POLITEKNIK
MALAYSIA
MUKAH

METAL CHIPS REMOVER

MICHAEL NICK ANAK TOMMY	20DKM13F2034
ROGEELIO JUMAH ROGER	20DKM13F1064
VALLERY ANAK TANA	20DKM13F1046
DANNY WILSON	20DKM13F1045
KELVIN DOUGLAS	20DKM13F1058

DEPARTMENT OF MECHANICAL ENGINEERING
POLITEKNIK MUKAH

SESSION: JUNE 2016

Metal Chips Remover

NAME	REG. NUMBER
1. MICHAEL NICK ANAK TOMMY	20DKM13F2034
2. ROGEELIO JUMAH ROGER	20DKM13F1064
3. VALLERY ANAK TANA	20DKM13F1046
4. DANNY WILSON	20DKM13F1045
5. KELVIN DOUGLAS	20DKM13F1058

This report is submitted to the Department of Mechanical Engineering in partial fulfilment of the requirements for graduation Diploma in Mechanical Engineering

PROJECT REPORT VERIFICATION

This report entitled "**Metal Chips Remover**" has been submitted and reviewed as to meet the conditions and requirements of project writing.

Reviewed by:

Supervisor 1	:	ROSMARIA BINTI IBRAHIM
Signature	:	
Date	:	20/10/16

"We declare that this report is our own work except each piece that we have explained the source"

1. Signature : 
   Name : MICHAEL NICK ANAK TOMMY
   Registration Number : 20DKM13F 2034
   Date : 20/10/2016

2. Signature : rogelio
   Name : ROGEELIO JUMAH ROGER
   Registration Number : 20DKM13F 1064
   Date : 20/10/2016

3. Signature : 
   Name : VALLERY ANAK TANA
   Registration Number : 20DKM13F 1046
   Date : 20/10/2016

4. Signature : 
   Name : DANNY WILSON
   Registration Number : 20DKM13F 2045
   Date : 20/10/2016

5. Signature : 
   Name : KELVIN DOUGLAS
   Registration Number : 20DKM13F 1058
   Date : 20/10/2016

ACKNOWLEDGEMENT

We would like to extend our utmost gratitude and appreciation to all those who gave us the possibility to complete this report. A special thanks supervisor, Mdm Rosmaria Binti Ibrahim, for the unwavering guidance, stimulating suggestions and support through the completion of the project and report.

We would also like to express our appreciation to the crucial role of the staff of Mechanical Engineering Welding Workshop, who gave the permission to use all required machinery and the necessary material to complete our project which is Metal Chips Remover.

As a team mate, we would like to thank each other for being cooperating and encourage each other during the progress of completing this Metal Chips Remover.

Last but not least, our thanks to all lecturers of Mechanical Engineering Department for great commitment in briefing and lecture us about the writing of Project Logbook and Final Year Project Report.

ABSTRACT

Our product name is METALS CHIPS REMOVER. The tools serve the purpose to help to clean machine that dealt with metal scraps. The idea was sparked as the problem, arose during the discussion while debating over cleaning a lathe machine. The problem that was found is that, the safety over a student or whoever that cleaned the machine. It's also take too much time to clean the machine and need many man power to just clean a single machine. So, for this project, we conducted our research which focusing on the machine where the metal scarp are allocated on the lathe machine. As for the tools design, we focus on the effectivity of the tools when used to clean the lathe machine. The design also focus on the right size, which it can go through the small and tight space on the lathe machine. We also make sure that the tools is affordable for every user. The estimated cost for manufacture this tools is around Rm350. We hope that this tool can help those that does their work in workshop.

Abstrak

Nama produk kami adalah METALS CHIPS REMOVER. Alat ini berkhidmat bertujuan untuk membantu untuk membersihkan mesin yang menghasilkan sisa logam. Idea ini tercetus apabila masalah timbul semasa perbincangan ketika melakukan pembersihan mesin larik. Masalah yang terdapat ialah, keselamatan ke atas seorang pelajar atau sesiapa yang dibersihkan mesin. Ia juga mengambil masa yang lama untuk membersihkan mesin dan memerlukan banyak tenaga kerja untuk hanya membersihkan sesebuah mesin. Jadi, untuk projek ini, kami telah menjalankan penyelidikan yang memberi tumpuan kepada mesin di mana sisa logam yang dihasilkan di mesin larik. Bagi reka bentuk alat, kita memberi tumpuan kepada efektifitas alat apabila digunakan untuk membersihkan mesin larik. Reka bentuk ini juga memberi tumpuan kepada saiz yang betul, yang ia boleh pergi melalui ruang yang kecil dan ketat pada mesin larik. Kami juga memastikan bahawa alat ini adalah mampu milik untuk setiap pengguna. Anggaran kos untuk pembuatan alat-alat ini adalah sekitar RM350. Kami berharap bahawa alat ini boleh membantu mereka yang melakukan kerja-kerja mereka dalam bengkel

CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.1 INTRODUCTION

Machines have always been an object of fascination in our society. They have been used many years to complete human tasks. Life is filled with many repetitive tasks, and if machines are able to perform those tasks, they can help to ease an overarching burden. With that said, machines are optimal replacements for humans in a working scenario.

There is a lot of purpose for us to create the machine (Metal Chips Remover). It is to reduce human labour in the industry. The machine will help people to get their work easily done with this simple and useful machine. This machine consists of mechanical features such as machining, transformer and programming. This machine can be place and use at any suitable place because the size of this machine is not too big compare to the existing machine.

1.2 PROBLEM STATEMENT

When brainstorming into the idea of the project, our team had notice that when getting rid of splinters on the lathe machine, it takes much time and energy to get the jobs done. It is hard to get rid of the splinters in the hidden angle and it takes too much time to sweep of the splinters off that machine.

1.3 OBJECTIVE

1. To design and fabricate a portable and rechargeable magnetic splinters remover.
2. To get rid of the splinters on the curvy, small parts and angle of the machine.
3. Reduce time to clean the machine after finishing a task.

1.4 SCOPE

The project is aimed to get rid of splinters on the angle that is hard to be reached from the lathe machine. The project is to be constructed only within PMU's Mechanical Engineering Workshop and it is estimated to be complete in next semester.

1.5 SYNOPSIS

Our project is aimed to removes splinters on the hard and small angle of the lathe machine easier where it will take less time and energy to use this gadget than using the small brush. The pro's of this gadget is, it has an adjustable tip that enable it to reach the small angle of the machine to removes splinters. It's also easy to use because it is portable and the battery inside this device is rechargeable and long lasting. The con's of this device is it can only be used to removes metal splinters as the magnet that we used was only suitable for metal.

1.6 ADVANTAGES

a) Easy to use.

b) Easy to use, not complicated like other cleaning machine.

c) Can clean splinter, in easy and fast way as much not using more man power.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

An electromagnet is a type of magnet in which the magnetic field is produced by an electric current. The magnetic field disappears when the current is turned off. Electromagnets usually consist of a large number of closely spaced turns of wire that create the magnetic field. The wire turns are often wound around a magnetic core made from a ferromagnetic or ferromagnetic material such as iron; the magnetic core concentrates the magnetic flux and makes a more powerful magnet.

The main advantage of an electromagnet over a permanent magnet is that the magnetic field can be quickly changed by controlling the amount of electric current in the winding. However, unlike a permanent magnet that needs no power, an electromagnet requires a continuous supply of current to maintain the magnetic field.

Electromagnets are widely used as components of other electrical devices, such as motors, generators, relays, loudspeakers, hard disks, MRI machines, scientific instruments, and magnetic separation equipment. Electromagnets are also employed in industry for picking up and moving heavy iron objects such as scrap iron and steel.

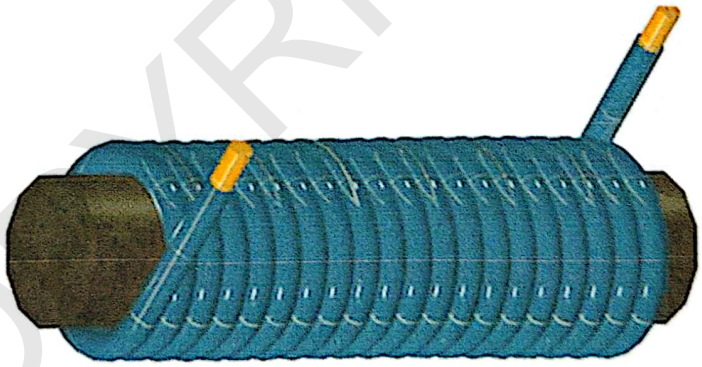


Figure 2.1.1

A simple electromagnet consisting of a coil of insulated wire wrapped around an iron core. A core of ferromagnetic material like iron serves to increase the magnetic field created. The strength of magnetic field generated is proportional to the amount of current through the winding.

