

DESIGN AND FABRICATION POWER WINDOW APPARATUS
(FRAME TYPE)

MOHD HIZIR ARAFAT BIN TAMBUN

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ABSTRACT

This Power window apparatus project main purpose is to train final year student for hands on experience and to work by their self. The study of manufacturing is very important to ensure student understand the requirements to do in this project. This project is about designing and fabricating the Power Window Apparatus for experimental use to help the students in a Automotive class for easy understand if the basic system of power window and how it works. This project involves the process of designing the test panel by considering the shape and also the advantages for student to use in their learning process. After the design has completed, it was transformed to the real product by fabricating process. This project also required analysis to test the power window operation failure factor. Numerous methods and process involve in this project for instance joining using welding process. After all the process have been done, this power window apparatus help us to understand the fabrication and designing process that involved in this project.

ABSTRAK

Tujuan utama projek 'power window apparatus' ini ialah memberi pelajar pengalaman belajar dan bekerja dengan sendiri. Pembelajaran di dalam bidang pembuatan adalah sangat penting untuk memastikan pelajar memahami apa yang harus dibuat dalam projek ini. Projek ini adalah mengenai merekabentuk dan menghasilkan peralatan 'power window' untuk tujuan eksperimen bagi membantu pelajar di dalam kelas Automotif untuk mudah memahami sistem asas bagi sebuah 'power window' dan bagaimana ia beroperasi. Projek ini melibatkan proses merekabentuk sebuah 'test panel' dengan mengambil kira bentuk dan juga kelebihannya dalam membantu para pelajar di dalam proses pembelajaran mereka. Setelah rekaan yang ingin dihasilkan siap, ia akan ditukarkan kepada produk yang sebenar di dalam proses penghasilan dimana rekaan tadi akan dijadikan sebagai panduan. Projek ini juga merangkumi analisis keatas faktor kegagalan 'power window' beroperasi. Kebanyakan cara dan proses yang terlibat dalam proses penyambungan bagi projek ini adalah menggunakan proses welding. Setelah semua proses yang terlibat dalam projek ini selesai, peralatan 'power window' ini membantu kita memahami proses merekabentuk dan menghasilkan yang terlibat dalam projek ini.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	FRONT PAGE	i
	SUPERVISOR DECLARATION	ii
	DECLARATION	iii
	DEDICATION	iv
	ACKNOWLEDGEMENT	v
	ABSTRACT	vi
	ABSTRAK	vii
	TABLE OF CONTENTS	viii
	LIST OF TABLE	xi
	LIST OF FIGURE	x
	LIST OF APPENDIX	xii
1	INTRODUCTION	1
	1.1 Synopsis	1
	1.2 Problem Statement	2
	1.3 Objective	3
	1.4 Scopes	4
	1.5 Project Planning	4

2	LITERATURE REVIEW	5
2.1	Introduction	5
2.2	Types of power window regulator (frame type)	6
2.3	The power window regulator application	8
2.4	Basic wiring of power window	8
3	METHODOLOGY	9
3.1	Project Flow Chart	9
3.2	Research Methodology	11
3.3	Project Gantt Chart	12
4	RESULTS AND DISCUSSION	14
4.1	Fabrication Process	14
4.2	Overall assembly of parts	17
4.3	Project Analysis	18
5	CONCLUSION	25
5.1	Introduction	25
5.2	Problem	25
5.3	Recommendation	26
5.4	Project Conclusion	26
	REFERENCES	27

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.1	Ribbon Style	6
2.2	Scissor Style	7
2.3	Honda Style	7
2.4	Power window situated in door panel	8
2.5	Basic diagram of power window wiring	8
3.1	Project Flow Chart	10
3.2	Project Gantt Chart	12
4.1	Apparatus design	14
4.2	Power window on the apparatus panel	15
4.3	Measuring and Material Selection	15
4.4	Cutting process	16
4.5	Welding process	16
4.6	Power window apparatus (frame type)	17
4.7	Testing the panel	18
4.8	Burden on panel	18
4.9	Graph Voltage Vs. Max load	20
4.10	Graph Power Vs. Max load	20
4.11	Graph Required power Vs. Max load	24

