DEVELOPMENT OF AUXILIARY EQUIPMENT FOR 1 SEATER DRAG BUGGY

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A report submitted in partial fulfillment of the requirements
for the award of the
Diploma of Mechanical Engineering

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SUPERVISOR'S DECLARATION

We hereby declare that we have checked this project and in our opinion this project is satisfactory in terms of scope and quality for the award of the degree of Diploma of Mechanical Engineering

Signature:
Name of Supervisor:
Position:
Date:

STUDENT'S DECLARATION

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

Signature

Name:

ID Number:

Date:

ACKNOWLEDGEMENTS

I am so glad and grateful to god for gave me strength and determination for done this project. I also would like to expess my sincere to my supervisor Mr Mohd Fazli bin Ismail. He always gives me guidance during processing this project. He helps me in any aspects and without him this project won't be done properly. I am really grateful with his support and continuous encouragement without feel any burden for him. I am also to say thank you to my instructor Mr Farizul Shahidan bin Rajuli, who teach and instruct me how this project should be make. He always gave his faith with my ability that this project will be done successfully.

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ABSTRACT

Development of Auxiliary Equipment for one seater drag buggy is one of the Mechanical Faculty project and this task of the project must be completed by Mechanical Engineering student. Project Objective is to design brake pedal, fuel pedal, piping and tank attachment and to fabricate the mechanical part of the system. This project must be complete to ensure the whole system of the drag buggy car can be applied. Several aspects must be consider when make analysis such as strength analysis, dimension analysis selection concept analysis. All the system must be done without collide or bother any system to avoid another system failure when applying. So, efficiency is important criteria to make this system go well. Then, fabrication and modification process should be making properly. If any problem occurs, it will become dangerous for the driver. Another thing that should have to develop this project is knowledge, skills and interest feeling. Without that, this project can't be going far. So, all the process must be follow on the flow and all system should be making correctly and properly for the perfection.

ABSTRAK

Pembinaan kelengkapan tambahan untuk kereta buggy ini adalah salah satu projek Faculti Mekanikal dan misi ini haruslah disiapkan oleh peljar Diploma Kejuruteraan Mekanikal. Objektf projek ini adalah untuk membangun dan membina tempat sambungan untuk pedal minyak, pedal brek dan tangki. Projek ini harus disiapkan untuk memastikan keseluruhan sistem kereta buggy ini dapat digunakan. Beberapa aspek harus diambil kira ketika analisis dijalankan seperti kekuatan, pemilihan konsep dan anggaran ukuran. Sistem untuk kereta ini haruslah disiapkan tanpa menganaggu atau melanngar sebarang sistem lain di dalam kereta ini dan mengelakkan sistem lain gagal untuk berfungsi. Jadi, kecekapan adalah salah satu kriteria penting untuk sistem ini siap dengan jayanya. Disamping itu, proses modifikasi haruslah dilakukan dengan betul. Jika tidak dilakukan dengan betul, ia akan mengundang bahaya kepada pemanduan. Antara penting yang harus ada ketika membangun projek ini adalah pengetahuan, skil serta minat. Tanpa kriteria itu, projek ini tidak akan kemana. Jadi segala proses untuk menyiapkan projek ini haruslah dilakukan mengikut aturan dan keseluruhan sistem haruslah dilakukan dengan betul untuk mencapai kesempurnaan.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

University Malaysia Pahang with Faculty Mechanical Engineering develop a speed buggy car contribute to FELDA. Actually, this off road buggy car use as observation car or another function that related with the car can produce in estate widely. So, one system required to this buggy car. The systems are tank attachment, brake pedal and fuel pedal. This project is to design brake pedal, fuel pedal and fuel tank attachments and fabricate the mechanical part of the system. All skills and knowledge that learned before is very useful to this project succeed.

1.2 Problem Statement

Scope of the task is to **complete the auxiliary equipment** for this speed buggy car. Auxiliary equipment is covered brake pedal, fuel pedal and fuel tank attachment. This system does not exist yet, so the system must complete the system for this car. the problem is to analysis how the attachment place can support and sustain the load or force when attachment install. All the force and load must be calculated to avoid this system failure. The other problem is the location and limitation area of the attachment. So, the result of this system should not bother another system of this car. The result also concerns the safety and then, it won't be any problem when applying all the system.

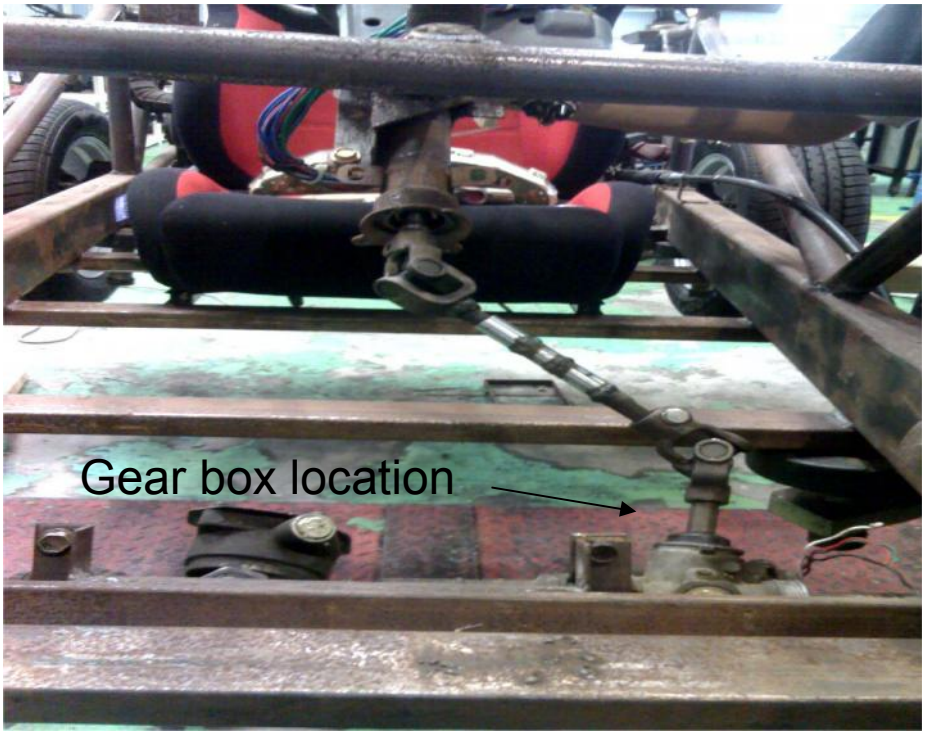


Figure 1.1: Pedals attachment and fuel tank attachment location

1.3 Project Objective

The objective of this project is to:

a) To design and modify brake pedal, fuel pedal, piping and fuel tank **attachments** for 1 Seater Drag Buggy.

b) To fabricate the mechanical part of the system.

1.4 Project Scopes.

The scope of this project is:

a) Literature review on the knowledge of design brake pedal fuel pedal, piping and fuel tank.
b) Design detail project by using sketching and Solid Work.
c) Simple analysis by using static calculation for pedal attachment and for tank using COSMOS.
d) Fabricate the attachments with the analysis of the system.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Single seater drag buggy is a light weight speed vehicle. The chassis are custom fabricated to reduce the weight and increase the stability of the vehicle. The drag buggy car commonly operates with rear wheel transmission and rear engine placement to give more acceleration power and it will increase speed of the car.

