NDS17

by [redacted]

Institution of MECHANICAL ENGINEERS

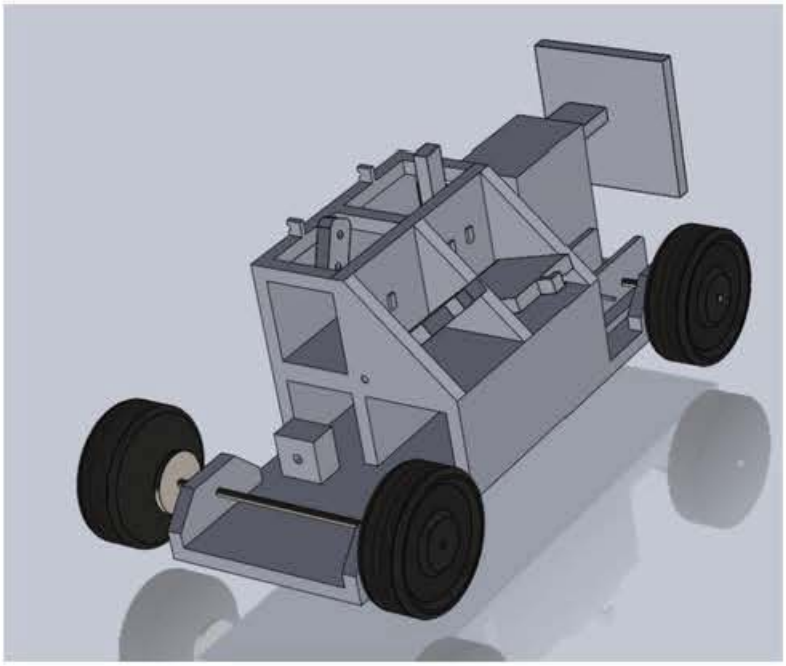
Kingston University London

Faculty of SEC

School of Mechanical and Automotive Engineering

Module No	Module title	Module leader
ME4013	Engineering Design, Materials and Manufacture	J Garcia
Assignment Title:	DMT: IMechE Design Challenge – Group Report and Logbook	

Group Name	Ndes 17



Group Members	
KU ID	Name

Contents

Contribution lists

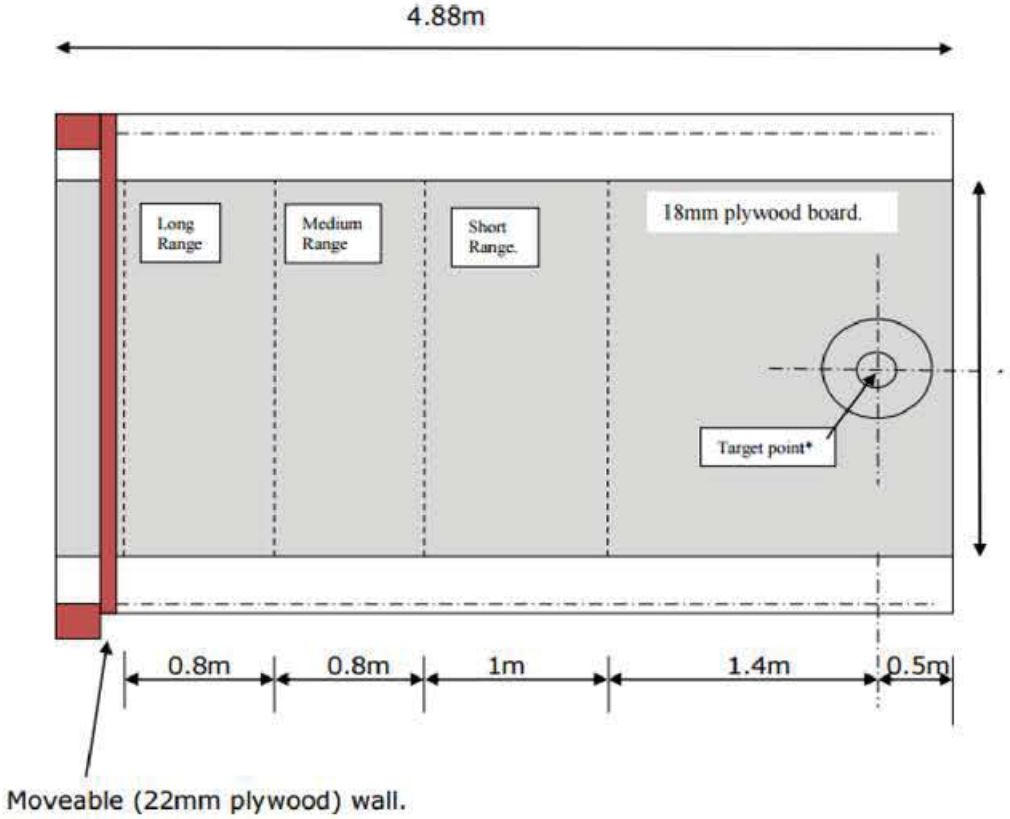
Name and KU ID number	Contributions
	Team leader Project management Product Design specification Evaluate against PDS Poster design Testing Art work Conclusion Recommendation Log book
	Research materials Introduction Abstract Costing Testing Presentation design References Log book
	Manufacturing Finial design Solids work 3D visuals Assembly drawing Materials selection Testing Calculation Log book

Abstract

- Introduction:
  Make a repeatable vehicle that can go forward hit a wall and come back, the team that stops the car nearest from the starting point gets the best result. The vehicle not necessarily needs to have wheels, it can slide, jump, roll etc.
- The theory:
  It could be any theory that doesn't break the competition rules, in our personal case, our car went forward switching a button that turns on the motor so the wheels make the car goes forward, In the front part of the car there was a switch ,so when the car hits the wall the switch makes the motor to change its circuit so instead of going forward it goes backward and the wire counts the exact amount of distance that the motor moved so after the car moves the exact amount of distance that went before hitting the wall , the wire cuts the energy from the motor , making it stop in the desired point.
- Groups & time manage:
  The number of persons per every group could be from 3 to 5 persons. In our personal case we were 3 persons, although we all contributed in every part, we divided our members so one person was more concern with the design part, the other member was more related with the presentation and the speech and finally the third person was more concerned with the report writing and the poster. For the time diving we made grant chart where we divided our project in to 6 steps and 6 weeks to make every step, making sure we meet at least once every week to check everything was going correctly.
- Conclusion:
  To make this car we went through different process from choosing the team mates to calculate the budget and the most suitable material for the manufacturing, there was some big issues with choosing the best design to make the car. We learned that not always it is possible to make every idea you have in to reality, in fact, most of the time the main idea we got, we had to improvise in every step make it work.

Introduction

The main target was to make a repeatable vehicle that starts from a point moves forward, hits a wall and then returns to its initial point. Although there were many rules, the most important rule was that the car cannot be controlled through any electronic remote device or any external help, should be just turn on the switch and moves itself, hit the wall and return and stop as closer as possible from the initial point.



The wall is movable; therefore, the procedure should be carried out 3 times with different distances stated by the teachers. The maximum limit of time was 2 minutes per round and the distance at where the wall should be, is shown in the image.

Although our car didn't make to represent our university in the competition we reached the semi-final in the test day, the car done all the stages very well but in the stopping, point we had an error of 5cm.

