

DESIGN AND FABRICATE OF HIGH SENSITIVITY SENSOR HOLDER

MUHAMAD FAHRID BIN ABD WAHID

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

Faculty of Mechanical Engineering
UNIVERSITY MALAYSIA PAHANG

SUPERVISOR'S DECLARATION

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

Signature:

Name of supervisor:

Position:

Date:

STUDENT DECLARATION

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

Signature:

Name: Muhamad Fahrid Bin Abd Wahid

ID number: MB09090

Date:

ACKNOWLEDGEMENT

Praise to God for His help and guidance that I am able to complete the task of the Final Year Project. I am thankful and grateful to my supervisor, Mrs Miminorazeen binti Loman for her advice and knowledge that she shared in the completion of the project. I appreciate her help for me while I am doing the Final Year Project from week 1 to the day I finished my Final Year Project.

I also would like to thank all my friends who have been really helpful during the course of conducting the Final Year Project. I also would like to thank the laboratory assistants and who have helped me in conducting machine and sharing knowledge in conjunction with the project that I am conducting.

I am sincerely grateful to my parents, Mr Abd Wahid B Badri and Mrs Jamaliah Bt Abdul Rahman for their love and sacrifice that they had for me throughout my life and their support for me in all activities that I have done. I also wanted to thank those people who have directly or indirectly helped in the completion of my Final Year Project. I sincerely appreciate all of your help.

ABSTRACT

This report shows the design and fabrication of a high sensitivity sensor holder. The objective of the report is to design and fabricate a high sensitivity sensor holder. This report also described the high sensitivity sensor holder which is beneficial to the end users. Design generation is showed and solid three dimensional structures modelling of the high sensitivity sensor holder was developed with computer aided design software. This report also explains the fabrication process that is needed for this project. Material that is being used in this project is aluminium sheet metal, screw, and spring. The problem encountered during completion of this project is also shown in the report. An idea of improvement for the high sensitivity sensor holder is also provided for further improvement of the high sensitivity sensor holder.

TABLE OF CONTENTS

	Page
SUPERVISOR’S DECLARATION	ii
STUDENT ‘S DECLARATION	iii
ACKNOWLEDGEMENTS	iv
ABSTRACT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	x
LIST OF FIGURES	xi
 CHAPTER 1 INTRODUCTION	
1.1 Background of the Project	1
1.2 Problem Statement	2
1.3 Objective	2
1.4 Scope	2
1.5 Flow Chart	3
1.6 Gantt Chart	5
 CHAPTER 2 LITERATURE REVIEW	
2.1 Type of High Sensitivity Sensor Holder	6
2.1.1 Magnetic Sensor Holder	6
2.1.2 Machining Sensor Holder 1	7
2.1.3 Machining Sensor Holder 2	8
2.1.4 Machining Sensor Holder 3	8

2.2	Type of Safety	
2.3.1	Screw	9
2.3	Fabrication Planning Process	
2.3.1	Bending	10
2.3.2	Shearing	11
2.3.3	Drilling	12
2.3.4	Welding	13

CHAPTER 3

METHODOLOGY

3.1	Introduction	14
3.2	Process Flow	14
3.3	Phase 1 – Establish Target Specification	15
3.4	Phase 2 – Design Concept	15
3.4.1	Design Concept 1	16
3.4.2	Design Concept 2	16
3.4.3	Design Concept 3	17
3.5	Phase 3 – Select Final Design	17
3.6	Phase 4 – Searching Material for the Product	19
3.7	Phase 5 – Fabrication of the Product	19

CHAPTER 4

RESULT AND DISCUSSION

4.1	Final Product	23
4.1.1	Component of Final Product	25
4.1.2	Function of Final Product Component	26
4.2	How to Use This Sensor Holder	26
4.3	Project Problem	27

4.3.1	Literature Review	27
4.3.2	Designing and Sketching	27
4.3.3	Material Preparation	27
4.3.4	Fabrication Process	27
4.4	How this Project Achieve the Objective And Solves the problem Statement	28
CHAPTER 5	CONCLUSION AND RECOMMENDATION	
5.1	Conclusion	29
5.2	Recommendation	29
REFERENCES		30
APPENDICES		31
A.	Gantt Chart	31
B.	Each Part of the Project with Dimension	32
C.	Machine use	36

LIST OF TABLE

Table No.		Page
3.1	Process Flow	14
3.2	Screening and Scoring	18
3.3	List of Material	20
4.1	Function of every part	25

LIST OF FIGURE

Figure No.	Page
1.1 Flow Chart	3
2.1 Magnetic Sensor Holder	7
2.2 Machining Sensor Holder 1	7
2.3 Machining Sensor Holder 2	8
2.4 Machining Sensor Holder 3	8
2.5 Screw	9
2.6 Bending	10
2.7 Shearing	11
2.8 Drilling	12
2.9 Welding	13
3.1 First Design Concept	16
3.2 Second Design Concept	16
3.3 Third Design Concept	17
3.4 Cap Holder	20
3.5 Screw and spring as Lock Part	21
3.6 Holder House	21
3.7 Holder Surface Plate	22
3.8 Final Product	22
4.1 Drawing Final Design	23

4.2	Final Product	24
4.3	Component of Final Product	25

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

The correct measurement or the correct information is very important in our daily life. Even during any work we need to get the correct information to make sure the work that we do in well and consider everything we want.

Today, manufacturer had come with creative and innovative design and ideas to encounter this problem. As example, a holder for sensor to make sure there is no defect on the result that effected by movement during getting the reading or etc.

While taking a reading a sensor, we need to make sure that the sensor does not move even an inch because it will affected the reading that we'll get. The way to avoid and encounter it the holder need to be design so that the sensor will fix at its holder.

As we all know, holder have very specific function which is to hold something. So those in this case, the sensor need to have its own holder in a way to encounter the unstable result or reading.

1.2 PROBLEM STATEMENT

There is currently no proper holder for high sensitivity acoustic emission sensor holder that can be moved everywhere or portable. The researcher or the doctor needs to hold it by themselves to do an experiment and acquire the reading. Human never can hold something at the fix position for a long time period. Due to that, the readings that will be obtained maybe not accurate at all because there will be small movements that might affected the reading.

1.3 OBJECTIVE

The objective of this project is;

