang biasa digunakan dalam pelbagai jenis pemotongan dan juga mempunyai pelbagai kegunaan. Di dalam projek ini, saya membuat penambahbaikkan pemotong iaitu reka bentuk dan membuat pemotong bermotor untuk bahagian mekanikal selepas itu akan digabungkan dengan menggunakan 24V DC motor untuk menjalankan sistem ini supaya ia akan dapat memotong tangkai buah dengan mudah tampa mengeluarkan tenaga dengan banyak. Pemotong ini dapat diangkat ke atas sehingga 3.2 m dan ke atas mengikut ketinggian penguna itu sendiri. Ia juga tidak terlalu berat untuk dibawa kerana mempunyai berat sebanyak 2.2 kg termasuk berat bahagian electro-mekanikal. Pemotong inin juga selamat digunakan kerana mata sabit C dikimpal dengan teliti bersama-sama kepingan aluminium dengan bolt dan nut supaya ia tidak mudah jatuh ke bawah lalu menyebabkan kecederaan. Reka bentuk untuk produk ini sesuai dengan bahagian electro-mekanikal dan dapat beroperasi dengan baik. Operasi sistem ini dikawal oleh alat kawalan untuk mengerakkan spindle motor. Apabila butang ON ditekan, spindle motor akan bergerak mengikut arah jam dan akan mengulung tali dimana pada masa yang sama tali itu akan menarik rod besi diatas dan melalui lubang yang ditebuk sehingga spring menarik sampai habis. Kemudian, apabila butang OFFditekan, spindle motor akan meeraikan tali dan spring akan memanjang semula ke posisi asalnya. Walaubagaimanapun, pemotong ini perlu dikawal seramai dua orang kerana salah seorang perlu memegang rod pemotong. Dengan itu, pemotong bermotor ini dapat menolong pengguna untuk mencantas tangkai buah dengan mudah dan juga boleh digunakan dalam jangka masa yang panjang.

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LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Overview

This project presents a design and development of a Motorized Cutter (Mechanical Part) that considers strength, durability, light in weight, easy to use and safe, save time and ergonomic factor. This cutter would be entirely different from existing cutters. The Diploma final year project allocates the duration of one semester, this large man-hour project requires significant efforts of the student to participate. Basically the entire Motorized Cutter project could be divided into three stages, which are concept review and development, designing and fabrication.

The Motorized Cutter is equipped by using all necessary items and methods for instance hollow pipe steel, black hollow steel, rectangular hollow steel, aluminum, spring, skills in manufacturing processes metal inert gas (MIG) welding to join the parts, drilling and also mechanical fasteners. The advantages of the proposed cutter to be developed can be seen that it can be harvesting fruit about 3.5 m height not included human height and at the same time this cutter is powered by 24V DC motor to control the movement of the spring that can extend and retract so the c-sickle easy to cut the fruits brunches.

The process of development is initiated from conceptual design stage by considering the function as well simplicity. In order to make friendly environmental-cutter, the ergonomic factor is also taken into account. Practical development involves the measurement, cutting the materials into required size and shape and assembly.

1.2 Problem Statement

People usually used a lot of energy when using the traditional cutter to harvesting fruits brunches or pruning fronds because some of the rod cutters made from heavy materials and took a long time to harvesting fruits. Have higher possibility for getting hurt because of the unsafe condition during harvesting fruits manually which is the blade peel easily fall down to ground when it unstable cutting the fruit brunches for a long time. It also easy to break and cannot used for a long term.

Figure 1.1: Traditional cutter

It is important to further improve the current design of Motorized Cutter (Mechanical Part), so that it more efficient to use.

1.3 Importance of The Project

The project leads the student understand how to use the knowledge and skill gathered before in solving problem. This project also promotes the student about capability of research, data gathering, analysis and then solving problem scientifically.

The project also will educate the student in communication like in a presentation and to defend their research in the presentation. The project also will generate students that have capability to make a good research report in thesis form or technical writing. This project also can produce and train student to capable of doing work with minimal supervisory and more independent in searching, detailing and expanding the knowledge and experiences.

1.4 Scope of The Project

i) Doing literature review about the cutter in the current market.

ii) Design the cutter according the sketching idea and then finalized the idea.

iii) Material considered

- Hollow pipe steel
- Black hollow steel
- Spring
- Rectangular hollow steel
- Aluminum
- Bolt and nut
- C-sickle

iv) Fabricate the cutter according the schedule.

v) Integrate the system between the mechanical part of motorized cutter and the electro-mechanical part.

1.5 Project Objectives

The objectives of the project are:

- To design the mechanical part of a Motorized Cutter and to fabricate the mechanical of the system.

1.6 Project Planning

The project begins with meeting the supervisor every week to define or discuss about the project. Then, do literatures review via internet, books, supervisor, and other relevant academic material that related to the title. The literature review is carried out through the project to keep up with the new knowledge about the current motorized cutter in the market.

At the same week schedule management is done using Microsoft Office. This takes a week to accomplish. Gantt chart is shown in figure 1.1.

Then, start with the sketching idea after that choose the best idea and finalized it. The selected idea is then transfer into solid modeling and engineering using Solidwork software.

The next task is preparation of progress presentation and report writing; both of these tasks take two week to be done. Before the midterm presentation and submit the report, I have prepared a speech for the presentation and double checked the report if it has mistakes.

Using the finalized drawing and sketching as references for the measurement and the materials needed. The fabrication process is schedule to takes on September and take about six weeks that include integrate the system, spraying and finishing.

Next task is the final report writing and final presentation preparation. This take about two weeks to accomplished. The report is guided by UMP Thesis writing guided and also the guidance from my supervisor. All the task is schedule to take about sixteen weeks overall.

1.7 Report Outline

ACTIVITIES		WEEK															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Meet the supervisor	Planning																
	Actual																
Difine product	Planning																
	Actual																
Do a literature review and	Planning																
gathering the data	Actual																
Sketching the idea	Planning																
	Actual																
Finalized the best idea	Planning																
	Actual																
Convert the best idea into	Planning																
Solidwork software	Actual																
Progress report and midterm	Planning																
presentation	Actual																
Listed the materials that are	Planning																
needed	Actual																
Fabrication the product	Planning																
	Actual																
Integrate the system	Planning																
	Actual																
Final presentation	Planning																
	Actual																
Thesis	Planning																
	Actual																

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A motorized cutter that operates at a motor speed and a control circuit that senses the motor speed and provides power to said motorized cutter at a level that corresponds to the motor speed, wherein more power is provided to said motorized cutter with a decrease in the motor speed.

The motorized cutter design is according to the present market demand and to fulfill criteria customers needs. It should be designed to crest a product in the market so that it will more quality and innovative.

2.2 Type of Cutter

Several Motorized Cutter with various function have been found.

i) Pole Pruner Cutter (Figure 2.1)
   Advantage – Used 5 pulley systems that can provide 30% more power and total rope control.
   Disadvantage – Have to change the rope if it breaking.