2.2 Fuel pedal and brake pedal system

The buggy fuel and brake pedal system is not too far with car and go kart system. Differences between buggy and normal car and kart just the design and how many they use. They normally may have two or four foot pedals. They also normally clutch pedal operated by left foot not in case of automatic transmission and right foot normally operated brake and fuel pedal. Most of car in this world use disc and drum system. That's same with this buggy car system.

Figure 2.1: three pedals car system

Figure 2.2: Four pedals car system (manual transmission)

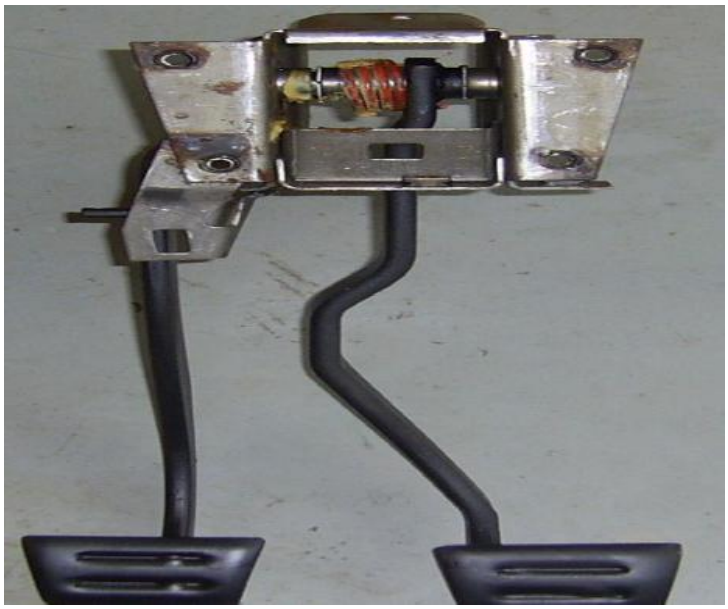


Figure 2.3: Two pedals car system (automatic transmission)

2.3 The Fuel Tank System.

Fuel tank is important part in buggy car system. Function fuel tank is to supply fuel to the engine for ignition process with air. The difference between the normal car and buggy car is the position of the tank. For normal car, the tank position at the rear car. For buggy car, the tank position at front car, it's because engine for the buggy car at rear place different with the normal that the engine located at the front place.

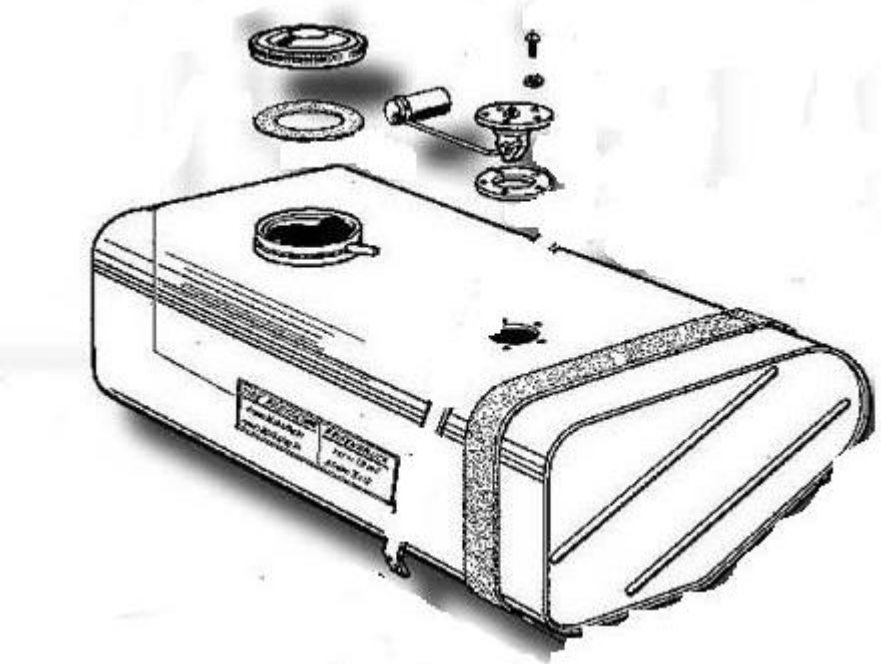


Figure 2.4: Commonly tank view

CHAPTER 3

PROJECT METHODOLOGY

3.1 Project flow Chart

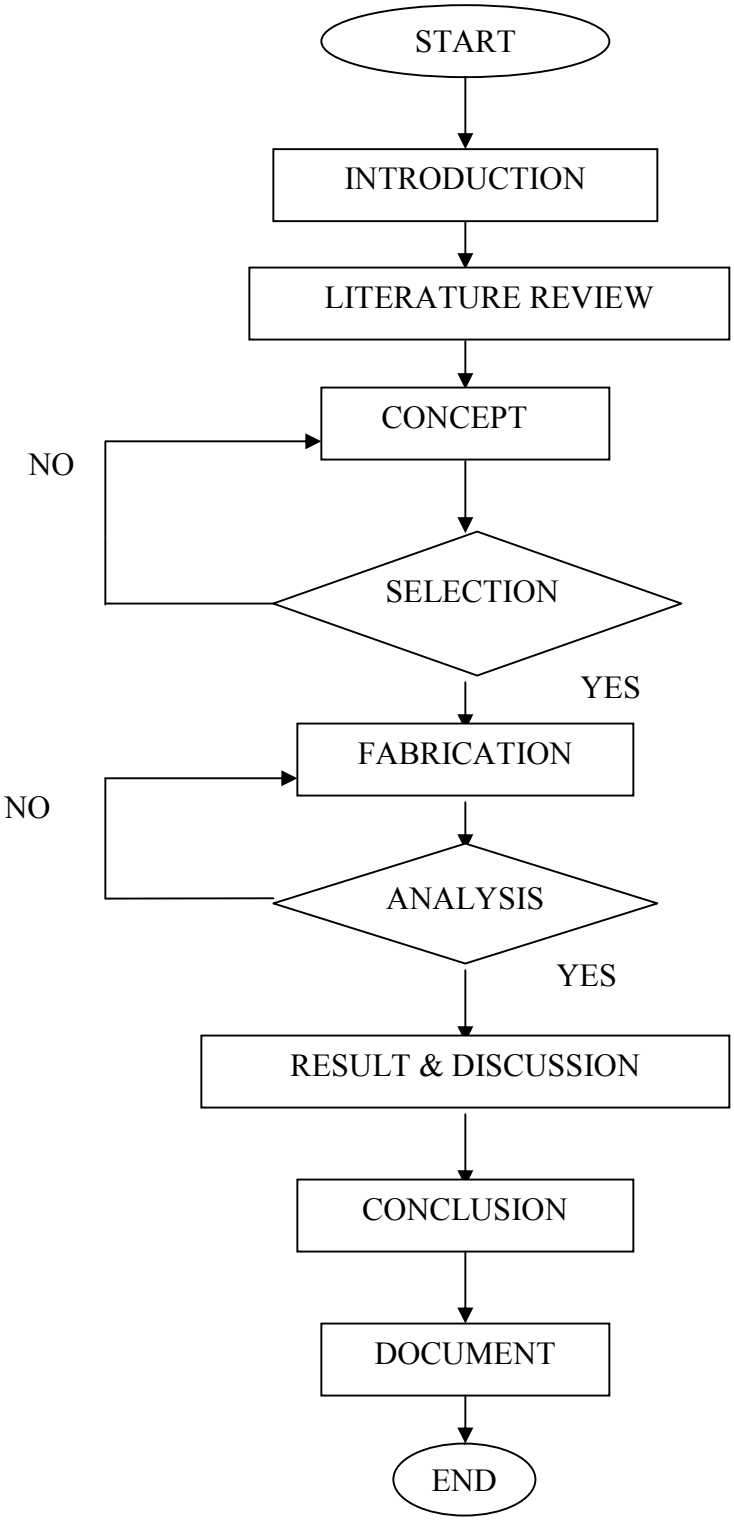
To make sure this project complete on schedule, flow chart is too important to assure all the planning running smoothly. This project will be start with literature review. This stage is enquiring about investigation and analysis of the literature review and fine the information that help this project.