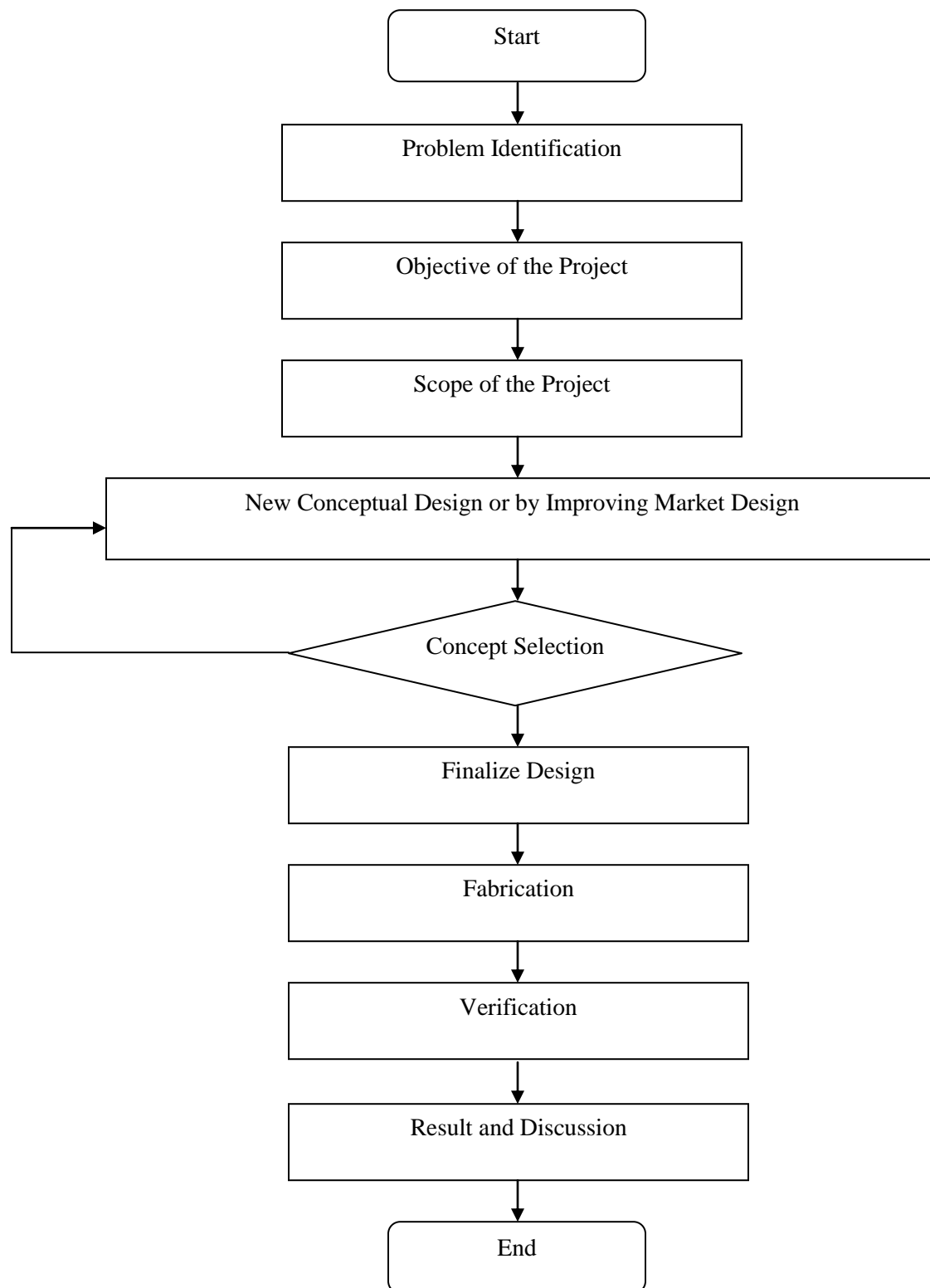
- Design and fabricate an equipment or holder to replace the human to hold the sensor.
- Reduce time and cost consumption for the equipment or the experimental work.

1.4 SCOPE

In this project, scope performed a range in the completion of a project. The scopes of this project are;

- This study focused on making a holder for high sensitivity of sensor.
- Function to hold the sensor well.
- The holder covers by rubber to hold sensor to stabilize the sensor placement.

1.5 FLOW CHART



The project starts identify the problem. It is a step for the project flow in order to find the problem in current product. This step helps to create a different design to improve the product.

After identify the problem for the project, project continues with identify the objective. The objective is very important in every work because every procedure to make a project will depend on it. It will help to know the main point to make the project success or not.

The project continues with identify the scope of the project because this scope can help the progress to create the new product design for the project and to make sure the method chose will be within the range and achievable objective.

Next continue it with literature review and research about the title. This is consists a review of the design of holder and type of safety. These tasks have been done through research on the internet.

From the flow chart, start to design new concept. Use datum as reference. Then improve the design. Try to come with several concepts. Then compare the criteria from each design which are the best. If the best design chosen still needed to be improved go back to the previous step. If no improvement is needed go to next step. Produce the drawing together with dimension of the product and the type of materials needed.

After completing the previous tasks, start the fabrication process. Gather the parts needed for the project to proceeds the fabrication process.

Here come the testing and evaluation process. The high sensitivity sensor holder will be test to see is it fulls the requirement such as safety, ability and strength. During testing, if a problem occurs, the process of fabrication the holder will step back to the previous process. The reason to step back is to fix the error.

After all parts had been joined together and no error, here comes the phase of result and discussion. In this part, how high sensitivity sensor holder function will be

informs. Beside, how to achieve objective and solve problem statement of the project will be discuss in this phase.

1.6 GANTT CHART

Gantt chart is an important to guide work progress during this project. With Gantt chart what we need to be done first can be plan accordingly. Other than that, this project will run smoothly and finish on time. Refer Appendix A to see a Gantt chart that being used for this project.

CHAPTER 2

LITERATURE REVIEW

2.1 TYPES OF HIGH SENSITIVITY OF SENSOR HOLDER

There are two types of common sensor holder in the market which are the clip one and the holder that can be fixed or clamp the sensor by using adjustable. Many company especially the medic sector using this type of sensor nowadays.

Usually the sensor holder made up from metal or aluminium. Some of it has so simple design and some of it has creative design. There are a few of it just can hold or clamp one or two sizes of sensor and there are also a few of it can hold or clamp in various sizes.

2.1.1 Magnetic Sensor Holder

Based on the sensor holder on Figure 2.1, it made up from several materials such as magnet, aluminium bar, and steel. It functions by the sensor being clip the clipper

at the end of the bar and the holder will stick to the surface controlling by the magnet. This sensor holder have disadvantage based on the design. It can perform well on the flat surface only and can stick if the surface is conductor only.



Figure 2.1

Source: Google Image

2.1.2 Machining Sensor Holder 1

In figure 2.2 is the on of the type of adjustable sensor holder. This type of holder made up from steel block. It fabricate by using CNC technology. It usually use using a machine and it is not portable.

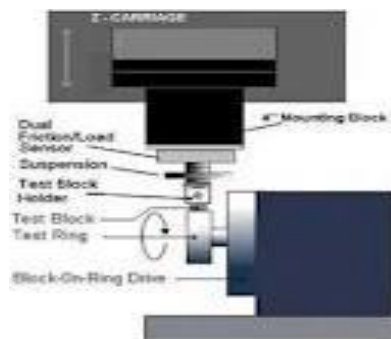
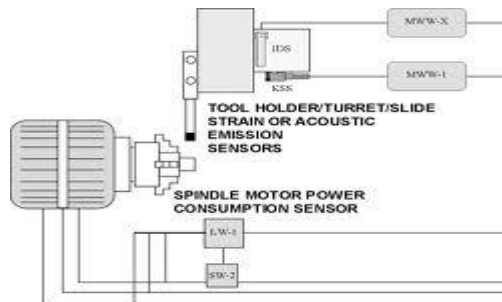


Figure 2.2

Source: Google Image

2.1.3 Machining Sensor Holder 2

In figure 2.3 is the sensor holder in round shape. It made up slightly same with the holder before. Usually use with the machine and it is not portable.

**Figure 2.3**

Source: Google Image

2.1.4 Machining Sensor Holder 3

In figure 2.4, it is round adjustable sensor holder. It is also same with 2 of the holder before. But this design can move on X-axis compare to the 2 of the holder before which are fix.