The other two important part of the competition was the presentation where all team members should give a speech explaining all the features about the car, the cost of it, the design and manufacturing process and how end up with this idea explaining all the error and conclusions.

The other important part was the poster where we should state our idea, the cost of the materials used in the car, an AutoCAD of the design and a brief explication of the whole process.

This project had two major targets, first, to put all the knowledge we got from the whole year and put it in practice, and learn from taking the theoretical background in a more practical

ambient to learn from the mistakes and improve for the future when we start to work in real life.

Other important aspect was the team working, a basic skill in any engineering field but especially in any related to mechanical engineering. The competition was built intentionally so the members can learn about how to deal with other team members in different aspects of the project.

The group can be made up to 5 members, each member of the group should contribute equally proposing an initial design for the vehicle, voting for the best design and finally working together in the different aspects of the whole process like the assembly, report writing, poster design and the team presentation.

Product design specification

Safety:
The design must not have cable outside the vehicle so it cannot be dangerous. It can be inside by using cable management facility so it can be safe and the cables cannot be damaged.
The design must not have sharp edges so that the general public cannot get injury.

Use and performance:
The vehicle must be an appealing for anyone.
The design must run safely and reach back to the start point.

Maintenance:
The design could be made with interchangeable design so which can be replaced if one breaks.
Materials should be easy to clean and polish.

Aesthetics:
The design must have bright colours to appeal to specification.
The design should have a smooth texture from a good quality finish.

Size:
The design must be a size comfortable to be held by the specification.

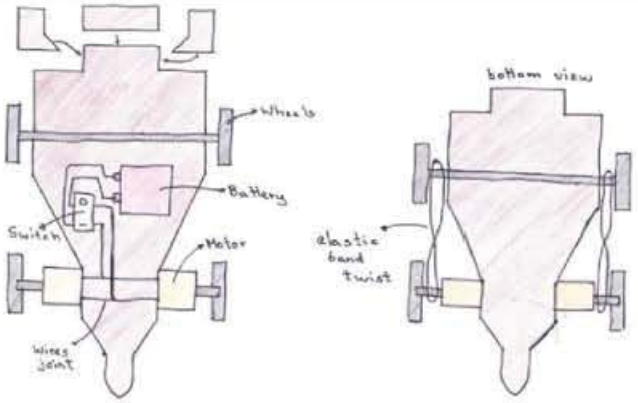
Weight:
The design must be no heavier so it can be comfortably to move faster.

Cost:
The design must be based on the specification £20 (including VAT £25)

Environmental requirement:
Materials which are not recyclable should be avoided wherever possible.

Concept Ideas

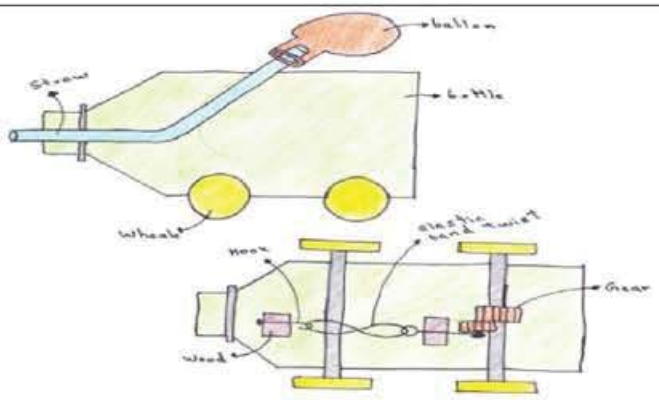
Idea one:



In this design, using the battery to power the motor to generate the vehicle to move forward. Once the vehicle moving forward, using the switch to turn off the motor. Than elastic band will be twisted between the front and back wheels so that the elastic band will push the vehicle to starting point.

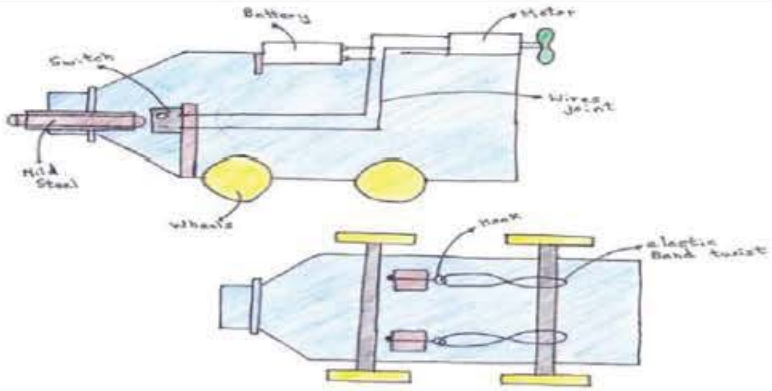
Advantages:	Disadvantages:
- It will be easy to manufacturing - The cost will be less - Less weight	- The switch cannot be turn off - Less force to move the vehicle backwards - Elastic band can be break while vehicle moving forward

Idea two:



In this design, using the straw to blow the air into the balloon than release the air to generate the vehicle to move forward. To move backwards using gear and elastic band to be attached together to the wheel and to make the elastic band to twist easy using the hook to join with gear, so while the vehicle move the gear make the elastic band to twist.

Advantages:	Disadvantages:
- The cost will be less - Less components easy to manufacturing	- Less accurate due to the less weight - Less force to move forward and backward - Elastic band can be hard to twist

Idea three:

In this design, using the battery to power the motor to generate the vehicle to move forward. Once the mild steel hit the wall it will push the switch to turn off the motor, than elastic band was be attached the hook which will generate the vehicle to move backward.

Advantages:	Disadvantages:
- The cost will be less - Easy to manufacturing - Good balanced weight	- Less accurate - Less force to move forward and backward - Elastic band can be hard to twist and can be break

Evaluate each solution against the PSD

Concept Idea 1:

Safety:

The design must have cable outside the vehicle so it can be dangerous. It does not have cable management facility and the cables can be damaged. The design does not have sharp edges.

Use and performance:

The design has appeal for anyone. The design run safely and will not reach back to the start point.

Maintenance:

The design will be made with interchangeable design so which can be replaced if one breaks. Materials should be easy to clean and polish.

Aesthetics:

The design has bright colours to appeal to specification. The design has a smooth texture from a good quality finish.

Size:

The design has a comfortable size based on specification.

Weight:

The design has less weight so it can be comfortably to move faster.

Cost:

The design has based on the specification
£10 to £15 (including VAT)

Environmental requirement:

Some of the Materials are recyclable.

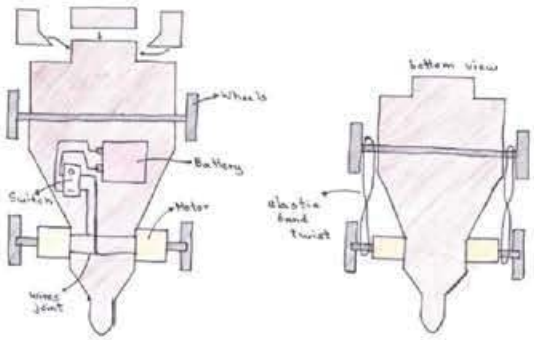


Figure 1: the concept ides one

Concept Idea 2:

Safety:

The design does not have any cables. The design can have sharp edges so that the general public can get injury.

Use and performance:

The vehicle has appeal for anyone. The design does not run safely and will not reach back to the start point.