Then, the next stage is developing design ideas sketching for all parts. Several ideas will be create and that ideas must be possible with this project. At least three ideas are need to choose the best ideas selection.

Then, go through to selection the best ideas. After that, detail design of the parts by using Cad drawing with true dimension. If the problem occurs when develop detail design such as dimension error, turn back to the selection ideas and make a correction.

After confirm the detail design, the fabrication process can be start. Period of this stage is longer with other stage. Concentration for this stage is important to avoid any problems. After finish the fabrication process, analysis will be make to make sure the system can be running. If any problem occurs when analysis the system, make sure go back to fabrication process to do the correction for that error. Lastly, prepare a proper report for this project before submit and also prepare the final presentation

Figure 3.1: Flow Chart



3.2 Drawing

The drawings divided by two:

a) Sketching: sketching the concept ideas before chooses the best ideas as a concept of the project.

b) Solid works drawing: the best concept sketching will be transfer to Solid Works application with true dimension.

3.3 Sketching

This project sketching ideas consist three ideas, three for fuel pedal, brake pedal, clutch pedal attachment and three for fuel tank attachment. Only one design consider as the final ideas. The sketching ideas are:

3.3.1 Fuel, brake, clutch pedal attachment.

When develop concept of ideas for pedal attachment, several criteria must be concern. One of the criteria is possibility the system can be apply. Another criteria is spacing of the foot when step on the entire pedal.

3.3.1.1 Concept A

In this case, the entire pedal won't clash with another system (gear box) and problem only apply which step on the pedal, foot surface will clash and bother with attachment of linkage (cable).

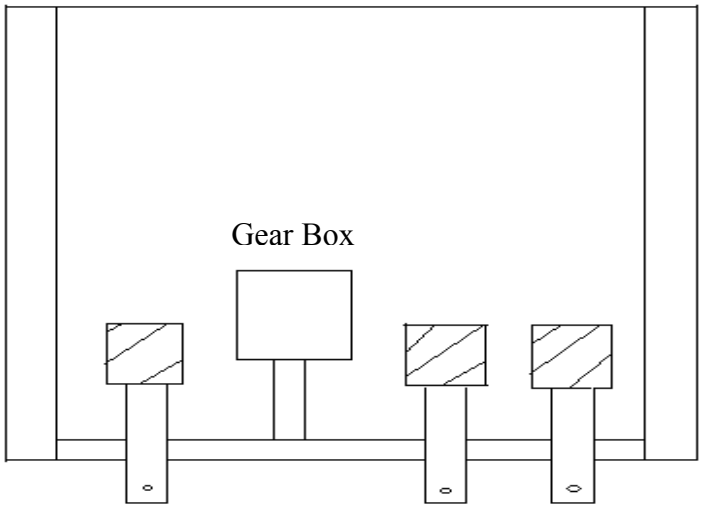


Figure 3.2: Concept A

3.3.1.2 Concept B

For this concept, both side feet can step on the pedal because the distance between two pedals is wide but the problem here is the middle pedal will clash with another part of this car (gear box).

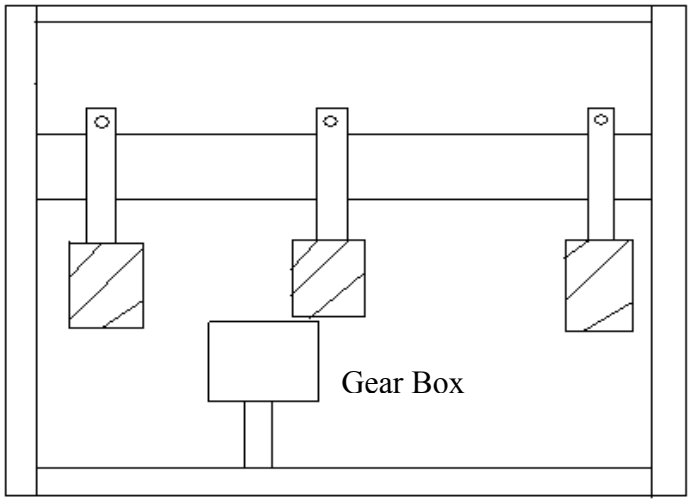


Figure 3.3: Concept B

3.3.1.3 Concept C

This concept is nearly same like concept B, the positioning of the pedals higher than Concept A. The different of this concept is even the middle pedal(brake pedal) can only be apply with the right foot side, the placement of that don't bother any system of this car.

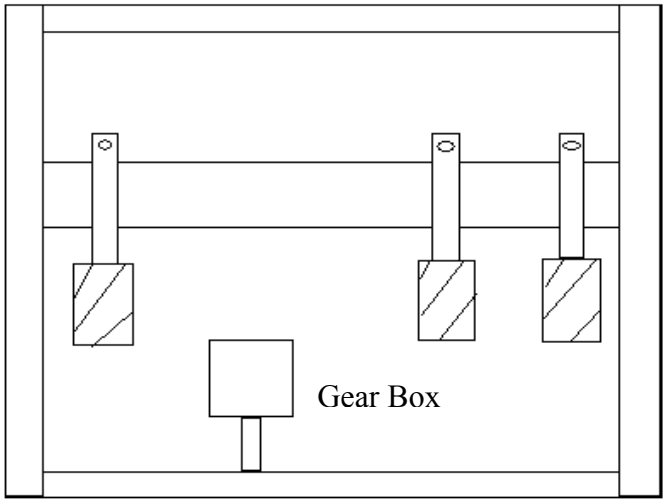


Figure 3.4: Concept C

3.3.2 Fuel tank attachment

In case develop ideas for fuel tank attachment, spacing placement of the fuel tank is the main problem. It's same with the pedal attachment concept. For the fuel tank attachment, supervisor gives two tank capsule shapes first to design the concept. Suddenly, he changes the tank with T-shape tank. So, redesign ideas for this tank needed.

3.3.2.1 Concept A

For this concept, sizes of the tank are suited and match with the attachment space and the fuel tank difficult to out of track. Instead, the distances between the fuel tank a bit narrow but still safety for use.

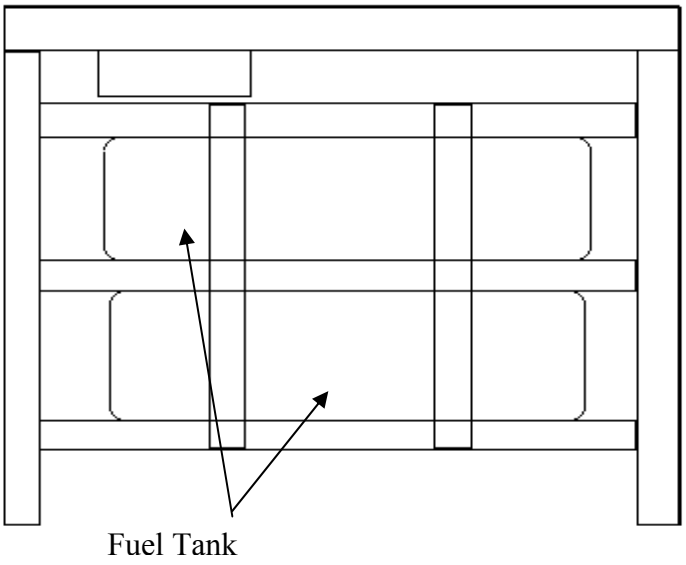


Figure 3.5: Concept A (fuel tank)

3.3.2.2 Concept B

This concept, distance between two tanks more wide. The problem is the tank easy to leak when collides with anything because the position of the tank is over from the space.