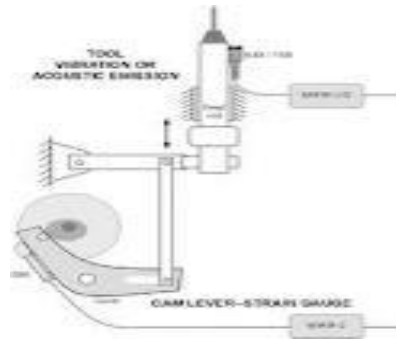


Figure 2.4

Source: Google image

2.2TYPE OF SAFETY

Safety is the most important thing that we need to take care. Even in our daily life, safety is the most important thing and the first thing that we think over after. Same goes to the sensor holder. There must have safety to make sure several things are in good condition such as the sensor must hold or clamp the sensor tightly but softly. If the holder just clamp or hold the sensor tightly but do not soft it will make the sensor easy to break down.

2.2.1 Screw

Screw is commonly used in any mechanical component. The basic function of screw is to join to part of components. Other than that, screw also used to tighten some of the component. The example of screw is in figure 3.1.



Figure 2.5

Source: Google Image

2.3 FABRICATION PLANNING PROCESS

2.3.1 Bending

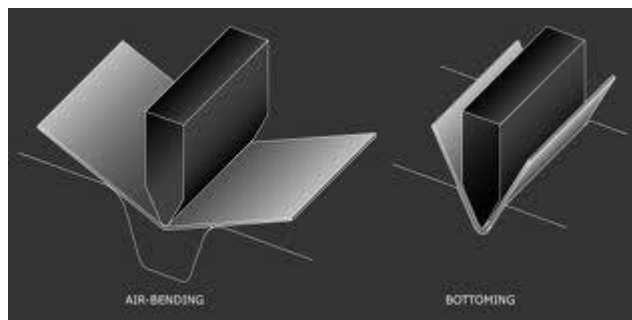


Figure 2.6

Source: Google search

Bending is a process by which metal can be deformed by plastically deforming the material and changing its shape. The material is stressed beyond the yield strength but below the ultimate tensile strength. The surface area of the material does not change much. Bending usually refers to deformation about one axis.

Bending is a flexible process by which different shapes can be produced. Standard die sets are used to produce wide variety of shapes. The material is placed on the die, and positioned in place with stops and or gages. It is held in place with hold down. The upper part of the press, the ram with the appropriately shaped punch descends and form the V-shaped bend.

For this project, I plan to use bending to make high sensitivity sensor holder. The item that will bend is aluminium plate.

2.3.2 Shearing

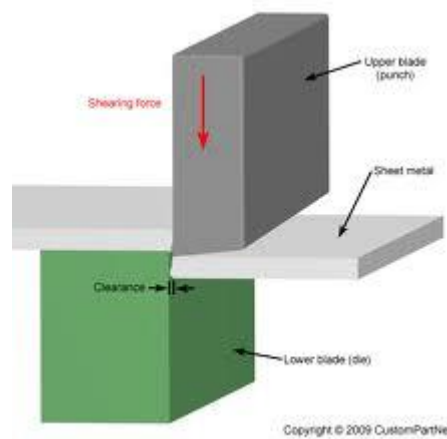


Figure 2.7

Source: Google search

Cutting process are those in which a piece of sheet metal is separated by applying a great enough force to cause the material to fail. The most common cutting process is performed by applying a shearing force, and is therefore sometimes referred to as shearing process.

The shearing process is performed on a shear machine, that can be operated manually (by hand or foot) or by hydraulic, pneumatic, or electric power. A typical shear machine include a table with support arms to hold the sheet, stops or guides to secure the sheet, upper and lower straight-edge blades, and a gauging device to precisely position the sheet.

The sheet is placed between the upper and lower blade, which are then forced together against the sheet, cutting the material. In most devices, the lower blade remains stationary while the upper blade is forced downward. The upper blade slightly offset from the lower blade, approximately 5-10% of the sheet thickness. Also, the upper blade is usually angled so that the cut progress from one end to other, thus reducing the required force.

I plan to cut the steel aluminium plate, aluminium block and steel block according their size that i want by using shearing process.

For CNC milling machine, coding is the important thing to run the machine. There are two ways to make a coding that is using simulator or master cam. CNC milling machine is more accurate than conventional milling machine. I plan to use typically milling machine and CNC milling machine to fabricate the sensor holder.

2.3.3 Drilling

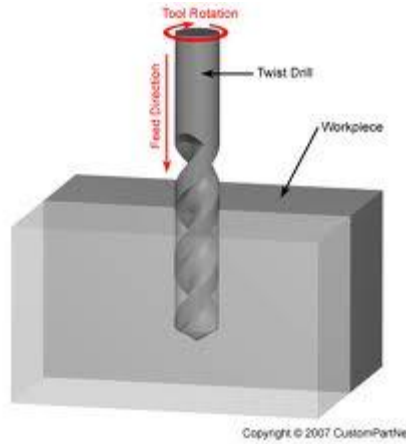


Figure 2.8

Source: Google search

There are many machines capable and used to drill, ream, or thread holes in a part. Drilling is the manufacturing process where a round hole is created within a work piece or enlarged by rotating an end cutting tool, a drill. For this project, I used drilling process to make a hole and slot.

2.3.4 Welding

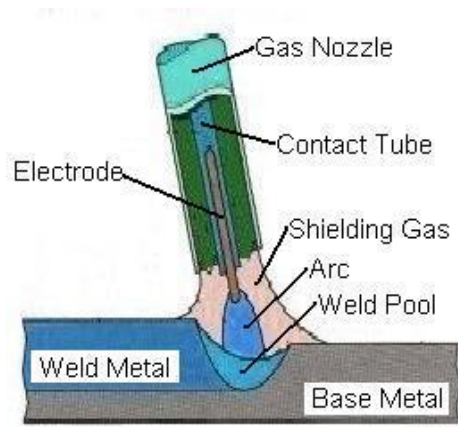


Figure 2.9

Source: Google search

Welding is one of the joining processes that join part together to be a product. In faculty laboratory there has two type of welding that is metal inert gas welding, MIG and arc welding.

Arc welding uses a welding power supply to create an electric arc between an electrode and the base to melt at the welding point. They can use either direct current or alternating current, and consumable or non-consumable electrodes.

While MIG welding uses high deposition rate welding process, wire is continuously fed from a spool. MIG welding is therefore referred to as a semiautomatic welding process.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

CHAPTER 3 is the methodology has been used to make efficient high sensitivity sensor holder. In this chapter, a project flow chart is defined. The information that included is establishing target specification, design concept, select final design concept, searching material for the product and fabrication of the product. It also allows others to replicate our study and run new and different studies that are based on our methodology.

3.2 PROCESS FLOW

Table 3.1 shows below the process flow of making a high sensitivity sensor holder. The manufacturing process consists of 5 phases.

Table 3.1: Process flow

PHASE	TITLE
Phase 1	Establish target specification.
Phase 2	Design concepts.
Phase 3	Select final design.
Phase 4	Searching material for the product.
Phase 5	Fabrication of the product.

3.3 PHASE 1 - ESTABLISH TARGET SPECIFICATION

After the investigation of the objective, criteria selection will be developed. Criteria selection here means the criteria that what people will look on the product. It is focus on the existing product on the market. Then, when the new product is done, compare it with the existing product on the market. The new good design should have better criteria than the product on the market. This is the criteria that I had to use to the new design for the secure remote holder.