Maintenance:

The design will be made with interchangeable design so which can be replaced if one breaks. Materials cannot be easy to clean and polish.

Aesthetics:

The design has bright colours to appeal to specification. The design does not have a smooth texture from a good quality finish.

Size:

The design must be a size comfortable to be held by the specification.

Weight:

The design has less weight so it can be comfortably to move faster.

Cost:

The design has based on the specification £5 to £10 (including VAT)

Environmental requirement:

Some of the Materials are recyclable.

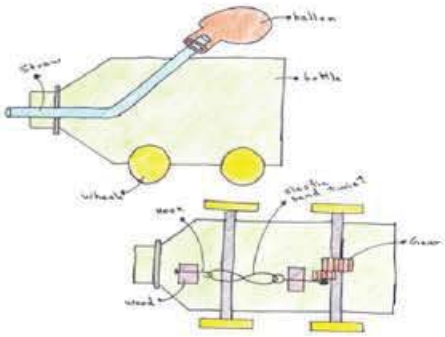


Figure 2: the concept idea two

Concept Idea 3:

Safety:

The design does not have cable outside the vehicle so it cannot be dangerous. It has cable management facility so it can be safe and the cables cannot be damaged. The design has sharp edges.

Use and performance:

The vehicle must be an appealing for anyone. The design cannot run safely and could not able reach back to the start point.

Maintenance:

The design will be made with interchangeable design so which can be replaced if one breaks. Materials cannot be easy to clean and polish.

Aesthetics:

The design has bright colours to appeal to specification. The design does not have smooth texture.

Size:

The design has a size comfortable to be held by the specification.

Weight:

The design has less heavy so it can be comfortably to move faster.

Cost:

The design has be based on the specification £15 to £20 (including VAT)

Environmental requirement:

Materials can be recyclable.

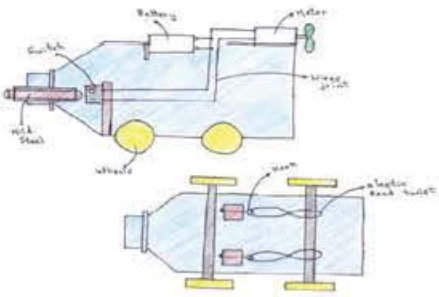
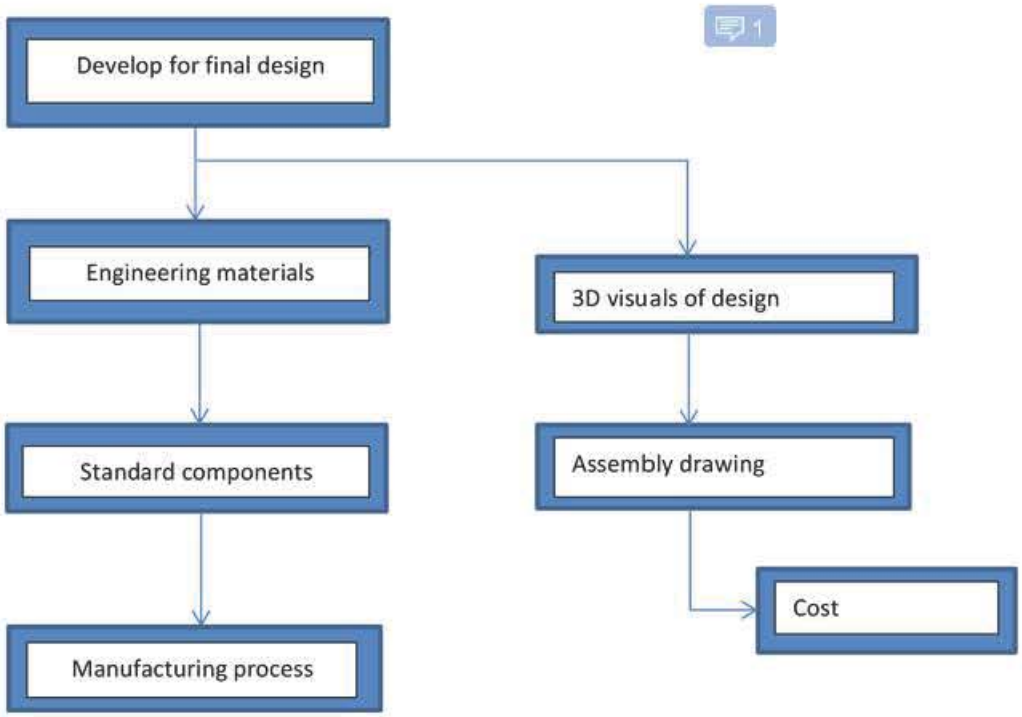


Figure 3: the concept idea

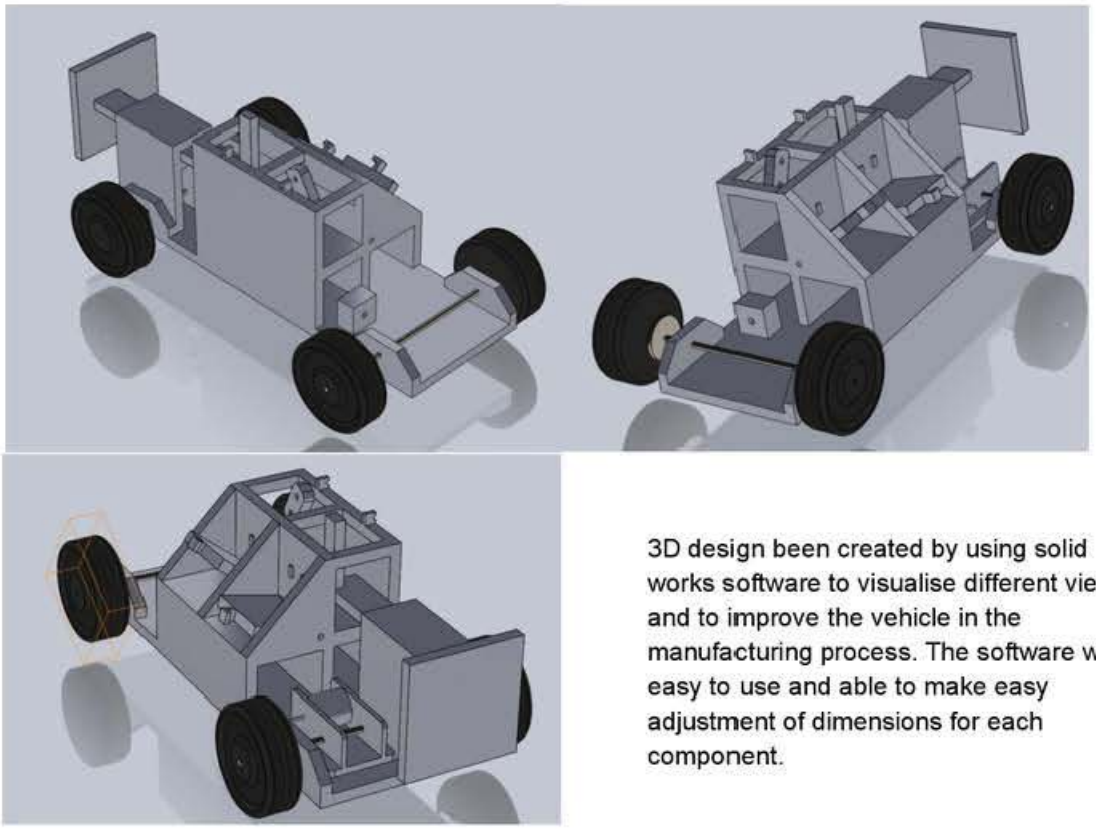
List of specific development for finial design

- The design should have more accurate to move the vehicle forward to hit the wall than will back to starting point.
- The design need to have less weight materials so that the vehicle can have more force to run faster, however the weight need to balance so that the vehicle does not go different direction.
- The design need to have better handles to lift and to release the materials easy.
- Need to refine the design and develop it with an understanding of materials.
- Need to think about the construction (break it down into parts).