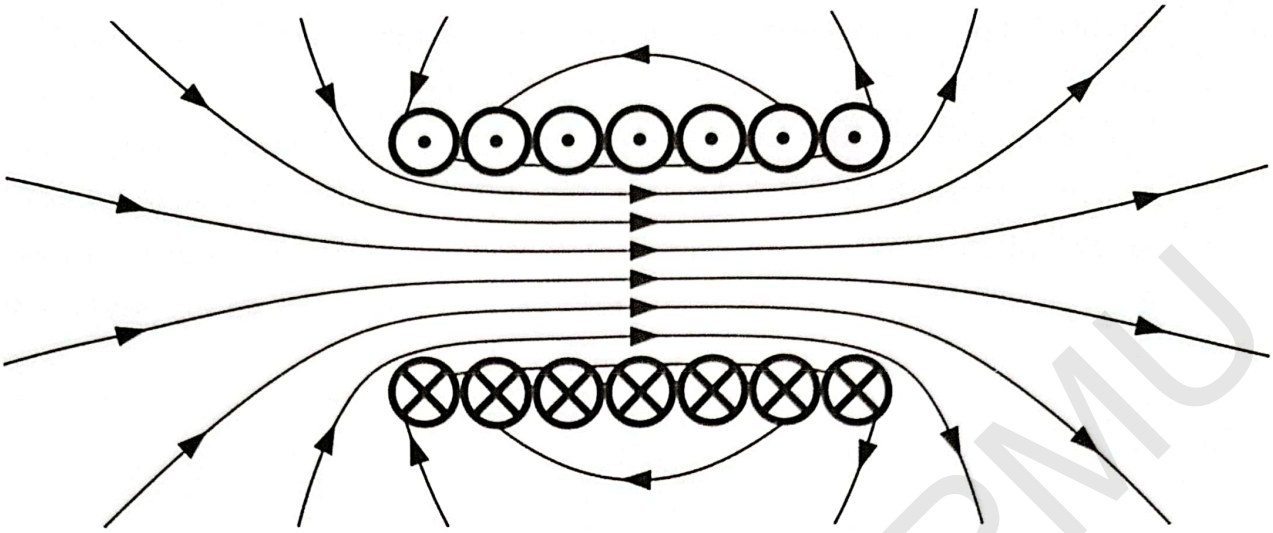


Figure 2.1.2

Magnetic field produced by a solenoid (coil of wire). This drawing shows a cross section through the center of the coil. The crosses are wires in which current is moving into the page; the dots are wires in which current is moving up out of the page.

2.2 HISTORY OF ELECTROMAGNET

Danish scientist Hans Christian Ørsted discovered in 1820 that electric currents create magnetic fields. British scientist William Sturgeon invented the electromagnet in 1824. His first electromagnet was a horseshoe-shaped piece of iron that was wrapped with about 18 turns of bare copper wire (insulated wire didn't exist yet). The iron was varnished to insulate it from the windings. When a current was passed through the coil, the iron became magnetized and attracted other pieces of iron; when the current was stopped, it lost magnetization. Sturgeon displayed its power by showing that although it only weighed seven ounces (roughly 200 grams), it could lift nine pounds (roughly 4 kilos) when the current of a single-cell battery was applied. However, Sturgeon's magnets were weak because the uninsulated wire he used could only be wrapped in a single spaced out layer around the core, limiting the number of turns.

Beginning in 1830, US scientist Joseph Henry systematically improved and popularized the electromagnet. By using wire insulated by silk thread inspired by Schwinger's use of insulated wire to make a galvanometer, he was able to wind multiple layers of wire on cores, creating powerful magnets with thousands of turns of wire, including one that

could support 2,063 lb (936 kg). The first major use for electromagnets was in telegraph sounders.

The magnetic domain theory of how ferromagnetic cores work was first proposed in 1906 by French physicist Pierre-Ernest Weiss and the detailed modern quantum mechanical theory of ferromagnetism were worked out in the 1920s by Werner Heisenberg, Lev Landau, Felix Bloch and others.

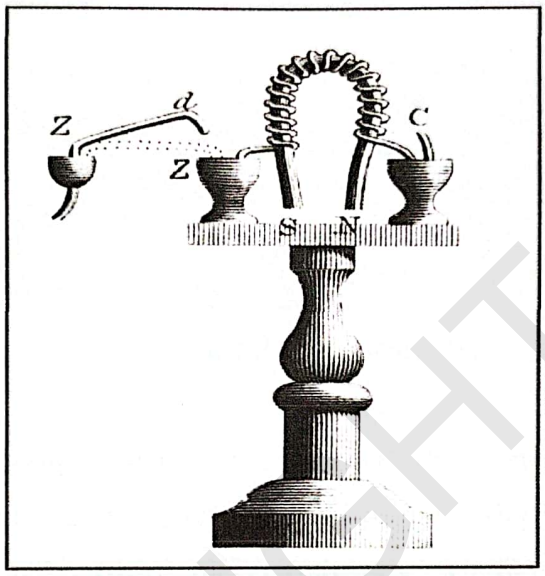


Figure 2.2.1 Sturgeon's electromagnet, 1824

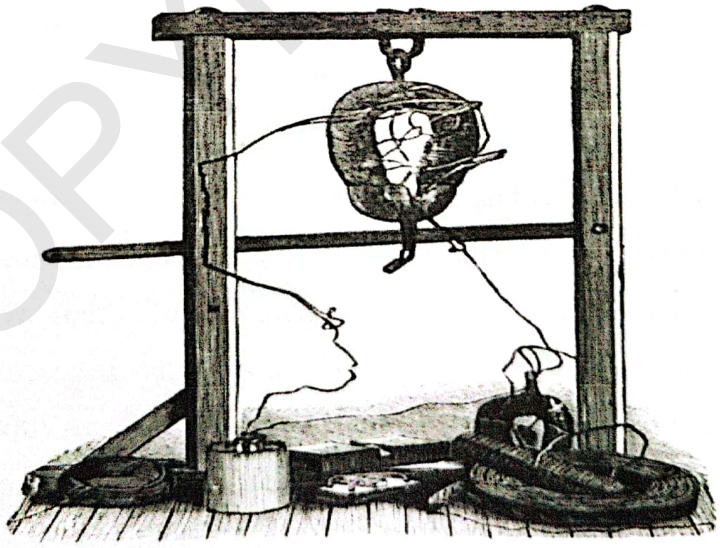


Figure 2.2.2 One of Henry's electromagnets that could lift hundreds of pounds, 1830.

2.3 PREVIOUS DESIGN

An electromagnet is a magnet that runs on electricity. Unlike a permanent magnet, the strength of an electromagnet can easily be changed by changing the amount of electric current that flows through it. The poles of an electromagnet can even be reversed by reversing the flow of electricity. These are the previous designs before our design is created:

i. Transformers

Figure 2.3.1 Transformer

A transformer is simply two electromagnets which are magnetically coupled together. There is electrical isolation between the two windings, but power can be transferred from one winding (the primary) to the other winding (the secondary) via the alternating magnetic field. They work on AC voltages. The ratio of the secondary output voltage to the primary input voltage is equal to the ratio of the number of turns in the secondary winding to the number of turns in the primary winding. (i.e., Vout/Vin = Nsecondary/Nprimary)

The photo on the left is a control transformer, and takes 230Vac in and drops it to 115Vac out for control circuits in industry. You can also turn it around and put 115Vac in and get 230Vac out. Transformers have a kVA rating which is the rated output Voltage times the rated output Amps divided by 1000. The one above is rated at 0.200kVA or 200VA. The two photos on the right show how to demonstrate the transformer action using two coils and the AC electromagnet.

ii. Battery Powered ElectroMagnet

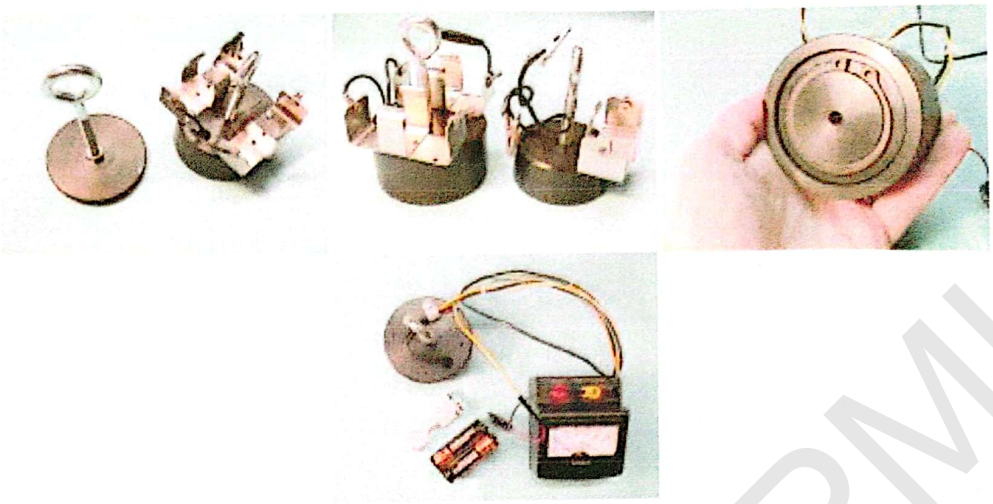


Figure 2.3.2 Battery Powered Electromagnet

This is a lifting electromagnet which is capable of holding 500lbs with just 2 D cell batteries. It is made of two parts - the yoke which also contains the coil, and the plate. The secret to the large holding force is that the plate and yoke are carefully machined so that there is no gap between them when they are placed together.