Figure 2.1: Pole Pruner Cutter

ii) Fiskars Pruner Cutter[6] (Figure 2.2)

Advantage – Made from fiber glass and can extend until 12 feet.

Disadvantage – Only cut limited size of bunches.

Figure 2.2: Fiskars Pruner Cutter

iii) Scissor Pole Cutter (Figure 2.3)

Advantage – Ultimate cutting height from the ground of most other types hedging without leaving the ground.

Disadvantage – The cutter is too light.

Figure 2.3: Scissor Pole Cutter

iv) Saw Pole [8] (Figure 2.4)
Advantage – Specially designed sickle (C-sickle pattern) and support with saw cutting blade.
Disadvantage – Took a few minute to get fresh fruit bunches.

Figure 2.4: Saw Pole

2.3 Basic Part

Basically, there are two parts in Motorized Cutter design, C-sickle and body.

i) C-sickle; is usually made from steel plate and sharp also designed in almost C shape to give higher cutting efficiency.

ii) Body; have hollow pipe steel, spring so it can extend and retract, black hollow steel to support the spring and the rod

2.4 Joining Method

Joining involves in assembly stage. Commonly used method to join metal part is Metal Inert Gas (MIG) welding.

2.4.1 Metal Inert Gas (MIG) Welding

Figure 2.4 illustrated schematic of MIG method: An arc is struck between a consumable electrode and the sheet metal to be welded. The consumable electrode is in the form of continuous filler metal. An inert gas surrounds the arc and shields it from the ambient to prevent oxidation. Carbon steels, low alloys steels, stainless steels, most aluminum alloys, zinc based copper alloys can be welded using this process.

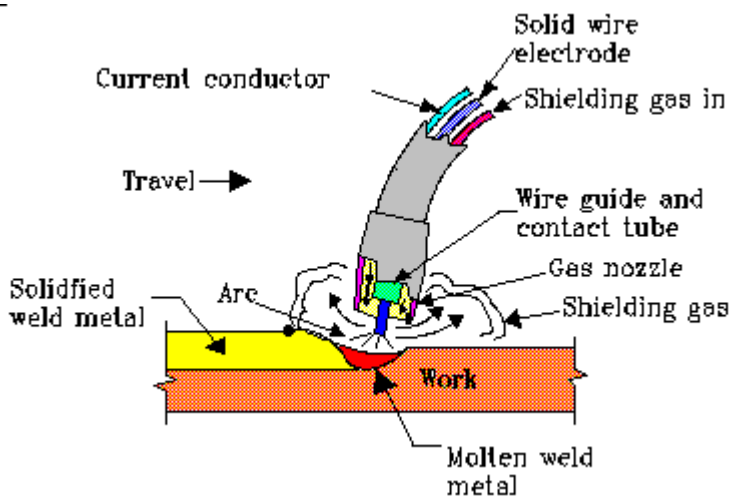

Figure 2.5: Schematic of Metal Inert Gas (MIG) welding

Figure 2.6: A GMAW wire feed unit

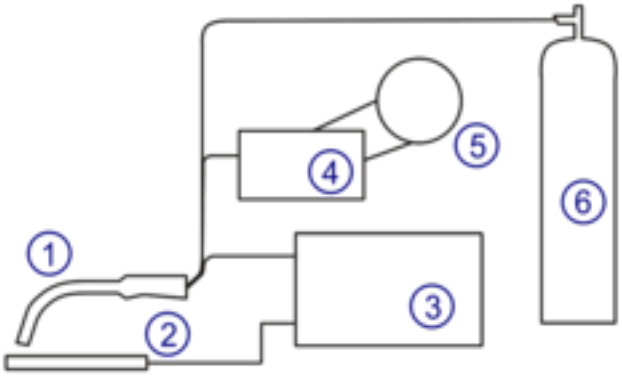

Figure 2.7: Basic component used in MIG operations

i. Gun
ii. Workpiece
iii. Welding machine
iv. Control system
v. Wire
vi. Sheilding-gas source

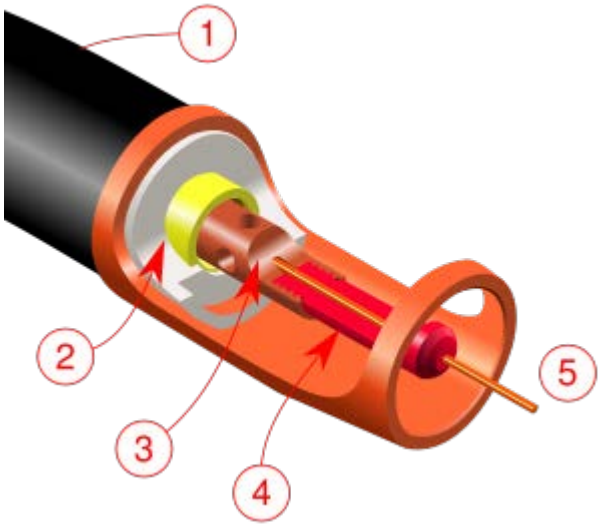

Figure 2.8: GMAW torch nozzle cutaway image. **(1)** Torch handle, **(2)** Molded phenolic dielectric (shown in white) and threaded metal nut insert (yellow), **(3)** Shielding gas nozzle, **(4)** Contact tip, **(5)** Nozzle output face

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.

There is a different MIG-welding process, conventional MIG and pulsed MIG:

1) Conventional MIG uses a constant voltage DC power source. Since the spray transfer is limited to a certain range of arc current, the conventional MIG process has a lower

limit of arc current (or heat input). This also limits the application of conventional MIG to weld material thicknesses above 4 mm. Below 6 mm it is recommended that backing is used to control the weld bead. [1]

2.4.2 Mechanical Fasteners

A fastener is a hardware device that mechanically joins or affixes two or more objects together. Fasteners can also be used to close a container such as a bag, a box, or an envelope; or they may involve keeping together the sides of an opening of flexible material, attaching a lid to a container, etc. There are also special purposes closing devices, e.g. a bread clip. Fasteners used in these manners are often temporary, in that they may be fastened and unfastened repeatedly.

The most common method of mechanical fastening is by use of bolts, nuts, screws, pins and a variety of other fasteners. These operations are known also as mechanical assembly. Mechanical fastening generally requires that the components have holes through which the fasteners are inserted. These joints may be subjected to both shear and tensile stressed and should be designed to resist these forces. [3]

Figure 2.9: Mechanical Fasteners

2.5 Drilling

Drilling is the process of using a drill bit in a drill to produce cylindrical holes in solid materials, such as wood or metal. Different tools and methods are used for drilling depending on the type of material, the size of the hole, the number of holes, and the time to complete the operation.

Under normal usage, swarf is carried up and away from the tip of the drill bit by the fluting of the drill bit. The continued production of chips from the cutting edges produces more chips which continue the movement of the chips outwards from the hole. This continues until the chips pack too tightly, either because of deeper than normal holes or insufficient *backing off* (removing the drill slightly or totally from the hole while drilling). Lubricants and coolants are sometimes used to ease this problem and to prolong the tools life by cooling and lubricating the tip and chip flow. Coolant is introduced via holes through the drill shank.

