DESIGN AND FABRICATION OF FOLDABLE FOOTBALL GOAL

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Report submitted in partial fulfilment of the requirements for the award of
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SUPERVISOR'S DECLARATION

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

Signature :
Name of Supervisor : MR NASRUL AZUAN BIN ALANG
Date :

STUDENT'S DECLARATION

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

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ABSTRACT

This report presents about football goal that always been used especially in field and soccer court. The usage of a goal is as the posts to shoot the ball trough it. All the ideas of the goal designs and materials are based on the student creativity. The selection for the material that suitable to be used for the foldable goal frame is a material which light in weight, long lasting life and can endure high load. So, the materials that are proposed in this project are mild steel and hinges. In this report will focus more on fabrication of the foldable football goal by using the mechanical machine like welding and grinding machine.

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ABSTRAK

Laporan ini membentangkan tentang goal yang sering kali digunakan terutamanya di padang permainan mahupun di gelanggang bola sepak. Gol merupakan suatu alat yang digunakan sebagai tempat untuk menjaringkan bola. Kesemua idea mereka bentuk dan bahan yang sesuai untuk menjalankan projek ini ialah bergantuk pada kreativiti pelajar. Pemilihan bahan yang sesuai untuk digunakan pada rangka gol boleh lipat ini merupakan bahan yang mempunyai berat yang ringan, jangka hayat yang tahan lama dan boleh menahan beban yang berat. Maka, bahan yang dicadangkan untuk membuat alatan ini merupakan ‘mild steel’ dan engsel. Dalam laporan juga ini akan lebih memfokuskan kepada pembuatan gol boleh lipat yang menggunakan mesin mekanikal seperti mesin kimpal dan mesin canai.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

There will include about the problems statement of this project in this chapter. Then, it will be followed by the current design of the project, solution of the problem statements, objective of the project, and also including scopes of the project.

1.2 Project Background

Football is not only the number one sport in Malaysia but also in this entire world. The other game or sports like football are street soccer and futsal. This sport mostly needed the same equipments when we want to play it. One of the most important equipment that needed in these games is the goal. It is use as the place or target to shoot the ball though it. Sometimes we can see the players make the goal with the, slippers, stone, cone, and so on. Besides, they also use the mini goal. Mostly the goal is not portable and quite hard to carry. The portable goal must be easy to carry and easy to keep. We can found lots of mini goal that use in football game but usually it is fixed. It is required much time to move or store after it have been used. So, to make it easy to move and restore, the portable goal must have the adjustable frame to make it easy to move and keep. In other word is the body of the goal can be fold (foldable).Foldable goal means that the model or the prototype of the truss frame can be fold that can make the goal easily to carry and store it.

The project is to fabricate foldable truss frame that can make it easy to be store. The structure of this foldable goal must be robust, stable, and light. The prototype is design based on this problem and to improve the design that available. The suitable part will be choosing to make it foldable.

1.3 Problem Statement

A lot of current soccer goal is quite hard to carry or remove because it body frame not foldable and need some space to store it. Mostly all of the designs are fixed and locate permanently that cannot remove to anywhere. In addition, the goal that have been designed was unstable that can exposed the injuries to the players. One innovation is needed for those who love to play soccer with assorted atmospheres. It is desirable to have football goal that light in weight and possible to own by every single household.

1.4 Market design

Nowadays, we can see some mini goals that have been use as target to shoot the ball. Even the designs that available in the market are different but almost all of the designs are single seated and fixed. As the consequences, it is quite hard to carry anywhere and needed a little bit space to store it because of the size factor. This below figure is the example current of the mini goal design:

Figure 1.1: Training Goal Post

Figure 1.2: General Football Goal Post

1.5 Problem Solutions

There are some specifications that have been considered to solve this problem. The specifications are:

1.5.1 Size
1.5.2 Light weight
1.5.3 Foldable frame
1.5.4 Good stability
1.5.5 Tough body/frame

1.6 Project Objectives

There are three main objectives to achieve in this research which are:

1.6.1 To design and fabricate a foldable goal prototype.

1.6.2 Have a good stability, robust truss, and stable.

1.6.3 Easy to carry and keep.

1.7 Project Scopes

The ability to contribute the scope in designing the product is important to make it success. It can be the benchmarking for the development of the product. To accomplish the objectives, there are three scopes project which are:

1.7.1 Sketch and design a new football goal to make it easy to store and carry.

1.7.2 Fabricate the prototype that has the limit size at 960mmx350mmx 570mm.

1.7.3 Fabricate a foldable goal using various mechanical processes (welding, cutting, and grinding).

1.7.4 Auto-CAD or Solidwork software's is used in design process.

1.8 Project Flow

As the chart shown below, the start started with finding the problems that was face by the goal consumers. For the diagram as shown as below, the project starts with literature review and research about the current design of the goal trough the internet and from view at the field and football court. After doing the literature study, the problems statement had been found. The next step is to find the project objectives as the way to solve the problems and lastly determine the project scopes.

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. There are four concepts selections have been designed. The evaluation concepts have been done to get the final concept. Concept D has be the final concept after the evaluation process.

The next step is to list down the material needed to fabricate the goal. There are only two materials needed in this fabrication process which are hollow mild steel and the hinges to allow the goal can be fold.

Before the making the joining process, the steel must be measured first according to the design. After all the parts have been cut, the project proceeds to next step that is joining process. In this step, the MIG welding have been chosen to join the part.

After finish the joining process, the product will be test whether it fulfills the requirement such as can be functioned, safety, strength and it stability. If the product cannot be function well or having others problems, it will turn back to the modification process.

The finishing process will be done on the product after there is no problem on it. The goal will be coloured with paint. The last process is the project must be presented to the panels and continue with the project report submission.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The story in this chapter will tell about the history about the football goal post and its type. Besides that, it also includes the material that has been used to fabricate the goal post and its process.

2.2 Goal (Sport)

Goal refers to a method of scoring in many sports. It can also refer to the physical structure or area of the playing surface in which a score is made. The structure of a goal can vary widely from sport to sport. In sports where goals are the sole method of scoring, the goal is often a rectangle structure set in the center of each end of the playing surface. Frequently, there is a net to catch the ball or puck as it is sent into the goal. Some sports do not require the net within their rules while others do. Other sports, especially those that use field goals, have very different structures. Most have a variation on the theme of goal posts and crossbars (frequently an elevated crossbar supporting goal posts with the object being to have the ball pass over the crossbar, rather than under it.)

