UNIVERSITI MALAYSIA PAHANG

BORANG PENGESAHAN STATUS TESIS ◆

JUDUL: DEVELON AND DESIGN SCHEMATIC DIAGRAM AND MECHANISM TRANSMISSION BUGGY ONE SEATER

SESI PENGAJIAN: 2008/2009

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DEVELOP AND DESIGN SHEMATIC DIAGRAM AND MECHANISM ON ONE SEATER DRAG BUGGY

MUHAMMAD IBRAHIM B MD NUJID

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

Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

NOVEMBER 2008

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: En Mohd Fazli B Ismail
Position: Instructor Engineer
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: Muhd Ibrahim B Md Nujid
ID Number: MB06053
Date:

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The lastly I want to acknowledge my sincere indebtedness and gratitude to my parent and siblings. I cannot find appropriate words that could properly describe for their devotion, support, faith my ability to attain my goal.

ABSTRACT

Development Buggy one seater is project continued from idea Mr Fazli and Mr Wong. The Buggy chassis is already finished by Mr faizul and I need upgrade or create transmission linkage the complete their system. Project need need to continue to make sure a Buggy finish until it can move and drive. The project also involves design and fabrication a rear engine transmission system by concerning the aspect the linkage, safety and don't bother any system. The gear transmission system need to fabricate to make sure is suitable for the system. Modifications are required to improve the system. With a new concept of the linkage and mechanism, the analysis needed to approve the design. Mostly, this project is required to develop the skills in fabrication, design and testing. Whole of this project is particular involves suitable system of design and fabrication for transmission linkage and mechanism for Buggy. Diploma final year project will allocate the one semester to complete a project. This project also required the adequate student to finish a task given. The task division need to apply, for the entirely three part will be make that is a development of auxiliary system, steering system and transmission linkage system.

ABSTRAK

Pembinaan Buggy ini adalah sambungan projek idea dari En Fazli dan En Wong. Rangka Buggy yang telah siap oleh En Faizul dan saya perlu menambah lagi untuk menyempurnakan sistem yang perlu ada pada sebuah buggy itu. Projek perlu diteruskan bagi memastikan buggy siap sehingga boleh bergerak dan dipandu. Projek ini juga melibatkan reka bentuk dan membuat sistem enjin transmisi belakang dengan tumpuan laluan kabel, keselmatan dan tidak mengganggu sistem lain. Di sini sistem transmisi perlu dibangunkan untuk memastikan ia sesuai dengan sistem. Untuk memperbaiki sistem yang ada, modifikasi diperlukan. Dengan adanya konsep laluan dan “mechanism”, analisis adalah untuk membuktikan reka bentuk yang telah dicipta. Secara keseluruhan projek ini adalah untuk membina kecekapan dalam mereka, membina dan menguji. Keseluruhan projek ini adalah adalah melibatkan meraka bentuk yang sesuai bagi sistem transmisi untuk buggy. Projek tahun akhir diploma ini mempunyai tempoh satu semester untuk disiapkan. Projek ini juga melibatkan tenaga pelajar seramai tiga orang untuk menyiapkannya. Di dalam projek ini, pembahagian tugasan di[erlukan. Secara keseluruhannya, projek ini dipecahkan kepada tiga bahagian iaitu sistem “auxiliary”, sistem transmisi dan sistem pengendalian.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

This project was supposed to make an Off-Road Buggy for plantation monitory such as FELDA Holding. It is design for off-road explore on plantation and extreme condition for any locations. After design fabrication has done, the buggy will be proposed to Felda Plantation (subsidiary of Felda Holding) as a collaboration project between university and government department. This project was divided into three major parts for PTA students to handle it under En. Mohd Fazli B Ismail as supervisor. The three major parts were steering system, auxiliary and transmission system for the buggy. This project is to modified and creates linkage transmission system for this buggy. Overall this project has required capability of design, knowledge and fabrication for each part in the system.

1.2 Problem Statements

The Mira engine is commonly used in front body of the chassis. But for this project, the position engine is placed at the rear chassis. So the system of transmission has change instead.

The problems statement in my parts is to create linkage transmission for the buggy that use rear engine. This project must have to solve it how the linkage from rear engine can get through to pedal acceleration, brake and clutch. The linkage that creates must not bother to any system and attach the cable from rear engine. Also these projects have

modified the 5 speed shift tick that has produce by supervisor. And now that another problem has been recognize are that extent cable create not be function. Example when cable is pull all extent cable follow but when cable is push it is do not work include the extent.

Figure 1.1: Engine at the front chassis Mira

Figure 1.2: Engine at the Rear chassis Buggy

1.3 Project Objective

The project objective is:-

a) Develop a new schematic diagram plan
b) Fabrication of transmission linkage system
c) Develop and design a Mechanism

1.4 Scope

Scopes will be discussed on subject in the Industrial Design

1) Investigation of Problem
   - In this process, the buggy have must ensure that problems.
   - Identifying latent or hidden problem at transmission for buggy.

2) Set target specifications
   - Based on transmission buggy problem and rear engine condition and position.
   - Developed flow chart.
   - Set ideal and acceptable values.

3) Conceptualization.
   - In this process, this project will concentrate creating the schematic diagram plan.
   - This project will make simple sketches known as thumbnail sketches of each concept.
   - This project also design and develop Mechanism and do analysis for the mechanism.

1.5 Project Flow Chart

This flow chart and Gantt chart that use for the set up this project from start I get this project till finish the project. This Gantt chart referred at appendix