First, remove the battery holders that come with it. Then a soldered longer wire to it, along with two banana plugs and a 9v battery clip in order to connect an ammeter in series with either a 2 cell AA battery holder or a 4 cell AA battery holder from Radio Shack. Also put a cable clamp on it so there wouldn't be any strain on the wires from the coil assembly. Then put a longer eye bolt into the plate, and secured it with a flat and lock washer.

2.4 Current design

i. Metal Chips Remover (M.S.R)

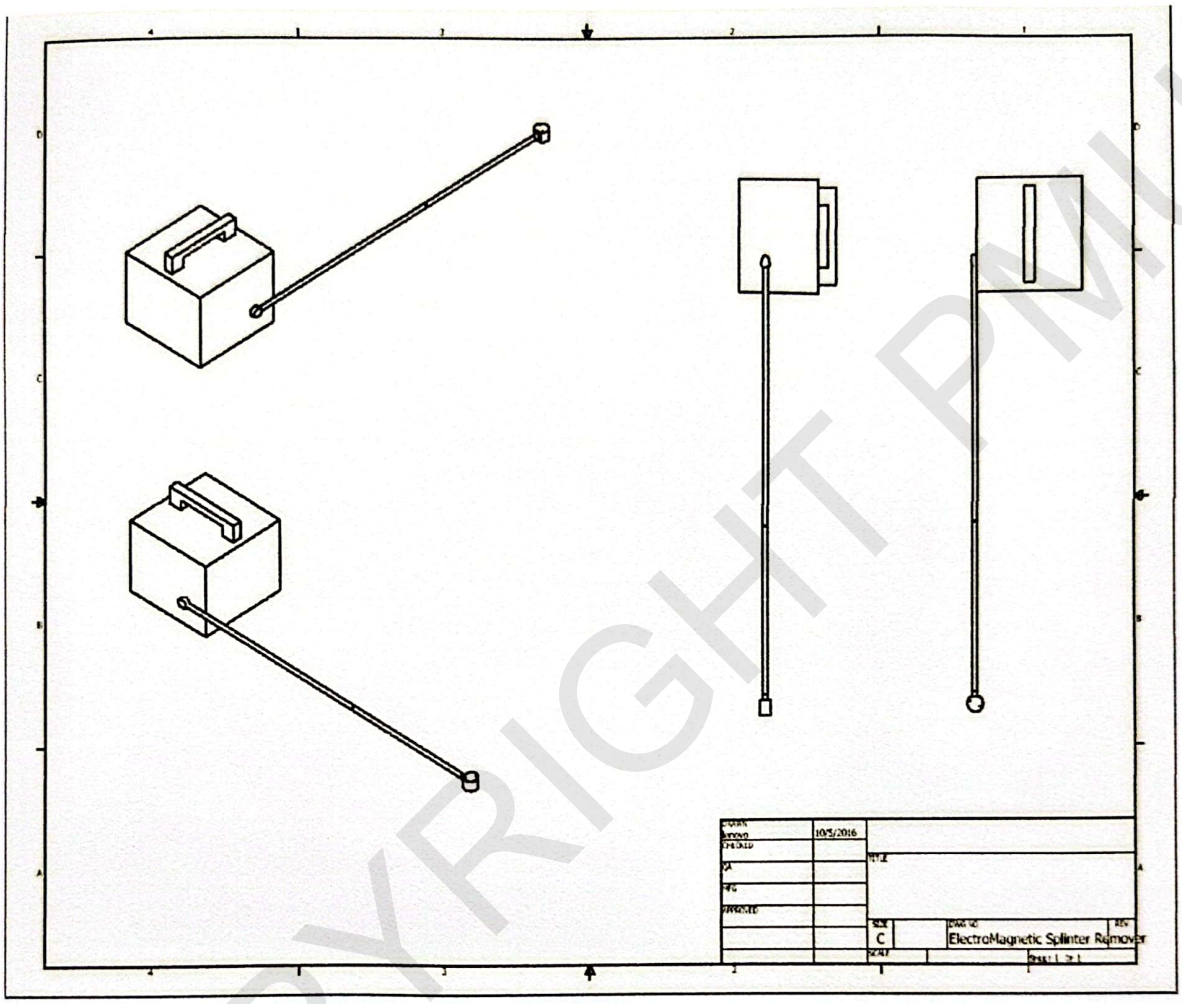


Figure 2.4.1 Current design

When we decided that our design project would be a Metal Chips Remover (M.S.R), we had several ideas on the concept and the design. After trying to incorporate every important aspect of the different designs we considered we came up with our ideal design. The ideal design would be something as described here on. Our electromagnet metal chips remover is based on green technology concept.

This electromagnet metal chips remover will consist of two parts which is main body which will store power supply and the second body, tips, which the transformer are placed. Different than the previous designs, we are trying to make our project to be an

automatic and easy to handle electromagnet metal chips remover. This will ensure the design can fulfil the needs of the metal chips removing.