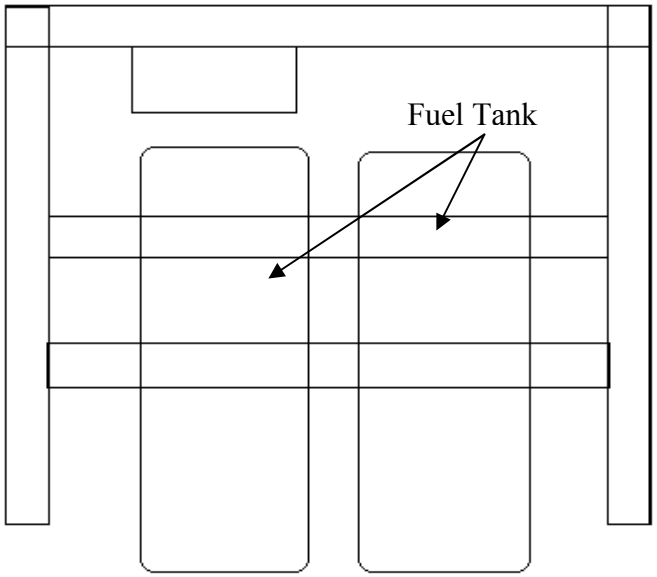


Figure 3.6: Concept B (fuel tank)

3.3.2.3 Concept C

This concept is nearly same with Concept A, size of the tank match with attachment space but the position of the tank don't look properly and effective .Then, there will be a problem because it difficult when installing and installing the tank.

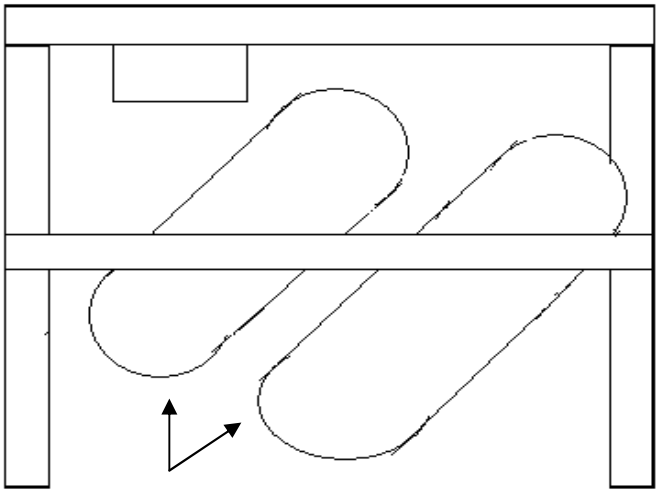


Figure 3.7: Concept C (fuel tank)

3.3.2.4 Concept D

For this tank, the size is bigger than last tank. In this concept, the tank will clash with another system of this car (brake pump reservoir). But this concept look properly and effective.

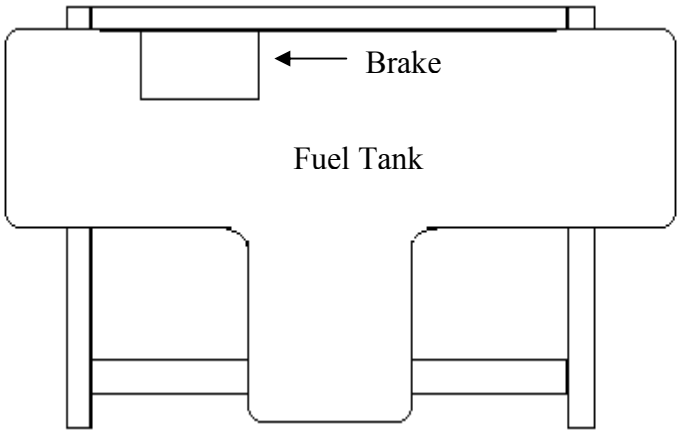


Figure 3.8: Concept D (fuel tank)

3.3.2.5 Concept E

Brake pump reservoir not bothers this tank for this concept. There has no problem with spacing for this tank just the side of the tank looks over from the field but it still safety to use.

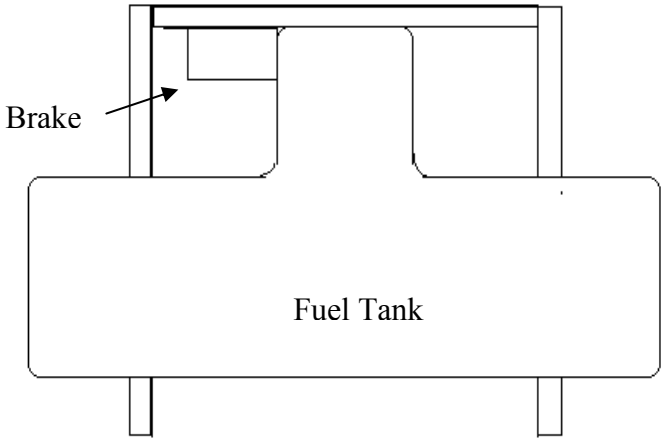


Figure 3.9: Concept E (fuel tank)

3.4 Solid Works Drawing

After confirm selection for both concept fuels tank and pedals attachment, all the sketching must be transfer to the solid works drawing. That's mean, all dimension must follow the actual dimension. It's so useful for fabrication process soon

3.4.1 Fuel brake, clutch pedal attachment

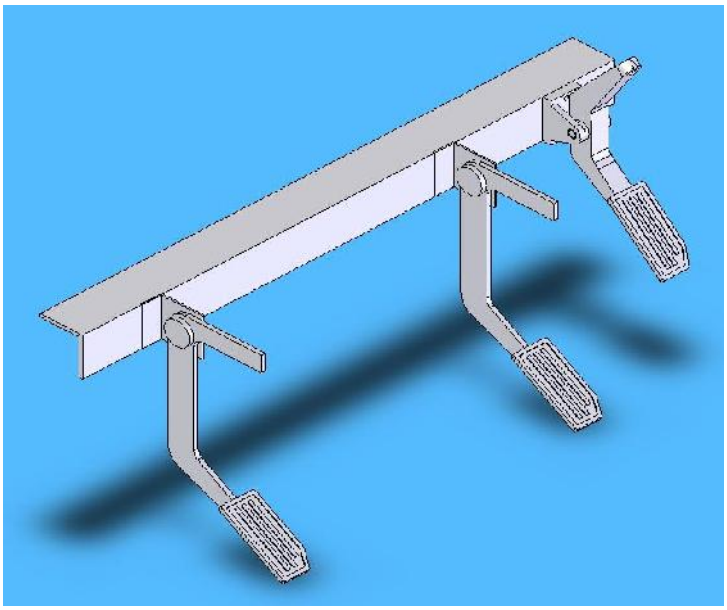


Figure 3.10: Fuel brake and clutch pedal attachment view

The reason why this concept selected even it has the disadvantages but it most effective than the other concept. Only this concept allows foot to step on without bother any mechanism in this car. Although the first concept (concept A) still can step on the pedal but the surface of foot will collide with cable attachment, it could become damage of that cable sooner if that concept chooses.