LIST OF TABLES

TABLE NO.	TITLE	PAGE
4-1	Experimental Analysis 1	19
4-2	Relation between calculation and experimental analysis 2	23

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Sketch	28
B	Solid Work drawing	29
C	Part of power window apparatus	30

CHAPTER 1

INTRODUCTION

1.1 Synopsis

1.1.1 General Synopsis

The project involves designing and fabricating a Power Window Apparatus (Frame Type). This power window apparatus would be entirely use for learning and educational process. As the Diploma final year project allocates the duration of 1 semester, this large man-hour project therefore requires significant efforts of the students to participate. Basically the entire Power Window Apparatus could be divided into 3 stages, which are concept review and development, designing and fabrication.

The Power Window Apparatus is equipped by using all necessary items and method for instance sheet metal, rectangular hollow steel, skills in manufacturing process by perform arc welding to joint the parts and etc. The advantages of the power window apparatus to be developed can be seen in its flexibility to be moved such that, man are offered to make their task easier since the apparatus to be used in class.

The process of development is initiated from designing the shape of the apparatus panel by considering the strength as well. In order to produce user friendly product that is suitable to the consumer or the user, consideration to the ergonomic factor is taken into account. It involves the measurement process before the materials are cut into pieces before joined together.

1.1.2 Specific Synopsis

My project title is Design and Fabrication of Power Window Apparatus (Frame Type). The project involves small analysis of the power window application frame body and fabrication of the apparatus panel itself with concerns regarding strength, durability, ergonomic factor, dynamic resistance and convenience. Simple concept of apparatus is required to improve its durability and functions. Test need to be done to verify the strength of the panel right before the fabrication process to avoid material and fund wasting. The projects prerequisites are Static, Dynamic and Strength of Material. Overall, the project will meet acquire skills of design, analysis, and fabrication.

1.2 Problem Statement

The concept of the Power Window Apparatus is to facilitate teachers or lectures in their teaching process. This power window apparatus will primarily help staff especially members of Faculty of Mechanical Engineering to teach the students about the application and system works like an actual power window use in car. Members are facing problem while they need to look how the actual power window that is used in car works. Thus, with the development of this power window apparatus, it is hope that it can contribute to give them ideas how to overcome the learning process in order to show the application and how it works.

1.3 Objective

1.3.1 General Objective

Diploma final year project objective is to train the student to practice the knowledge and skill that have been gathered before in solving problem using academic research, to born an engineer that have enough knowledge and skill.

This project also important to train and increase the student capability to get know, research, data gathering, analysis making and then solve a problem by research or scientific research. It will educate the student in communication like in a presentation and educate them to defend their research in the presentation.

The process will generate students that have capability to make a good research report in thesis form or technical writing. Moreover it 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.

1.3.2 Specific Project Objective

Basically this project is base on this objective:

- (i) Study about the power window, power window regulator and how the power window works.
- (ii) Apply the study and assemble it fabricated.
- (iii) Work in time giving.
- (iv) Project planning and problem solving.

1.4 Scopes

- (i) Design of a test panel.
- (ii) Fabricate the panel.
- (iii) Test the designed system works like an actual power window.

1.5 Project Planning

Project starts with the literature review and research on this final project title and a little review about power window regulator and component. This consist a review of the welding application and examples car power window works. These tasks have been done through research on the internet, books and others sources. After gathering all the relevant information, the project undergoes with design process. In this step, from the knowledge gather from the review is used 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 the transfer to solid modeling and engineering drawing using Solid Works program.

After the engineering drawing and simulation is completed, the drawing will be used as a reference for the next process, which it is fabrication stage. This process is consists fabricate the parts that have design before by following the entire dimension.

At the end, when all the process mentioned above is done, the material for report writing is gathered. The report writing process will be guided by the UMP final year report writing guide. This process also included the presentation slide making for the final presentation of the project. The project ended after the submission of the report and the presentation slide has been presented.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Definition Power windows or electric windows are automobile windows which can be raised and lowered by depressing a button or switch, as opposed to using a hand-turned crank handle.