Block diagram to develop for the final design

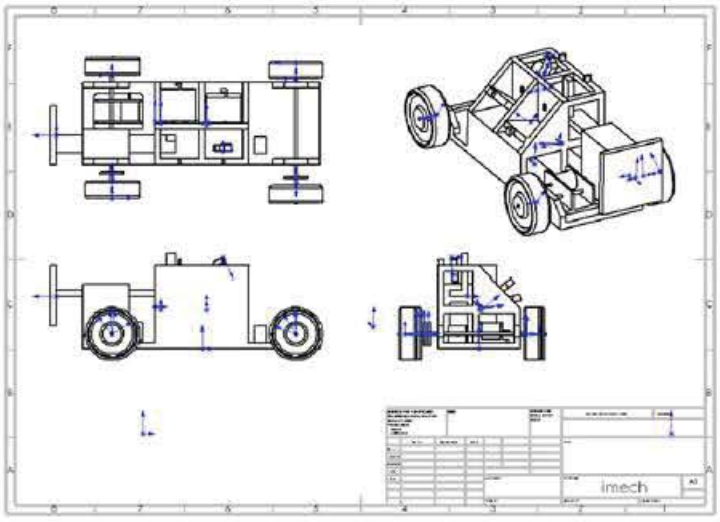


3D visuals of final design



3D design been created by using solid works software to visualise different views and to improve the vehicle in the manufacturing process. The software was easy to use and able to make easy adjustment of dimensions for each component.

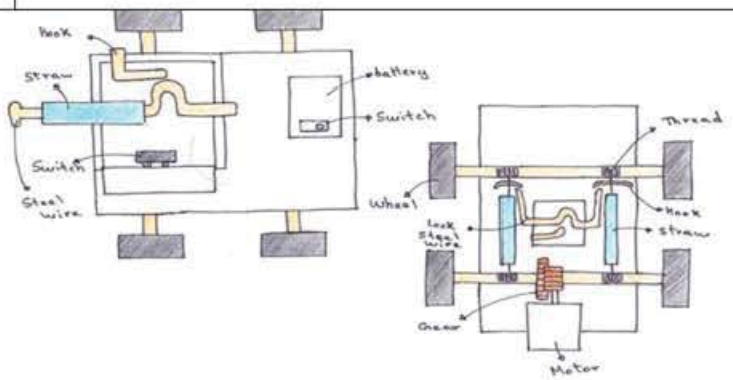
Figure 4: 3D visuals of the final design



The assemble drawing of the vehicle using solid work. This represents the three different views of top, front and side with 3D visual.

Figure 5: assembly drawing

Final product specification based original PDS

Final design:

In the final design, it has been recreated the new design using the solution of each concept ideas. In this design, using the battery to power the motor to move the vehicle forward with switch been added on. When the steel wire hit the wall, it will push the lock than the other switch will be released so that the vehicle can move backward. While it be running the thread which as joint the front and back wheels start to rotate once in close to the starting point the hook which has been attached with wheel will hit the lock than will release which make the wheels lock to stop the vehicle to starting position.

Advantages:	Disadvantages:
- Move faster and more accurate - Work forward and backward - Less weight and balanced - Easy to manufacturing	- Thread can be break - Can might not stop in starting point

Safety:

The design has cable management facility so it can be safe and the cables cannot be damaged. The design does not have sharp edges so that the general public cannot get injury.

Use and performance:

The vehicle will be appealing for anyone. The design will run safely and reach back to the start point.

Maintenance:

The design has been made with interchangeable design so which can be replaced if one breaks. Materials will be easy to clean and polish.

Aesthetics:

The design will might not bright colours. The design has a smooth texture from a good quality finish.

Size:

The design has a size comfortable to be held by the specification.

Weight:

The design is less weight so it can be comfortably to move faster.

Cost:

The design has based on the specification £20 (including VAT £25)

Environmental requirement:

Some Materials are recyclable.

Manufacturing process

To manufacture the design, our group have not used a lab and decided to manufacture the vehicle in home this because the materials we used was simple and easy to make the design.

The vehicle started to create as planed in the 3D design. However the design has to be reduced some materials due to the cost based on the specification. Also There was a problem while manufacturing, which was the power of the motor will be less so than the vehicle will move slower and may not be able to come back because of the weight added on the thread which could able to break it.

Once again started to remake the design with more simple way and reduce some bits of materials.

Figure 6: shows the vehicle created first

Stage one:

The stage one process to collect all the materials required for the vehicle, than started to make the top part of the vehicle using the form board. Started with cutting the form board same dimensions of rectangle into four pieces, than using hot glue to join all the pieces into square. Next was to add the steel wires and the hook to lock with the switch.

Stage two:

In this stage, create the base of the design. Cut form board into two pieces of rectangle (big) and other two pieces of rectangle (small), than using hot glue to join them together into square. Add the wheels into the square.

Stage three:

In this stage, join the wires together using the electric tape. Solder the wires together into switches, battery and motor. Then add the thread between the front and back vehicle, while add the straw middle of the thread so that it cannot get damage. However there is a chance to break it.

Stage four:

In this stage, join the top square into the base using the hot glue. However the vehicle needs something else to join it to together, so it will easy to remove the form board in case the wires get damage. Decide to use the strong tape to join the materials together to the base.