FLOW CHART

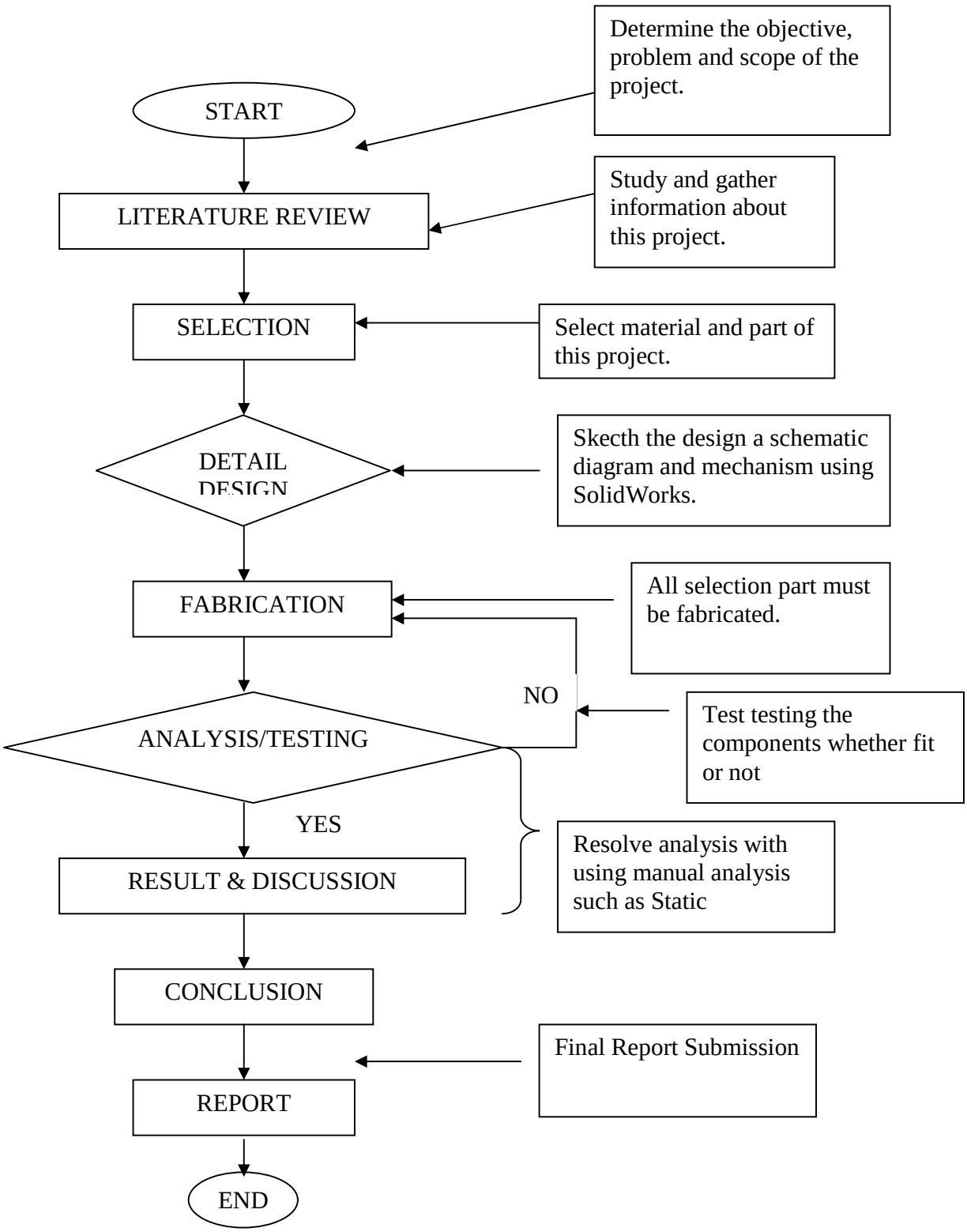


Figure 1.3: The project planning for Buggy linkage transmission.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

A dune buggy is a recreational vehicle with large wheels, and wide tires, designed for use on sand dunes or beaches. The design is usually a modified vehicle with a modified engine mounted on an open chassis. The modifications usually attempt to increase the power to weight ratio by either lightening the vehicle or increasing engine power or both. They are also often referred to as air buggies, and those with an open frame chassis are called sandrails.

A similar, more recent generation of off road vehicle, often similar in appearance to a sand rail but designed for different use, is the "off road go kart". The difference between a *dune* buggy or go kart and an "off road" buggy or kart is sometimes nothing more than the type of tires fitted -sand tires or all terrain tires - but "off road" go karts and buggies are a rapidly developing category of their own. [1]

2.2 Rear-Engine Transmission System

In automobile design, a rear-engine design layout places both the engine and drive wheels at the rear of the vehicle. The center of gravity of the engine itself is actually past the rear axle. This is not to be confused with the center of gravity of the whole vehicle, as an imbalance of such proportions would make it impossible to keep the front wheels on the ground.

Rear engined cars are almost always rear wheel drive, a layout known as RR. The exception is certain high performance four wheel drive models from Porsche.

This layout is typically chosen for three reasons, packaging, traction, and ease of manufacture:

- Since the engine is located at an extremity, the rest of the vehicle can be used for passengers and luggage
- Having the engine located over the driven wheels increase downward pressure which is helpful for grip on loose surfaces
- The drivetrain can be assembled as a unit and installed easily at the factory -easier than a FF layout where the driven wheels also steer the car

The disadvantage of the rear engine configuration is that placing the engine outside the wheelbase creates significant problems for car handling as, when the car begins to slide on a corner, the end of the car will tend to want to swing wide and overtake the front — especially under braking. This tendency is referred to as oversteer and creates potential safety issues both for ordinary drivers, and even in racing applications. There are also occasions where expert drivers find such behavior desirable in drifting, a motorsport based on intentional oversteer. Details on the handling characteristics of rear engined cars were prominently featured in the 1965 book Unsafe at Any Speed.

In addition, even though the rear wheels benefit from the additional traction the added weight of the engine gives, the front wheels still need traction in order to steer the car effectively. For this reason, a rear engined car can also be prone to understeer.

Most manufacturers have abandoned the rear engined layout apart from Porsche who has gradually developed their design with improvements to the suspension as well as electronic aids to reduce the shortcomings of the layout to acceptable levels.

On the De Lorean, to compensate for the uneven (35/65) weight distribution caused by the rear-mounted engine, the car had rear wheels with a diameter slightly greater than the front wheels. [2]

Figure 2.1: Example Rear-Engine at the Car

Source: www.ritzsite.demon.nl

2.3 Automatic Transmission

An **automatic transmission** (commonly "AT" or "Auto") is an automobile gearbox that can change gear ratios automatically as the vehicle moves, freeing the driver from having to shift gears manually. Similar but larger devices are also used for heavy-duty commercial and industrial vehicles and equipment.

Most automatic transmissions have a set selection of possible gear ranges, often with a parking pawl feature that will lock the output shaft of the transmission. Continuously variable transmissions (CVTs) can change the ratios over a range rather than between set gear ratios. CVTs have been used for decades in two-wheeled scooters but have seen limited use in a few automobile models. Recently, however, CVT technology has gained greater acceptance among manufacturers and customers.

Some machines with limited speed ranges or fixed engine speeds, such as some forklift trucks and lawn mowers, only use a torque converter to provide a variable gearing of the engine to the wheels. [3]

If you have ever driven a car with an automatic transmission, then you know that there are two big differences between an automatic transmission and a manual transmission:

- There is no clutch pedal in an automatic transmission car.
- There is no gear shift in an automatic transmission car. Once you put the transmission into **drive**, everything else is automatic.

Both the automatic transmission (plus its torque converter) and a manual transmission (with its clutch) accomplish exactly the same thing, but they do it in totally different ways. It turns out that the way an automatic transmission does it is absolutely amazing!

In this article, we'll work our way through an automatic transmission. We'll start with the key to the whole system: planetary gearsets. Then we'll see how the transmission is put together, learn how the controls work and discuss some of the intricacies involved in controlling a transmission.

Just like that of a manual transmission, the automatic transmission's primary job is to allow the engine to operate in its narrow range of speeds while providing a wide range of output speeds.

Without a transmission, cars would be limited to one gear ratio, and that ratio would have to be selected to allow the car to travel at the desired top speed. If you wanted a top speed of 80 mph, then the gear ratio would be similar to third gear in most manual transmission cars.

Probably never tried driving a manual transmission car using only third gear. If you did, you'd quickly find out that you had almost no acceleration when starting out, and at high speeds, the engine would be screaming along near the red-line. A car like this would wear out very quickly and would be nearly undriveable.

So the transmission uses gears to make more effective use of the engine's torque, and to keep the engine operating at an appropriate speed.