The first electric power windows were introduced around 1946 by Lincoln. These are driven by a small electric motor inside the door and have come to be universal in the industry. Prior to that date, in the few vehicles offering this feature, the windows were driven by hydraulics or off the engine vacuum. In the 1950s, electric power was also applied to the tailgate window, in many station wagons.

In a typical installation, there is an individual switch at each window and a set of switches in the driver's door, so the driver can operate all the windows. However, some models like Saab and Saturn have used switches located in the center console, where they are accessible to all the occupants. In this case, the door-mounted switches can be omitted.

Power windows are usually inoperable, when the car is not running, as the electrical system is not 'live' once the ignition has been turned off.

The power window is a mechanism that allowed the window moving up and down automatically. With the Power Window Apparatus, it helps the instructors or

lectures in their teaching process. It is also helps the students to know the application and how the power window works in actual car easily. So, this apparatus panel is designed and fabricated to achieve the objective.

2.2 Types of Power Window Regulator (frame type)

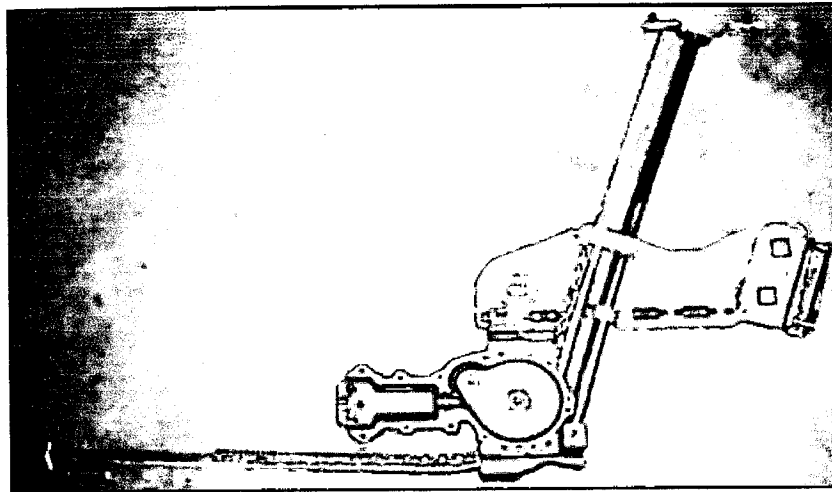


Figure 2.1: Ribbon style

This regulator, commonly referred to as the "ribbon style" was prone to failure, and wisely redesigned midway through the 1986 production run. The early style regulator, show at left, has a sealed motor, and can't be easily serviced. If the flimsy ribbon doesn't break, then over time, the grease on the ribbon attracts dirt and hardens, packing grime into the motor, slowing it down and eventually overloading it. Both of my units were slow and noisy it is purchased in car.

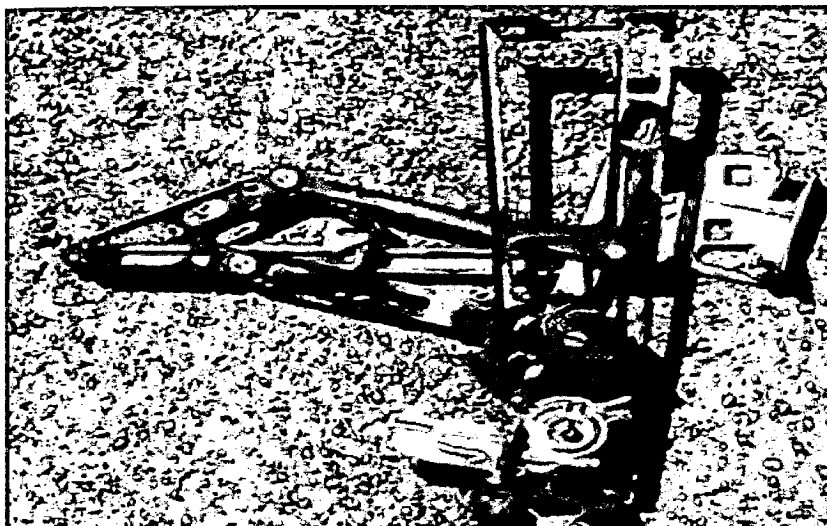


Figure 2.2: Scissor style

Driven by a steel gear. It operates quickly, quietly, and doesn't depend on a thin nylon ribbon to carry the weight of the window. They can be purchased for anywhere from \$120 used to \$500 for a new set. The only modifications required involve drilling two carefully placed holes in the bottom side of the door, and a very simple modification of the passenger side motor wiring harness.