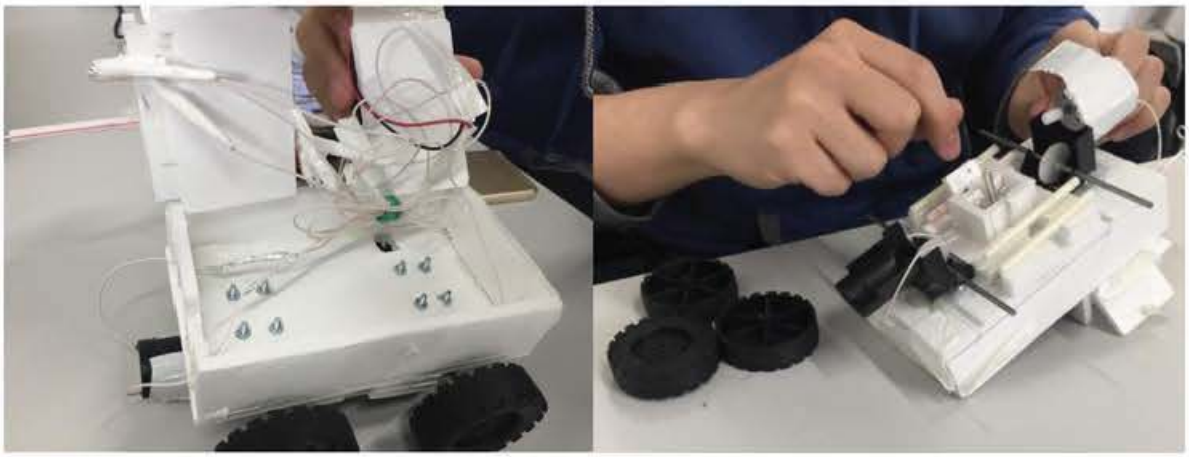


Figure 7: the making of the vehicle

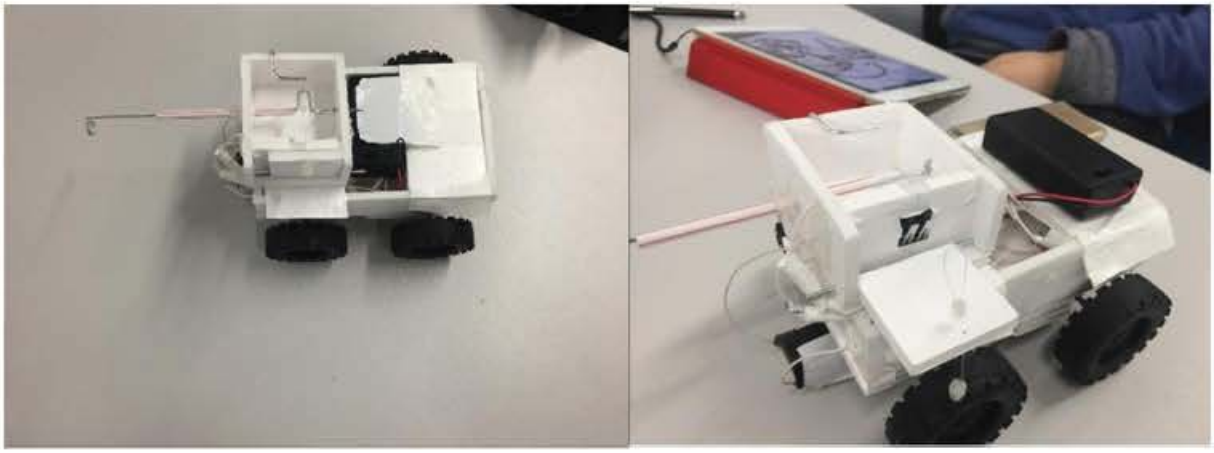
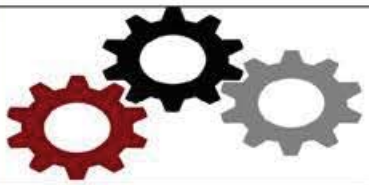


Figure 8: the final view after the manufacturing

List of materials

MATERIAL NAME	MATERIAL COST (£)	MATERIAL PORPOUSE	MATERIAL IMAGE
MOTOR	3£	TO MAKE THE CAR MOVE FORWARD AND BACKWARD	
BATTERY X 2	0.60£/battery 0.60X2=1.20£	TO GIVE ENERGY TO THE MOTOR	
Form board 120 cm	2.40£	The chassis of the car	
Thread 60 cm	0.70£	To measure the returning distance , once the car heated the wall	
Straw x 4	0.60£	To protect the thread from twisting or ripping apart.	
Gears x 3	1£/gear 1 x 3 = 3£	To send the traction of the motor to the wheels	
Wheels x 4	0.50£/wheel 0.5 x 4 = 2£	To make the car move	
Steel wire 30 cm	3.20£	To switch the motor to the opposite direction	

Hook	Free	To measure the exact distance to the stopping point	
Switch SPDT	2£	To turn on/off the motor	
Shaft	2£	To join the wheel	

TOTAL MATERIAL COST:

MOTOR……..£3

BATTERY X2 ……£1.20

FORM BOARD……£2.40

THREAD……£0.70

STRAW X 4 …… £0.60

GEARS X 3 ……£3

WHEELS ……£2

STEEL WIRE ……£3.20

SWITCH SPDT ……£2

SHAFT ……£2

TOTAL ……£20.10

Testing

In the testing, found out the problems we had with the vehicle. The vehicle did not stop on the starting point; however it just away from 2 to 4cm and the vehicle still was inside the circle point. When we were testing the 5m distance the thread was broken so we have to fix the thread again. This could be happens more often due the force applied to the weak thread. The good about the vehicle during the testing was the vehicle runs in good speed to reach the wall and having same speed to come backwards. It also has less sound.

As group decide to have some more the research to replace the thread. However the materials we came up will be too hard to move the vehicle forward and backwards. The cost will be going over the specification.

Distance (m)	*Point (10 to 2)*	*Time (s)*
3m	2	0.17s
4m	2	0.33s
5m	2	0.66s

Overall the results were good, the time going to the distance was quick and the vehicle able to complete all three distance. However need to find the solution to stop the vehicle into the point between 10 or 8.

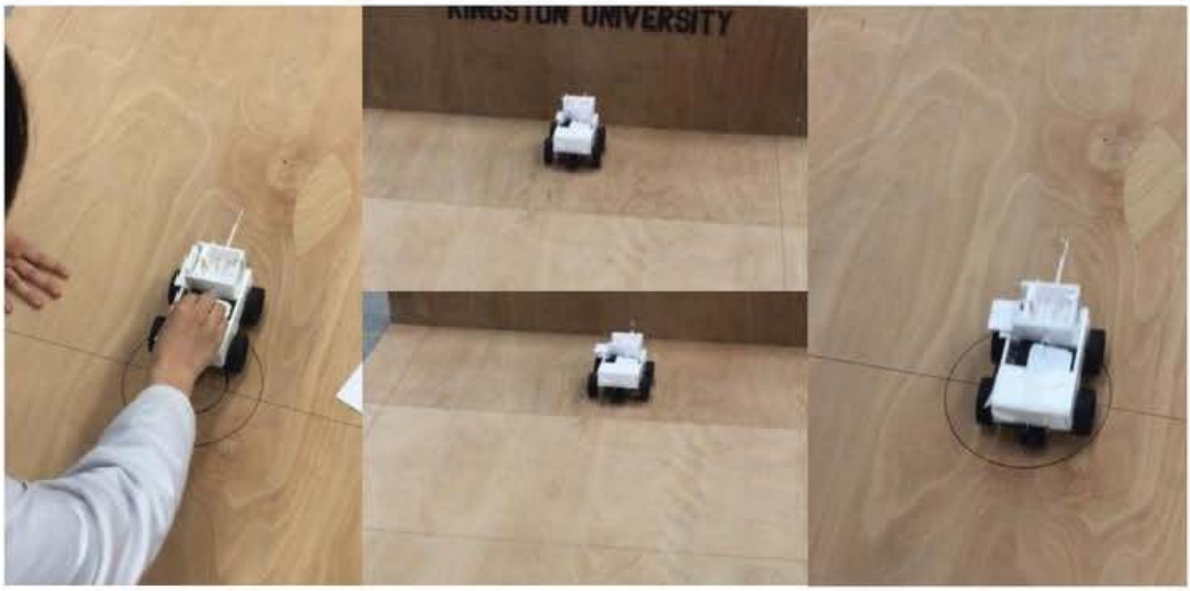


Figure 9: shows how the vehicle runs during testing

Conclusion

Overall, the processes involved in designing the vehicle for IMechE design challenge went well. In the challenge we have created a Gantt chat to manage the time and data to complete the project but somehow the management did not went well because we spent some more time on each section to make sure the design to come out well. Than started to research the materials for the design.