The key difference between a manual and an automatic transmission is that the manual transmission locks and unlocks different sets of gears to the output shaft to achieve the various gear ratios, while in an automatic transmission, the same set of gears produces all of the different gear ratios. The planetary gearset is the device that makes this possible in an automatic transmission. [4]

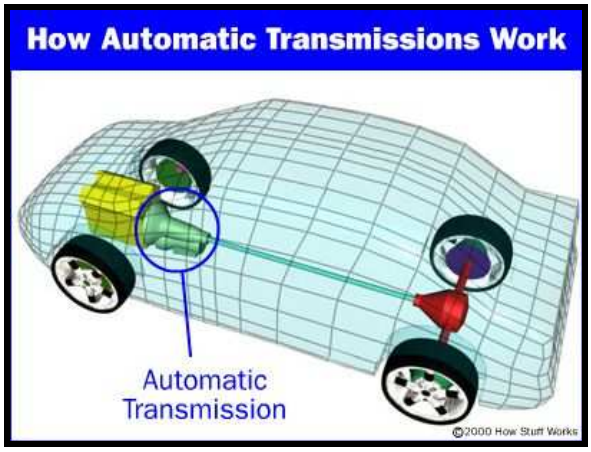


Figure 2.2: Location of the Automatic Transmission

Source: http://auto.howstuffworks.com/automatic-transmission.htm

2.4 Component

a) Engine

- An engine whose purpose is to produce kinetic energy output from a fuel source is called a prime mover
- A motor is a device which produces kinetic energy from a preprocessed "fuel" (such as electricity, a flow of hydraulic fluid or compressed air). [5]

Figure 2.3: Example Mercedes V6 Engine in 1996

Source: http://en.wikipedia.org/wiki/Engine

b) Gear shift stick

- In most modern passenger cars, gears are selected through a lever attached to the floor of the automobile—this selector is often called a gear stick, gear lever, gear selector, or simply 'shifter'. [6]

Figure 2.4: Example 5 Speed Shift Stick of a 1999 Mazda Protege

Source: http://en.wikipedia.org/wiki/Manual_transmission

c) Cable

- A flexible metal or glass wire or group of wires. All cables used in electronics are insulated with a material such as plastic or rubber. [7]

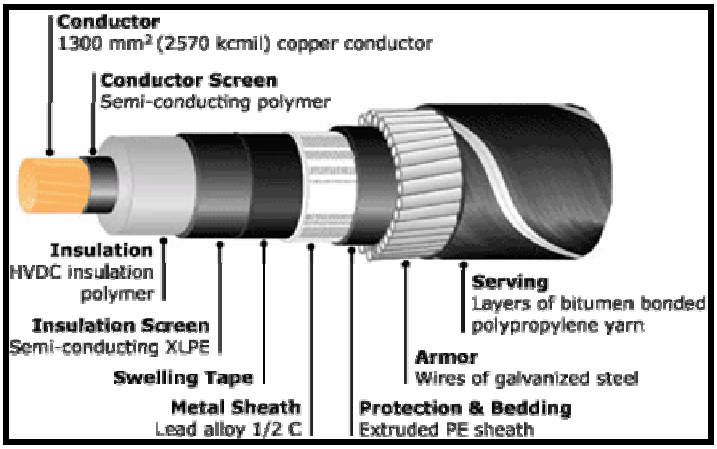


Figure 2.5: Example of Cable

Source: source: www.crosssoundcable.com

CHAPTER 3

PROJECT METHODOLOGY

3.1 Project Flow

Methodology is the method that used from early project develops until the end product release. It consist several stage of conducting this whole project. This flow will explain detail about each step of **Industrial Design Method** in developing new product that will achieve the required specification.

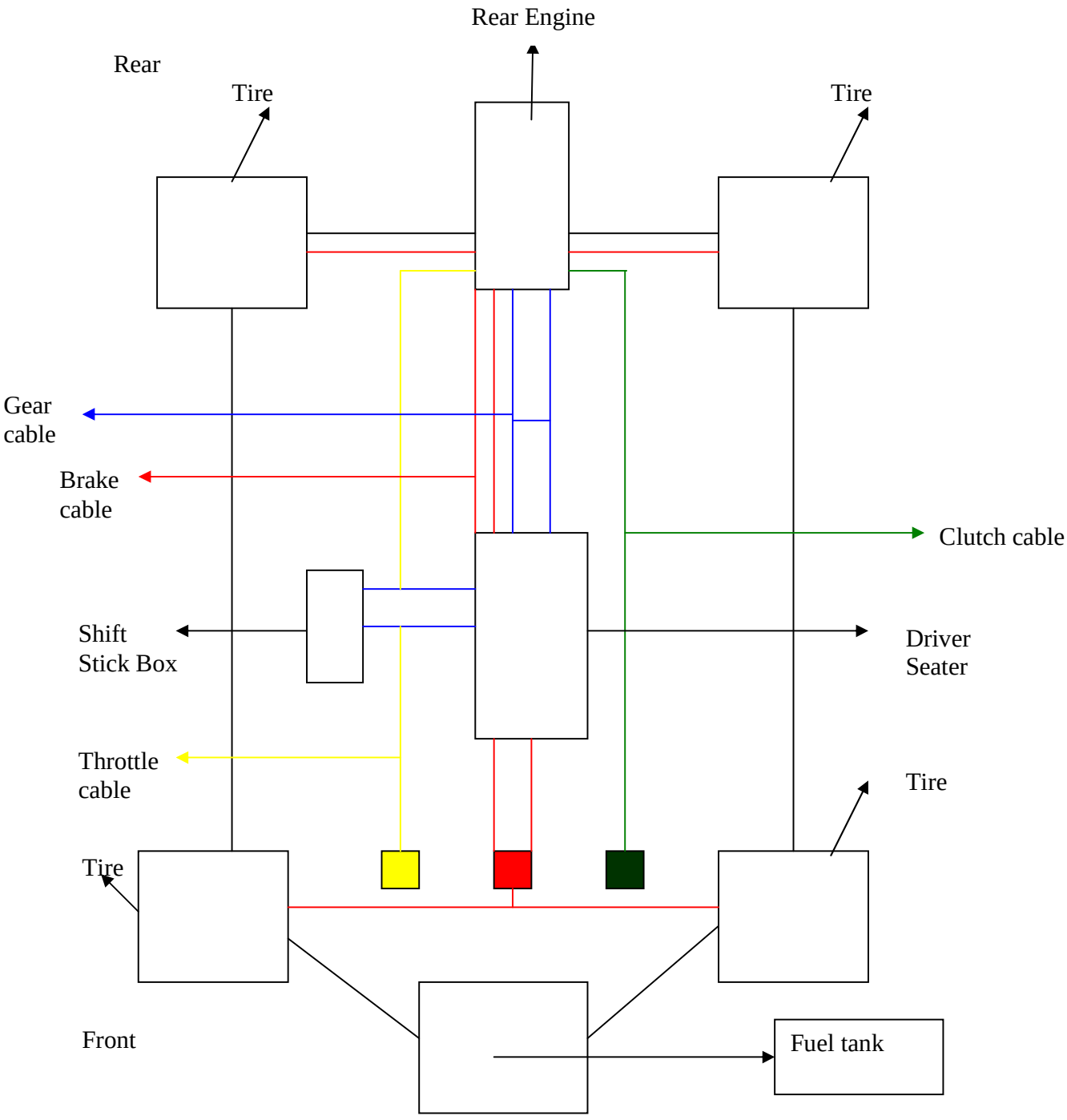
3.1.1 Problem and Part Studies

This is the first step of the flow. Which is the project had to identify the problems in the system and list down the causes of the problems. This also have to studies each part in the steering system to gain more knowledge and understanding the principal of each component.