3.4.2Fuel tank attachment

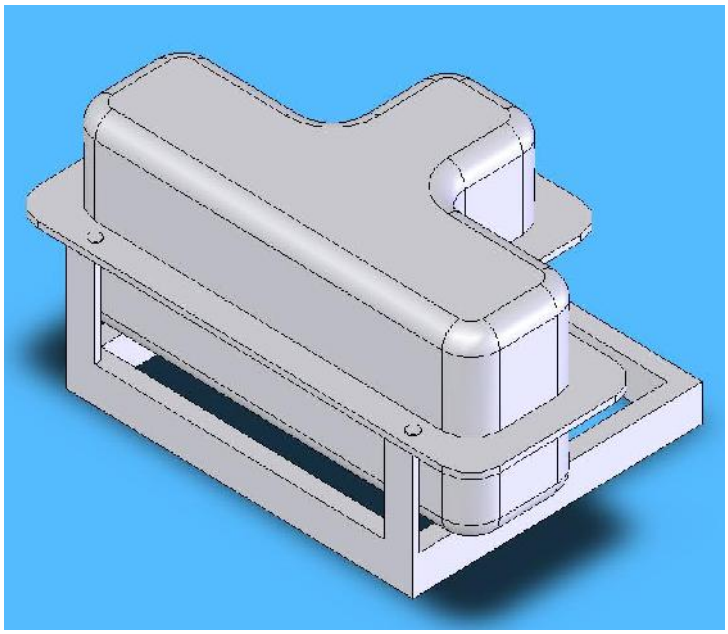


Figure 3.11: Fuel tank attachment view

Concept A, B and C was rejected early after supervisor decides to change the tank from the capsule shape to the T shape. Just concept D and E will be considered as a chosen one. But the concept is choosing because it won't bother the other part of this car. If the concept D choose, that tank will collide with another part (bake pump reservoir) worry the tank will be leak. So, only the concept E is the most effective concept after observe at several aspects.

3.5 Fabrication and Modification Process

Fabrication process is another major thing when development this project. This stage can be start after designing process done. In this process, a lot of method will be applied. So, skills and knowledge have been learn before is important. For this project, several have been used like welding, drilling and grinding.

3.5.1 Welding Process

The parts use welding as a process is fuel tank. Welding require because to weld the holder of the tank. Welding is most effective process than the other process because it's tougher. Another process use welding as a process is pedal part. The holder to attach pedal must use this process. The commonly equipment uses in welding process are welding electrode, shield face, arc welding. Skillful and knowledge is needed when using this process.

Figure 3.12: Welding process view

Figure 3.13: Welding process view

3.5.2 Drilling Process

This drilling process is use when to tight the fuel tank with the holder. Bolt and nut is using to tight them. So, its need to make hole and only drilling process can be use. The equipment for this process are drill machine, goggle.

Figure 3.14: Drilling process

3.5.3 Grinding Process

This process also important, scope for this process is to discard all the sharp edge at all parts. Cutting the material also use this method. The equipment and tool use in this process is grinder and goggle

Figure 3.15: Cutting process view

Figure 3.16: Cutting process view

CHAPTER 4

RESULT AND DISSCUSION

4.1 Introduction

All the system such fuel pedal attachment and pedals attachment must be analyze for several aspect to make sure all the system are functioning and all cost require can be estimate by using **simple analysis**. In this stage, all process should be done properly to avoid any failure when applying that system. This is important part for this project, any mistakes will become problem for the system. When develop a product or project, a quality is the main thing everyone must be care. The aspects must be considering when analyze process are following below:

a) Design dimension and spacing.
b) Design selection
c) Strength
d) Material estimation

4.2 Design dimension

When design and confirm selection concept ideas of this project, all dimension uses must be in true dimension. It's important to avoid error occur when fabrication process. Space is another thing aspect must be considered because it will make the system smoothly applying.

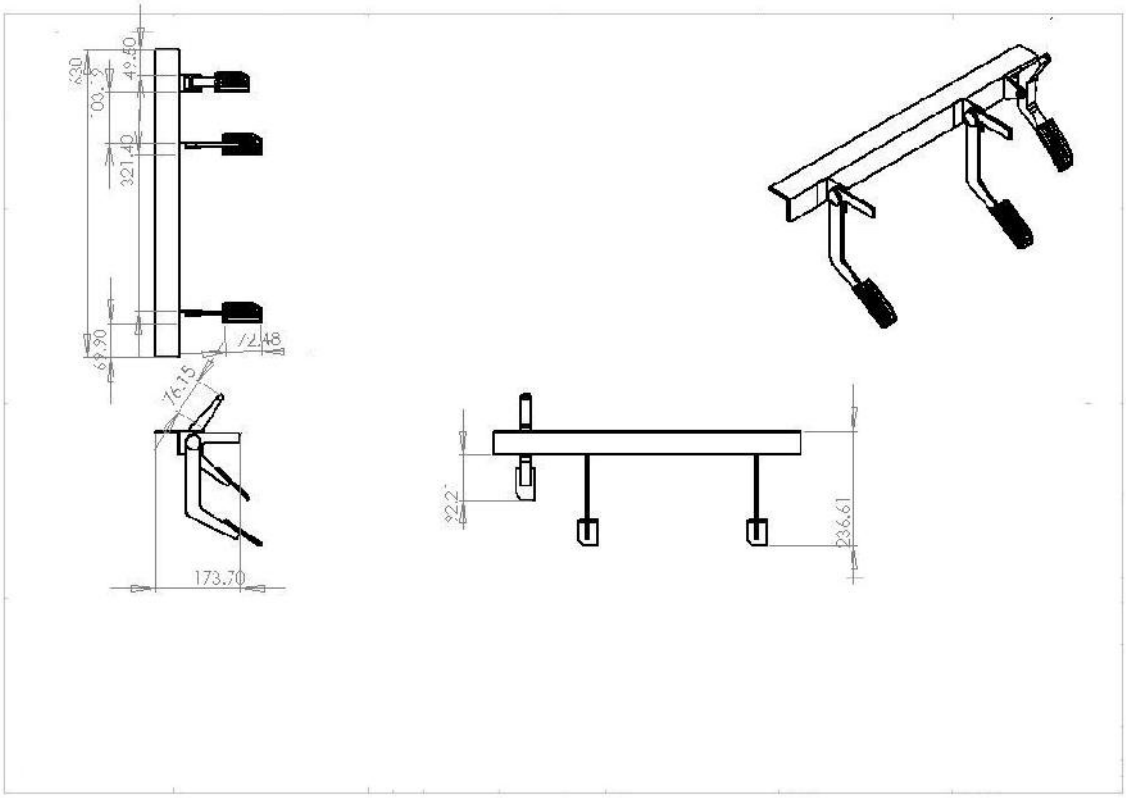


Figure 4.1: dimension of pedals attachment

Figure 4.1 shown the true dimension of the pedals include brake pedal, fuel pedal and clutch pedal. Dimension for these pedals is important to make sure distance between two foot not clash each other and problem nothing occur when step on the pedals. If look back at the concept of this system, gear box located between pedals attachment space. So, skills and knowledge are needed to avoid each system (pedals and gear box) wont bother each other.