2.3 Method of Scoring

In some sports, the goal is the sole method of scoring, and in these sports, the final score is expressed in “goals” where the winner is the team that accumulates the larger number of goals in the given time.

In other sports, a goal is the primary, but not the sole method of scoring. In these sports, the goal is worth a set number of points, and there is another method of scoring which scores fewer points (often one point). In these sports, the score is expressed as the number of goals plus the number of alternate scores and the combined total of points with the winner being decided on total points. For example, an Australian Rules Football the score may be expressed as follows: Sydney 10-4-64 Brisbane 9-12-66.

In this example Sydney scored 10 goals (at six points each) and 4 behinds (one point each) for a total of 64 points. Brisbane scored 9 goals and 12 behinds for a total of 66 points. Despite having fewer goals, Brisbane won the game.

Other sports use a Field Goal as one of several methods of scoring. The field goal can be a primary or secondary score and is used when there are several possible scoring methods. In these sports, the object of the game is to score a greater number of total points than the opponent. Scores are expressed solely as numbers of points.

2.4 Goal Post Structure

In many games, at each end of the field of play, there are two vertical posts (or uprights) supporting a horizontal crossbar. In some games, such as Association Football or Hockey, the object is to pass the ball between the posts below the crossbar, while in others, such as those based on Rugby, the ball must pass over the crossbar instead. In Gaelic football and Hurling, in which the goalposts are similar to those used in rugby, the ball can be kicked either under the crossbar for a goal, or over the crossbar through the posts for a point. There are other variants too.

The vertical supports are usually called Goal Posts and the horizontal top is usually called the Crossbar. Scores in these games normally require that the ball or puck be sent between the posts, under the crossbar and completely behind the goal line. The space under the crossbar and between the goal posts is colloquially referred to as the goal mouth.

In Australian Rules Football, there is no crossbar but 4 uprights instead. In Netball, a single post at each end of the court supports a horizontal hoop that the ball must fall through. While in Basketball, where the hoop and associated backboard was originally supported on a post, the posts themselves have been done away with in most cases, and the hoop and backboard now are suspended over the court from a stadium wall or ceiling.

2.5 Association Football

In association football, the goal is the sole method of scoring. It is also the term used for the scoring structure. To score a goal, the ball should pass totally over the goal line between the goal posts and under the crossbar and no rules may be violated (such as touching the ball with the hand or arm).

The goal structure is defined as a frame 24 feet (7.32 m) wide by 8 feet (2.44 m) tall. Most commonly a net is used both to catch the ball and indicate that a goal has indeed been scored, however the net is not absolutely required.

2.6 Goal Complies with UEFA and FIFA Regulation

2.6.1 Aluminium soccer goal free-hanging net support: Made from special super-stable aluminium profile with high quality alloy. Size 732 x 244 cm (frame), 200 cm depth. Aluminium, for inserting into ground socket, with welded mitre joints. The upper net brackets are screwed on with 16 mm

stainless steel screws located in the profile. For back using galvanize steel posts with pulley and locking device (Ø 60 mm).

Figure 2.6.1: Aluminium Soccer Goal Free-Hanging Net Support

2.6.2 Aluminium leisure goal (with two holes): Super stable reinforced aluminium constructions, fully welded, rectangle 80 x 80 mm. Back and side bars made from turbular steel Ø 30 mm, so a net is not necessary (open to). 4 plates welded to the ground frame allow for safe ground anchoring.

Figure 2.6.2: Aluminium Leisure Goal (With Two Holes)

2.6.3 Aluminium soccer goal system 120 x 100 mm: Made from super special aluminium profile with high-quality alloy. Official size 732 x 244 cm. Complies with FIFA regulations. Top quality meeting highest demand of the professional league.

Figure 2.6.3: Aluminium Soccer Goal System 120 x 100 mm

2.6.4 Senior portable aluminium goal post wheels and handle: Made from special super-stable aluminium profile with high quality alloy. Size 732 x 244 cm (frame), 200 cm depth. Transport wheels for freestanding 120 x 100 mm soccer goals. Tyre wheels, diameter 20 cm. Easy attachment. Supplied in sets 8 (4 wheels per goal). The goal also has two large sides handle so it can be easily transported.

Figure 2.6.4: Senior Portable Aluminium Goal Post Wheels and Handle

2.6.5 Transport trolley for soccer goal: Large running wheels for ease transport. Made from high quality aluminium profile, simply fastened to the side of the base frame. With portable system, using 2 stainless steel screws diameter 10 mm. Wheels, diameter 20 cm easy attachment. Aluminium construction with large transport wheels for screw fastening to the front bar of the goal frame. Please specify the measurement of the existing goal frame when placing your order.

Figure 2.6.5: Transport Trolley for Soccer Goal

2.6.6 Aluminium soccer goal with back adjustable: Aluminium, for soccer goal, foldable. Protection adjustable from 1.50 – 2.00 m. the net is attached to welded loops. The base frame is attached to the goal post with 16 mm stainless steel screws. Made from special super stable aluminium profile with high quality alloy. Official size 732 x 244 cm. Complies to UEFA and FIFA regulations. Aluminium, 100 x 120 mm oval profile, for the ground frame 50 x 50 mm rectangular profile.

Figure 2.6.6: Aluminium Soccer Goal with Back Adjustable

2.6.7 Aluminium hobby soccer goal: Aluminium, welded in one piece. Goal frame made from Boxed profiles 80 x 80 mm, net brackets made from 60 x 3 mm tubular pipes. Frame dimensions 3.00 x 2.00 m. The goals are also available with welded net hooks (extra charge).

Figure 2.6.7: Aluminium Hobby Soccer Goal

2.6.8 Aluminium junior soccer goal: Have goal frame profile 120 x 100 mm. From reinforced aluminium with special high quality alloy. Frame size 500 x 200 mm. This goal is welded in a single piece. The goals are equipped for anchoring in the ground. Greater projection makes for better stability. Handles on the side of the base frame, tubular pipes diameter is 30mm.