We wrote design specification of what we felt the design should do or have. Then came up with four initial ideas and compared them to the specification whether those design matches to the design specification so decides to pick the final design and develop to own specification.

Created block diagram to develop the solution like a plan to help produce the design in the time management. Than started to work on solids work to create the design in 3D visuals which went, however could not able to do in more details. For example could not able to show how the design be joined together and some parts be missing how the wires can be joined to the motor and battery. The 3D visuals will help to understand how the design look after it be manufactured. Using solids work created assembly drawing of the design.

Finally started to manufacturing the design went well, however the design has to be reduced some materials due to the cost based on the specification. Also there was a problem while manufacturing, which was the power of the motor, will be less so than the vehicle will move slower.

We produce a bill of materials to calculate the cost it all went well but at end of the total cost was close to the specification.

The challenging areas:

- When finding the solution to move vehicle forward and backward was bit hard so we decide to come up with more solution to solve this problem.
- When using solids work it was bit hard to show everything what wanted to be so decide the main part of the design can be show in 3D visuals,
- There were too many parts or components so it was difficult to find each one the cost calculate and it was challenging to pick which one going to manufacture and other going to be standard components.

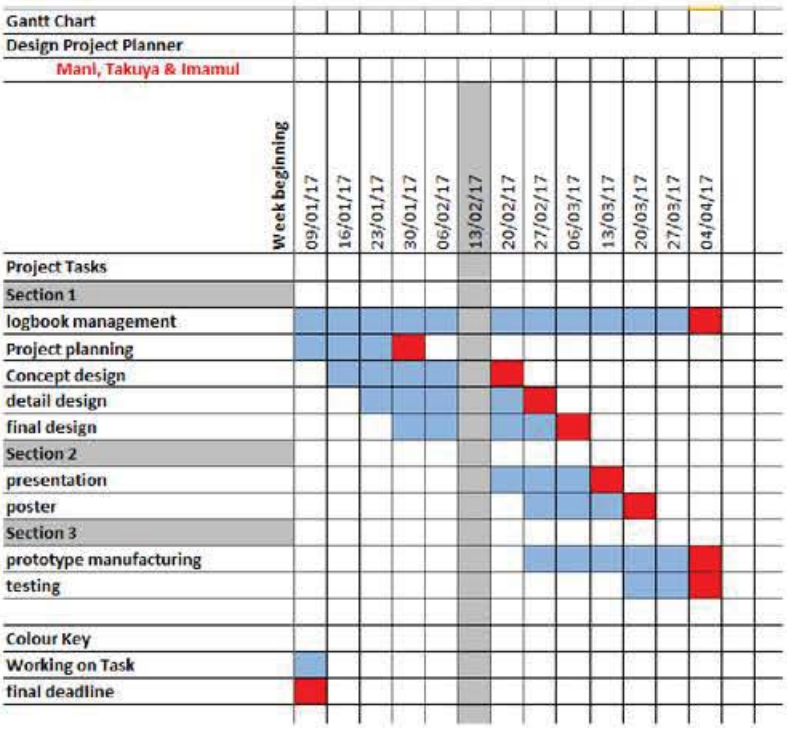


Figure 10: The initial Gantt chart

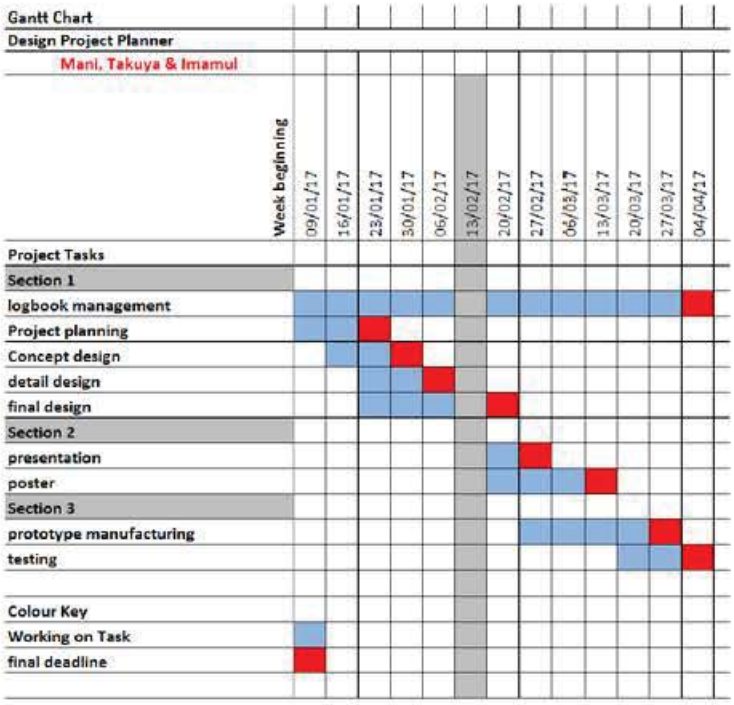


Figure 11: The final Gantt chart

Recommendation

1. The research on the materials to know availability to choose based on the cost and quality that relates to manufacture before really wanted to purchase.
2. The thread need to replace with the strong materials because the thread is bit weak and easy to break.
3. The structure of the vehicle needs to fix bit larger, so that it have more space to add the parts to assembly.
4. The components chosen should be ensuring before purchase grading the right power to hold the force.

Reference

- Imeche challenge 2017 / first year, URL : http://www.imeche.org/docs/default-source/1-oscar/Get-involved/design-challenge-specification-(version-5)-march-2017300db28d54216d0c8310ff0100d05193.pdf?sfvrsn=0

MATERIALS IMAGE REFENRECE:

1/ MOTOR:
https://www.google.co.uk/search?q=MOTOR+IMAGE&source=lnms&tbm=isch&sa=X&ved=0ahUKEwigrKqcjMfTAhUEAxoKHZqUB8AQ_AUICigB&biw=1920&bih=974#imgrc=E9oNN_YlPr_XdM:

2/ BATTERY:

https://www.ecigarettedirect.co.uk/media/catalog/product/cache/2/small_image/720x/9df78eab33525d08d6e5fb8d27136e95/b/a/basen-battery-upright-_single_.jpg

3/ Form board:

https://sc02.alicdn.com/kf/HTB1LsbaIFXXXXX8aXXXq6xXFXXX3/220830728/HTB1LsbaIFXXXXX8aXXXq6xXFXXX3.jpg

4/ thread:

http://2.bp.blogspot.com/-gKZ-hO2ocB8/TsQS1PsP7xI/AAAAAAAAA-o/8aG8_zPUWis/s1600/Thread-738693.jpg

5/ straw:

https://armswideopen.files.wordpress.com/2013/01/bendy-straw.jpg

6/ gears:

http://www.clker.com/cliparts/E/v/h/Z/f/3/3-gears-hi.png

7/ wheels:

http://i00.i.aliimg.com/wsphoto/v1/1833411482_1/Yellow-DIY-font-b-Small-b-font-Smart-Toy-Car-font-b-Model-b-font-Robot.jpg