Straight fluting is used for copper or brass, as this exhibits fewer tendencies to "dig in" or grab the material. If a helical drill (twist drill) is used then the same effect can be achieved by stoning a small flat parallel with the axis of the drill bit. For heavy feeds and comparatively deep holes oil-hole drills can be used, with a lubricant pumped to the drill head through a small hole in the bit and flowing out along the fluting. A conventional drill press arrangement can be used in oil-hole drilling, but it is more commonly seen in automatic drilling machinery in which it is the workpiece that rotates rather than the drill bit. [2]

Figure 2.10: Drilling machine

2.6 Vertical Band Sawing Machine

Band saws use thin, flexible, continuous steel strips with cutting teeth on one edge. They are used primarily for cutting curves in stock or in food processing plants to cut and trim meat, poultry, and fish. The blade runs on two pulleys, driver and idler, and through a work table where material is manually fed. Automatic feeds can be used for production cutting. However, this machine is usually considered a manual-feed tool. The two types of band saws, horizontal and vertical, are named for their respective cutting blade positions.

The operator is required to hand-feed and manipulates the stock against the blade to saw along a predetermined line. The user must also keep the stock flat on the work table and exert the proper cutting force. [4]

Figure 2.11: Vertical band sawing machine [5]

CHAPTER 3

METHODOLOGY

3.1 Introduction

Project methodology is a body of practices, procedures and rules used by those who work in a discipline or engage in an inquiry and set of working methods. Project methodology for development and frame model for removable seat is shown by flow chart in the figure.

3.1.1 Project Flow Chart

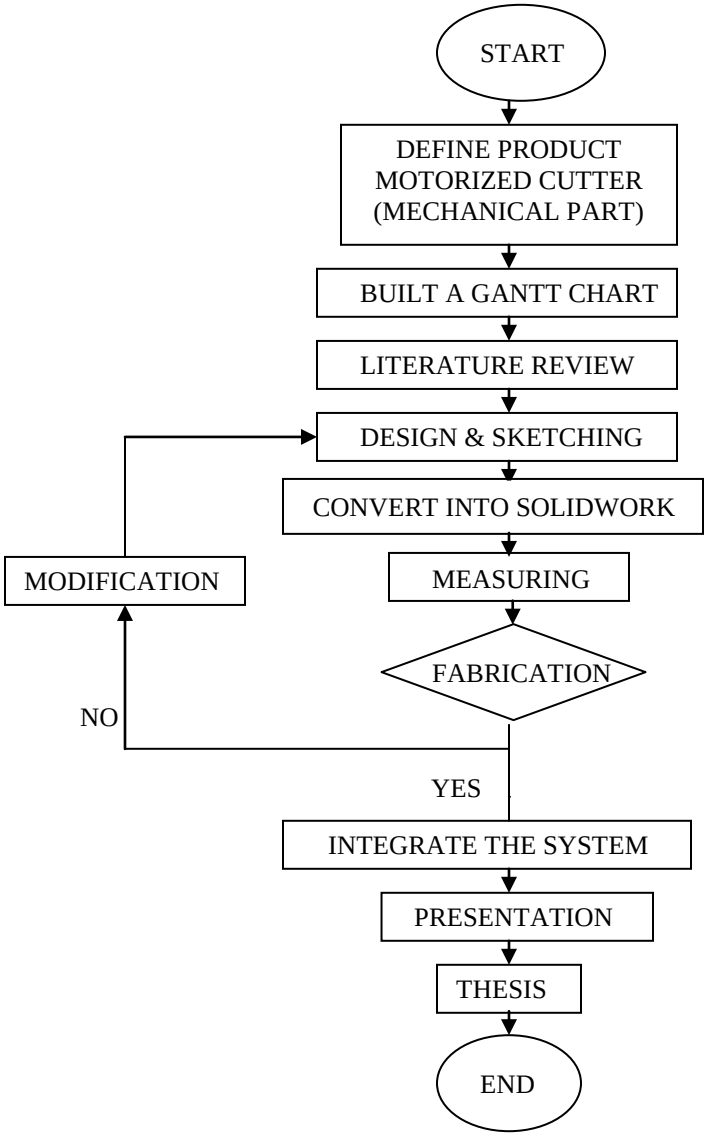

Figure 3.1: Project flow chart

Figure 3.1 show the flow chart of methodology. The project starts with define product of Motorized Cutter (Mechanical Part) and built a Gantt chart so that the flow of the project will become smooth. Then, find literature review and research about the title. This consist a review of the concept of Pole Pruner Cutter, Fiskars Pruner Cutter, Scissor Pole Cutter and types of motorized cutter available in the market. These tasks have been done through research on the internet, books and others sources.

After gathering all the relevant information, the project undergoes design process. In this step, from the knowledge gather from the review is use to make a sketch design that suitable for the project. After several design sketched, design consideration have been made and one design have been chosen. The selected design sketched is then transfer to solid modeling and engineering drawing using Solidworks program. The materials and the measurement needed for the motorized cutter listed down and calculated to give an ergonomic shape of the motorized cutter.

Next, after the needed material is listed, acquisition step take places. There are a lot of materials that needed to be bought such as hollow pipe steel, black hollow steel, spring and C-sickle. Some of the needed materials is well-prepared by the university.

After all the parts needed had been gathered, the project proceeds to next step that is fabrication process. The finished drawing and sketching is used as a reference by following the measurement and the type of materials needed. The fabrication process that involved is cutting, drilling and others. After every process was finished, the parts are checked to make sure that the output of the process obeys the product requirement.

If all the parts had been processed, the parts are joined together to produce full-scaled motorized cutter. Here come the testing and evaluation process. The motorized cutter will be test to see if it fulfills the requirement such as strength, safety, maneuverability and ergonomic aspect. During the testing, if problem occur such as malfunction or unstable rod, the motorized cutter will step back to the previous process, where the error is fixed. The motorized cutter is expected to have an error that may cause

the part to be redesign and re-fabricate again. Then finalize the process by doing some finishing process such as spraying.

After finishing fabricate the body of motorized cutter, it time to integrate the system between motorized cutter (mechanical part) and motorized cutter (electro-mechanical part) to see these two parts is working together using a 24V DC motor and battery that control the movement of the spring so it can extend and retract. With this system the sickle can easily harvesting fruits brunches.

Finally, after all the parts had been joined together, the last phase of the process is data discussion. In data discussion, the draft report and all the related articles are gathered and hand over to the supervisor for error checking. The finish product will be compared with the report to make sure that there is no mistake on both project and report. Lastly, prepare for presentation to present the project.

3.2 Design and Sketching

3.2.1 Introduction

This chapter explains detailed process involved in the fabrication. This will include the design and sketching that had been chosen to be the final for fabrication.