Figure 2.6.8: Aluminium Junior Soccer Goal

2.6.9 Aluminium junior soccer goal (potable systems): Goal Frame Profile 120 x 100 mm and Ground Frame Profile 80 x 60 mm. The net support made from 50 x 4 mm tubular aluminium and the side bracings are also welded on the goal and form a compact fully welded construction. The ground frame is fitted with a profile channel for option net attachment by net hooks. The goal is supplied with net hooks and sides handle for easily transported. For one junior soccer goal. The weights are integrated in the rear ground frame (about 30 kg per goal).

Figure 2.6.9: Aluminium Junior Soccer Goal (Portable Systems)

2.6.10 Aluminium street soccer goal: Free standing, extremely robust goal for practice and leisure. All aluminium goal frames. Posts with 80x80 mm rectangular profile. Mesh width 50 mm (mini) and 100 mm (maxi), so the goal is suitable for both soccer and street hockey.

Figure 2.6.10: Aluminium Street Soccer Goal

2.7 Basic Parts

I. **Cross bar:** Located at the top of the frame goal.

II. **Front bar:** Located at the bottom of the cross bar. As the supporter of the cross bar. Have two sides which are at the left and right.

III. **Ground bar:** Located at the back of the both side of the front bar as the supporter to make the goal post stable.

IV. **Back-stay:** Connections between the upper backdrop and the lower backdrop. Also function to make the goal post become more stable. Also located at the right and the left sides of the goal.

V. **Upper backdrop:** To connect the back stay with the crossbar. Located at the both sides of the goal post and between the cross bar and the backstay.

VI. **Lower backdrop:** To connect the backstay with the ground bar. Located at the both sides of the goal post that is between the backstay and the ground bars.

2.8 Goal Post Safety

The Goal post Standard BS 8462 was introduced in October 2005 to make sure that all the goal posts used in official matches and training are sports equipment and not toys. All the goal posts conform to law one of the game and can be used in official matches.

Toy Mini Soccer goals and other Far East imports may not meet these new standards. Goals with rusting corners, creased net stanchions and missing parts should not be used. Toys are manufactured to BSEN 741 and BSEN 5665 which excludes all types of sports equipment including goal posts. To conform to law one of the game goalposts should have no advertising on the front of the posts or the goal net, they should have a method of supporting the net away from the crossbar, the material of

manufacture and shape must confirm and the size should be correct to the inside of the posts. Metal welded and screw in net hook fixings should not be used to attach nets to posts. Grants may be available from The Football Foundation to upgrade goal posts at affiliated football clubs, schools, local authorities and other relevant community organizations.

2.9 Goal Post Usage Guidelines

I. **Check It**: Make sure goalposts are in good condition and properly constructed. Homemade goalposts should never be used - they do not have built-in safety features and may be particularly hazardous for younger players. Goalposts should always be properly maintained at all times especially un-welded corner frames that expand apart. If any part of a goal frame becomes loose or detached the goal should not be used in any circumstance.

II. **Secure It**: Goalposts of any size must be securely anchored to the ground at all times. Freestanding goalposts must be anchored or weighted down to prevent them toppling forward, and should be removed from the pitch when not in use and stored securely. If goals can be dismantled and locked away it is advisable to do this to prevent unauthorized usage. If goal posts are to be left outside un-attended then they should have the nets removed and be stored face down with the longest leg to the ground, and securely chained together face to face.

III. **Test It**: Adults should test the goalposts to make sure they are stable by safely exerting a downward force on the crossbar, backward force on both upright posts and forward force on both upright posts. Do not do any testing whilst children are around the goal posts. Never put goalposts in

position un-anchored always complete the installation before moving to the other side of the pitch. Always inform children of the dangers of swinging and climbing on crossbars especially if you witness it actually happening. Always follow the goalpost manufacturer's instructions.

IV. **Respect It**: Goalposts should only be used for their intended purpose; in particular, children and adults should not swing or climb on them. Repair any damaged paintwork or breach of the protective coating and inspect welds and all fixings on a regular basis. When fitting ground sockets take time and ensure the posts are fitted square and that no undue pressure is exerted to the corner joints. Look after your goalposts and they will give many years of quality performance.

2.10 Joining Method

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

Figure 2.10: Metal Inert Gas (MIG) Welding

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

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

capability of the process and makes it possible to weld in all positions. It is important for the quality of the weld that the spray transfer is obtained.

There are two different MIG-welding processes, conventional MIG and pulsed MIG:

I. 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.

II. Pulsed MIG uses a DC power source with superimposed periodic pulses of high current. During the low current level the arc is maintained without metal transfer. During the high current pulses the metal is transferred in the spray mode. In this way pulsed MIG is possible to operate with lower average current and heat input compared to conventional MIG. This makes it possible to weld thinner sections and weld much easily in difficult welding positions.

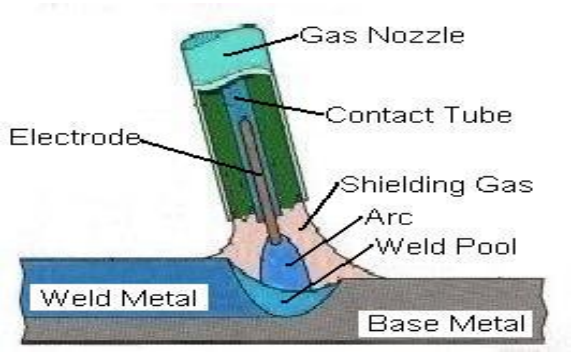


Figure 2.10.1: Schematic of Metal Inert Gas (MIG) Welding

GMAW is frequently referred to as MIG welding. MIG welding is a commonly used high deposition rate welding process. Wire is continuously fed from a spool. MIG welding is therefore referred to as a semiautomatic welding process.

There are some advantages and disadvantages in using MIG welding:

The advantages of MIG welding

I. All position capability
II. Higher deposition rates than SMAW
III. Less operator skill required
IV. Long welds can be made without starts and stops
V. Minimal post weld cleaning is required.

The disadvantages of MIG welding

I. Costs money of consumable, such as tips and nozzles
II. Is not worth a dang on paint, rust, or dirty surfaces
III. No good for thick steel because it does not get the proper penetration.