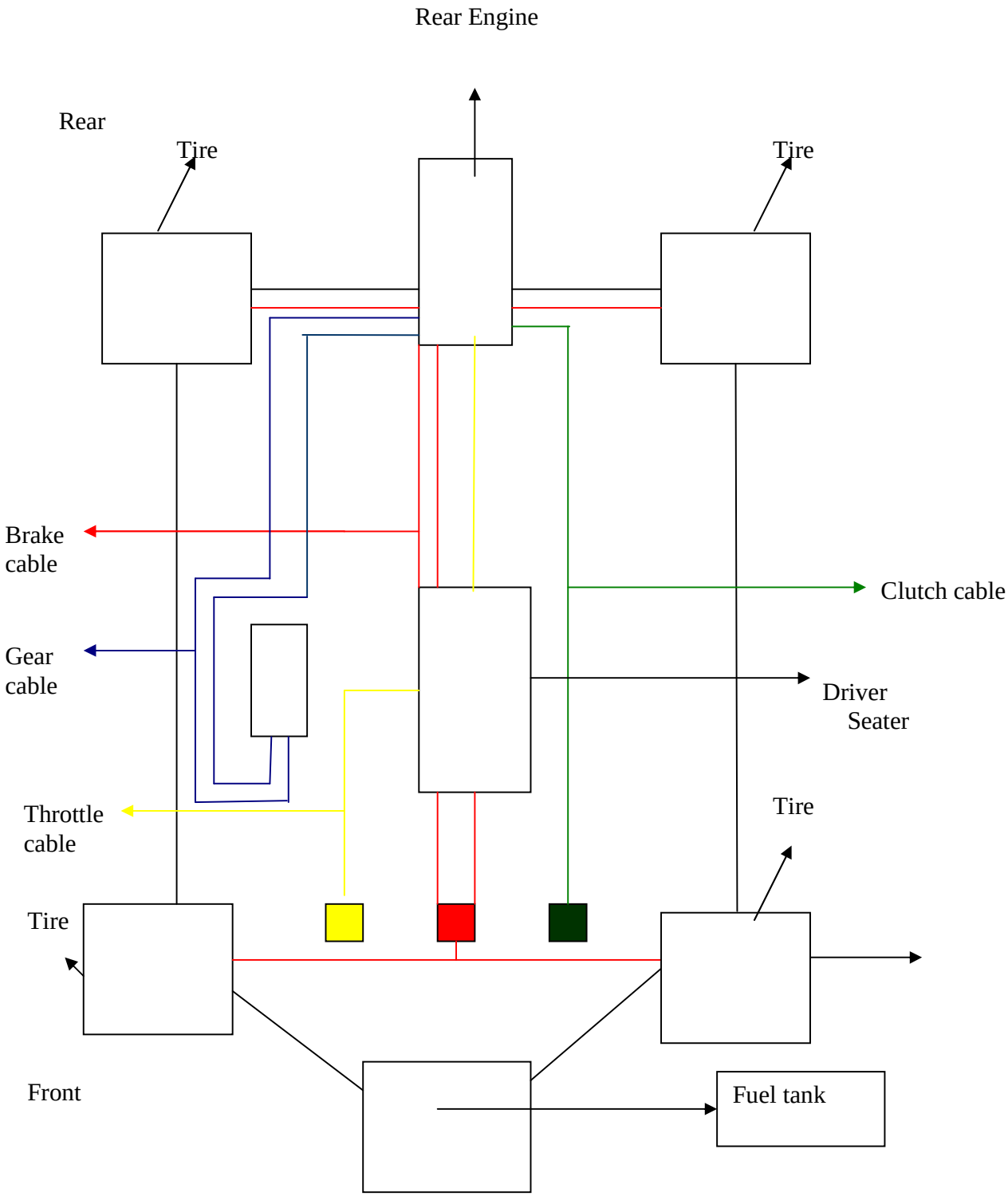
3.1.2 Designing Linkage Concept and Selection of Best Concept

This stage will need a lot of new concept to help in development of the best concept. This is because the concepts that develop from sketch are being compared by several aspects such as size, strength, material and ergonomic.

Concept A


Rear Engine
Rear
Tire
Tire
Gear
cable
Brake
cable
Clutch cable
Shift
Stick Box
Driver
Seater
Throttle
cable
Tire
Tire
Front
Fuel tank

Concept B


Rear Engine
Rear
Tire
Tire
Brake
cable
Clutch cable
Gear
cable
Driver
Seater
Throttle
cable
Tire
Tire
Front
Fuel tank