3.2.2 Design

The design of the Motorized Cutter must be compliance to several aspects. To 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 cabinet are:

i) Strength: Must have strength to support the sickle when it cutting the brunches
ii) Safety: The joint between the sickle and the top of the rod must be strong so it can avoid the possibilities of getting hurt if the blade peel fall down to the ground.

iii) Energy: Less of energy when using this product because of the rod material is light weight and easy to handle it.

iv) Time: Do not waste time when handle it and faster.

v) Material: Availability of material is one of aspects that have been considered. The material available can be used depend on their purpose.

3.2.3 Drawing

The drawings are divided into two categories, which are:

i) Sketching – All the ideas for the motorized cutter are sketched on the paper first to ensure that idea selection and be made after this, and

ii) SolidWorks Software – The selected design or concept sketched is transfer to solid modeling and engineering drawing using Solidwork software.

3.2.4 Design specifications

The design of the Motorized Cutter must be considered that it can endure several specifications, which are:

i) The cutter will have a minimum height of 3.5m to harvesting high fruits brunches.

ii) Overall materials are 3.5m of hollow pipe steel as the top and bottom rod, 500mm of hollow black steel for the spring support, spring that can make the rod extend and retract, C-sickle as the cutting tool, aluminum as the C-sickle’s place and solid steel to lock the bottom rod with spring support and to avoid the spring movement.

iii) The C-sickle can easily change when its blade become blunt.

iv) The maximum weight of this motorized cutter not included the electro-mechanical part is 1.7kg and save time.

3.2.5 Sketching Drawing Selection

From the existing ideas, four sketching had been considered and compared as shown in Figure 3.1 to Figure 3.4

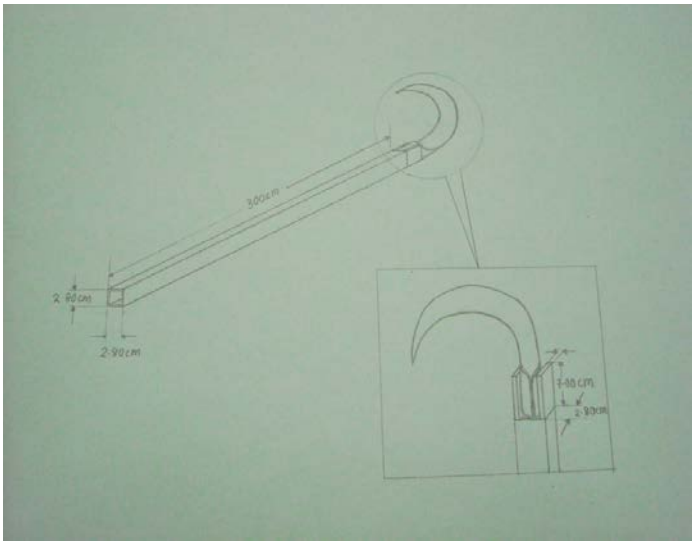

Figure 3.2: Sketching 1

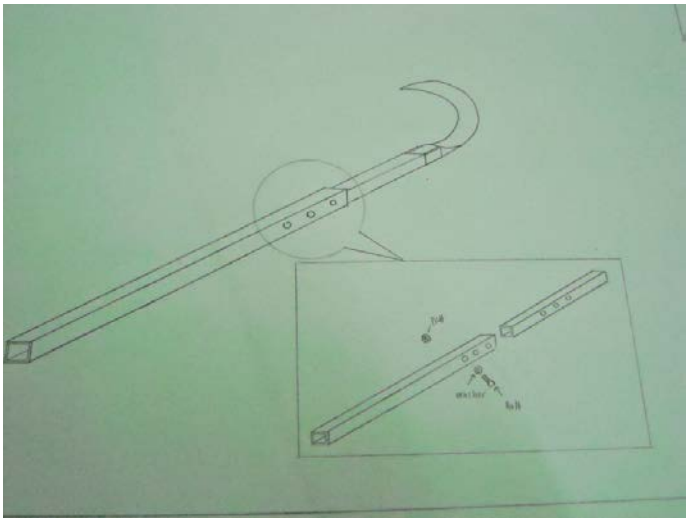

Figure 3.3: Sketching 2

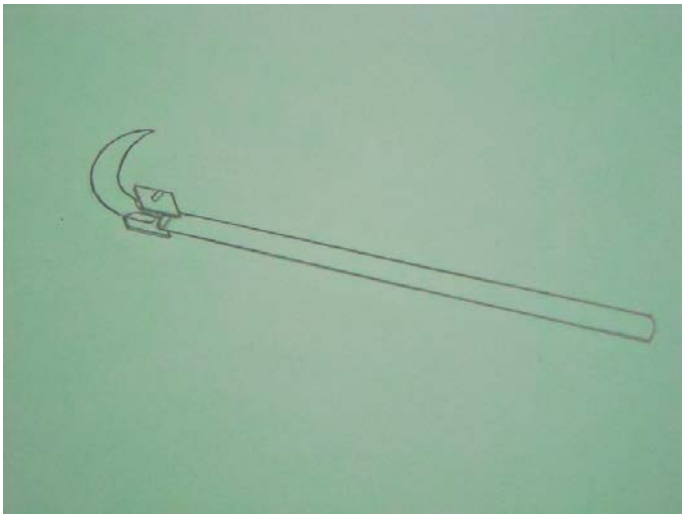

Figure 3.4: Sketching 3

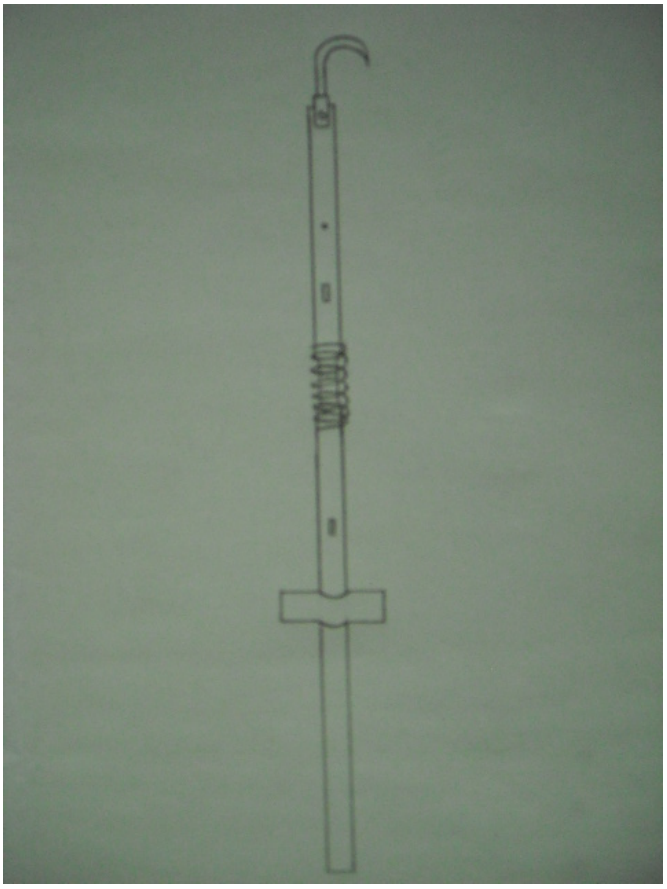

Figure 3.5: Sketching 4

3.2.5.1 Finalized Design

After comparing the above design and extracting good features, the design is finalized as shown in Figure 4.5.