2.11 Grinding Process

Grinding is a finishing process used to improve surface finish, abrade hard materials, and tighten the tolerance on flat and cylindrical surfaces by removing a small amount of material. Information in this section is organized according to the subcategory links in the menu bar to the left.

In grinding, an abrasive material rubs against the metal part and removes tiny pieces of material. The abrasive material is typically on the surface of a wheel or belt and abrades material in a way similar to sanding. On a microscopic scale, the chip formation in grinding is the same as that found in other machining processes. The abrasive action of grinding generates excessive heat so that flooding of the cutting area with fluid is necessary.

Figure 2.11: Hand Grinder

CHAPTER 3

METHODOLOGY

3.1 Introduction

In this chapter, it will explain about the process that involved during the fabrication process. I also will explain about the design and analysis that had been chosen to be as the final idea to be producing or fabricate. All the fabrication process in this project is going to be explained in details.

3.2 Project Methodology

3.2.1 Identify the problem statement and find the solutions.

3.2.2 Concept design.

3.2.3 Finalize concept and evaluation.

3.2.4 Material selection.

3.2.5 Fabrication process.

3.2.6 Testing and improvement process.

3.2.7 Finishing.

3.3 Design

The design of the foldable goal post must be compliance to several aspects. All the design consideration must be done wisely and carefully to ensure the design can be fabricated and the parts or the product can function. There are some aspects that must be concerned which are:

I. **Strength**: Must have certain strength to ensure that it can support the force applied to the goal body frames.
II. **Durability**: The goal must have a long life time to use. The quality must be the first consideration.
III. **Safety**: Not exposed any injuries to the players or consumers.
IV. **Ease to use**: The design must not so complicate to make sure it can be easy to use.

3.4 Drawing

Before the drawing process, the designs of the foldable goal concepts have be made by doing the sketching. After all the concept designs have done, it will continue with the concept generation as the evaluation process to determine the best concept.

Next, when the final concept have be chosen, the design of the concept will be transfer to the 2D drawing by using Computer Aided Design, (CAD) drawing to has the top view, side view, and the front view including the goal dimensions.

The Solidwork software's was using to make the 3D drawing to make the goal view more clearly. All the dimensions are same as the 2D view in CAD drawing.

3.5 Concept Method Selections

The concept method must be considered with 2 methods:

I. Concept generation.

II. Concept screening.

3.6 Concept Generation

Concept generation is a process that we can show our ideas. All the ideas will be transformed to the sketching and drawing. The concept generation is important to make our ideas blooming and to improve our design. Furthermore, with the concept generation, we can get the betters design. There are four concepts generation in this project. All of the concepts are same as below:

3.6.1 Concept A

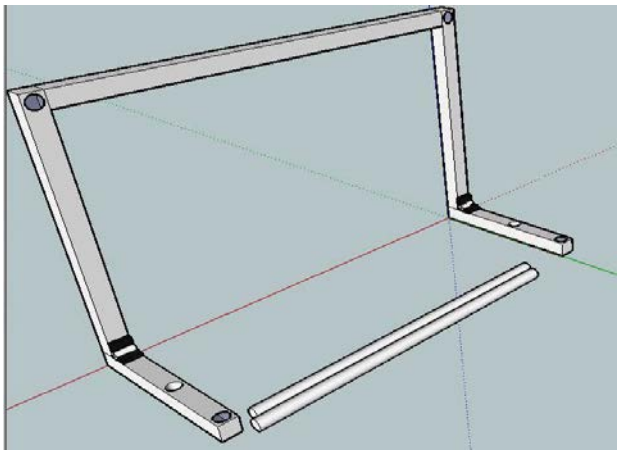


Figure 3.6.1: Concept A Design

Table 3.6.1: Advantages and Disadvantages of Concept A

ADVANTAGES	DISADVANTAGES
Can be fold 1 by applying the hinges function.	Connecting rods are used between ground bar and cross bar (need time).

Table 3.6.1: Continue

Connecting rod is used for stability.	Number of bar increases.
The size of the goal can be reduced by folding the ground bar	The rod can be out of the hole when the force acting at the goal is high.

3.6.2 Concept B

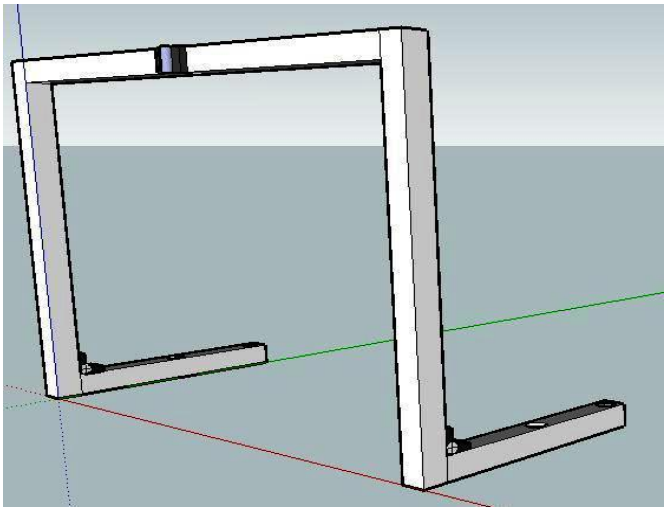


Figure 3.6.2: Concept B Design

Table 3.6.2: Advantages and Disadvantages of Concept B

ADVANTAGES	DISADVANTAGES
Two parts can be folded (ground bar and cross bar).	Connecting rods are used between ground bar and cross bar (need time).

Table 3.6.2: Continue

Can be reduced twice size than concept A.	The rod can be out of the hole when the force acting at the goal is high.
For stability purposes, connecting bar is installed as supporter between ground bar and cross bar.	Can fold automatically when the force applied since there is no lock at the back.