Concept C

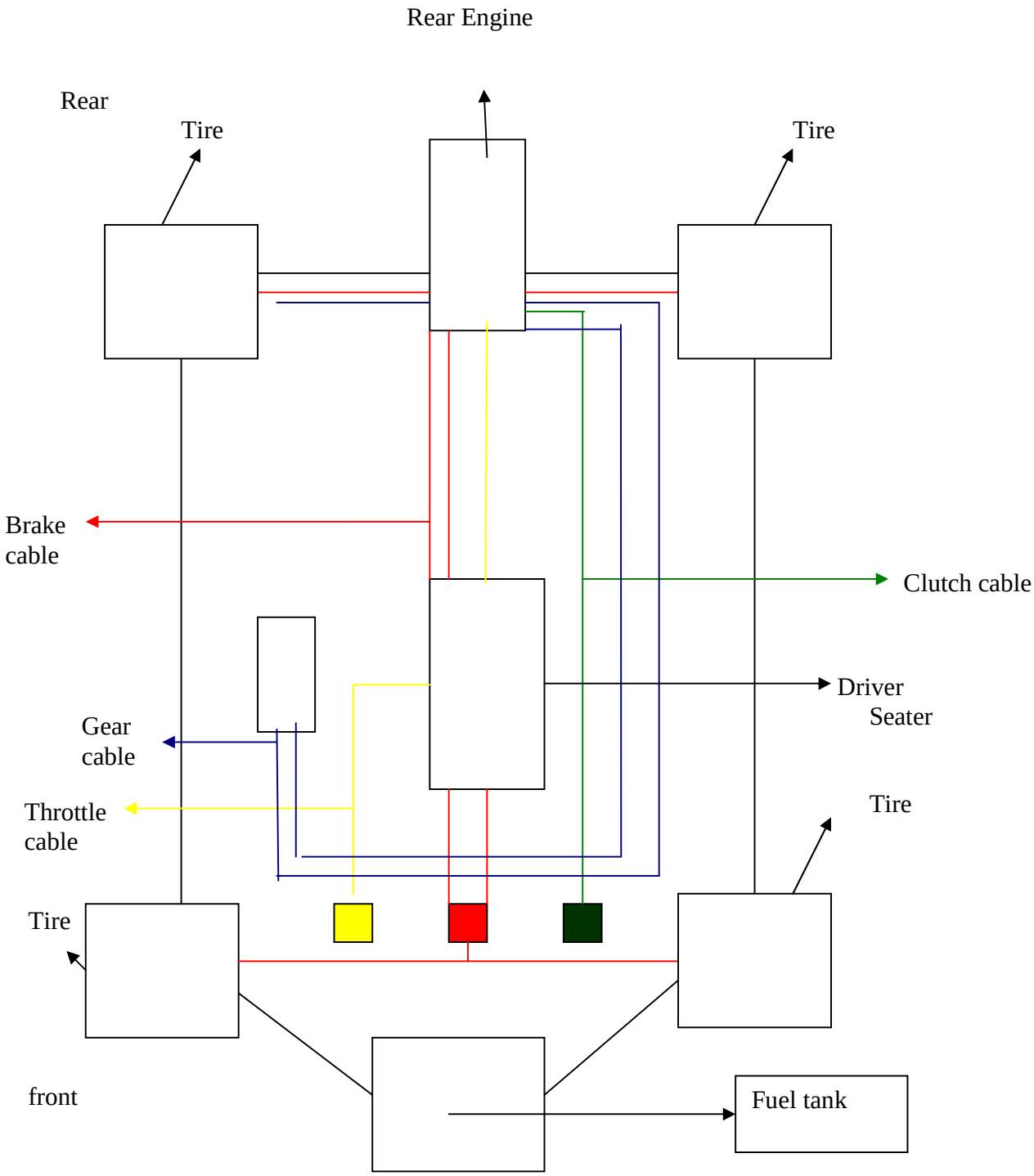

Rear Engine
Rear
Tire
Tire
Brake
cable
Clutch cable
Driver
Seater
Gear
cable
Throttle
cable
Tire
Tire
front
Fuel tank

Table 3.1: Advantage and Disadvantage Each Concept

Concepts	**Advantages**	**Disadvantage**
A	• Cost of manufacturing • Cost of maintenance • user friendly • less risk of damage exposure	• -design of position of model component are limited due to short cable • wire easily crash when accident
B	• Arrangement location	• higher risk of cable cut due to larger coverage area of cable placement on vehicle body
C	• More organize cable design	• all cable are at risk of being cut if an impact hits the cable placement body part

3.1.2.2 Concept Generation and Evaluation

Three concepts for the linkage were developed. The table below shows the evaluated against with the Pugh concept selection.

Table 3.2: Table Pugh concept

	Concept			
Selection of criteria	Concept A	Concept B	Concept C	Rear engine linkage
Ease of Maintenance	+	+	+	0
Ease of use	+	+	+	0
Handling	0	0	0	0
Power	+	+	-	0
Length	0	+	+	0
Ease to manufacture	+	-	+	0
Efficiency	+	-	+	0
Quantity of material	-	-	-	0
Strength	+	0	0	0
Pluses	6	4	5	
Same	2	2	2	
Minus	1	3	2	
Net	5	1	3	
Rank	1	3	2	

Notes:

+ = Better than - = Worse than 0 = Same as

Criteria	Concept 1	Concept 2	Concept 3	Final Concept
Lightweight	1	1	1	Concept 3
Cable strength	4	1	2	Concept 1
Variety of gear speed	4	2	3	Concept 1
Ease to manufacture	4	1	3	Concept 1
Easy to handling	4	2	1	Concept 1
Easy to use	5	3	4	Concept 1
Quantity of material	2	3	4	Concept 3
The material cost	2	4	3	Concept 2
Power and efficiency	4	2	3	Concept 1
Strength	3	4	2	Concept 2

Table 3.3: Table Metric Concept

Concept A is selected as the best concept linkage because is fulfill the required specification such as:-

- This location is suitable for mechanism for transmission
- Size which is suitable

3.1.3 Designing Mechanism

After connection all the extend cable didn't work, this project must recognize other concept which is create a new mechanism. In this stage the designing create using 3D Solidworks drawing and analyze using cosmos software to determine that mechanism that creates is suitable for this project.

3.1.3.1 Final Assemble Drawings

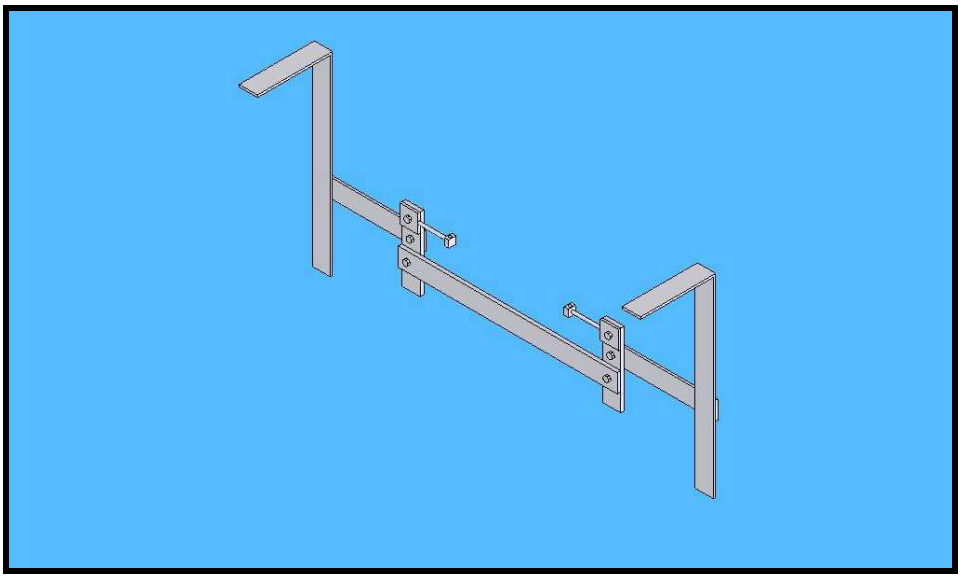


FIGURE 3.1: Mechanism Assemble View

This mechanism is connected from Engine transmission from back to Shift tick gear box. This function is allowing movement mechanism from rear engine transmission.