- A. Easy to use
- B. Safety
- C. Durable / long life time
- D. Lightweight
- E. Nice design
- F. Low cost
- G. Strong

3.4 PHASE 2 - DESIGN CONCEPT

The purpose of this project is to design a high sensitivity sensor holder that can be used by tester or anyone who carry out an experiment about animal bone efficiently. It is also should look more efficient than existing product on market. The motivation for this project is to help to hold the sensor to get better result of the experiment.

It will look more efficient and if people who use it, they could be feel better and easy to carry out their experiment. Those are new design of high sensitivity sensor holder and the datum is the one that have been in the market now.

3.4.1 Design Concept 1

This concept design according the size of the sensor and have the screw to fix it up.

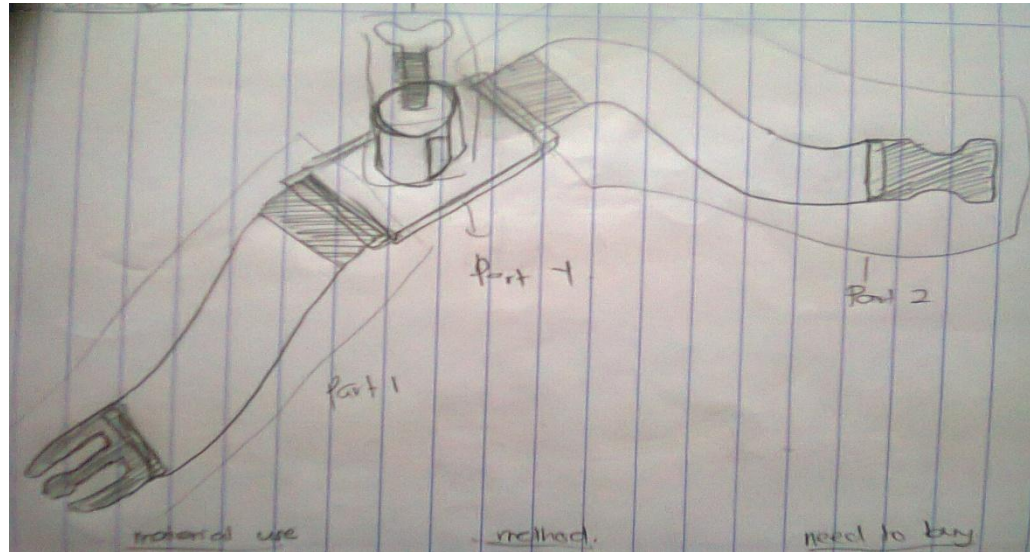


Figure 3.1: First design concept

3.4.2 Design Concept 2

This concept same like concept 1 but it does not have screw to fix the sensor but the holder is design based on the sensor shape and size.

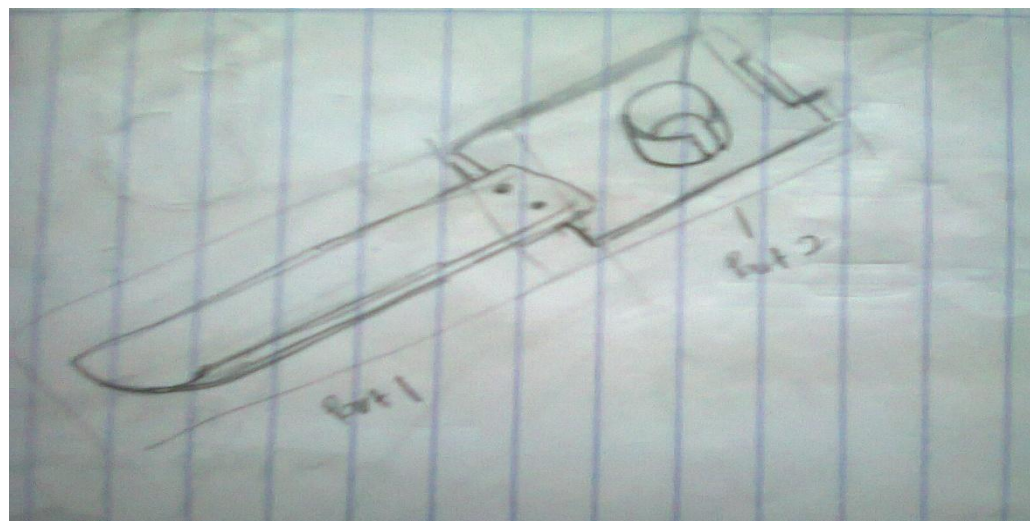


Figure 3.2: Second design concept

3.4.3 Design Concept 3

This design a bit same with the first design but the holder of the sensor is square. But even though the holder is square it makes it easy to tester to set the sensor up and it has screw to tie it up.

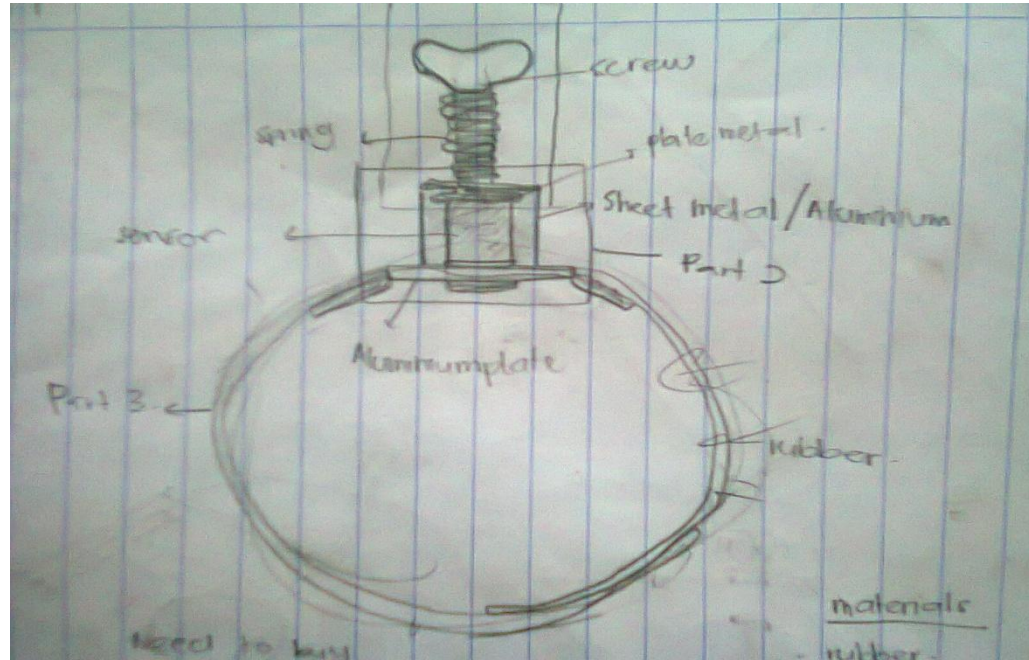


Figure 3.3: Third design concept

3.5 PHASE 3 – SELECT FINAL DESIGN

After the design concept, the best design is studied to relate it with criteria selection and then, making the decision which design is the best. For this project, two method I used to choose the design which are scoring and screening method.

Table 3.2 used to select which criteria is the best.