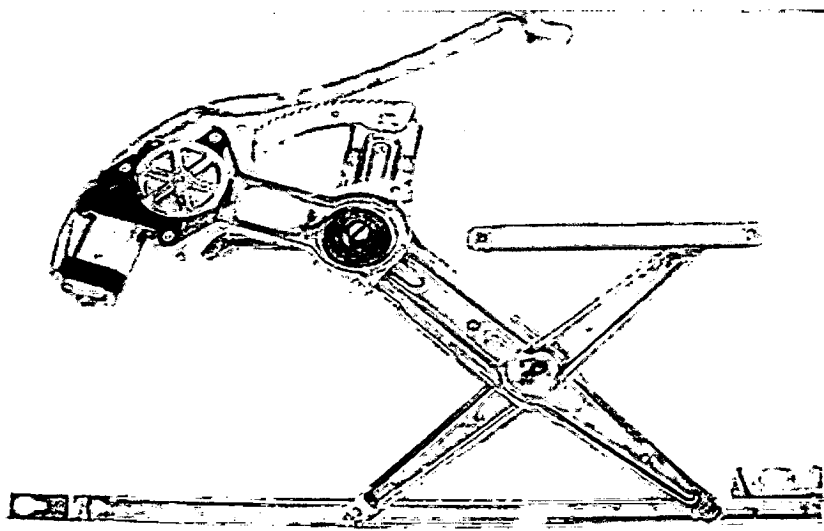


Figure 2.3: Honda style

Use in Honda cars since 1970. It is produce widely and it is very light. The strength is to support the glass window.

2.3 The Power Window Regulator Application

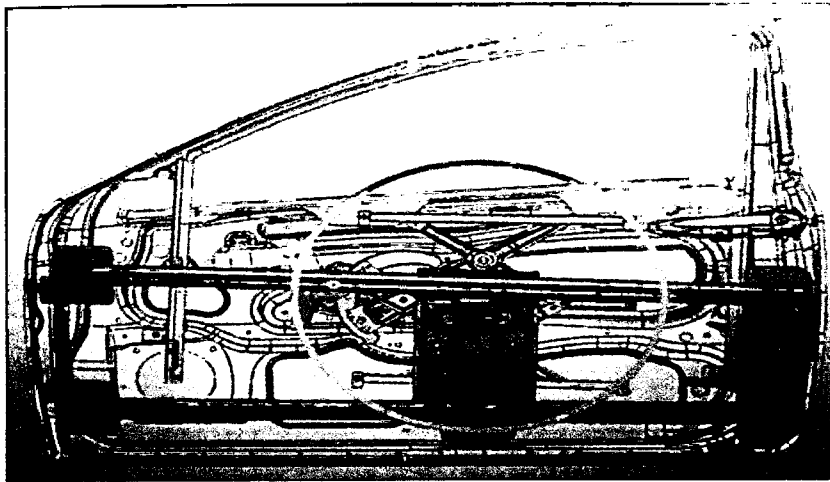


Figure 2.4: Power window situated in door panel

2.4 Basic Wiring of Power Window

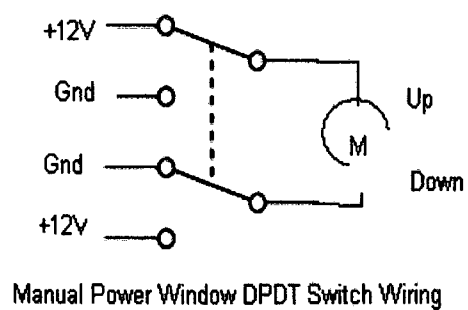


Figure 2.5: Basic diagram of power window wiring

CHAPTER 3

METHODOLOGY

3.1 Project Flow Chart

This consist a review of the concept of power window (refer Figure 3-1), power window regulator and power window functional operation based on power window that has been used in a actual car. These tasks have been done through research on the internet, books and others sources.