CHAPTER 3

METHODOLOGY

3.1 Design Process

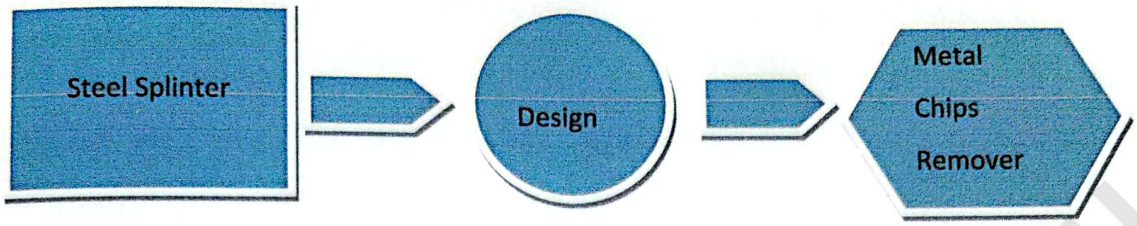


Figure 3.1.1: Black Box Model

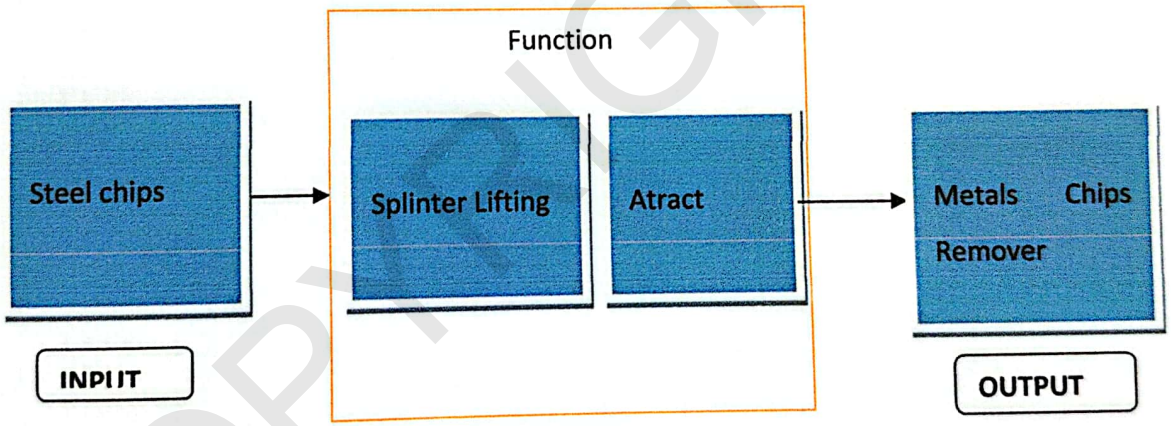


Figure 3.1.2: Design Process

3.1.1 CONCEPT GENERATION

MORPHOLOGY DIAGRAM

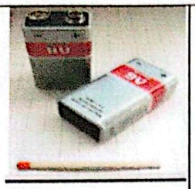
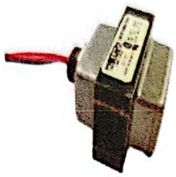
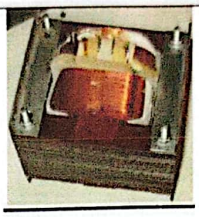
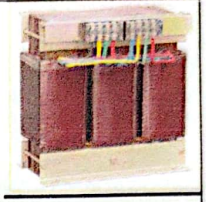
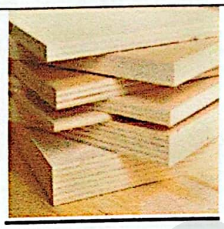
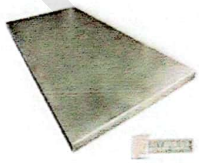
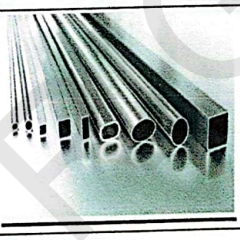
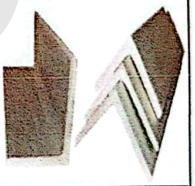
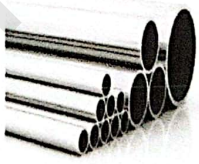
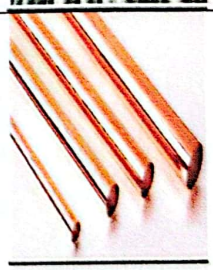
TYPE OF POWER SUPPLY				
TYPE OF TRANSFORMER				
TYPE OF BODY COVER				
TYPE OF STEEL				
TYPE OF PIPE				

Table 3.1.4: Morphology Diagram

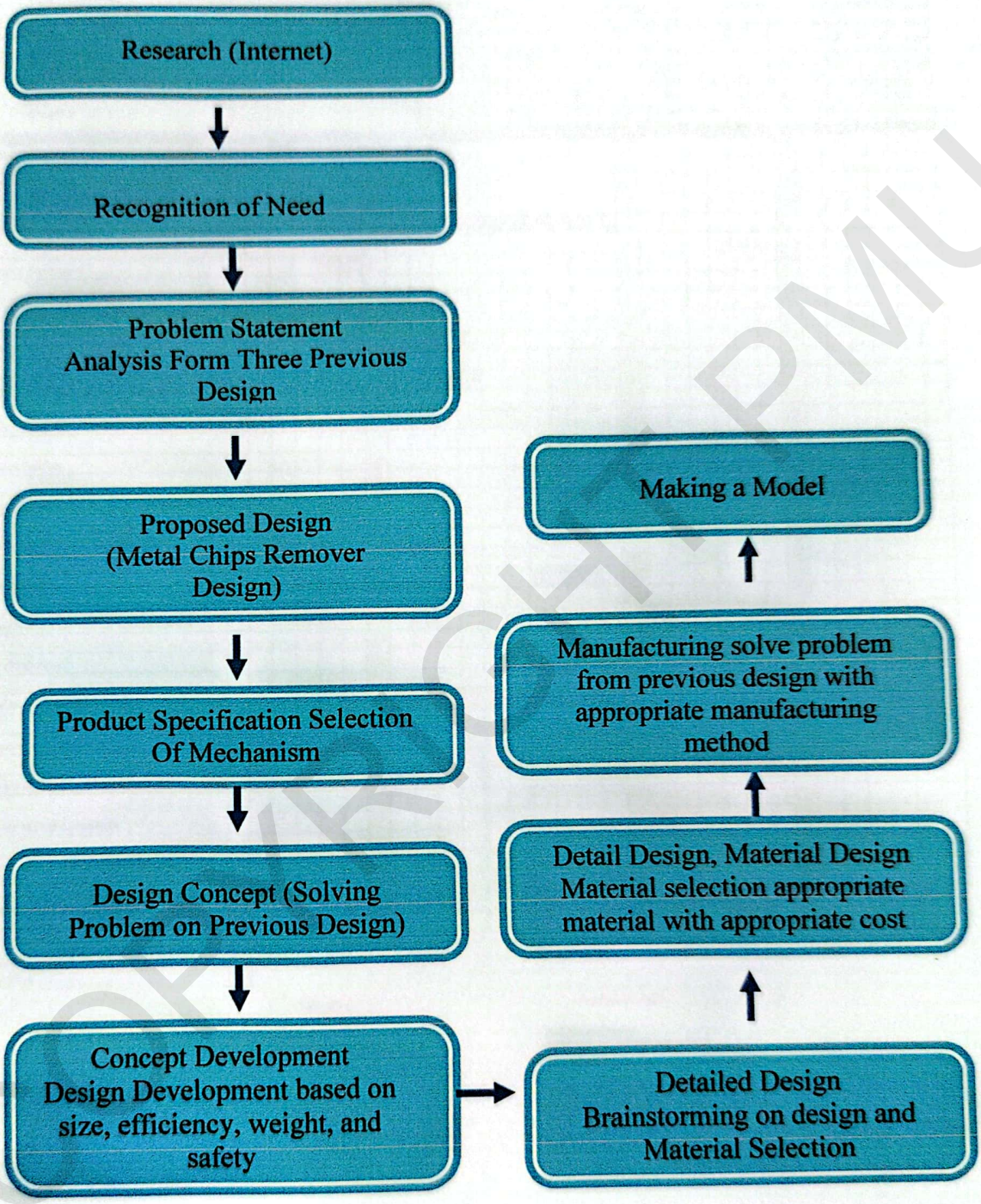
3.1.2 CONCEPT EVALUATION

CONCEPT EVALUATION TABLE

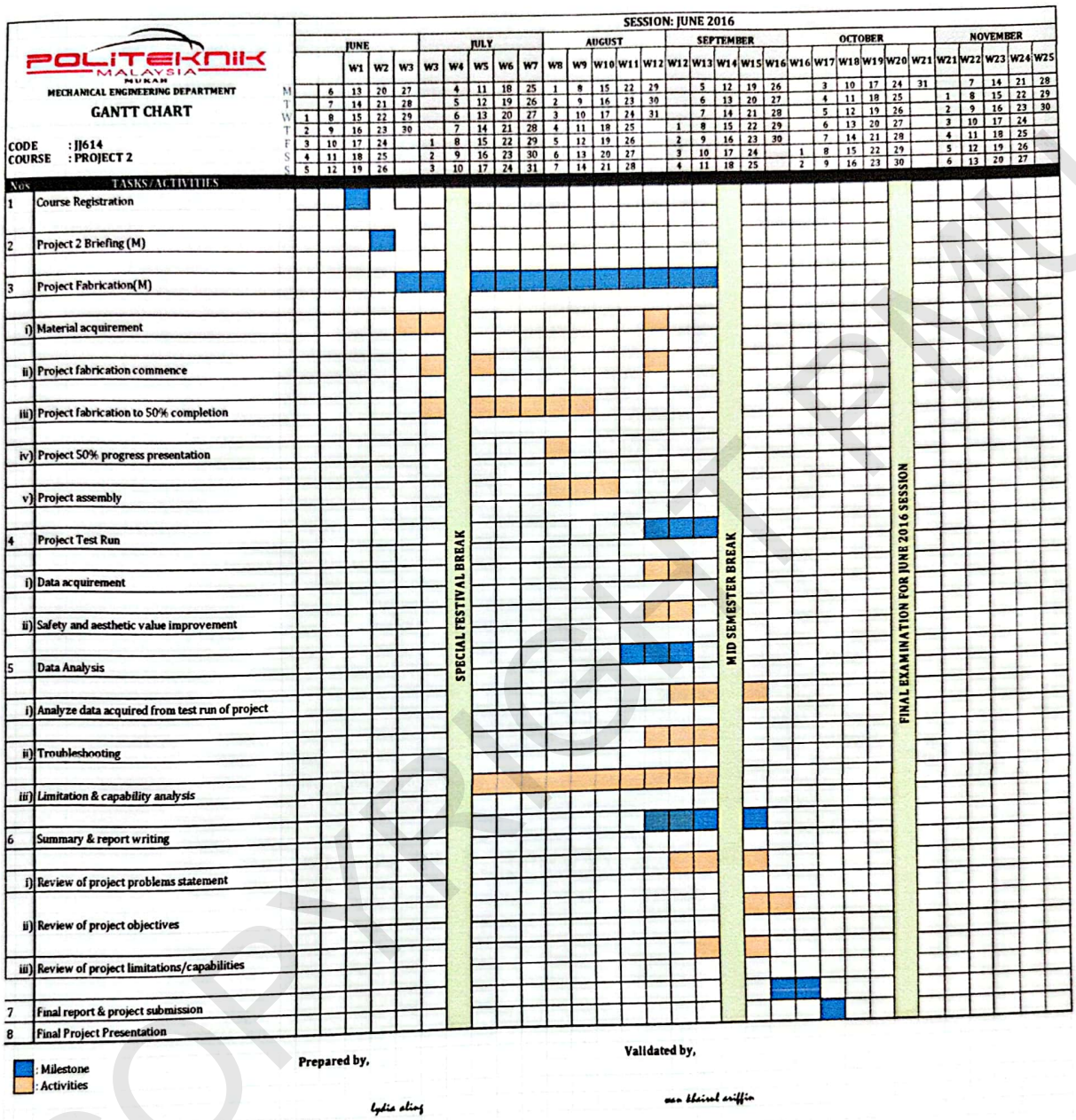
Evaluation Criteria	Weighting, Wt	I	II	III	IV
1. Energy Consumption	10	+	S	-	-
2. Environmentally Friendly	5	+	S	-	S
3. Weight	2	-	+	-	+
4. Life Span	10	+	+	S	S
5. Maintenance	7	-	+	+	+
6. Time	3	-	+	+	+
7. Safety Measure	10	+	+	+	+
	Total Measure	4	5	3	4
	Total -	3	0	3	1
	Total S	0	2	1	2
	Overall Total	1	5	0	3
	Weighted Total	18			