Table 3.2: Screening and scoring method

	Concept			
Selection Criteria	Example 1	Example 2	Example 3	Reference
Safety	0	-	0	0
Easy to handle	+	-	0	0
Low cost	0	+	-	0
Long life time	0	-	0	0
Light weight	-	0	-	0
Nice design	+	-	+	0
Sum +'s	2	1	1	0
Sum 0's	3	1	3	4
Sum -'s	1	4	2	0
Net score	1	-3	-2	0
Rank	3	2	1	2
Continue?	Yes	No	Revise/Combine	Combine

		Concept					
		Example 1		Example 3 & Reference		Example 3	
Selection Criteria	Weight	Rating	Weight score	Rating	Weight score	Rating	Weight score
Safety	25%	4	1.00	5	1.25	4	1.00
Easy to handle	25%	3	0.75	4	1.00	3	0.75
Low cost	15%	3	0.45	3	0.45	3	0.45
Long life time	10%	3	0.30	3	0.30	3	0.30
Light weight	10%	3	0.30	3	0.30	2	0.20
Nice design	15%	4	0.60	4	0.60	4	0.60
	Total Score Rank	3.40 2		3.90 1		3.30 3	
	Continue?	No		Yes		No	

3.6 PHASE 4 – SEARCHING MATERIAL FOR THE PROJECT

For this project, many suggestions that I receive from friends, supervisor and lab instructor and finally I choose several material to fabricate my project which is high sensitivity sensor holder. Table 3.3 show the material that I used to fabricate this project. I choose all these material because of the factor that based on my scoring and screening criteria.

Table 3.3: list of material

Part	Material	Dimension (mm)
Holder house	Aluminium sheet	120x40x1
Holder cap	Aluminium sheet	40x40x1
Belt	Zap on	1000
Surface plate	Aluminium sheet	60x40x1
Lock part	Steel	(screw and spring)

3.7 PHASE 5 – FABRICATION OF THE PRODUCT

Firstly, gather all the material that needs to use such as aluminium sheet metal and cut it based on the dimension needed by using sheering machine. I also used drill a hole on the plate for screw.



Figure 3.4: cap holder



Figure 3.5: screw and spring as lock part

After that is bending house holder. Unfortunately, the bending process needs me to bend manually without using bending machine. The bending machine at lab was under maintenance.



Figure 3.6: holder house

I used drilling process to drill a hole for sensor on the holder surface plate.



Figure 3.7: holder surface plate

Lastly, I join all the part by welding.



Figure 3.8: final product

CHAPTER 4

RESULT AND DISCUSSION

4.1FINAL PRODUCT

The final product design and final product in several views are shown in the figure 4.1 and figure 4.2

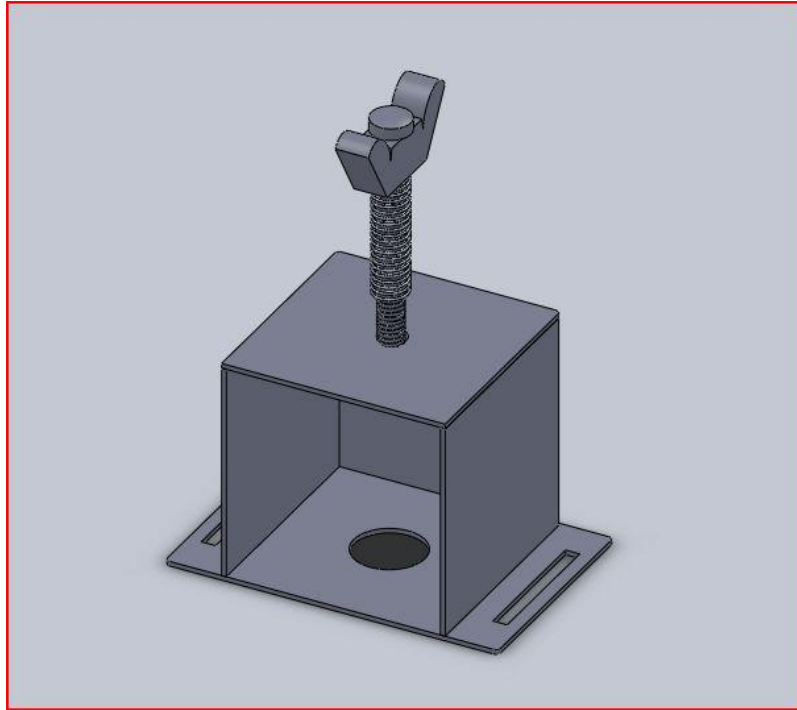


Figure 4.1: Drawing final design



Figure 4.2: Final product

4.1.1 Component of Final Product

The component for this product are locking slot, sensor holder, and the zap on belt as shown in the figure 4.3

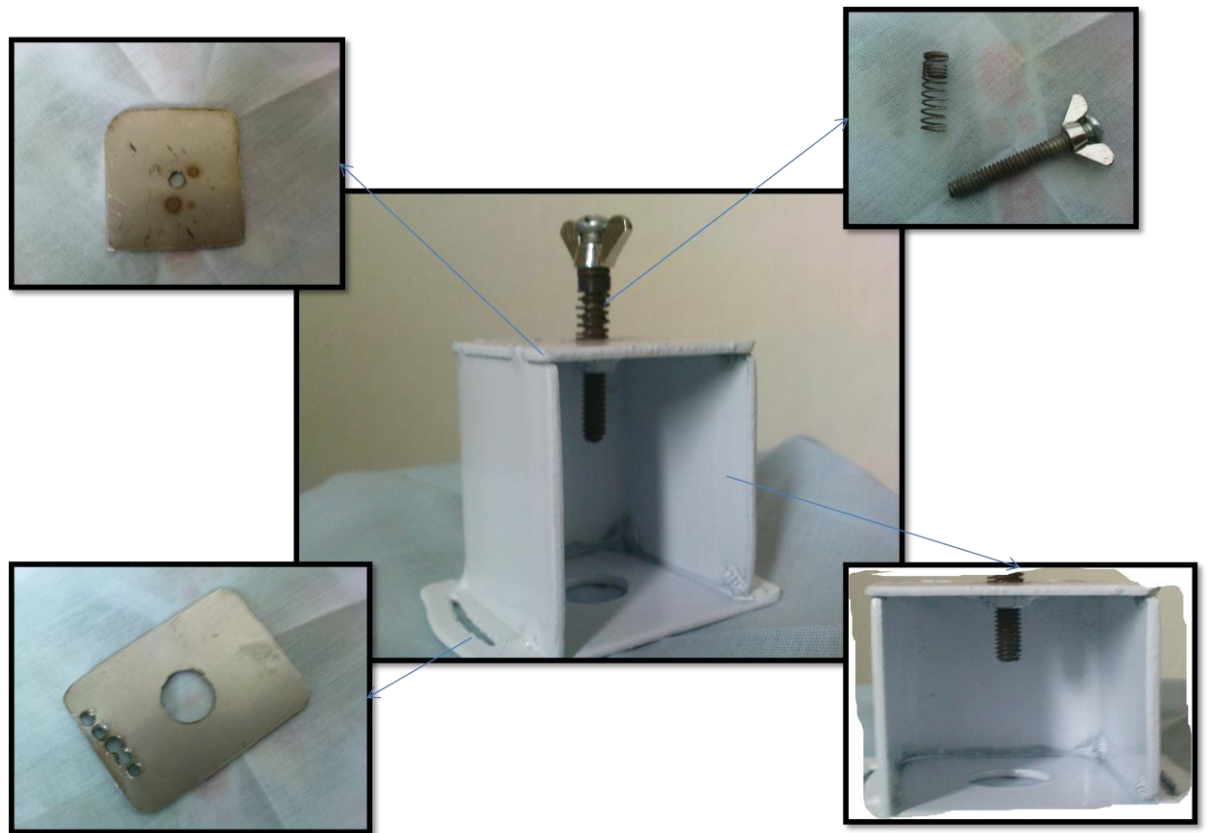


Figure 4.3: Component of final product

4.1.2 Function of Final Product Component

Table 4.1 shows the function of every part on the product.