3.6.3 Concept C

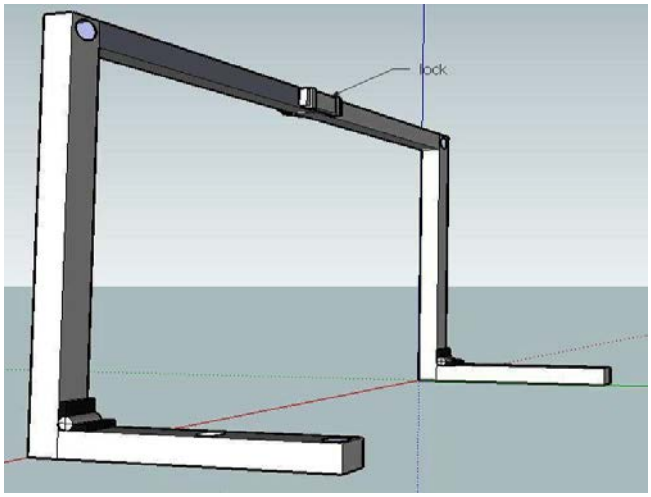


Figure 3.6.3: Concept C Design

Table 3.6.3: Advantages and Disadvantages of Concept C

ADVANTAGES	DISADVANTAGES
Locking system is added at the back of the cross bar. Make it robust than concept B.	Connecting rods are used between ground bar and cross bar (need time).

Table 3.6.3: Continue

Also can reduce the goal size by fold it at the ground bar and cross bar.	

3.6.4 Concept D

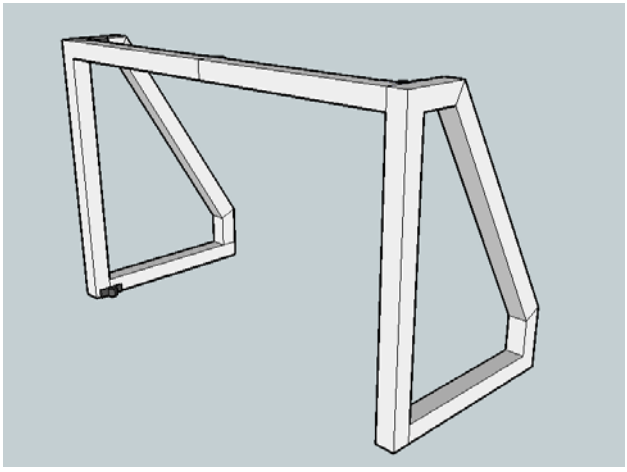


Figure 3.6.4: Concept D Design

Table 3.6.4: Advantages and Disadvantages of Concept D

ADVANTAGES	DISADVANTAGES
Not use the connecting rod as the support at the back.	More hinges needed.
Backdrop & backstay function as the goal support make it better than concept A, B and C.	Quite expensive.
Can be fold like concept B and C.	Time consuming to manufacture-higher than other concepts.

3.7 Concept Screening

Table 3.7: Concept Screening Table

	SELECTION / CRITERIA		CONCEPT VARIANTS			
			A	B	C	D
1	Easy to use		-	0	-	+
2	Reduce space		-	0	+	+
3	Stability		-	0	0	+
4	Design		+	0	0	0
5	Easy to manufact		+	0	−	−
6	Manufacturing cost		+	0	−	−
7	Light in weight		0	0	0	0
	∑ +	Pluses	3	0	1	3
	∑ 0	Sames	2	7	3	2
	∑ −	Minuses	3	0	3	2
+=Better Than - =Worst Than 0 =Same As		∑ Net score	0	0	-2	1
		Ranking	3	2	4	1
		Continue	NO	NO	NO	YES

3.7.1 Studies of the concept screening table show that concept D get the highest positive sign. So, as a result, concept D is the best concept to fabricate.

3.8 Final Concept

After making the evaluation of the concept designs, concept D is the most suitable foldable goal design to produce. Even it is quite expensive because of the manufacturing processes, but it has a good quality. It is more stable than other concepts because it has the permanent support at the back (backstay and backdrop). So, the consumers do not need to install the both connecting rods. In other word, it is not wasting a time. The consumers just only need to push out the backstay part and then the goal will open.

Besides that, when the consumers use the connecting rods as the goal's backstay, maybe it can be lost. When the rods lost, the goal post can not stand properly so, it cannot be used.

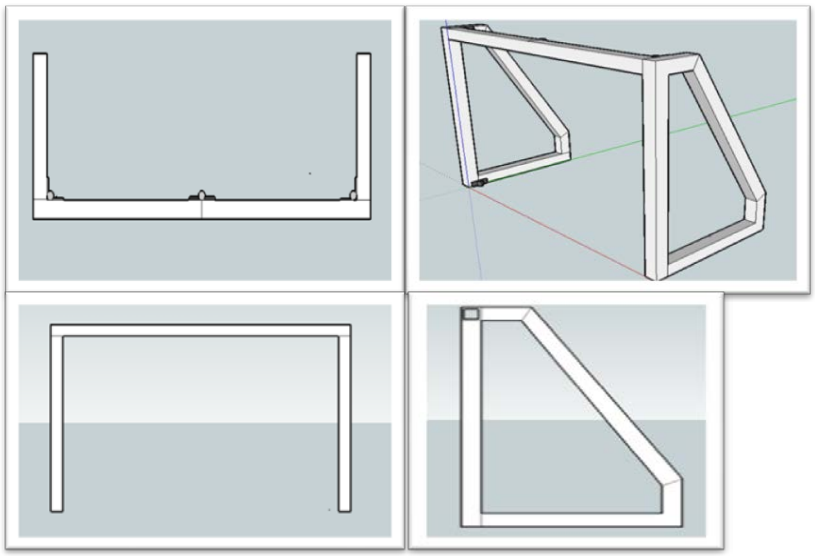


Figure 3.8: Foldable Football Goal Final Concept

3.9.1 List of Materials

Table 3.9: Materials Selection Table

BIL	TYPE	SIZE (mm)	PART	QUANTITY
1	HOLLOW STEEL	30X30X480	CROSS BAR	2
2	HOLLOW STEEL	30x30X185	UPPER SITE BACKDROP	2
3	HOLLOW STEEL	30 x 30X570	FRONT POST	2
4	HINGES	30 x 15	JOINING PARTS	5
5	HOLLOW STEEL	30x30x350	GROUND BAR	2
6	HOLLOW STEEL	30 x 30X170	DOWN SITE BACKDROP	2
7	HOLLOW STEEL	30 x 30X420	BACK STAY	2

3.10 Material Characteristics

Table 3.10: Table of Materials Characteristics

Material	Weight kN/m³	Modulus of elasticity GPA	Modulus of rigidity GPA	Yield strength		Coefficient of thermal expansion
				Tension	Shear	
Stainless steel		190	73	520		17.3
Mild steel	77	200	79	250	400	0.27