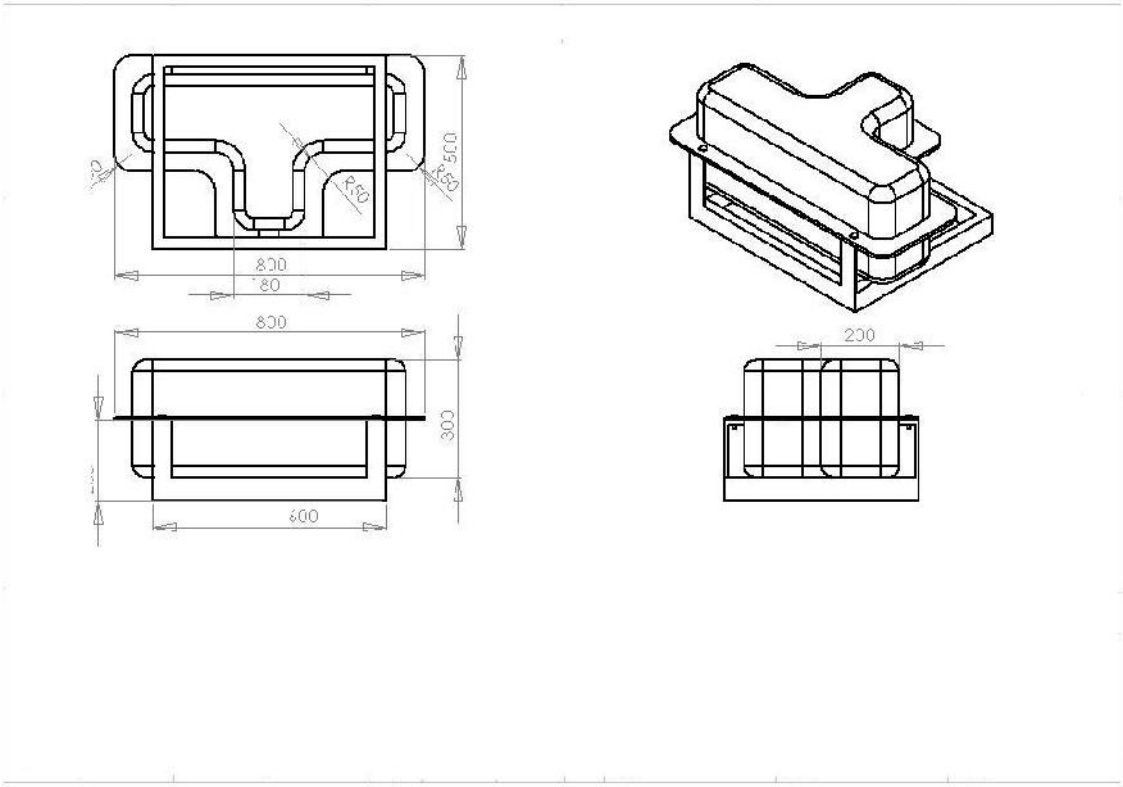


Figure 4.2: Dimension of fuel tank attachment

Figure 4.2 show the true dimension of fuel tank attachment. For the fuel attachment, the problem is the limitation of space of placement, same like pedals attachment problem. So, the true dimension is so important to avoid collide with another parts if the error dimension occur.

4.3 Design Selection

Table 4.1: Selection for pedals attachment

		CONCEPT	A	B	C
BIL	NEEDS				
1	Easy to install and uninstall		+	+	+
2	Space		+	+	+
3	Don't clash with another parts		-	-	+
4	Allowing both foot to step on all pedals		-	-	-
PLUSES			2	2	3
MINUSES			2	2	1
NET			0	0	2
RANK			2	2	1

The table showed the rating table for the whole concept. Concept C is a seed one from the other concept, so Concept C chosen as a selected design.

Table 4.2: Selection for fuel tank attachment

BIL	NEEDS	CONCEPT	A	B	C	D	E
1	Suit the placement		+	-	+	+	+
2	Space		+	-	+	-	-
3	Look properly		+	+	-	+	+
4	Don't bother any parts		+	+	+	-	+
PLUSES			4	2	3	2	3
MINUSES			0	2	1	2	1
NET			4	0	2	2	2
RANK			1	4	2	4	2

For this table, concept A is rank number one. But it can't be choosing because concept A until concept C used capsule shape tank as a reference. After discussion with supervisor, the fuel tank change into T shape tank. So, just concept D and E consider as selection design. Concept E is chooses because the rank is better than another one design.

4.4 Strength

For analysis strength of this part, simple static analysis needed for pedals attachment to analyze how force can react with the holder of the pedals. In fuel tank case, cosmos work require to analyze the maximum load that holder can support the fuel tank.

4.4.1 Pedals attachment static analysis

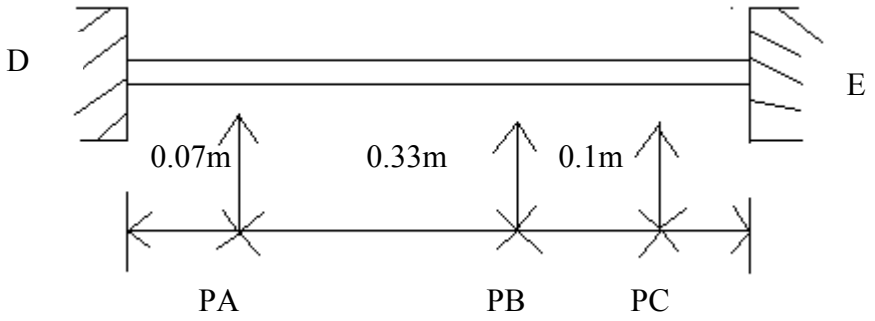


Figure 4.3: Top view

Assume force for each pedal 1/6 weight, weight assume 60kg.so, that's force 10x9.81=98.1

∑ Moment at d point =0

Rf (reaction force) = (98.1 N) (0.07 m) + (98.1 N) (0.4 m) + (98.1 N) (0.5 m)

= 6.867 + 39.24 + 49.05

= 95.159 N

> The reaction force for each force attach value at 95.159 N. after multiply with three, the value is 285.477 N. so, if one or two pedal was applied, that system wont be failure because it still in range below 285.477 N.