Table 4.1: Function of every part

PART	FUNCTION
Sensor Holder	To hold the sensor during carry out the experiment
Locking Slot	To hold the sensor so that the sensor will not move
Zap On Belt	To fix up the sensor at animal bone

4.2HOW TO USE THIS HIGH SENSITIVITY SENSOR HOLDER?

First, take this sensor holder to the animal bone that want to test. By using the zap on belt, tight it ups the sensor to the bone.

Next, put the sensor inside the chamber of holder and fix it toward a hole inside the chamber. After that, using the screw, fix it up to make sure the sensor will not move while carry out the experiment

4.3PROJECT PROBLEMS

4.3.1 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 own ideas on this project.

4.3.2 Designing and Sketching

In the market, there is currently no high sensitivity sensor holder especially portable and can use at animal bone. So there are no references the can be referred. All the drawing and dimension need to generate by student itself.

4.3.3 Material Preparation

In faculty central store there are limited resources on type of material. Therefore, I have to change my first plan which is using many type of material to one type of material only which is aluminium sheet metal.

4.3.4 Fabrication Process

The drill tool size are needed is not available. So I have to make a work by using manual method to get the actual size. That is why the process need more time to finish it.

Other than that, my product consists of small part thus making the fabrication harder. Small part is hard to hold because of lack suitable holder foe small components such as for drilling, welding and bending.

Besides that, there are so many things happen in fabrication the product during welding process such as defect. This defect happens because lacks of skills to operate a machine such as MIG welding machine. Furthermore, the heat must suitable to the type of material that has been used.

4.4HOW THIS PROJECT ACHIEVES THE OBJECTIVE AND SOLVES THE PROBLEM SATEMENT

There is currently no holder for high sensitivity acoustic emission sensor holder that can move anywhere or portable. To solve the problem, idea to produce high sensitivity sensor holder with efficient look had come. The sensor holder can be use on animal bone without any problem. Other than that, the result that will get will not affect by the movement of the sensor because it has a lock.

A several new concept designs were come out to solve the problem. Those new concept designs are created based on the objective. Then, they were comparing to look, which of them could be the final design that will be fabricate.

The user can use it easily. Besides, they do not have to worry about getting unrealistic or unstable reading because there is the lock for the sensor. That means the objective of the product had been achieved.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

The project was completed and the high sensitivity sensor holder is capable to be use to hold the acoustic emission sensor. The objective of the project is achieved at the end of the design and fabrication

5.2 RECOMMENDATION

The high sensitivity sensor holder has its weakness which will need to be improved to get a better result. The shape of the design is quite flat. It is better if the surface of the holder a bit round shape because it basically use on the non flat surface and quite round.