Table 3.1.5: Concept Evaluation Table

3.1.3 DESIGN FLOW CHART



3.2 DESIGN PLAN



3.3 PROJECT DESIGN

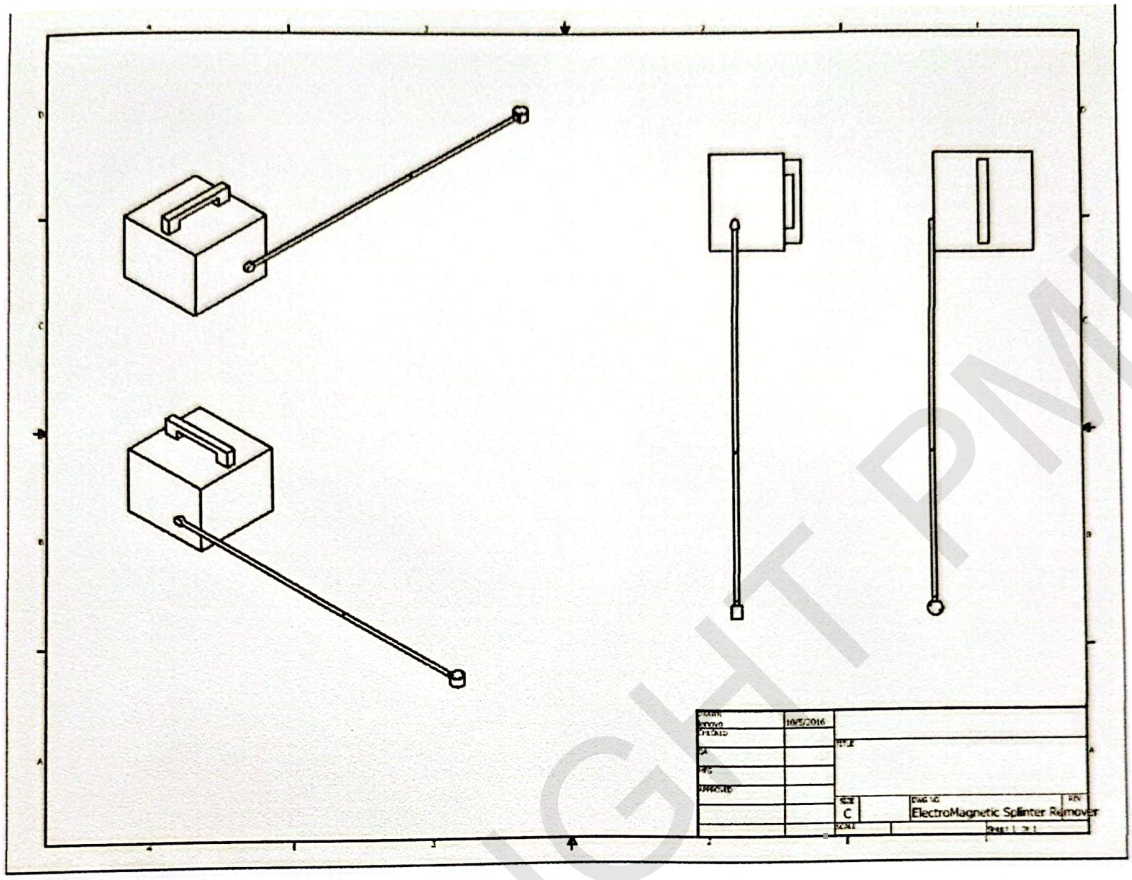


Figure 3.3: Proposed Project Design

3.4 PROJECT ASSEMBLY DESIGN

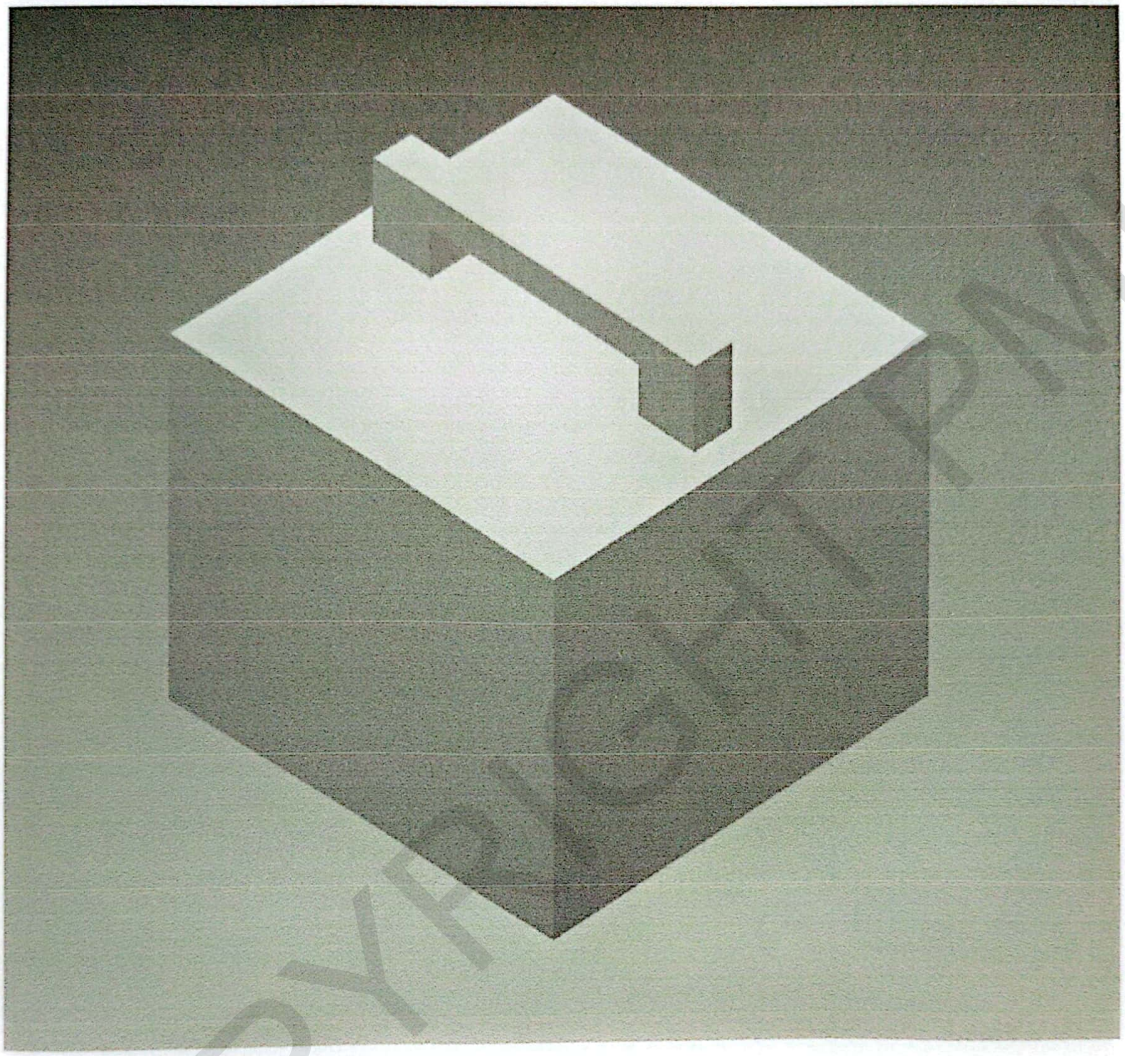


Figure 3.4.1: Main Body

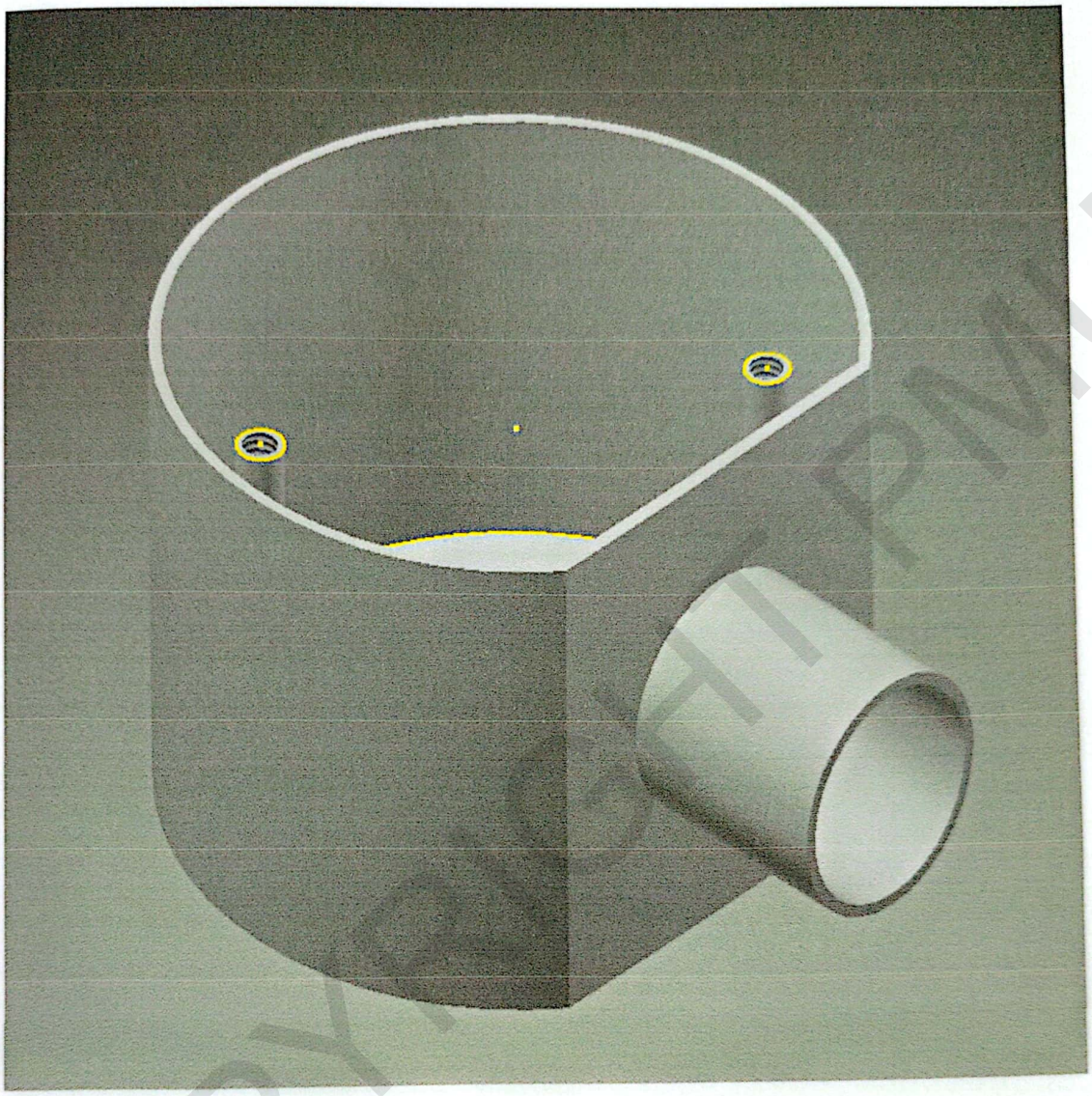


Figure 3.4.2: Tips

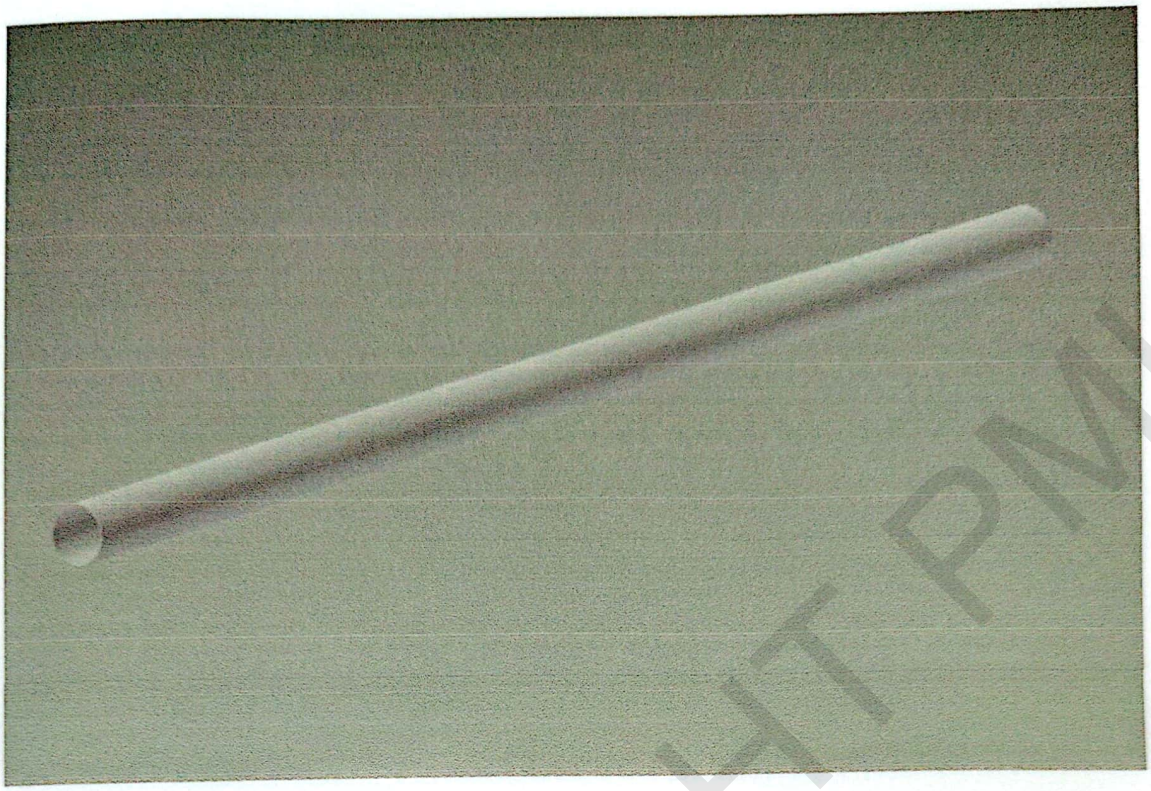


Figure 3.4.3: PVC Pipe

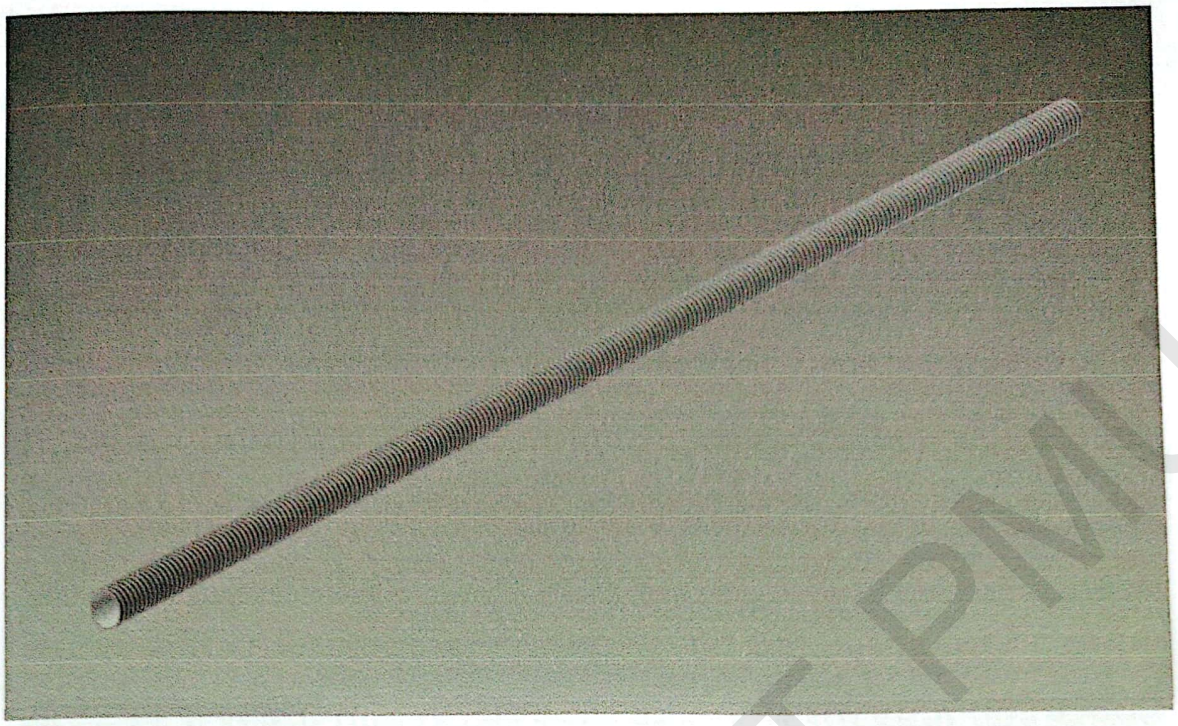


Figure 3.4.4 PVC Flexible

3.5 MATERIAL SELECTION

3.5.1 ElectroMagnet

3.5.1.1 Matrix High Output 9.6V 1600mAh Ni-MH Small Type Battery

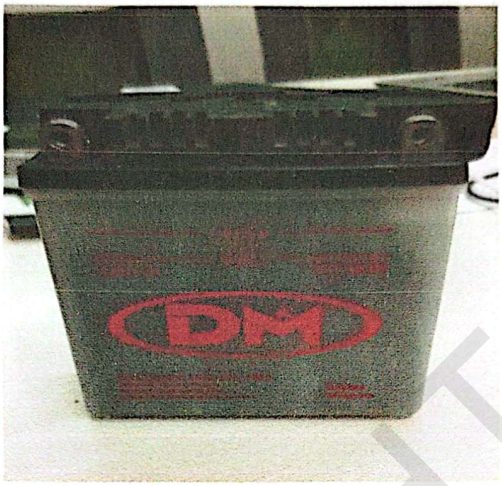


Figure 3.5.1: Matrix High Output 9.6V 1600mAh Ni-MH Small Type Battery

A **wet**-cell **battery** is the original type of rechargeable **battery**. It is commonly found in aviation, electric utilities, energy storage and cellphone towers. The **battery** contains a liquid electrolyte such as sulfuric acid, a dangerous corrosive liquid that damages what it comes into contact with.

3.5.1.2 Steel Rod

Figure 3.5.2 Steel Rod

A hollow structural section (HSS) is a type of metal profile with a hollow tubular cross section. The term is used predominantly in USA, or other countries which follow US construction or engineering terminology.

HSS members can be circular, square, or rectangular sections, although other shapes are available, such as elliptical. HSS is only composed of structural steel per code.

HSS is sometimes mistakenly referenced as hollow structural steel. Rectangular and square HSS are also commonly called tube steel or structural tubing. Circular HSS are sometimes mistakenly called steel pipe though true steel pipe is actually dimensioned and classed differently from HSS. (HSS dimensions are based on exterior dimensions of the profile, while pipes are essentially dimensioned based on interior diameters, as needed to calculate areas for flow of liquids.) The corners of HSS are heavily rounded, having a radius which is approximately twice the wall thickness. The wall thickness is uniform around the section.

In the UK, or other countries which follow British construction or engineering terminology, the term HSS is not used. Rather, the three basic shapes are referenced as CHS, SHS, and RHS, being circular, square, and rectangular hollow sections. Typically,

these designations will also relate to metric sizes, thus the dimensions and tolerances differ slightly from HSS.