4.4.2 Fuel tank simple cosmos analysis

a) Stress analysis

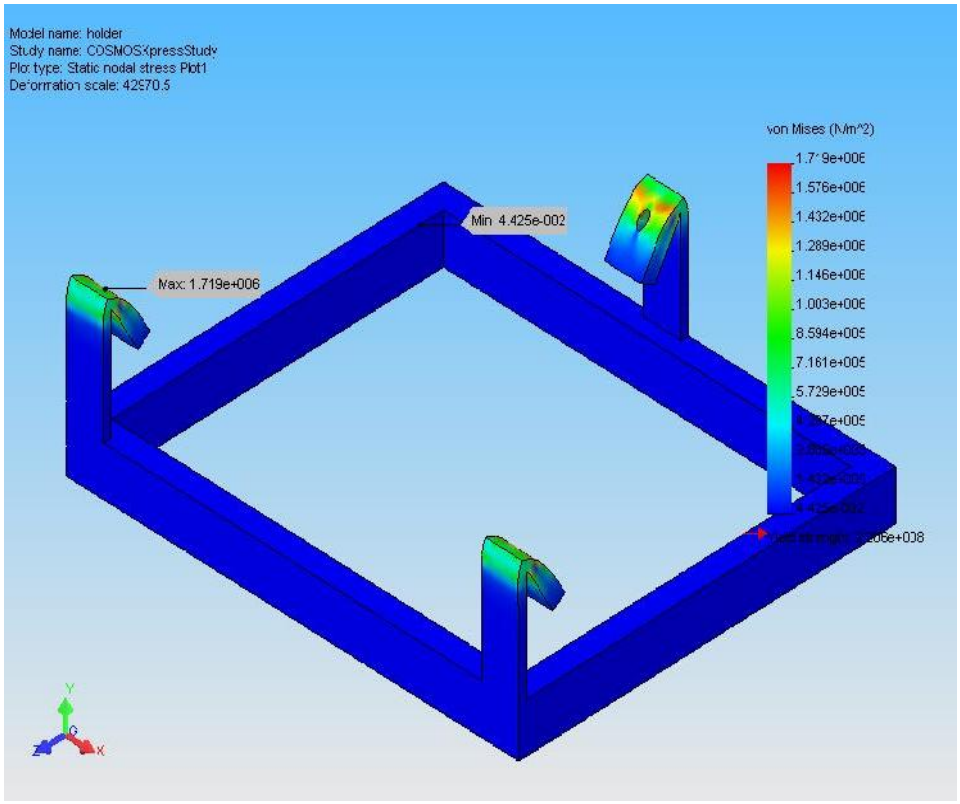


Figure 4.4: Stress analysis view

Load apply assume is 10 kilogram equal to 98.1N. The result maximum stress can be load is 1.719e6 N at the holder of the tank and minimum stress can be load is 4.425e-2 N at base, place that bottom tank attach.

b) Displacement distribution result

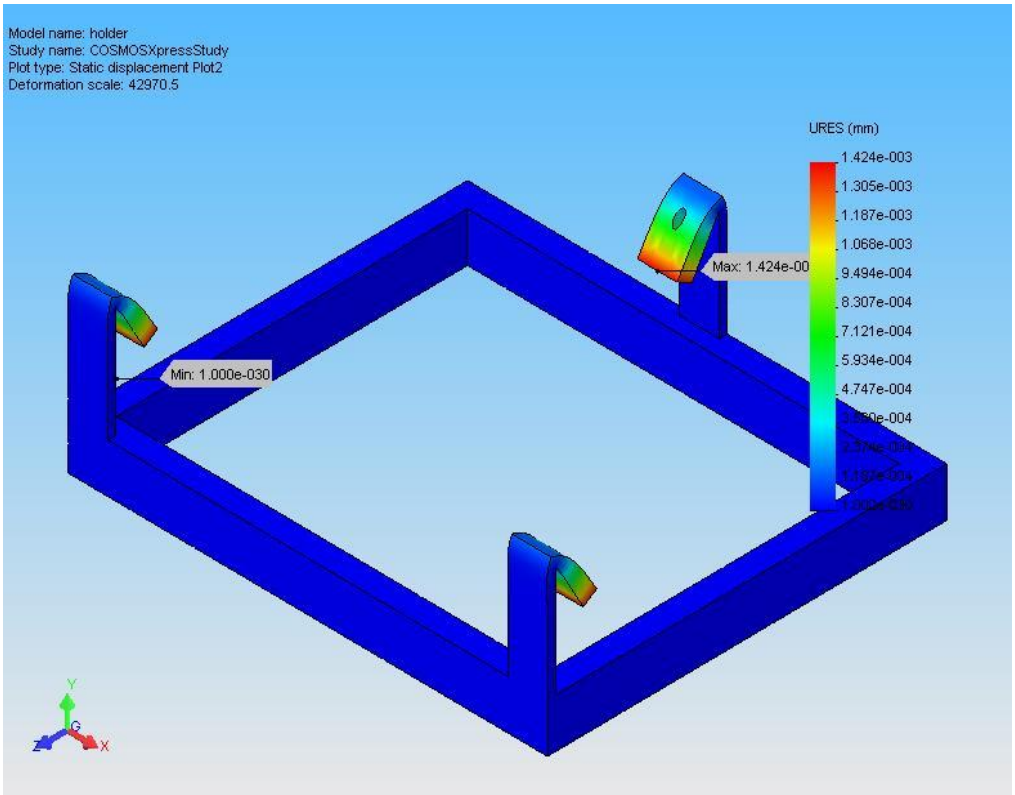


Figure 4.5: Displacement distribution result view

Load apply same like stress analysis, 10 kilogram equal to 98.1 N. The maximum displacement can be held 1.424e3 mm at point that orange colour at the figure and the minimum displacement is 1e-30 mm at the upright of the holder.

4.5 Material estimation

Table 4.3: Material estimation

No	Part	Picture	Quantity
1	Fuel tank		1
2	Pedals		3
3	steel		1(around 50mm)

4.6 Final product

Figure4.6: Pedals attachment view

Figure4.7: Fuel tank attachment view

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introductions

Whether this project achieves this target or not will be concluding, this chapter is to summarize the whole final year project. Even any unpredicted problems occur during processing project. Then, some recommendations needed for improvement when developing this project. There are future plan to make good additional for this system. Therefore knowledge and skills get be learned during this project especially in automotive field and that can be share with the public. This project also a good experience, expose mind to think widely and give more beneficial for own self.

5.2 Conclusion

The project objectives were achieved and the task absolutely done is the main important thing. The goal of the project objective is to design and modify brake pedal, fuel pedal, piping and fuel tank attachments for 1 Seater Drag Buggy. All the process has been done followed with step and states his project is completely finish and success even faced any problem and error when developing this project.

Figure 5.1: Speed Buggy Car

5.3 Recommendations

Some recommendations need to help improvement and make it mostly perfect. It is so useful for the development a project. It also will improve the performance the project .Below recommendations according this project:

a) Make earlier preparation before start make any process.
b) Uses tougher, light and well material.
c) Add a rib at the holder to make it harder.

5.4 Future Plan.

To improve this project for future, several plans should be states. Below future plan have suggested:

a) Design the own fuel tank for more suit with the car.
b) Uses pedals like go kart pattern for more easy.

REFERENCES

BOOKS

1. William H.Crouse and Donald L. Anglin. Automotive Mechanics Tenth Edition. Mc Graw Hill Publisher..
2. Ferdinand P. Beer and E. Rusell Johnston Jr. Vector Mechanics for Engineers: Statics Seventh Edition (2004). McGraw Hill Publisher.