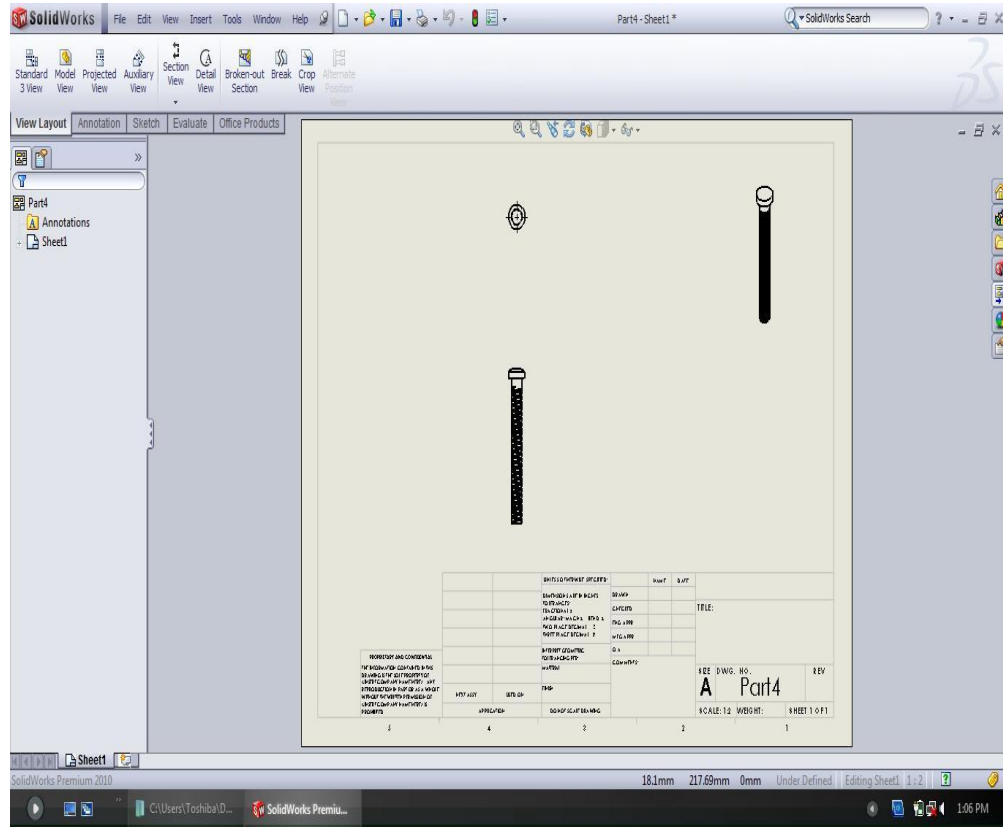
REFERENCES

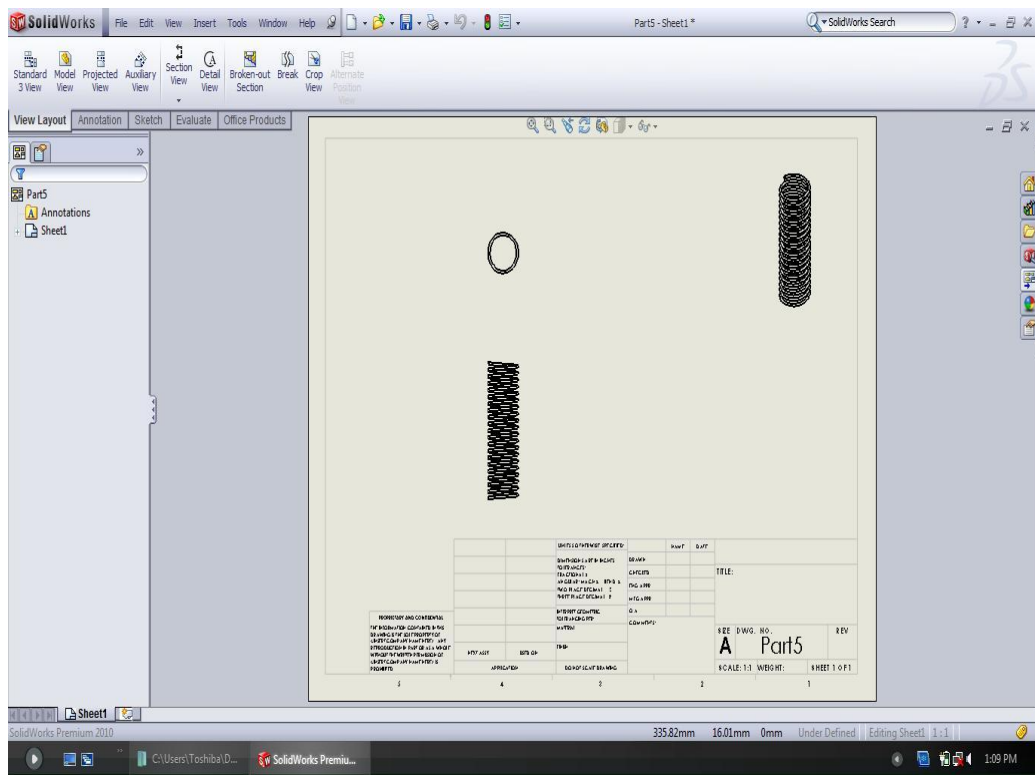
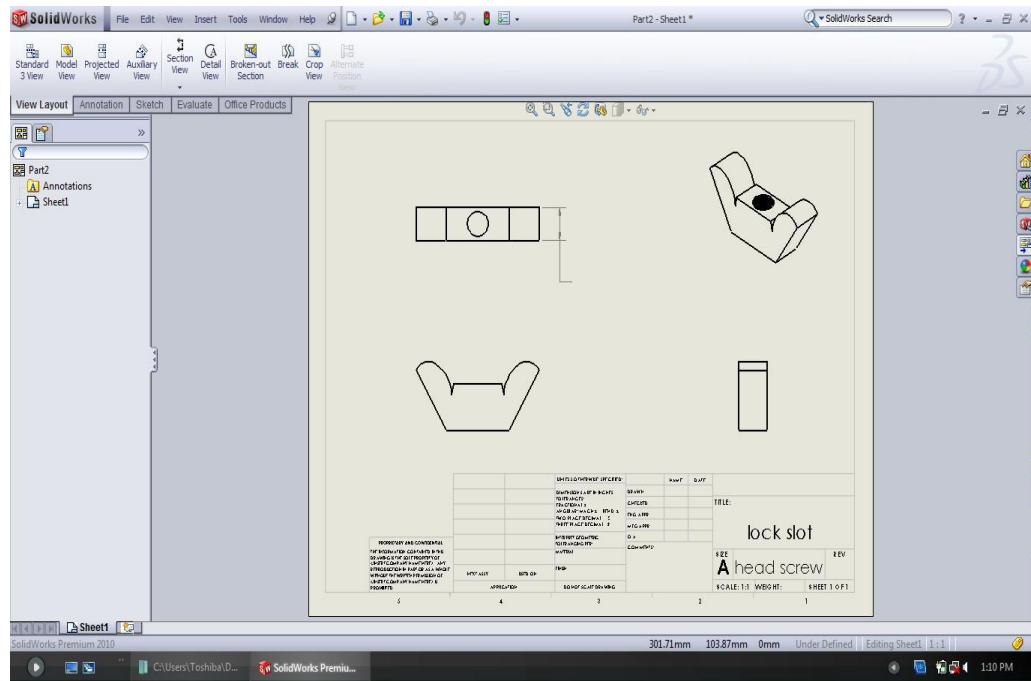
1. Sensor Holder, Online, <http://www.sensorholder.info/>
2. Organize, The Home Store, Online, <http://www.organize.com/soorbl.html>
3. 7. Bending: Introduction, Online,
4. http://www.efunda.com/processes/metal_processing/bending.cfm
5. 8. Sheet Metal Cutting (Shearing), Online,
<http://www.custompartnet.com/wu/sheetmetal-shearing>
6. 9. Basic Operation of Lathe, Online,
7. http://www.nmri.go.jp/eng/khirata/metalwork/lathe/intro/index_e.html
8. 10. Milling, Online, <http://www.custompartnet.com/wu/milling>
9. 11. Engineers Edge, Drilling Process and Machines, Online,
10. <http://www.engineersedge.com/manufacturing/drilling-machines-process.htm>
11. 12. MIG Welding, Online, <http://www.weldingengineer.com/1mig.htm>