3.5.1.3 Aluminium Board

Figure 3.5.3 Aluminum Board

Aluminium is a chemical element in the boron group with symbol **Al** and atomic number 13. It is a silvery white, soft, ductile metal. Aluminium is the third most abundant element (after oxygen and silicon), and the most abundant metal in the Earth's crust. It makes up about 8% by weight of the Earth's solid surface. Aluminium metal is so chemically reactive that native specimens are rare and limited to extreme reducing environments. Instead, it is found combined in over 270 different minerals. The chief ore of aluminium is bauxite. Aluminium is remarkable for the metal's low density and for its ability to resist corrosion due to the phenomenon of passivation. Structural components made from aluminium and its alloys are vital to the aerospace industry and are important in other areas of transportation and structural

materials. The most useful compounds of aluminium, at least on a weight basis, are the oxides and sulfates. Despite its prevalence in the environment, no known form of life uses aluminium salts metabolically. In keeping with its pervasiveness, aluminium is well tolerated by plants and animals. Owing to their prevalence, potential beneficial (or otherwise) biological roles of aluminium compounds are of continuing interest.

3.5.1.4 Flexible PVC Pipe

Figure 3.5.4 PVC Pipe

Flexible polyvinyl chloride, or PVC pipe, is a bendable form of pipe that is ideal for situations where the utilization of rigid pipe is not practical or desirable for some reason. Strong and long-lasting, flexible PVC pipe can be used as part of water systems, for running hookups to washing machines, or as part of a system for ponds and winter gardens. The pipes can be purchased at any hardware or home supply store, as well as at many building supply outlets and online venues.

There are a number of advantages associated with using bendable PVC pipes. One has to do with simplifying the process of plumbing installations. Because the flexible pipe can easily routed in any direction necessary, this form of PVC piping can be used in areas where space is very limited or that simply would not accommodate a rigid pipe.

Flexible PVC pipe fittings are much like the fittings for any type of pipe, so no special tools are needed for the installation.