From the gained information, it is used 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 Solid works program. The materials and the measurement needed for the trolley listed down and calculated to give an ergonomic shape of the panel.

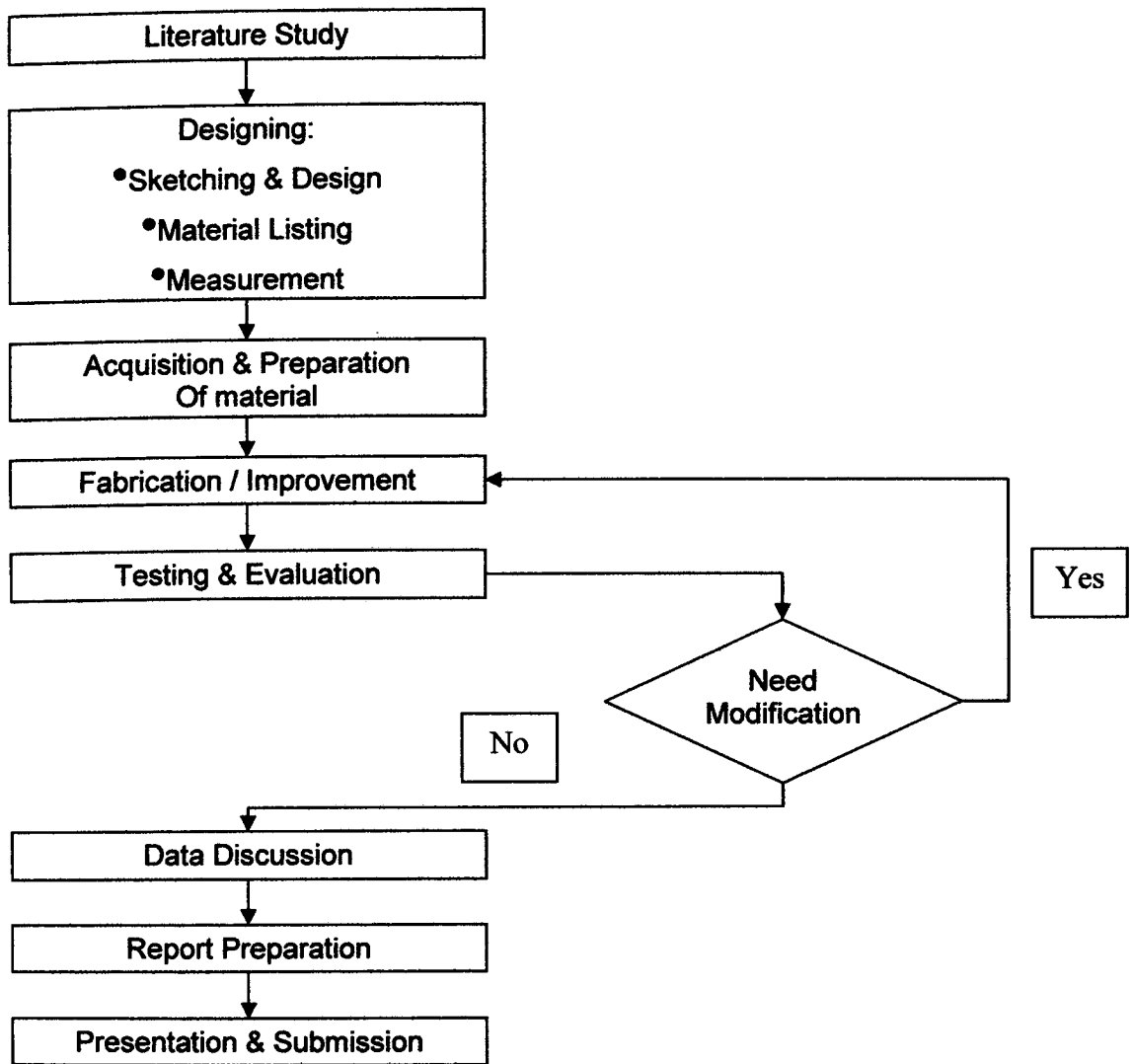


Figure 3.1: Project flow chart

Next, after the needed material is listed, acquisition step take places. Some of the needed material is available at the Mechanical Engineering Laboratory.