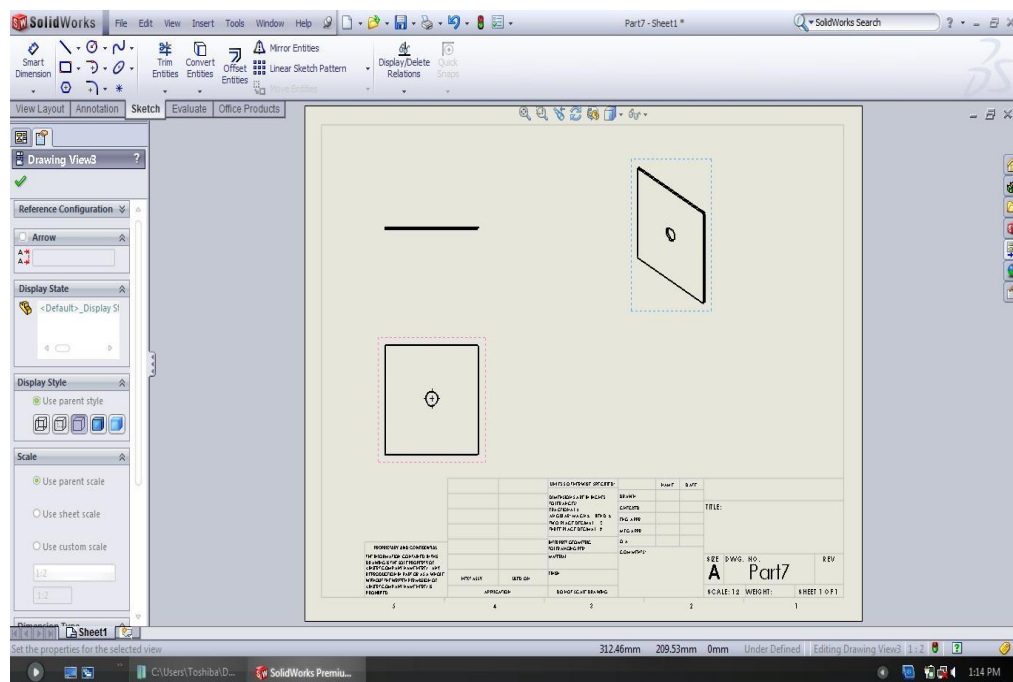
APPENDIX A

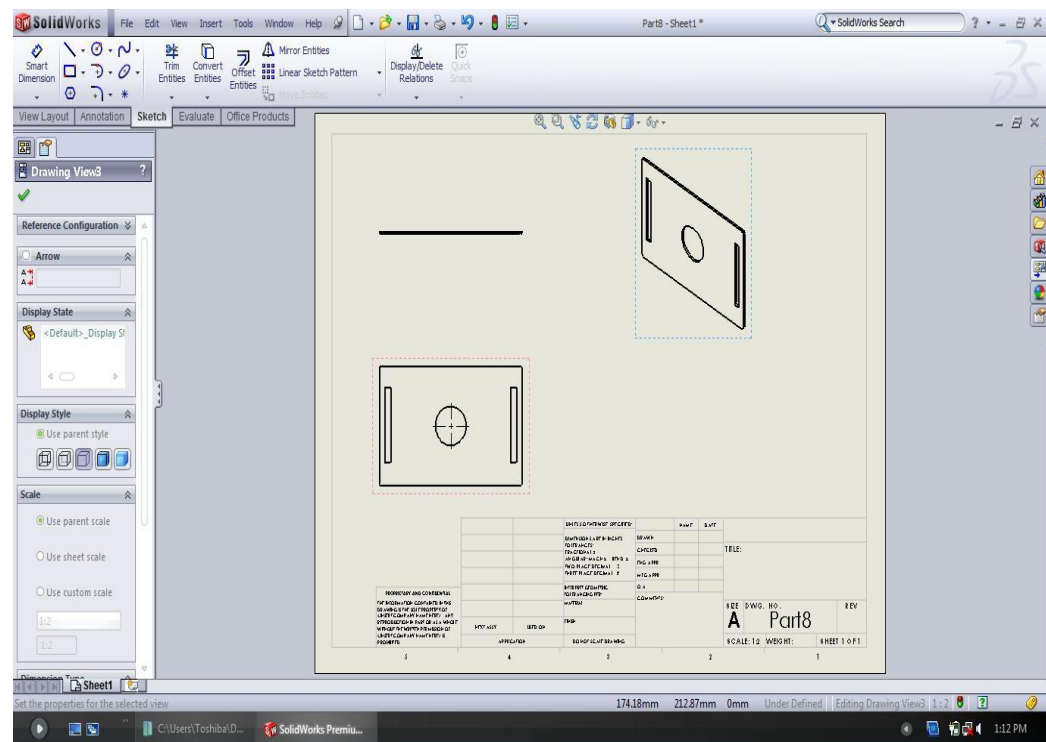
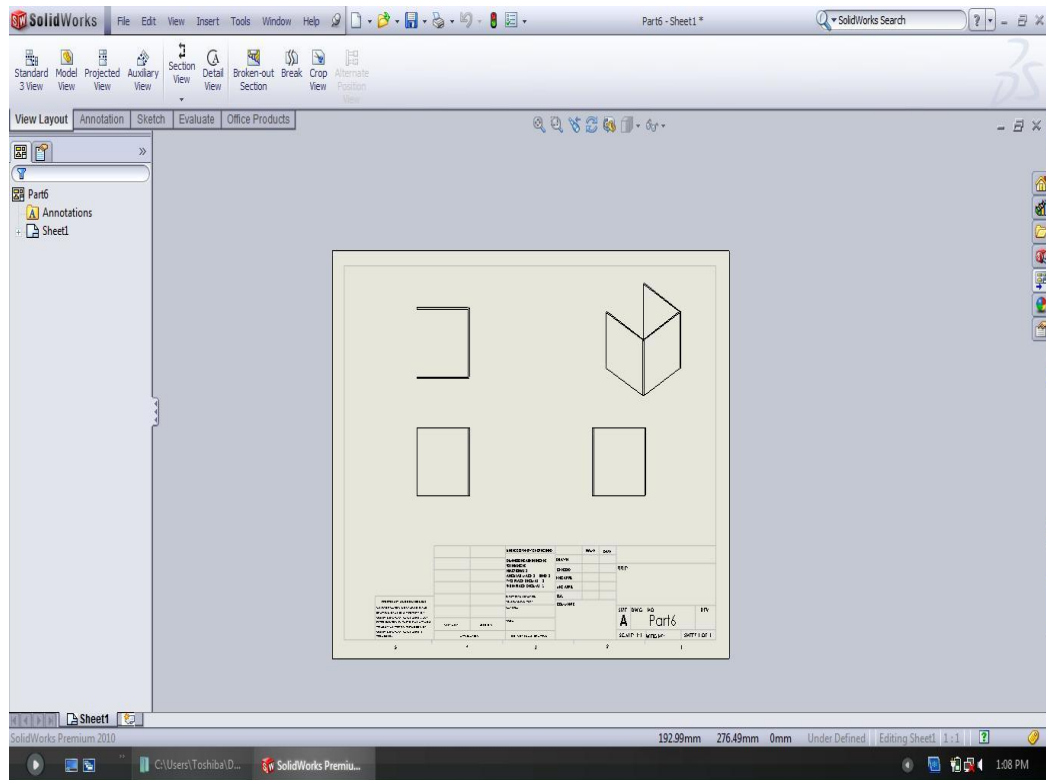
[illegible]

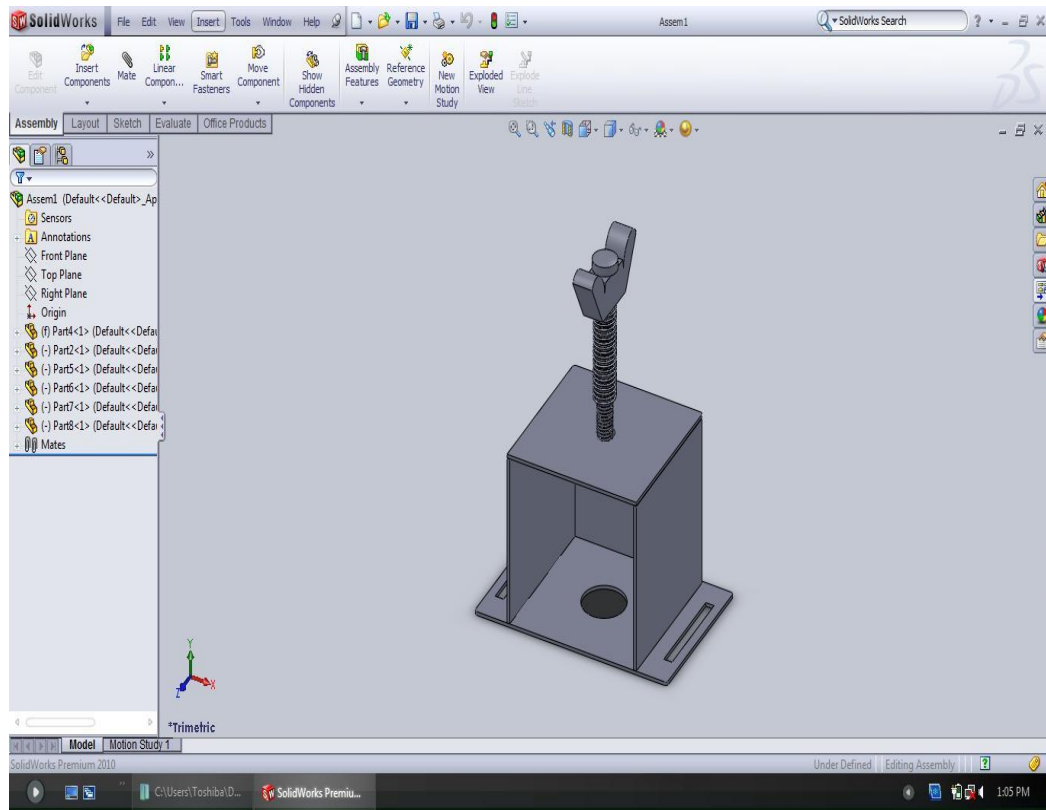
APPENDIX B











APPENDIX C**WELDING**



SHEERING

**DRILLING**