Flexible PVC pipe is sometimes thought to be unsuitable for situations where there is a need to keep water warm. However, that is not necessarily the case. A PVC water pipe will actually experience less heat loss than many forms of steel or copper piping. This makes the pipe an ideal selection for a number of indoor and outdoor projects.

3.5.2.5 Transformer

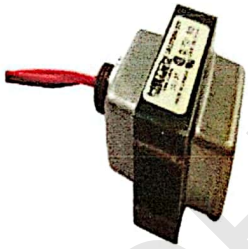


Figure 3.5.5 Transformer

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Electromagnetic induction produces an electromotive force within a conductor which is exposed to time varying magnetic fields. Transformers are used to increase or decrease the alternating voltages in electric power applications.

A varying current in the transformer's primary winding creates a varying magnetic flux in the transformer core and a varying field impinging on the transformer's secondary winding. This varying magnetic field at the secondary winding induces a varying electromotive force (EMF) or voltage in the secondary winding due to electromagnetic induction. Making use of Faraday's Law (discovered in 1831) in conjunction with high magnetic permeability core properties, transformers can be designed to change, efficiently AC voltages from one voltage level to another within power networks.

Since the invention of the first constant potential transformer in 1885, transformers have become essential for the transmission, distribution, and utilization of alternating current electrical energy. A wide range of transformer designs is encountered in electronic and electric power applications. Transformers range in size from RF transformers less than a cubic centimeter in volume to units interconnecting the power grid weighing hundreds of tons.

3.5.1.6 Electrical Wire

Figure 3.5.6 Electrical Wire

Building wiring is the electrical wiring and associated devices such as switches, meters and light fittings used in buildings or other structures. Electrical wiring uses insulated conductors.

Wires and cables are rated by the circuit voltage, temperature and environmental conditions (moisture, sunlight, oil, chemicals) in which they can be used, and their maximum current. Wiring safety codes vary by country, and the International

Electrotechnical Commission (IEC) is attempting to standardise wiring amongst member countries. Colour codes are used to distinguish line, neutral and earth (ground) wires.

3.5.1.7 Inverter

Figure 3.5.7 Inverter

A power inverter, or inverter, is an electronic device or circuitry that changes direct current (DC) to alternating current (AC).