After all the parts needed had been gathered and cut, 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, welding, 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 which is to hang the power window against the panel and being as apparatus.

If all the parts had been processed, the parts are joined together to produce full-scaled apparatus panel. Here come the testing and evaluation process. The panel will be test to see if it fulfills the requirement such as ergonomic aspect, safety, strength and maneuverability. During the testing, if problem occur such as malfunction or unstable platform, the panel will step back to the previous process, where the error is fixed. The panel is expected to have an error that may cause the part to be re-designed and re-fabricate again. The panel may be finished by doing some finishing process such as spraying.

After all the parts had been joined together, here comes the last phase of process that 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.

3.2 Research Methodology

To fabricate this Power Window Apparatus, the design panel is made from hollow steel 2.5cm². The base and regulator stand of this panel apparatus is joined by welding method. It shows that this panel is fully welded for each of joining.

To hang the power window regulator, it just screws it to the panel. This method can be done due to original car power window which is screwed against to the door panel. project starts with literature review and research about the title.

3.2.1 Joining Method

The joining method that used is the permanent joint that is welding joint. The welding machine that is used is from GMAW or Gas Metal Arc Welding type.

- (i) Make sure the ground clamp is connected well, and is in close proximity to where you are welding.
- (ii) Pull the trigger on the welding gun to set the regulator.
- (iii) Double check the wire type and diameter of the wire. Make sure the tip size matches.

3.3 Project Gantt Chart

Scope	Week(s)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Literature Review	■	■												
Design & Measurement consideration			■	■	■	■								
Acquisition & Material preparation				■	■	■	■	■						
Methodology study					■	■	■	■						
Fabrication						■	■	■	■	■				
Evaluation & Improvement							■	■	■	■	■			
Report writing				■	■	■	■	■	■	■	■	■	■	
Presentation								■	■	■	■	■	■	■

Figure 3.2: Project gantt chart

- (i) **Week 1-2**
This project starts with finding the information about power window, how it works and the failure that usually happen in actual car. In the process to make the research, all accommodations are used so that information is gathered correctly.
- (ii) **Week 3-5**
After the research is made, now is the designing stage where it starts with sketching. Then the selected sketch is design manually by SolidWorks.
- (iii) **Week 5-7**
Material is selected in this week. Material is selected based on it strength so that it can received force from the burden that will put on the power window regulator.
- (iv) **Week 6-8**
To decide the best method to fabricate this panel.
- (v) **Week 6-10**
After made the methodology research, continue with fabrication stage that will use all information and decision made for the pass few week. This stage finished according the planning.
- (vi) **Week 9-11**
An experiment is made to make a research about the voltage and power based on given force or load.
- (vii) **Week 3-13**
Report writing is updated time to time based on process made
- (viii) **Week 6**
Mid-presentation
- (ix) **Week 14**
Preparation for final presentation

CHAPTER 4

RESULT AND DISCUSSION

4.1 Fabrication Process

4.1.1 Design by Solidwork Program

This process is proceeded with the design selection. Then it is applied to the engineering design using solidworks program. The final design can be seen as it in Figure 4-1 below. Figure 4-2 shows how the power window regulator is applied to the panel apparatus.