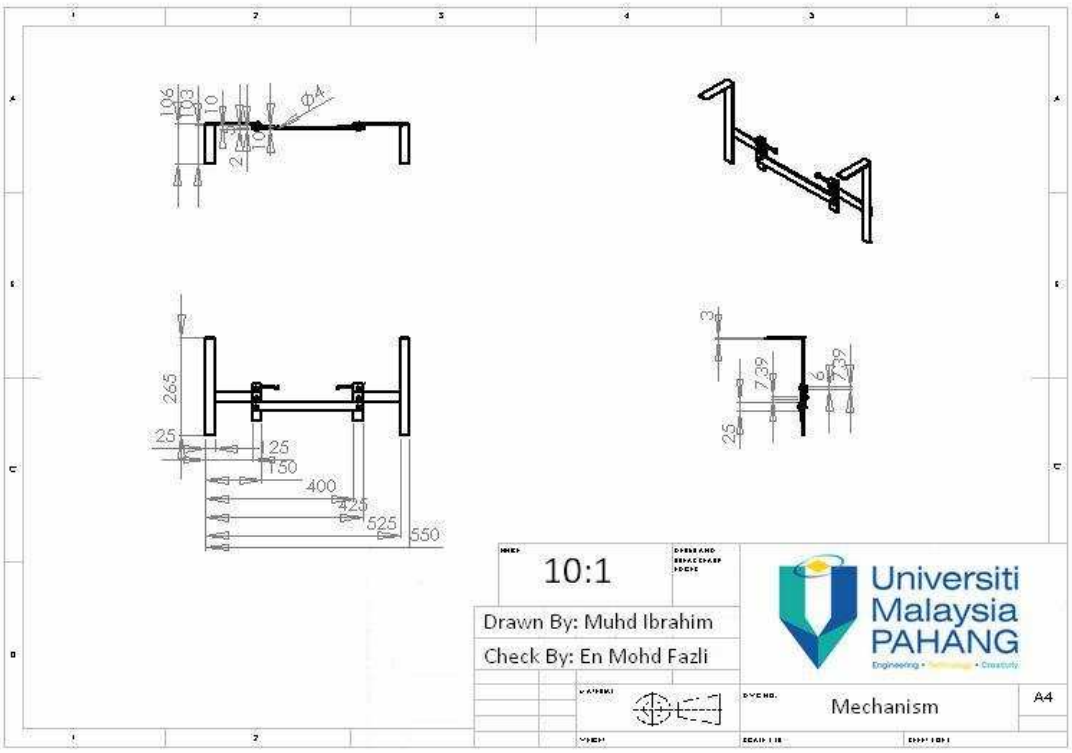


Figure 3.2: Technical Drawing Assemble View

3.1.4 Fabrication and Modification

In this stage I have to start fabricate the extent shift tick gear, cable and something that can attach cable from rear-engine the finalize concept using the selected materials.

3.2 Flow Fabrication Process

3.2.1 Type of Fabrication

This type of fabrication is consists that all the parts have design before by following all the dimension using various type of manufacturing process. These types of process are:-

a) Measuring and Making

The fabrication process is start with measuring and making the material into dimension needed.

b) Cutting Process

In this process the material needed have cut according to its length and cut again to get the length needed. This process is done using disc cutter.

Figure 3.3: Cutting Process

c) Drilling Process

This process progress is when the material has been measured and marking to drill. The hole position is measured and mark using equipment like steel ruler and steel marker. After marking the hole position, the centers of the hole is mark using hand center drill and hammer and after the holes has marked, the holes now ready to be drill.

Drilling process is done by using hand drill. The drilling process used two sized of drill bit. Firstly, small drill bit size 3 mm is used to drill all the position. This is because to reduce center positioned error while drilling. After the holes are drilled, the holes drill again using the size of drill bit 6mm. the drilling process ended when all the holes are drilled.

Figure 3.4: Drilling Process

d) Welding Process

The welding process is dangerous process and need a skilful to perform this process and student must put safety first priority. When do welding, must wear shield protection to avoid firework and lightning from welding.

Figure 3.5: Welding Process

3.3 Selecting Material Used For This Project

Material for fabrication is important to decide. In this project the material that are use are:-

a) Aluminum

b) Stainless steel

Aluminums

- Very light weight.
- Naturally generates a protective oxide coating and is highly corrosion resistant.
- 100 percent recyclable with no downgrading of its qualities.

Stainless steel

- Remarkable versatile material with many applications.
- yield strength is a very low proportion of the tensile strength
- Strength.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Rear Engine Cable Linkage Concept Problems

Initially, this project is to create a system of linkage transmission but unfortunately the system did not function like how it should be according to the theory. This is due to the cabling problem. This problem occurs when few cables were connected with each other to create one cable and the result is when the cable is extended it works well but when it's retracted the connection of the cables did not function properly thus making the retracting fail.

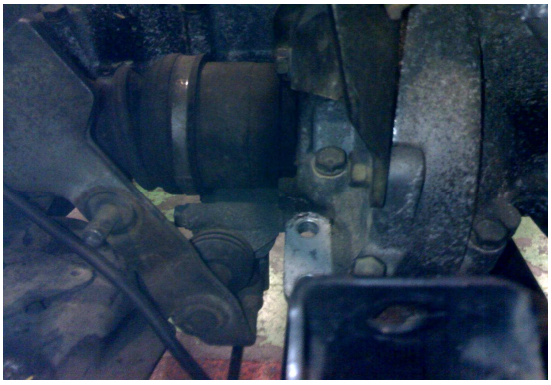


Figure 4.1: Before Attach the Cable at Gearbox

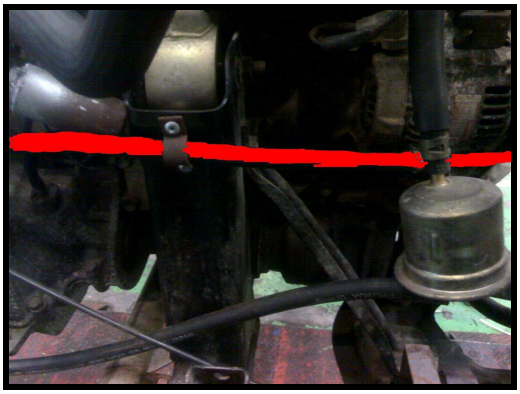


Figure 4.2: Red Color is
Passage Cable from Gearbox

The extension cable may cause a bit problem in this linkage but the only method for this project is to attach cable from rear side. The other linkage method will cause failure to the gear system.

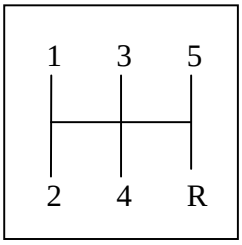


Figure 4.3: Position Gear at Shift Stick

The problem is when change a gear, that gear cannot function because all the extend cable that create cannot support. Example when change speed gear from neutral to gear one. It take time so long to resolve and finally at week 11 decided to create mechanism.

4.1.1 Component Parts

The components parts include the actual parts and modified parts at the buggy.

Table 4.1: Actual Parts

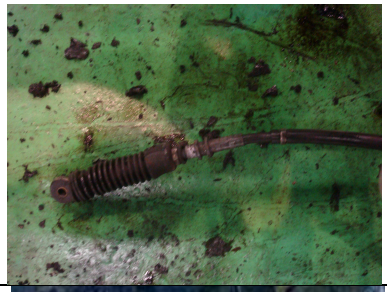
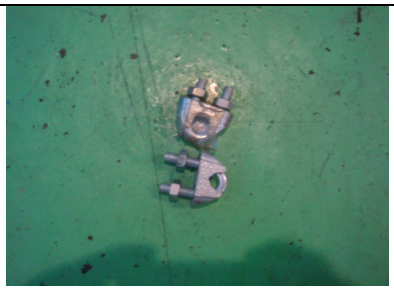
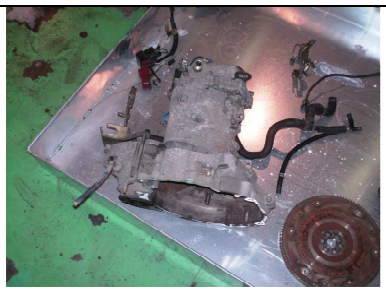
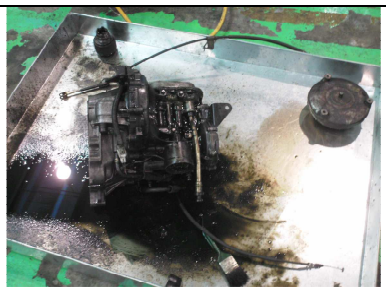
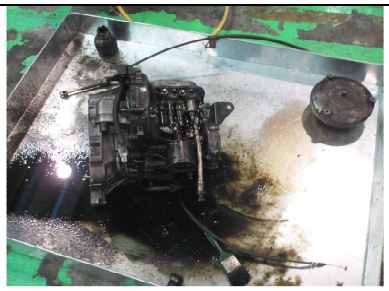
No	Parts	Description
1		Shift Stick Gear at Kancil Car
2		Cable Gear
3		Position at the rear engine gear

Table 4.2: Modified Parts

No	Parts	Description
1		The shift stick gear had modified to extend.
2		The real cable had used when to extend a cable.
3		The other cable use to extend from real cable.
4		Bracket is use to attach real cable and cable to extend.