3.11 Fabrication Processes

Fabrication processes is the process to combine or joining the parts to become a model or product. This process will make the product base 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. Besides that, fabrication process is a process to make only one product rather then manufacturing process that focus to large scale production. In the project fabrication process needed to make the base plate, framework of display board and display board. Fabrication process was used at the whole system production. This was include part by part fabrication until assembly to others component. In this project, there are some manufacturing processes were involve. All the processes will be explained as shown below:

I. **Measuring**: The materials are measured according to the design dimensions.

Figure 3.11: Measuring Process

II. **Marking**: All measured materials need to be marked to give precise dimension and easy to cut.

Figure 3.11.1: Marking Process

III. **Cutting**: The marked materials were cut into several pieces (goal parts) by using grinder.

Figure 3.11.2: Grinder as the Cutter Method

IV. **Eliminate:** After cutting process, eliminate the chips on the steel surface to avoid injuries.

Figure 3.11.3: Grinding Chips

V. **Joining**: Materials joined by the method of MIG welding and hinges.

Figure 3.11.4: Welding Process

VI. **Finishing**: Any rough surface cause by welding spark were grind to give smooth and safe surface.

Figure 3.11.5: Goal After the Welding Spark Have been Eliminated

VII. **Painting:** Coloured the goal frame with paint (white).

Figure 3.11.6: The Goal after Painted

3.12 Process Explanation

The fabrication process was started with measuring the material into the required dimension. All dimensions of each goal parts are mentioned in Table 6. After done the process, then proceed with the making process. Marked the materials to give the precise

dimension and make it easy to cut. Make sure all the making parts are followed the design dimensions to make it easy to join later. Use the L-shape in order to make sure the dimension of the material length is correct and precise.

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 by using the hand grinder cutter. Before proceeding with 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.

The next procedure is grinded the material that had been cut is to give smooth surface on the edge to make sure that joining process can be done precisely. Then, the joining process was carried out by using the Gas Metal Arc Welding or formerly known as MIG (Metal Inert Gas). First, the welding machine is set up to make sure that the output of the process will satisfy. Face shield, apron, goggle and others PPE equipment are not to be forget. Then, all the materials were weld together. During this process, a minor movement of the materials will give bad effect to the joint and to the framework. It is because the hollow tube will expand and twist a little due to the temperature changes.

After finished welding, the entire welded places were then grinded to make sure that the entire joint surface was smooth from any spatters or sharp edge. 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.

After all the process had been done, the product has been test to ensure it can be function well. To make the foldable goal look more interesting, it has been coloured with white paint.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

The final fabrication of the foldable football goal is done from only limited times due to several problems occur to the project. In this chapter will discuss mainly about the result of the project and all problems facing during the whole process from beginning till to the end of the fabrication process.

4.2 Result

This figure shown about the result for my project:

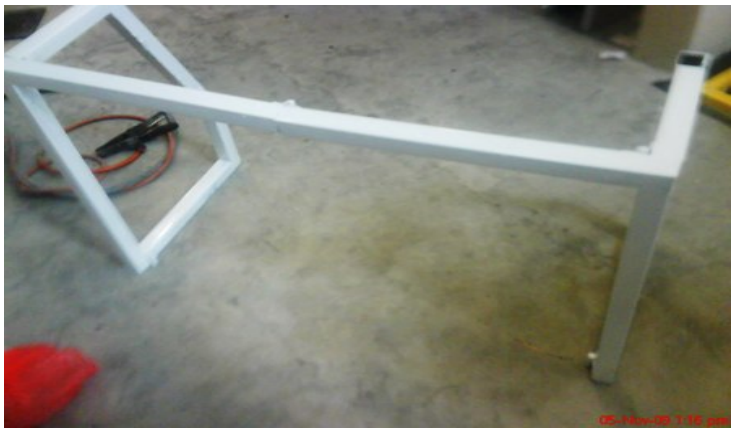


Figure 4.2: Foldable Football Goal Post

4.3 Basic Parts

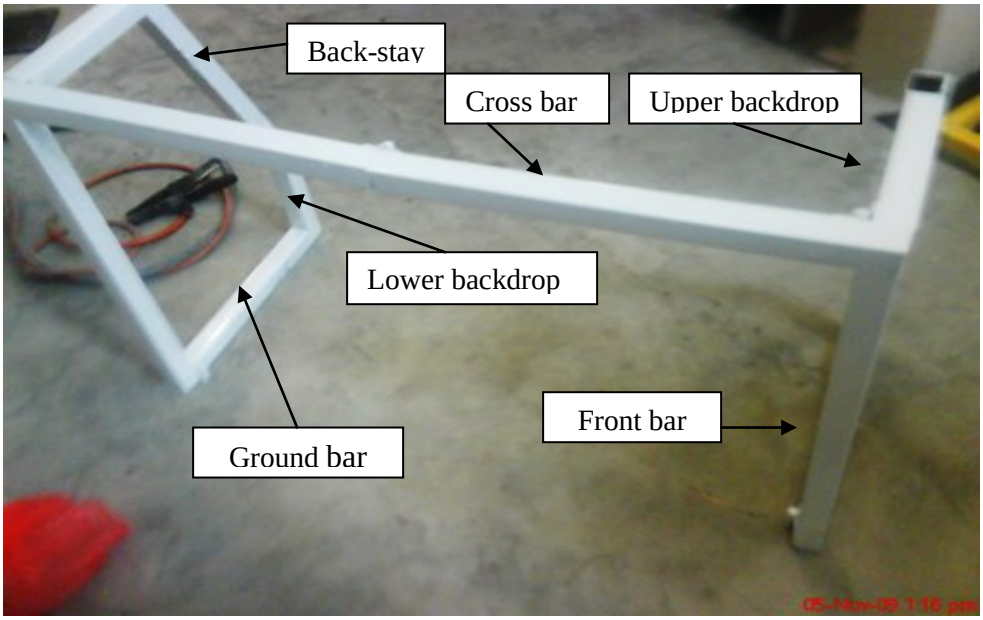


Figure 4.3: Parts of the Goal Post

1.4 Standard Operation Procedures

4.4.1 Let the goal post in the normal opened position.

Figure 4.4.1: Normal Opened Position

4.4.2 Fold the parts at the right and left of the goal post.

Figure 4.4.2: Position after the Right and Left Sides has been Folded

4.4.3 Folded the Centre part of the cross bar.

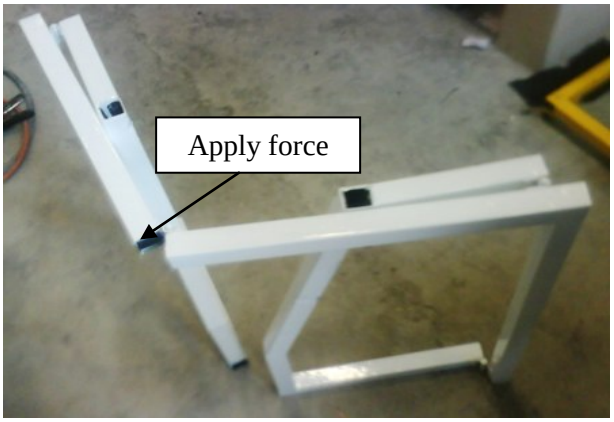


Figure 4.4.3: Folded the Cross Bar

4.4.4 Folded goal position**.**

Figure 4.4.4: Folded Goal Position

4.5 Cost Analysis

Table 4.5: Cost Analysis Table

NO	ITEMS	QUANTITY	PRICE(RM)
1	MILD STEEL	2	36.00
2	HINGERS	5	7.50
3	PAINT	1	6.00
	TOTAL		49.50

Labour cost = RM 0.50 per unit

Shipping cost = RM 1.00 per unit

Total + labour cost + shipping cost =RM49.50 + RM 0.50 + RM 1.00

= RM 51.00

4.6 Project Problems

4.6.1 **Literature Review**: Need to spend much time to study the literature review. The sources are quite hard to find because in the new hostel, there is no internet source yet.

4.6.2 **Designing & Sketching**: Take a time to think and generate the new idea to design the goal. Think the part of the goal that is suitable to be folded.

4.6.3 **Fabrication Process**: Since the mechanical lab is located at UMP Kuala Pahang, Pekan, so the students need to take a bus to go there. This quite wasting time because to go there, it need around one and half hours to arrive.

4.6.4 **Material Preparation**: Some of the materials are no available at the mechanical lab, so the students need to buy by them self. This also including the transportation cost to find and buy the materials at the hardware shop.

4.6.5 **Budget Preparation**: It is not so effective to use student's money to get the materials. The university should provide the initial budget to each student that need to buy the materials.

4.7 Problem During Fabrication Process

4.7.1 **Material:** Problem during this stage is very critical when the certain of the material need to buy by student in city or other place. So, this time we need to use our money to buy it. Certain student need to delay their project because no enough money to buy the material.

4.7.2 **Welding Process:** During welding process some problem has occurs. Using the MIG welding we need to set a suitable voltage. If the voltages to high, the material like mild steel will be melting.

4.7.3 **Equipment:** The first problem in fabrication is the equipment cannot be used such as welding machine. Beside that, the hand cutter also cannot be used to cut our material because the motor was broken.

4.7.4 **Laboratory located:** The Mechanical Metal Foaming Laboratory in Kuala Pahang, Pekan is located far from UMP Gambang. The students need to make bus reservation to go there. Furthermore, the journey to Kuala Pahang needs to take around two hours. In that two hours, the students can do their final year project if the metal foaming laboratory is still in Gambang.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

For the final chapter it represent about conclusion and recommendation for the project. From the recommendations, it can make improvement about the project in the future.

5.2 Conclusion

As the conclusions, my project has been done due to the project schedule. All the objectives of this project were successfully achieved. Even there are lots of the problems that I need to face in the journey to accomplish this project, but all that are challenging things. The problems including how to get the materials, times to finish the project on time since there are some equipment that not functioned yet in the lab, and the materials cost that I need to produce by my self first.

Besides that, in this project, I have applied all the mechanical techniques and skills of using several machines that I have learned since part one at University Malaysia Pahang. Thanks to all the instructor engineers of mechanical for teaching us since we are here. Without that knowledge, I do not think that this project can finish on time.

This project also generates my capabilities as a responsibility person. This is because I had to take care and take a look for my project. Beside that, I also had made a

private meeting with my supervisor, Mr Nasrul Azuan Bin Alang for a discussion about my project progress. With the discussion with him, I realize and can know about my mistakes that I have done in my slides presentation also including this final year project report. So by the time I also can make some improvement and learn how to share others opinion and idea to make my product better. Thanks to Mr Nasrul Azuan Bin Alang for giving me ideas, correct me when I wrong and help me to make this report.

A long this project, I also learned about the friendship and teamwork where some time we work together and give a hand to each other even each of us have work to do. With that, we can finish our project on time.

This final year project is also as the initial preparation before I start my industrial training. It is because when I do this project, I need to communicate to my supervisor, having a discussion, help each other to finish the project and so on. So, in the real industry, that entire thing also need and this is the beginning.