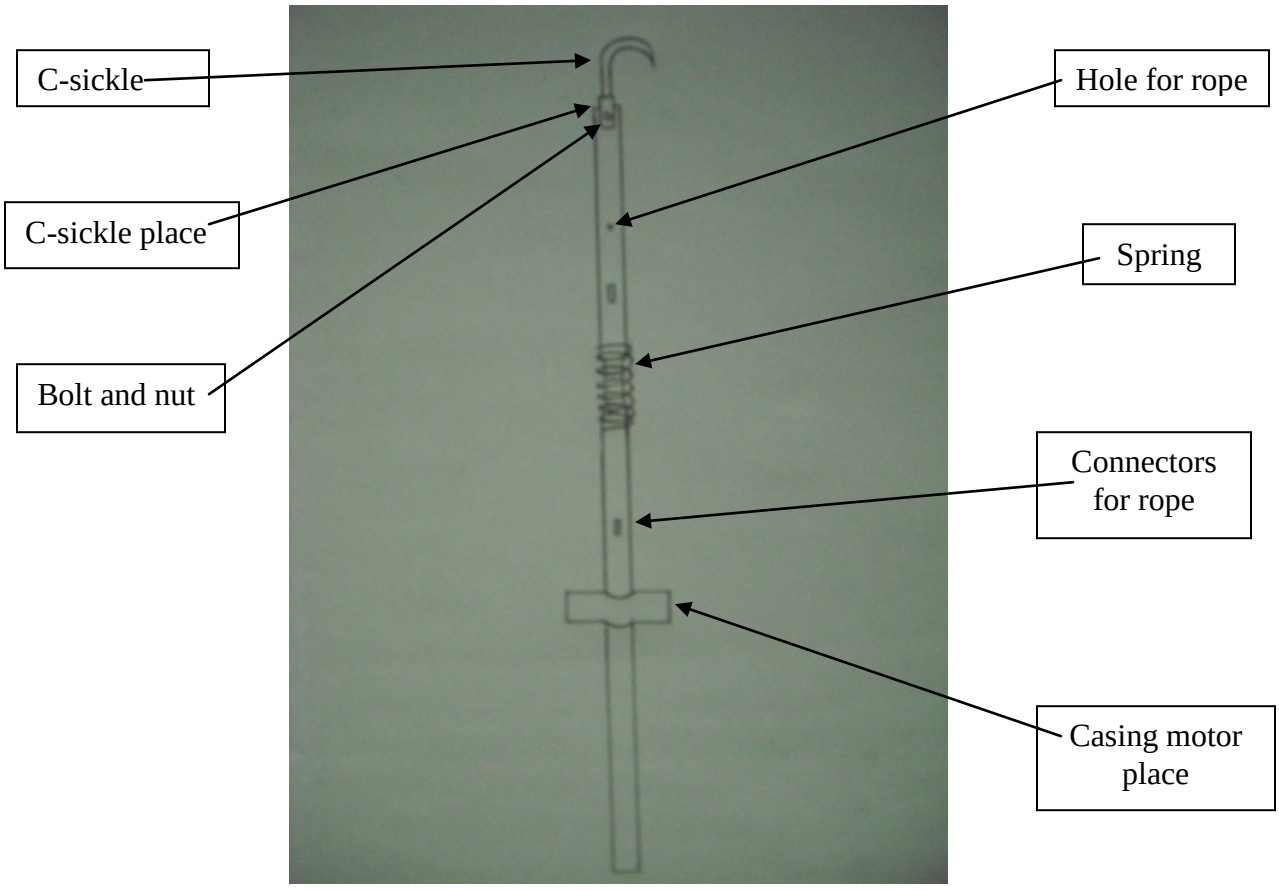

Figure 3.6: Finalized design

The design is made in such a way that consistent with the objective. It is easy to lift up because of it is light and easy to carry it. The safety and functioning also influence the design.

3.2.6 Solidwork Design Drawing

After a design has been selected, the step in the designing process is dimensioning. The design is separated into part by part and the dimensioning process is firstly sketched on paper. The dimensioning is base on relevant dimensions and also referring to the motorized cutter so that the design is fit into others part.

After dimensioning, the engineering drawing of the design is drawn using Solidwork application, at this stage solid modeling method is used. Part by part solid modeling created according to the dimension done before, after all part created, the 3D model is assembled with each other base on the design.

3.2.7 Overall View of the Design

3.2.7.1 Design Descriptions

Figure 4.6 shows that the final idea of the Motorized Cutter. Hollow pipe steel was chooser as the top and the bottom of the rod because of it light of weight than other steel. As the support of spring, the hollow black steel was chosen because of it durability. Solid steel is one of important part to lock the bottom rod with spring and its supporter also to avoid the spring from moving or peel of. C-sickle as the cutting tool to cut the brunches and it assembled with the aluminum to avoid it from peel of. Bolt and nut as a lock for the C-sickle but it can be open and closed so the C-sickle can be change if it become blunt. The rectangular hollow steel is made so the cable can through it without disturbing another part when the motor is on.