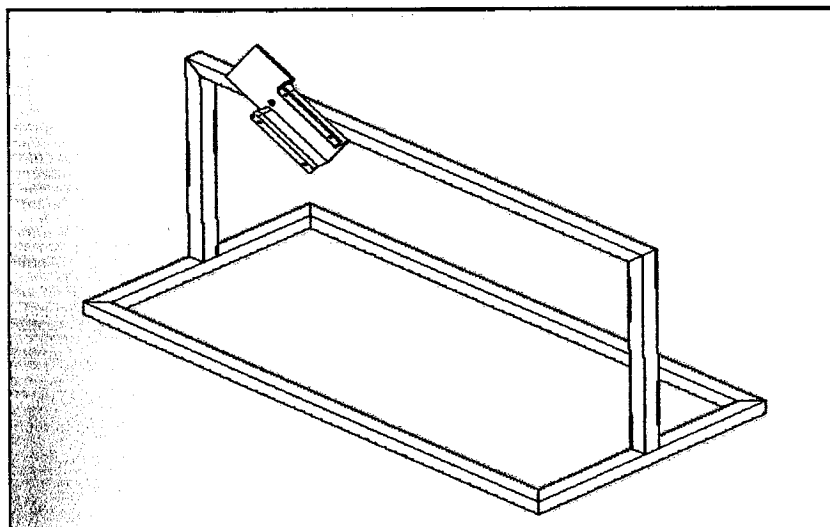


Figure 4.1: Apparatus design

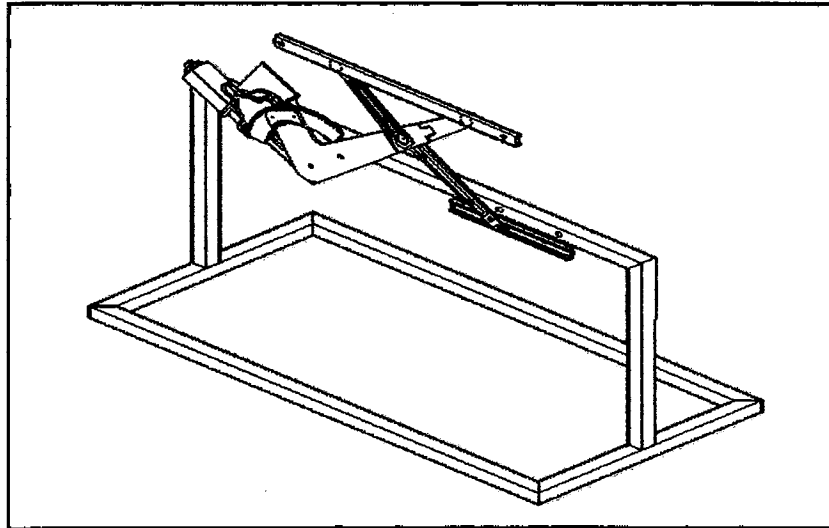


Figure 4.2: Power window on the apparatus panel

4.1.2 Measuring and Material Selection

After the design is finished by solidwork, it come for material selection and measuring method. The material used for this final project is hollow steel (2.5 cm x 2.5 cm). This material is used because it is has hardness strength so that it can provide stability to the apparatus panel. Measuring process can be referred Figure 4.2.



Figure 4.3: Measuring and material selection

4.1.3 Cutting Process

This process comes after the measuring process. By using grinder cutter, all measured material is cut. The process is showed in Figure 4.3

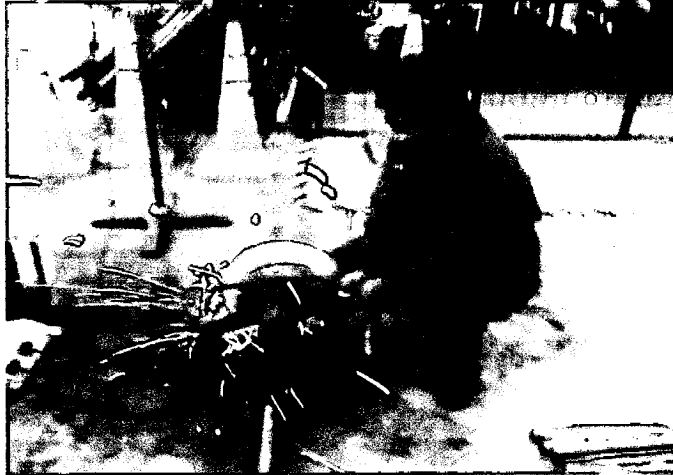


Figure 4.4: Cutting process

4.1.4 Welding Process

Welding process is using GMAW or Gas Metal Arc Welding. This method is use for joining. It is showed in Figure 4.4



Figure 4.5: Welding process