4.1.2 Part Convert Manual Transmission To Automatic Transmission

Table 4.3: Parts Convert Transmission

No	Manual Transmission Parts	Automatic Transmission Parts	Description
1			The 2 picture shown gearbox manual and automatic
2			All Component parts to gather in one compartment
3			Engine has all ready convert from manual to automatic transmission

4.2 Result and Discussion

4.2.1 Mechanism Analysis

The main purpose that mechanism creates is function gear transmission from rear-engine and that mechanism can move either front or back. This mechanism had create at week 10 because the extend cable did not work and did not have the time. It is function with movement and attach from shift stick gear to gearbox.

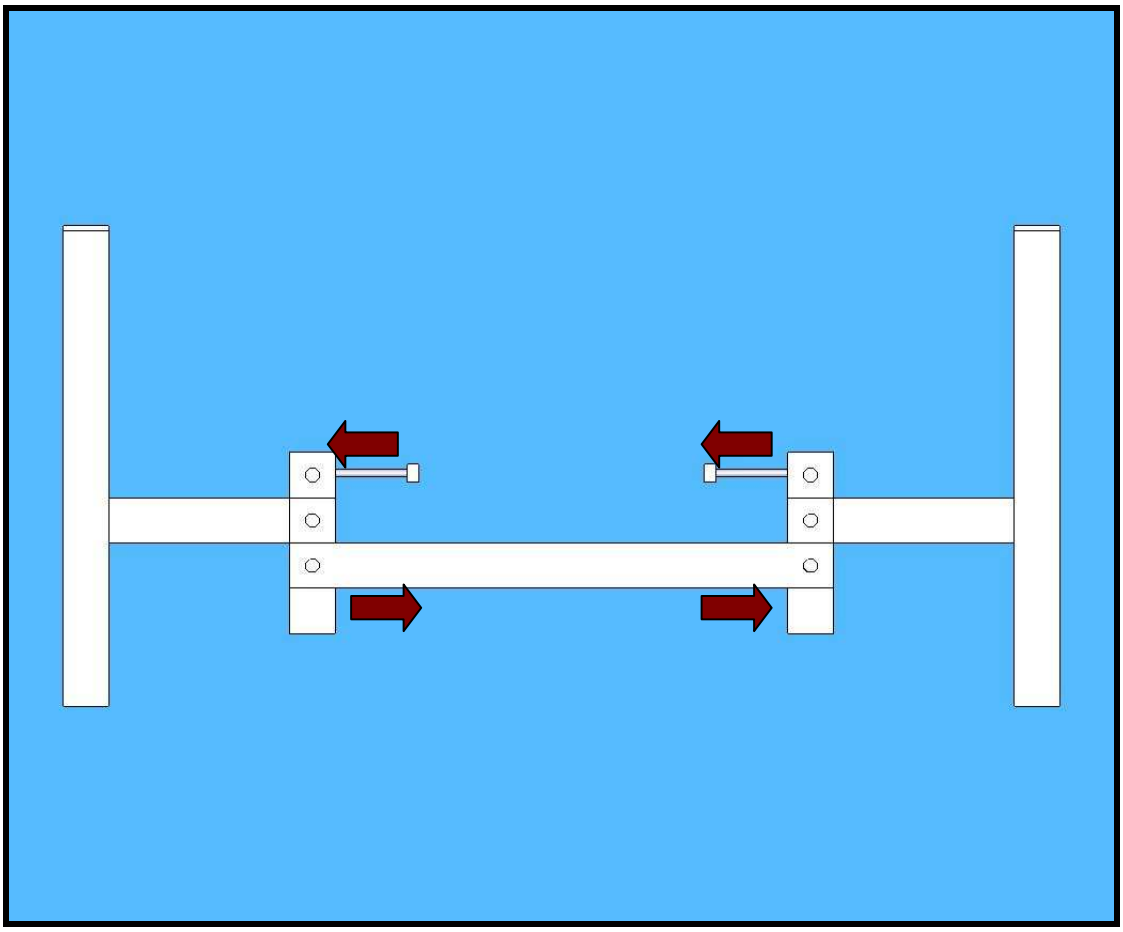


Figure 4.4: This Picture shown that Movement that Mechanism

Calculation

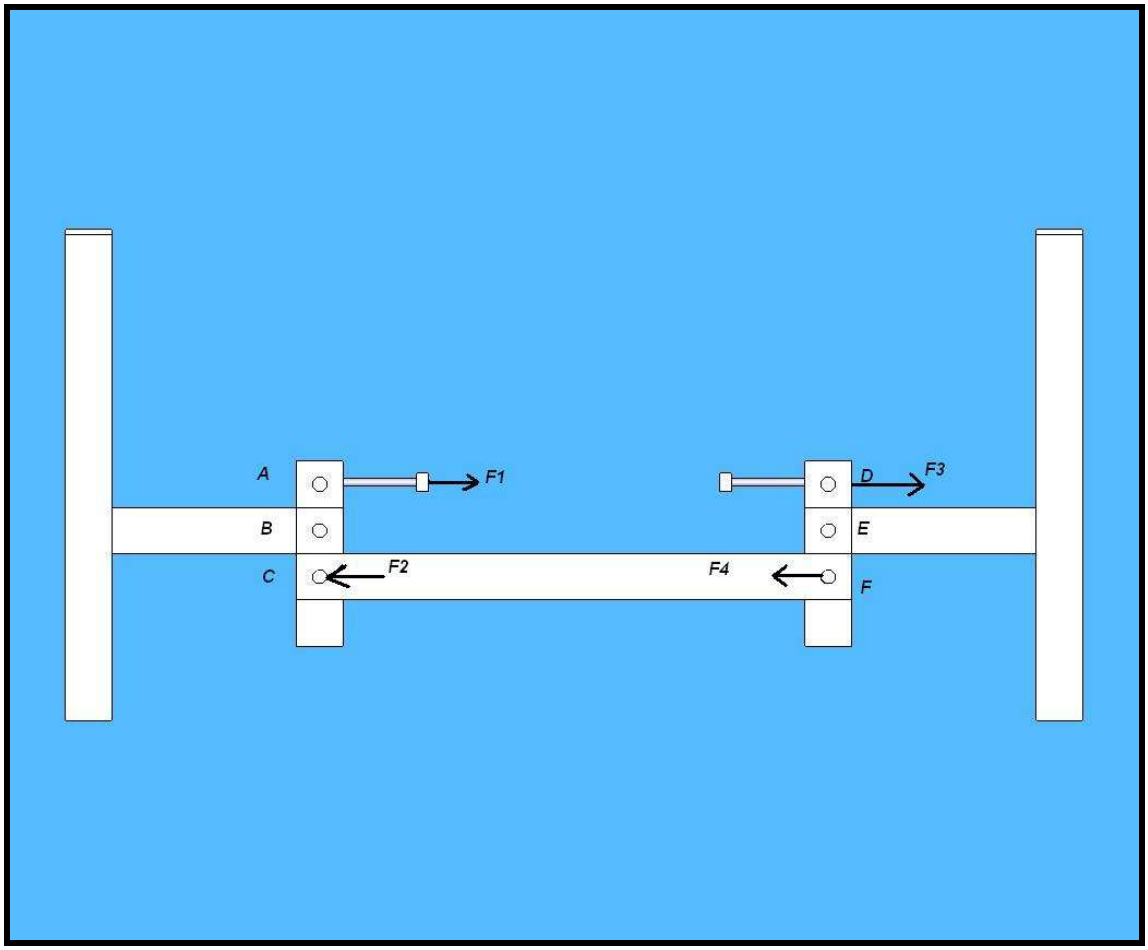
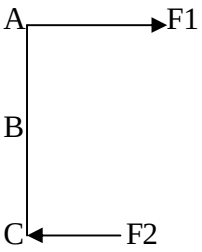


Figure 4.5: Force Each Movement

Free body diagram

Rear



Assume force for shift stick press and movement F1 is 1/2 weight, weight assume 60kg.so, that's force

F1 is 30 N and try finding F2.