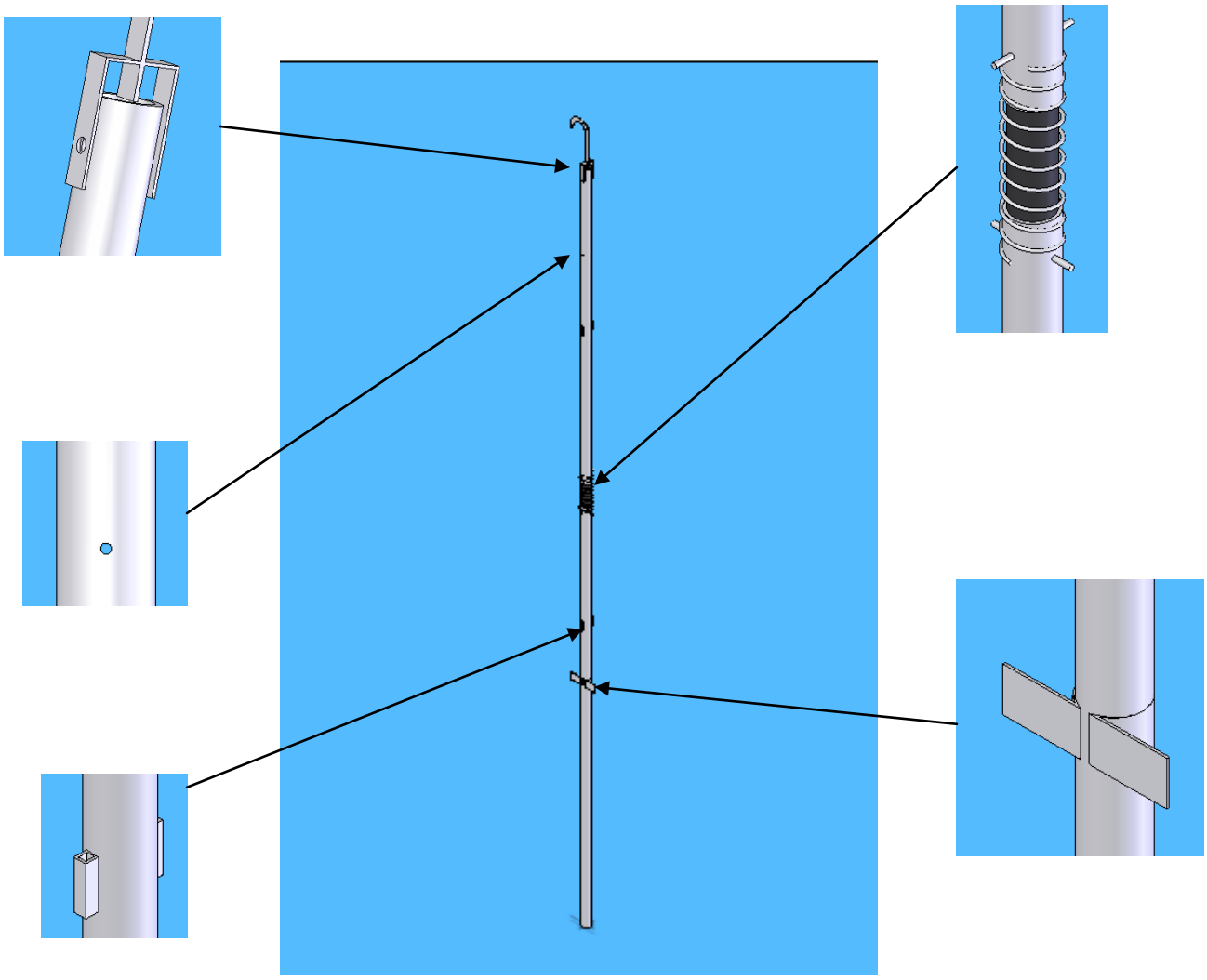

Figure 3.7: Isometric view

3.2.7.2 Materials

This is all the type of materials for the design needed:

i) Top of rod
   - 1 unit of hollow pipe steel with measurement of 1500mm length and 22mm of diameter

ii) Bottom of rod
   - 1 unit of hollow pipe steel with measurement of 2000mm length and 22mm of diameter

iii) Spring support
   - 1 unit of hollow black steel with measurement of 500mm length and 20mm of diameter

iv) C-sickle place
   - 1 unit of aluminum with measurement 2 x (80mm x 10mm x 2mm)

v) Casing motor place
   - 1 unit of aluminum with measurement (130mm x 35mm x 2mm)

vi) Locks
   - 2 units of solid steel with measurement of 50mm length and 10mm of diameter

vii) Rope connectors
   - 4 units of rectangular hollow steel with measurement of (40mm x 15mm x 15mm)

C-sickle and spring is a ready made component. C-sickle assembled with plate at the top of the rod and the spring assembled between the top rod and bottom rod:

- 1 unit of C-sickle with measurement
- 1 unit of spring

3.2.7.3 Functional Performance

The hole at the middle of the top rod is used for rope passage. When press the two upper buttons at the controller, the motor will turn in clockwise movement and attract the rope to twine round the motor's bar through the hole. Because of that, the spring will extend and make the C-sickle cutting the stick properly. Then, when the two below buttons is pressed the motor will turn in anti-clockwise movement and released the rope. The spring will retract according the system and back to its normal position.

3.2.7.4 Speciality

i) Light in weight; its easy to handling the cutter and easy to cutting the fruits brunches when raise the rod.

ii) Height; it's about 3.73 m long not include human height.

3.3 Fabrication process

3.3.1 Introduction

After designing phase, comes fabrication process. These processes are about using the material selection and make the product based on the design and by followed the design dimension. Many methods can be used to fabricate a product, like welding, fastening, cutting, drilling and many more method. Fabrication process is different from manufacturing process in term of production quantity. Fabrication process is a process to make only one product rather than manufacturing process that focus to large scale production. In the project fabrication process needed to make the support for spring, joining between bottom rod, spring and top rod, place for C-sickle and joining between C-sickle's place with the top rod. Fabrication process was used at the whole system production. This was include part by part fabrication until assembly to others component.

3.3.2 List of Process

In order to make the design come to reality, fabrication process needs to be done first. The fabrication process starts from dimensioning the raw material until it is finish as a desired product. The processes that involved are:

i) Measuring : Materials are measured to desired dimensions or location.
ii) Marking : All measured materials need to be marked to give precise dimension.
iii) Cutting : Marked materials are then cut into pieces.
iv) Joining : Materials joined by the method of welding and using bolt nuts.
v) Drilling : Marked holes are the drilled to make holes for bolts and cable holes.
vi) Bending : Deformed the aluminum and changing its shape.
vii) Finishing : Any rough surface cause by welding spark were grind to give smooth and safe surface.
viii) Spraying : Using black spray color to spray on the whole product.

3.3.3 Fabrication Procedure

The fabrication process was started with measuring the material into the required dimension needed. The types of material identification needed to make sure all part can be assembling in the correct way. The material were used to be measuring are hollow pipe steel, hollow black steel, aluminum, rectangular hollow steel and solid steel. All the measuring and marking process is done using measuring tape and steel marker. Firstly, do a measurement process to all the materials that will be cutting or drill to make sure the efficiency cutting. All the measuring and marking process is done using measuring tape and steel marker. (Figure 3.8)

Then, after several quantities of material had been marked, the next step is to cut the material into its desired length. This process is done using the floor cutter disc (Figure

3.9). Before proceeding this process, safety measurement had been carried out by wearing Personal Protective Equipment (PPE) such as goggle, gloves and ear plug. These safety measurements are so important in order to prevent the projectile spatter from the process. During this process, use the L-shape in order to make sure the dimension of the material length is correct and precise.

All the material that had been cut is grinded to give smooth surface to make sure that joining process can be done precisely (Figure 3.11). Then all the material was arranged into joining position.

Before the joining process, aluminum is arranged to cut using a vertical band sawing machine. Band saws use a continuous saw blade. Chip removal is rapid, because each tooth is a precision cutting tool and accuracy can be held to close tolerances eliminating or minimizing many secondary machining operations. Proceed with the bending process. (Figure 3.10)

The aluminum that had been cut will continue with the bending process so it can support the C-sickle. Bending is a process by which metal can be deformed by plastically deforming the material and changing its shape. Then, continue with the joining process. Using manual bending, bend the C-sickle place and also bend the casing motor place. Tools in this process are hammer and G-clamp. (Figure 3.15)

The joining process was carried out by using Gas Metal Arc Welding or formerly known as Metal Inert Gas (Figure 3.13). First, the welding machine is set up to make sure that the output of the process will satisfy. Face shield, apron, goggle and other PPE equipment are not to be forgotten. Then, all the materials were weld together. Then, welding the rectangular hollow steel so the cable can move freely when the motor is on. Weld the aluminum together with the C-sickle so that the cutter won’t be easily falling to the ground when cutting the fruit bunches. Then weld the spring at the top at bottom lock rod so it can give high accuracy when extend or retract. After that, weld the rectangular

hollow steel as the connector for the rope and also weld the casing motor place so it cannot move.