5.3 Project Recommendations

1.3.1 Hide the hinges on the cross bar to make it look more tidy.

1.3.2 Put the supporters between the cross bar and the backdrop to make the goal more stable and tough.

1.3.3 Hopefully, there are more foldable parts on the goal post can be created can reduced the size more.

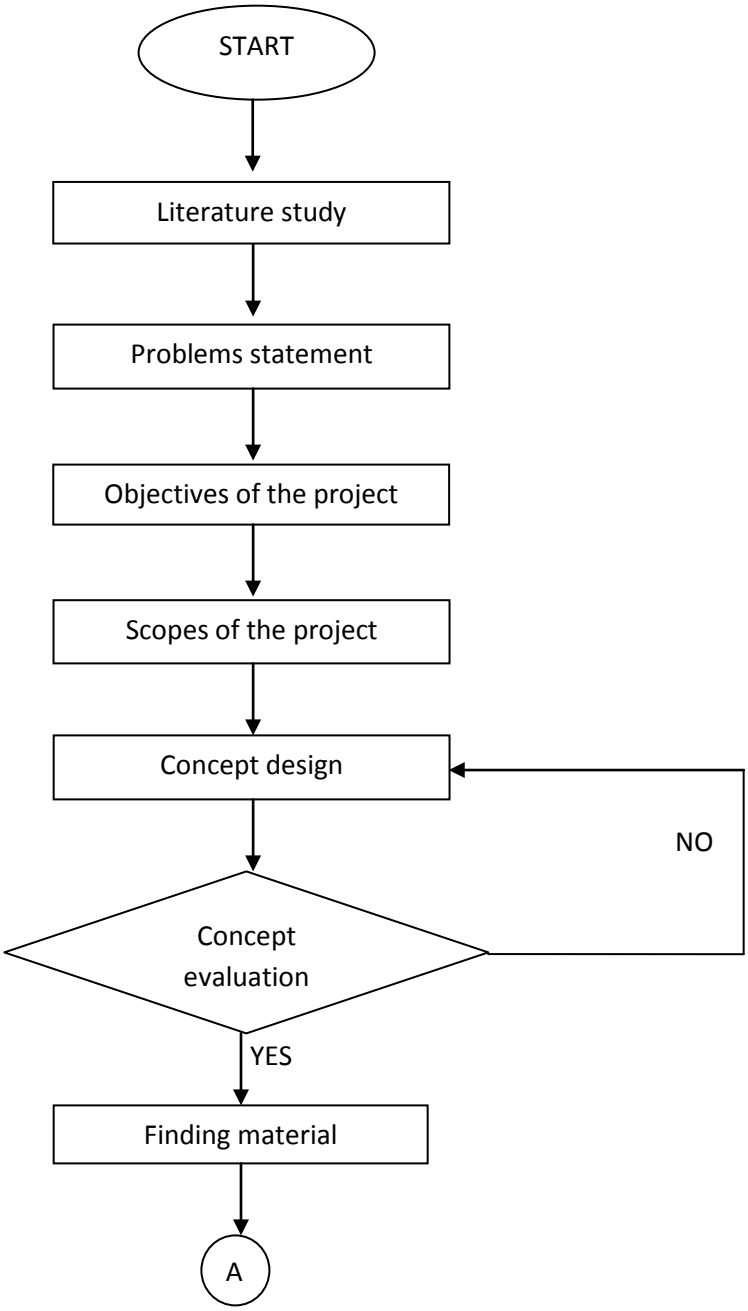
1.3.4 Put the holder at the suitable goal’s part to make it easy to carry after it has been folded.

1.3.5 Eliminate the sharp edge as the safety factor.

1.3.6 Use the circle material as the goal frame.

1.3.7 Increase the weight of the goal to make the goal truss stronger.

APPENDIX


START
Literature study
Problems statement
Objectives of the project
Scopes of the project
Concept design
NO
Concept evaluation
YES
Finding material
A

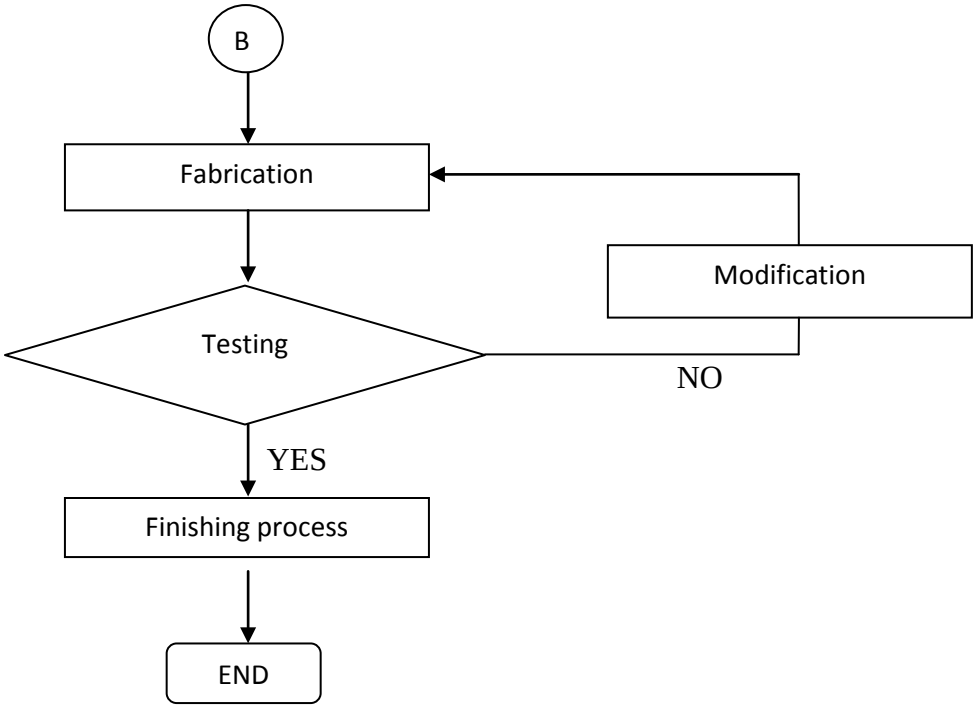


Figure: Project Flow Chart

Table 1: Gant Chart

Activity	Task	Week															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Literature review	Plan																
	Actual																
Determine the problems statement, the problem solutions,	Plan																
	Actual																
Project objectives & project scopes	Plan																
	Actual																
Sketch and design the concept selectios	Plan																
	Actual																
Concept evaluation and finalize	Plan																
	Actual																
Mid FYP presentation	Plan																
	Actual																
Materials preparation	Plan																
	Actual																
Project fabrication	Plan																
	Actual																
Testing and modification	Plan																
	Actual																
Finishing process	Plan																
	Actual																
Final presentation	Plan																
	Actual																
Writing and report submition	Plan																
	Actual																

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2 Dr John G. Nee, CMfgE**.** *Fundamentals of Tool Design,* 4th edition.

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2 http://74.6.146.127/search/cache?ei=UTF-, dated on July 27th, 2009.

3 www.cpsc.gov/cpscpub/pubs/soccer.pdf, dated on August 13th, 2009.

4 www.hope.edu/academic/engineering/engs451/2002/loomis.html&w=design+designs+soccer+goal+goals&d=C8axwxlMTNbZ&icp=1&.intl=us dated on August 13th, 2009.