WEBSITE

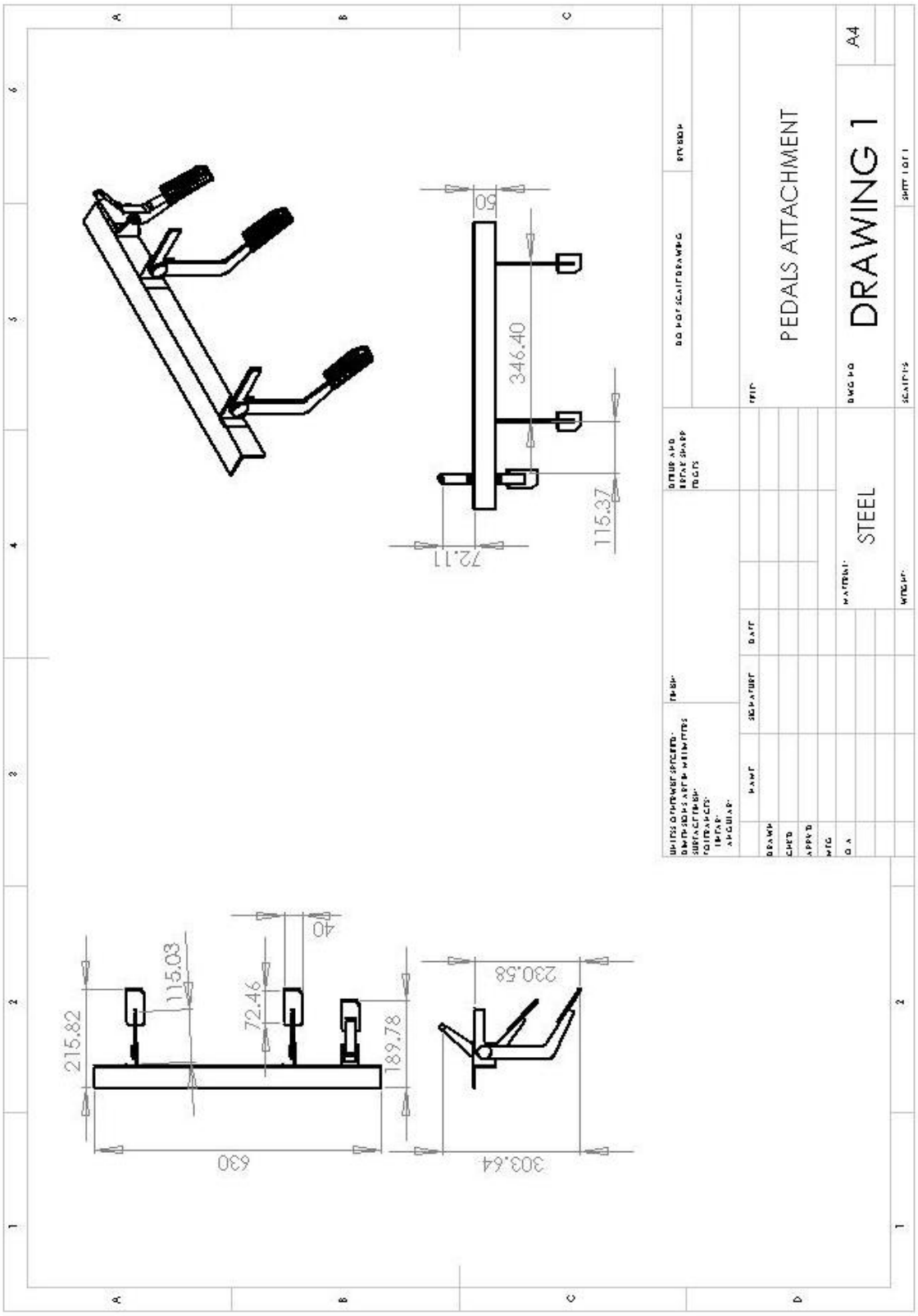
1. http://preprod.thrustmaster.com/thrustmaster/products
2. http://www.reenmachine.com /pedals2.jpg

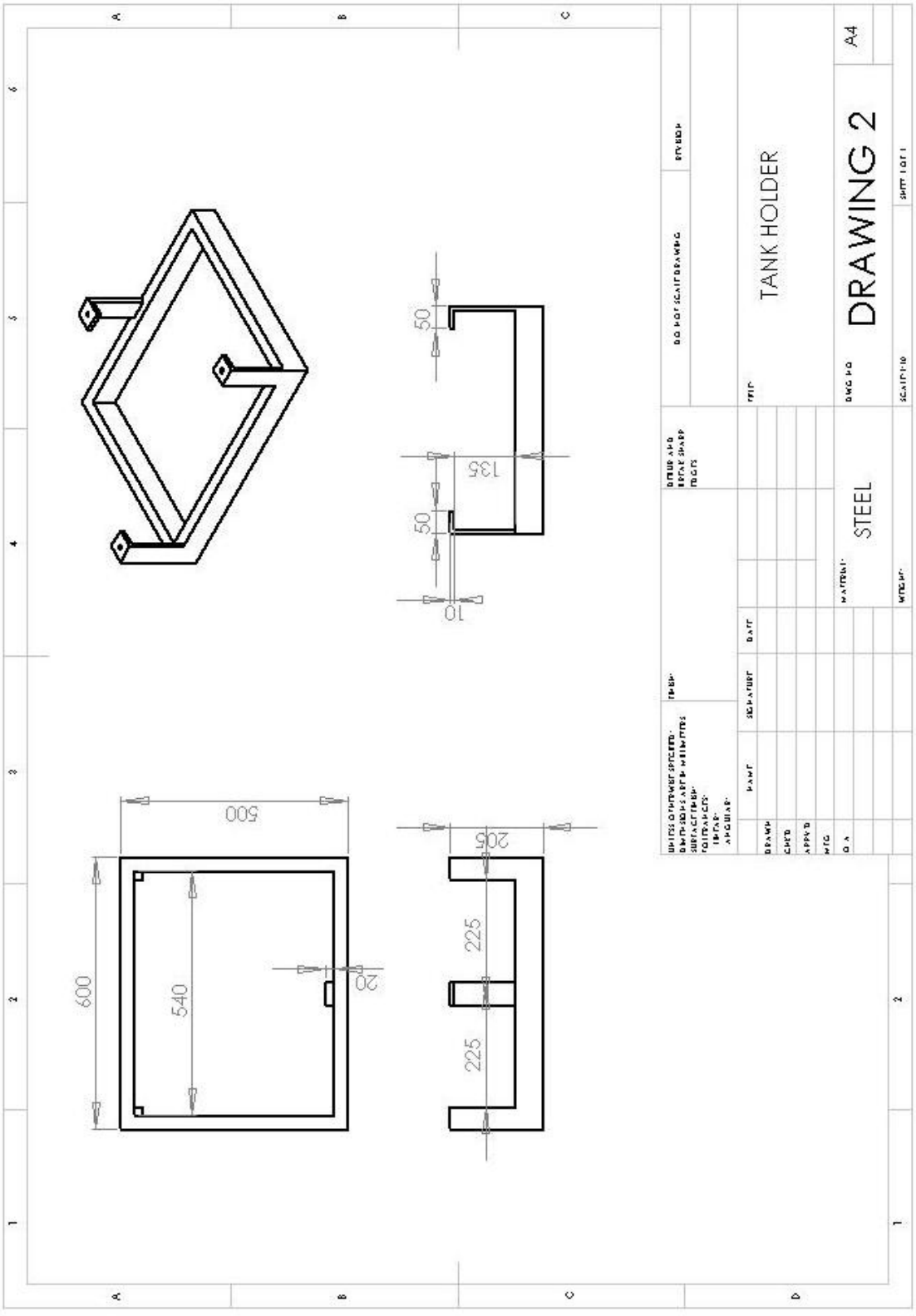
APPENDIX A

Gantt Chart

WEEK / TASK		1	2	3	4	5	6	7	8	9	10	11	12
Project selection from the PTA list project	Planned												
	Actual												
Develop idea for concept design	Planned												
	Actual												
Selection best ideas of the concept	Planned												
	Actual												
Selection material and process	Planned												
	Actual												
Detail design with the actual dimension	Planned												
	Actual												
Progress presentation	Planned												
	Actual												
Fabrication follow with the ideas that chosen one	Planned												
	Actual												
Report	Planned												
	Actual												
Presentation project	Planned												
	Actual												

APPENDIX B


PEDALS ATTACHMENT
DRAWING 1
STEEL
A4
346.40
115.37
72.11
50
215.82
115.03
72.46
40
189.78
630
230.58
303.64


50
135
50
10
500
600
540
20
205
225
225
STEEL
TANK HOLDER
DRAWING 2
A4