After finishing welding, the entire welded placed were the grinded to make sure that the entire joint surface was smooth from any spatters or sharp. During the process, the careless of wearing an ear plug will cause high risky damage to ears. Hand gloves and goggles are also need to give attention.

The C-sickle is weld with C-sickle place using MIG welding. Another method of joining using bolt and nut is too combined between C-sickle, top rod and C-sickle place. Using this method they will fasten together and easy to change the C-sickle if it blunt or damaged (Figure 3.14).

Then several locations were drilled to make hole for bolt and nut. Drilling machine was used during this process for joined the aluminum with the C-sickle (Figure 3.12). It is also one of the ways to make sure that all the joint are together perfectly before drilling any holes because any mistake of drilling will cause the material to damage. Drill the aluminum and the C-sickle for the bolt and nut hole according the dimension and also at the top rod to combine the C-sickle, the C-sickle place and bolt and nut. For the bottom rod, drill the upper of the rod and the bottom of black hollow steel so it can be locked by solid steel with the spring.

After all the process had been done, then continue the next process which is spraying process (Figure 3.16). Before that the whole product must be brush by using sand paper to ensure it from dirt and rust. The spray color used for the whole product is black.

Lastly, integrate the system which is the mechanical part of the motorized cutter combined with the electro-mechanical part to generate the system (Figure 3.17).

Figure 3.8: Measuring process

Figure 3.9: Cutting process 1

Figure 3.10: Cutting process 2

Figure 3.11: Grinding process

Figure 3.12: Drilling process

Figure 3.13: Joining process 1

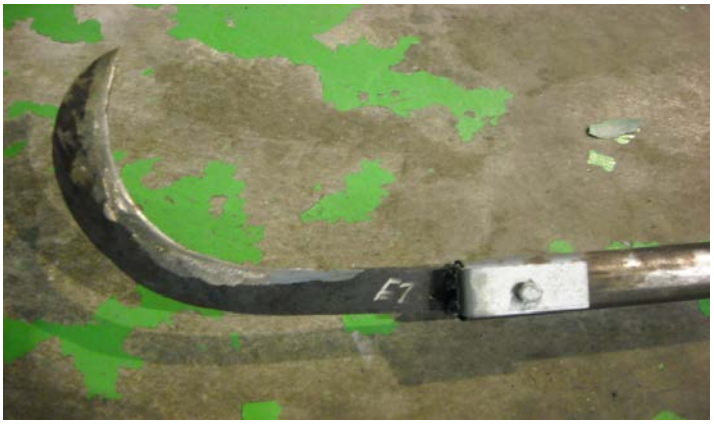

Figure 3.14: Joining process 2

Figure 3.15: Bending process

Figure 3.16: Painting process

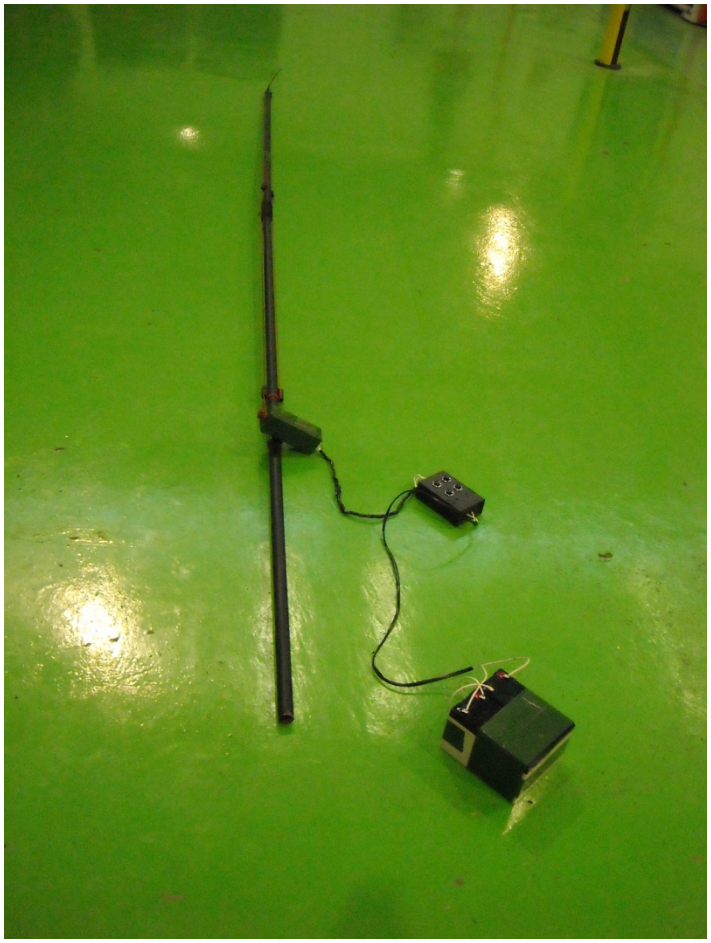

Figure 3.17: Integration system

CHAPTER 4

RESULT & DISCUSSION

4.1 Finishing product

This is the picture of finishing motorized cutter after combined with the electro-mechanical part.

Figure 4.1: Finishing Motorized Cutter

4.2 Specification

- Height – 3730mm from the ground not included the human height.
- Weight – 1.7kg not included the weight of electro-mechanical part.
- Color – Black

4.3 Testing the product

After fabricate the cutter, the body of motorized cutter then combined with the electro-mechanical part to testing it either it can be operate or not. The testing is held in UMP and takes a few type of tree to testing it effectual.

Figure 4.2: Testing the Motorized Cutter

Figure 4.3: Testing another tree

4.4 Discussion

For the result of the testing product, this motorized cutter is proof that it can lift up until 3.8 m and above and it weight is 2.2 kg including electro-mechanical part. When doing the testing, we have failed four times because of the rope that we were used is breaking. Then, we changed the rope that can capable of enduring a strong attraction to operating the system easily. Another problem that encounter during the testing is this motorized cutter need to be handled by two persons. One person holds the battery and the controller and another person hold the rod cutter. As a conclusion, this project is successful achieves the objective that is to design and fabricate of a motorized cutter for mechanical part.

CHAPTER 5

CONCLUSION & RECOMMENDATION

5.1 Introduction

In this chapter the problems encountered during the whole project are discussed. Then it goes to conclusion of the project and recommendation.

5.2 Project Problems

i) Literature review: The concept and ideas review for this project are not very wide because it is not widely modified by the manufacturer. Student should come with their ideas on the project.
ii) Hole: Hole for the rope is too sharp for it through in when press the on button and make it easily breaking.
iii) Holder: Do not have a holder to hold the rod because each person has their own comfort to hold it.
iv) C-sickle: The C-sickle does not have a higher cutting efficiency. It need to be sharpen always.
v) Handle: Need to be handle by two persons because one person need to hold the rod and another person need to hold both controller and the batteries.