AB=30mm@0.03m

BC=33mm@0.033m

Resolve

↷

∑MB+=0

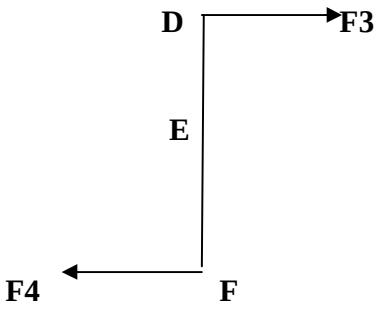
30N (0.03m) +F2 (0.033m) =0

0.9N=-F2 (0.033M)

0.9⁄0.033=-F2

F2=-27.27N

Front



When force F3 is moving at front and F4 moving back. Now want calculate how much force at F4?

F2=F3=27.27N

Assume that F3 is positive

DE=60mm@0.06m

EF=40mm@0.04m

Resolve

∑ME+=0

27.27N (0.06m) + F4 (0.04m) = 0

1.6362Nm= -F4 (0.04m)

1.6362/0.04 = -F4

F4= -40.91N

4.2.2 Design Dimension

When design mechanism 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.

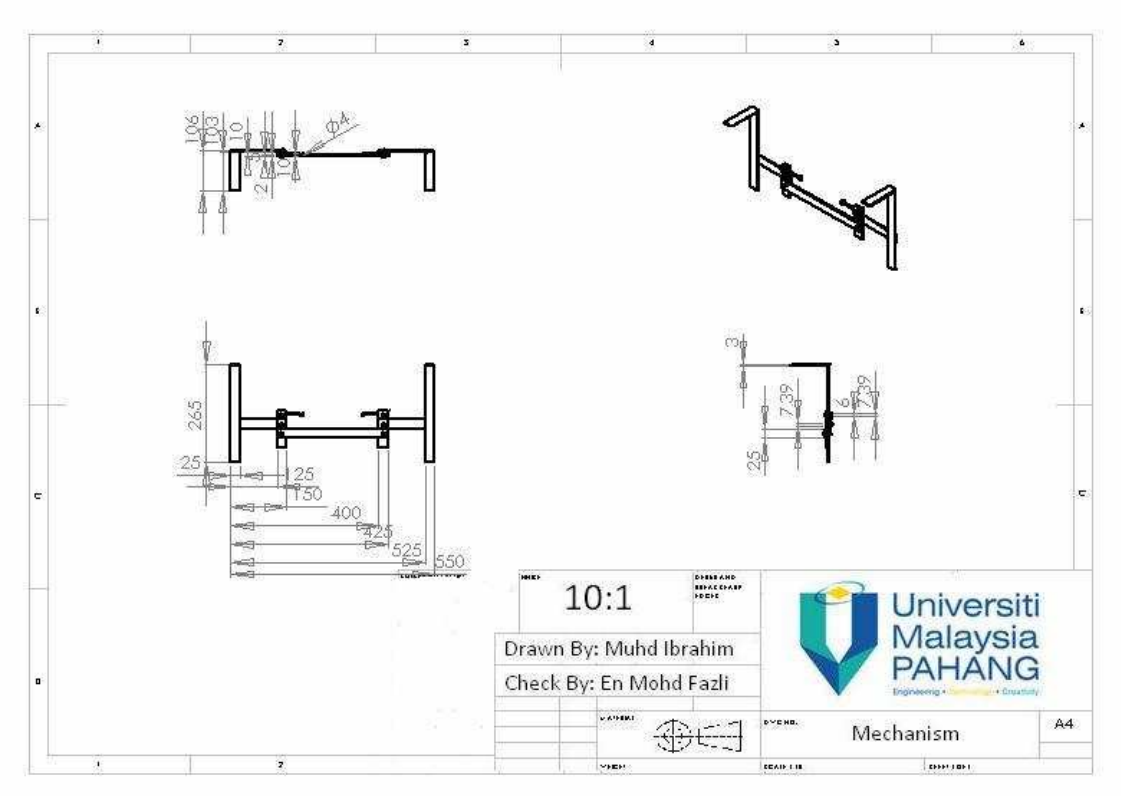


Figure 4.6: Mechanism Dimension Each View

4.2.3 Fabrication Needs

This mechanism must have several specific criteria such as high strength, light weight and do not damage when apply force. To achieve the specification needs material select is suitable on mechanism and have characteristics.

4.2.4 Final Product of Linkage

Figure 4.7: Full Fabrication

This final mechanism had modified against before one day before presentation so that mechanism attached to ground or off road.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTORODUCTION

For this chapter, a summary of this project is being established to conclude the whole project. There will also be recommendations for future project with similar objective, scope, and methodology in order to improve and gain a lot more precise result Therefore, a more complete understanding and enhanced application steps can be attained with industrial design method such as developing concepts and selected best concepts using Pugh analysis and metric. Simple analysis had done by calculating potential moment occur.

5.2 Conclusion

Generally it can be concluded that this project has reached its objective which is to develop a new schematic diagram plan, fabrication of transmission linkage system and develop and design a mechanism. In the development of a new schematic diagram plan, this project has came out with 3 concepts base on rear engine transmission and the best was using industrial design method which is Pugh analysis and metric. In the fabrication of transmission linkage system took for about 1 month.

5.3 Problem Faced During The Project

A lot major and minor problem faced during this project from beginning until end the project. The first problem is how to create that linkage the transmission stage because not knowledge about the car and the linkage. The second problem is happen during fabrication stage. The problem is about the cable because is very difficult to find long cable and not easily cut. Firstly fabrication, this project is used extend cable and using bracket to attach extend cable, so even get finish the fabrication the function did not work an did not practical to use. Theoretically the transmissions system should have worked but the fabrication result generate an error due to cabling problem and some other minor problems.

5.4 Recommendation

Several recommendations that need to express in improvement and good performance for the future final year project are:

- Time need to spend more.
- The specific planning should be confirmed first before the project started.
- The material need already prepares before started the project.
- If uses automatic transmission is easy because only have one cable.
- T-plate beam is suggested in the next project use in fabrication. .
- The middle of mechanism front and rear must use suitable material.

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APPENDIX

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 have been choose	Planned												
	Actual												
Report	Planned												
	Actual												
Presentation project	Planned												
	Actual												