The input voltage, output voltage and frequency, and overall power handling depend on the design of the specific device or circuitry. The inverter does not produce any power; the power is provided by the DC source.

A power inverter can be entirely electronic or may be a combination of mechanical effects (such as a rotary apparatus) and electronic circuitry. Static inverters do not use moving parts in the conversion process.

3.5.1.8 ON/OFF Switch

Figure 3.5.8 ON/OFF Switch

A switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another. The mechanism of a switch may be operated directly by a human operator to control a circuit (for example, a light switch or a keyboard button), may be operated by a moving object such as a door-operated switch, or may be operated by some sensing element for pressure, temperature or flow. A relay is a switch that is operated by electricity. Switches are made to handle a wide range of voltages and currents; very large switches may be used to isolate high-voltage circuits in electrical substations.

CHAPTER 4

PROBLEM, RECOMMENDATION AND FABRICATION

4.1 Introduction

It does bring a lot of benefits to the students that have involved in finishing final year project. The generated project was build based on design and specification that have been decided. Apart from that, the project must fulfil the entire safety feature to ensure no problem occur during machine operation. Every project must undergo test run so does our Metal Chips Remover. This method is a must to identify the result of operation, either fulfil the objective or vice versa. Besides that, the cost needed should also be reasonable and profitable with the result of carried out test run of generated machine. Those factors above are important in order to meet the goal.

4.2 Discussion

We encountered a lot of problems during designing and fabrication work. Many technical problems have occurs during project completion. One of the problems is that, the amount of the metals chips collected using only one transformer is lesser that expected. Other than that, the size of transformer also affecting the power to attract the metal chips to the transformer.

Besides that, our design for the product are a bit lacking. Based on the current design, it should be able to be handle by one person instead of two persons. Also, the power button are too far from the handler, as it are located at the main body which at the inverter.

4.3 Problem Statement

WEEK 1:

i) Hand grinding not yet provided.

- Workshop management will provide all necessary equipment.

WEEK 2:

i) Workshop management still provide all necessary equipment.

WEEK 3:

i) Special festival break

WEEK 4:

i) Dismantling metal part from the coil of the transformer.

- Dismantling by cutting the bottom part of the transformer.

WEEK 5:

i) Still figuring how to perfectly dismantling all metal part from coil without damaging the coil.

WEEK 6:

i) Removing the metal is a success but the 'W' shape metals are badly damage and cannot be used.

ii) Making the housing for the transformer and main body is in progress.

WEEK 7

i) Hole on body frame is not parallel to the main body.

- Cut the frame ensuring it can fit the body frame although it is not right angle.

WEEK 8:

i) The metal part are not grind to remove it, but instead we knock it off one by one

ii) Cutting the hollow bar and flexible PVC into the right size already done.

WEEK9:

i) Succession in removing the 'W' metal without damaging both coil and the metal.

ii) Wiring the reform transformer with power source (12v battery).

WEEK 10:

i) Having problem with overheating transformer while having trial with it.

- Detecting what the main source of the overheating with transformer.

WEEK 11:

i) The metal chips remover already completed assemble from the head to the main body.

ii) Still have not found where the problems lies with the overheating.

- Still experimenting with the transformer as to find the source of problem.

WEEK 12:

i) The problem source already found.

- As power are directly enter transformer, the transformer cannot store overloaded with power.

ii) Finding any ways to solve the problem which cause of overheating.

WEEK 13:

i) Solutions for the overheating already found.

- An inverter has been use to as to level down the power from direct current (DC) to alternating current (AC).

4.4 Fabrication

The action or process of manufacturing or inventing something. Metal fabrication is the building of metal structures by cutting, bending and assembling processes. It is a value added process that involves the construction of machines and structures from various raw materials.

4.4.1 Measure, mark and cut

Measure refers to a unit specified by a scale, such as an inch, or by variable condition. The dimension, quantity or capacity of something as ascertained by comparison with a standard. We measure the handle and flexible PVC according to design dimension. Apart from that, we also measure appropriate length of wire to specified length.

Mark refers to a line, figure or symbol made as an indication or record of something. After measuring the entire dimension, we mark all the measured flexible PVC and hollow steel before continuing cutting process.

Cut refer to remove of something from something larger by using a shaft implement. After measuring and marking process, we proceed to cutting process. We cut the handler and flexible PVC before proceeding to next fabrication process.

4.4.2 Installation

Installation is the action or process of installing something, or of being installed. We do installation of flexible hoses to the battery and inverter storage. Flexible PVC and the hollow steel to the body frame as how it is design. We also install head part.

4.4.3 Customization

Customization is a marketing and manufacturing technique that combines the flexibility and personalization of custom-made with the low unit cost associated with mass production. We customize the head part which store transformer to be the main part of the Metal Chips Remover. This custom-made main body is the main mechanism.

4.4.4 Wiring

Wiring is system of wires providing electric circuit for a device. We do wiring for the transformer before plug in it with power source.

4.4.5 Grinding

Grinding process is to smooth or sharpen by abrasion or friction. We also use grinding when doing cutting work.

4.5 Recommendation

As for our recommendation, we realize that our product have it weakness. So we purpose that, we need to make a compact main body for it fully optimize to be mobile and can be handle by one person only during the cleaning work.

Then, the power switch button also needs to be made near the handler button. As it will be more convenience for the user to switch off the power when no needs of using the device.

CHAPTER 5

CONCLUSION

5.1 Conclusion

JJ614 Project 2 is a mandatory requirement for final semester student for the award of Diploma in Mechanical Engineering. By taking this subject, a lot of experiences, knowledge and good teamwork that we have gained especially during completion of our final year project from designing to fabrication process. It gives us a lot of benefit and introduces us to real working environment.

Moreover, the production of our machine needed high level of problem solving skill where ideas and creativity of designation is required. This is to ensure students are capable to make project designation and fabrication to complete their task. Other than that, it will bring honour to polytechnic because able to produce skilful and talented students in mechanical field.

Furthermore, early exposure had been received on the needs of present technology of invention, new ideas and modification in production of machine. Even though, there are several problems encountered during completion of project, it can be improved from time to time to ensure successful project. Trials, challenges and problems that we have faced during completing our project does not make us give up but we learn more and more. In fact, we got a lot of new knowledge and experiences when the problems meet successful solution.

During the given time of project completion, all our team members and supervisor provide many ideas which are much benefited to produce successful project. Next, the team work and leaderships is also the key of success for completing the final project as we give our best contribution and support.

In conclusion, our project has been completed on time and according to work plan. Knowledge and theoretical that have been teach in polytechnic and the experiences and skills that student has gained from industrial training help a lot in producing

successful final year project. We had achieved those objective required for the machine production.

5.2 Cost

To fulfil our requirement budget for producing our project, we make a list to ensure the right amount we had used to spend. The purpose analysing our budget costs is to ensure our project is inexpensive and qualified in marketing price. Our budget lists are listed below:

Material	Price
Transformer	RM 30
Flexible PVC	RM 5
Wiring cable	RM 15
Inverter	RM 150
Battery	RM 30
Main body part	RM 5

Table 5.2.1: cost of materials and equipment used

5.3 Suggestion

During the completion of final year project, a wide range of experiences and knowledge's may be obtained. Subject JJ614 Project 2 is a very good exposure to student which let the student to express their skill, talent, experiences and techniques in completing a project.

Based on the conclusion and discussion of project outcomes, there are several suggestion for the future students in order to produce improvement and successful project. The improvement is important to improve quality of project to be generated. Below are some suggestions to be improved:

1. Early preparation has to be made, which is since Project 1. This is to prevent waste of time. In Project 1, students should able to produce their design and decide which project should be made. Continue to Project 2, student design and project fabrication will be carried out practically.

2. The time given for JJ614 Project 2 should be prolonging from four hours to six hours so that student can have enough time to complete their project within given weeks.

3. Team work and leadership is very important in order to prevent sleeping partner during fabrication work. Good organization in a team must be provided, team leader must show good example and play important role to ensure all the team members are giving full support and contribution.

4. During fabrication process, hand tools and power tools are mostly needed. Some tools are not required in the workshop, so we highly suggested each group to bring their own tools in order to work smoothly.

REFERENCES

1. https://en.wikipedia.org/wiki/**Transformer**
2. www.edisontechcenter.org/**Transformers**.html
3. https://en.wikipedia.org/wiki/Isolation_**transformer**
4. https://en.wikipedia.org/wiki/**Battery**_(electricity)
5. https://en.wikipedia.org/wiki/Power_**inverter**
6. https://www.altestore.com/store/**inverters**/off-grid-**inverters**-c559/

Appendix