5.3 Recommendation

Gathering data about the cutter from another source to get more information and make better. For the sharp hole, it needs to be cover by something that suitable so that the rope can move easily without breaking. Using more efficiency cutter like scissors or something else those have low mechanism system to handle it. Precise planning of the work progress will make sure that the project can be done in a shorter time. Having a good time management can guaranty that any of students task to complete in a good ways and also give more time to focus on others subject.

5.4 Conclusion

In general the project achieves objectives however some objectives are ignored due to time integrate the system. Overall perception of the project carried out was good. The project was completed on schedule despite being started late because the materials being arrive late. There were sufficient times the Motorized Cutter can be made better with features like adjustable by using a connecter.

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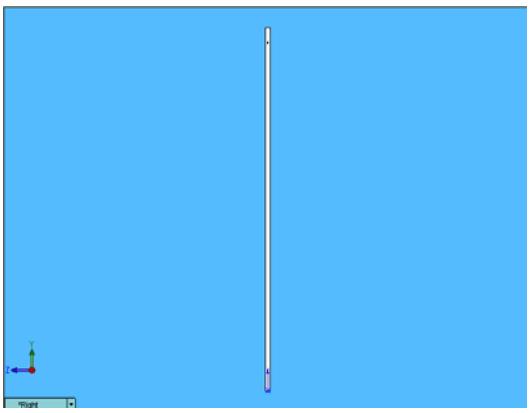
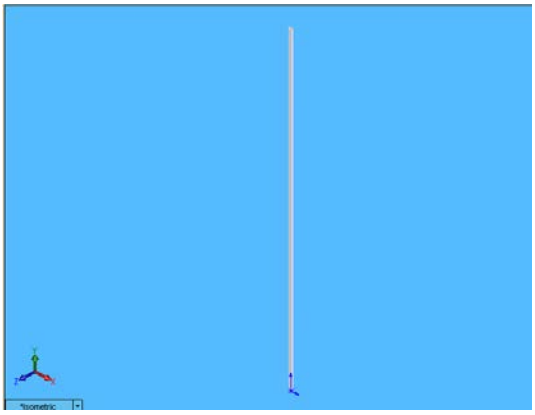
APPENDIX A

Motorized Cutter component

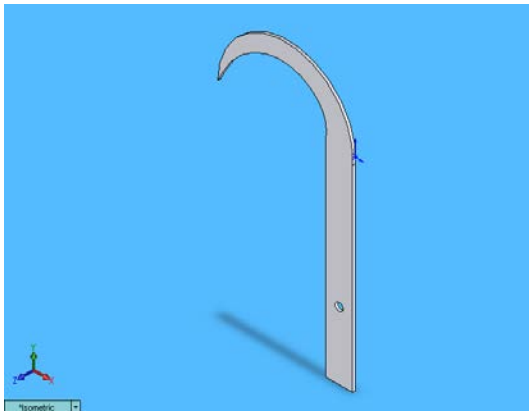


Top rod

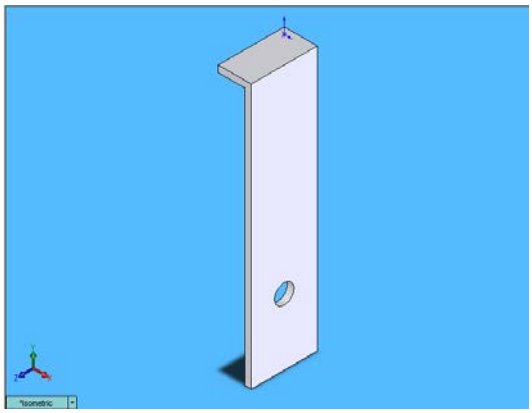


Bottom rod

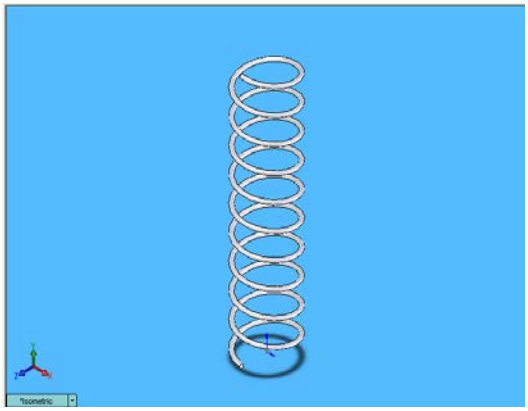
Middle rod



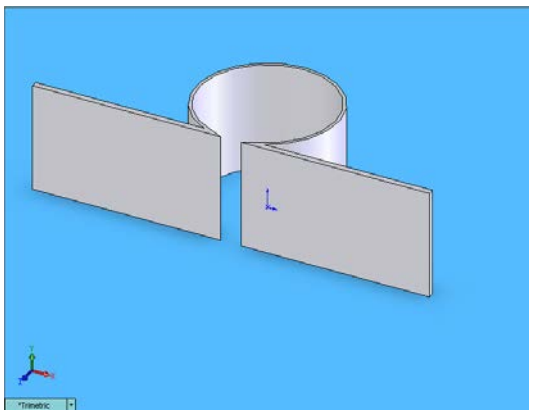
C-sickle



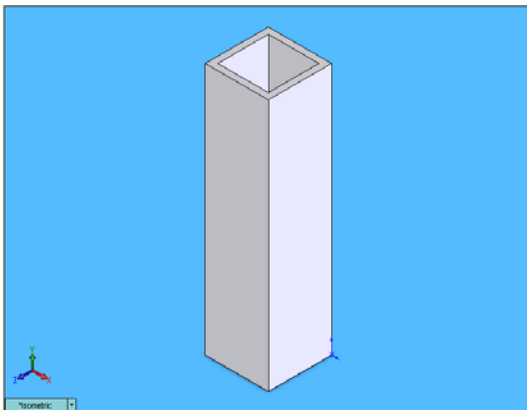
C-sickle place



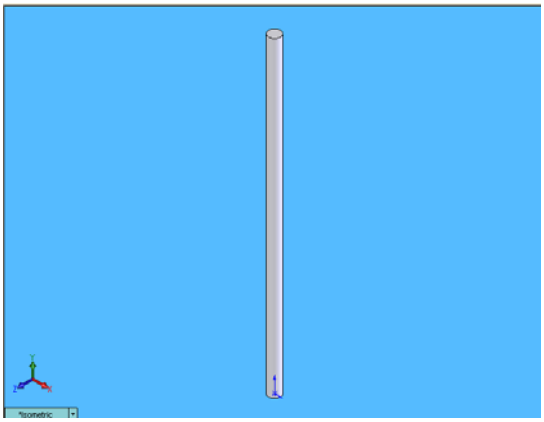
Spring



Casing motor place



Rope connectors



Solid steel