8/ steel wire:

http://thumbs1.ebaystatic.com/d/l225/m/mvaQqoCbCXgzyIxuwN6fM4A.jpg

9/ hook:

https://3.imimg.com/data3/AT/JX/MY-756156/stainless-steel-cup-hooks-250x250.jpg

10/ SPDT switch:

https://cdn.sparkfun.com/r/600-600/assets/2/7/c/c/c/517edaface395f581d000001.png

11/ wheel shaft:

https://ae01.alicdn.com/kf/HTB1kw_yKpXXXXasXVXXq6xXFXXXn/RC-HSP-86022-font-b-Wheel-b-font-font-b-Shafts-b-font-2P-For-1.jpg

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Faculty of SEC
School of Mechanical and Automotive Engineering

Module No	Module title	Module leader
ME4013	Engineering Design, Materials and Manufacture	J Garcia
Assignment Title:	DMT: IMechE Design Challenge – Group Report and Logbook	

Group Name	Ndes 17

Phase	Description	Contribution %
Readability for Competition	Suitability for Scrutiny – design to specifications	100%
	Internal Competition – performance / accuracy	80%
Design Tutor Name / Signature	N. De Silva	

Group Members			
KU ID	Name	KU ID	Name

Institution of MECHANICAL ENGINEERS

Kingston University London

Faculty of SEC
School of Mechanical and Automotive Engineering

Module No	Module title	Module leader
ME4013	Engineering Design, Materials and Manufacture	J Garcia
Assignment Title:	DMT: IMechE Design Challenge – Group Report and Logbook	

Group Name	Ndes 17

This form should be signed by all members of the group and a scanned copy included in the report:

A contribution of 100% against the name of the group member states that the student contributed to the work presented, as agreed with and expected by his/her group colleagues.

If the contribution happens to be different from the description above, the group should agree on an estimate of the contribution e.g. 60%. Please note that this percentage will be applied with allocating the mark for the particular student(s)

Group Members			
KU ID	Name	Contribution (%)	Signature
		100%	
		100%	
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IMeche Design Challenge log book 04/02/17

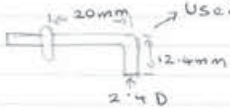
Group of three : - K1657449 Imamul
- K1638322 Takuya
- K1612758 Mani

Design Ideas for Imeche :

Idea 1:

Idea 2:

Key point



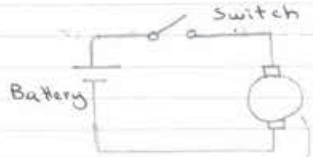
- Used as datum on the vehicle (No more than 6mm from the board).

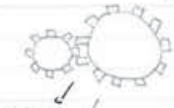
- Must fit within 0.4m x 0.4m x 0.4m
convert into mm
= 400 mm x 400 mm x 400 mm

Group Meeting one:

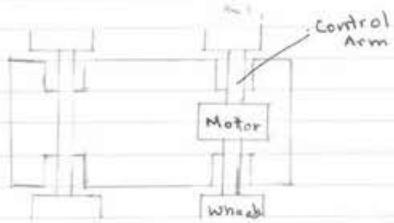
- Need to Think of idea ~~per~~ form the each person
- Draw it down.
- Research the Solution How to move backwards and forwards

How to move the vehicle: 07/02/17



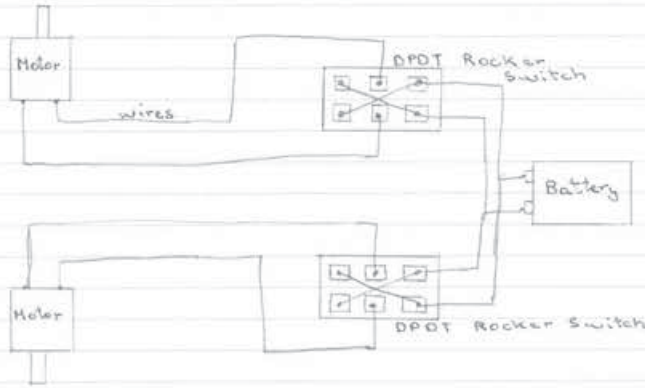


Gears to move the vehicle using motor, battery and switch. However need to think of how to make the vehicle go backwards.



Bottom view

Solution 1 :



solution 1

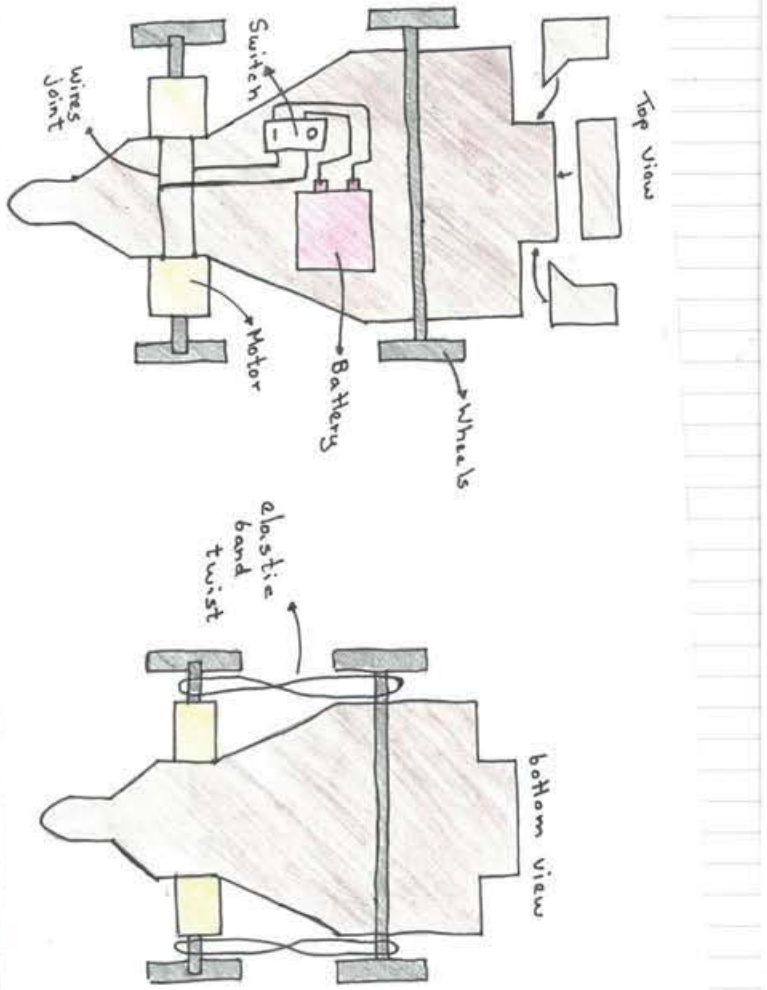
Problems :

- How the vehicle Stop
- How the switch going make it move backwards
- What materials going to fix.
- Speed control

Initil idea two:

- Advantages
  - * It will be easy to make
  - * lass weight
  - * cost lass

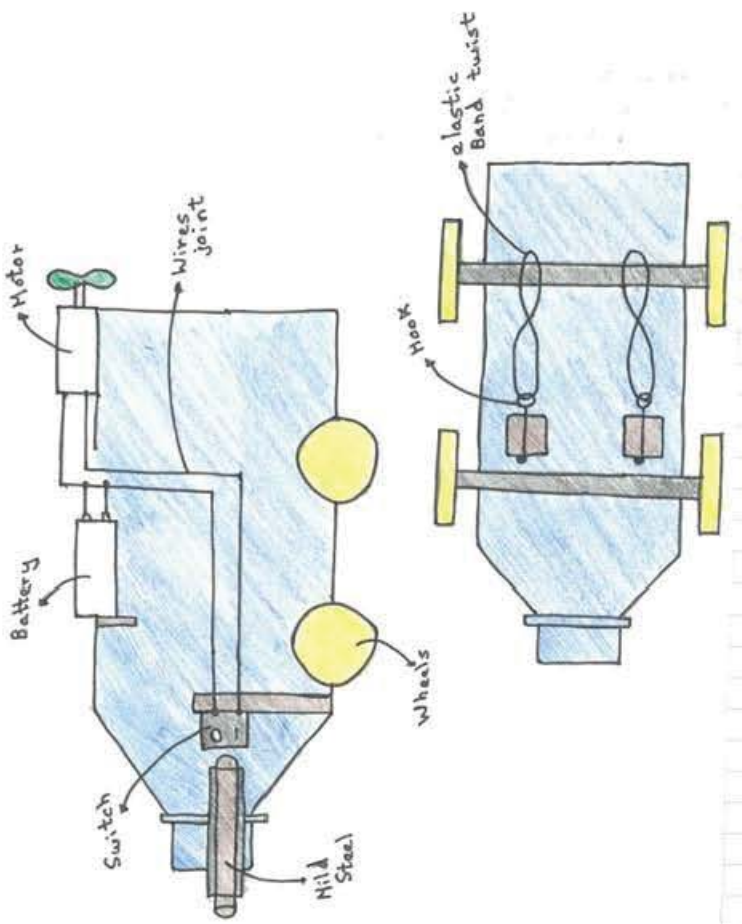
- Disadvantages -
  - * The switch cannot be turn off
  - * Less force to move backwards
  - * Elastic band can be break



This design was my final ideas and want to go manufacturing.

- Advantages
  - * Cost less
  - * Easy to make
  - * Good balanced

- Disadvantages
  - * Less accurate
  - * Less force to move forward and backward
  - * Elastic band can break



Group meeting three:

- Discuss about to pick Finial design
- How to improve.
- Listing the Specification requirement
- ~~Power~~ - ~~Power~~ discuss about presentation and poster

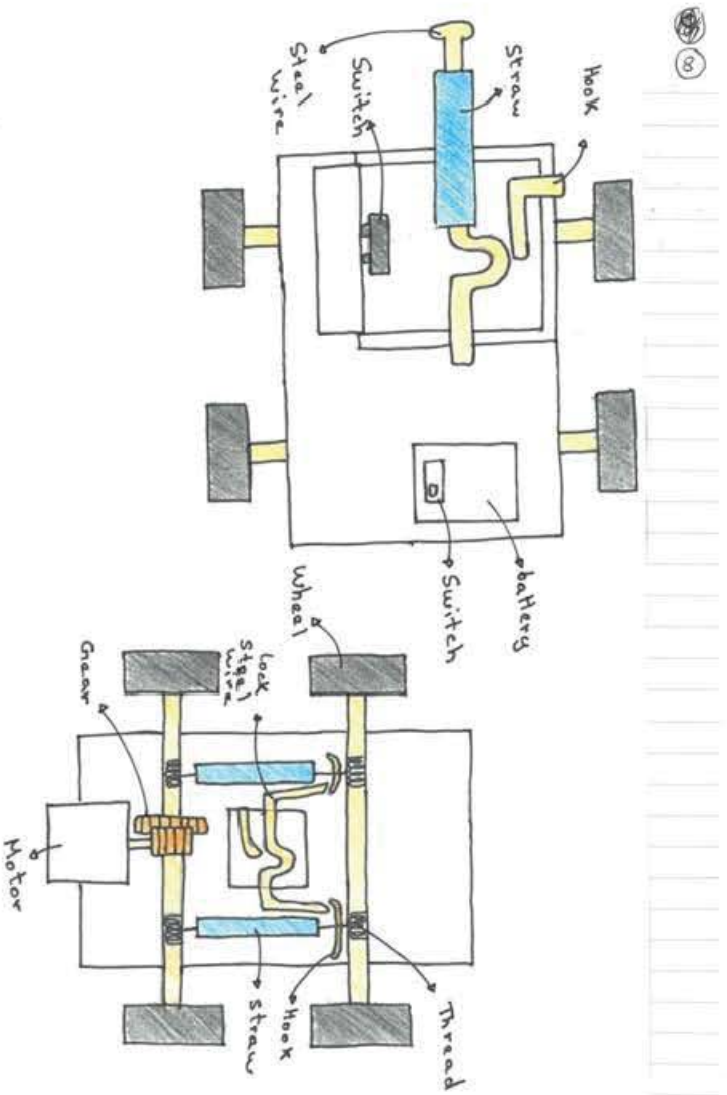
Plan: Poster

The Finial design solution as been picked from Takuya (How came up with the idea).

Reason why picked this solution:

- Advantages:
  - * Move faster
  - * Work forward & backward
  - * Less weight
  - * balanced

- Disadvantages:
  - * Thread can be break
  - * Can might not stop in starting point



compared to electrical system, the gear might be slightly unstable and complex. Therefore electrical might be better.

what is next ?

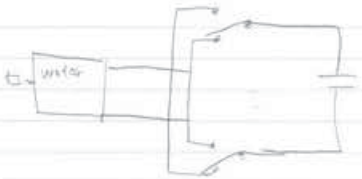
consider material
clarify the mechanism ~~to~~

The electrical circuit roll :

- stop the ~~de~~ device
- chang the direction of device movement

- to stop the device
  - cut circuit supply.

to change direction

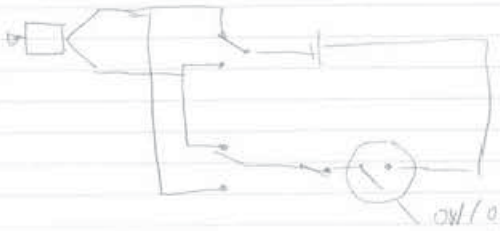


The direction flow could change by SPDT (single pole double throw) switch

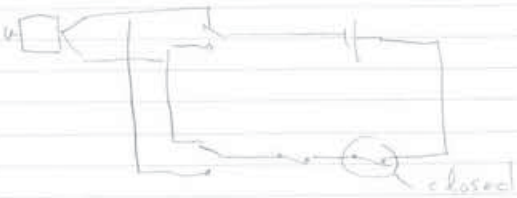
- Simplest 3 SPDT switches ~~are~~ are required

(9)

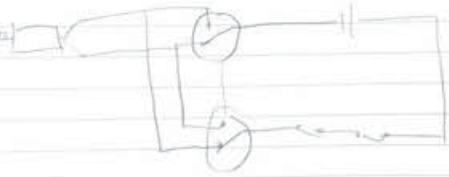
Rest



Forwards



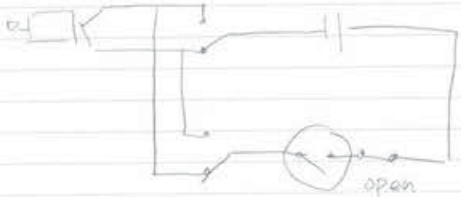
Backwards



(personal note)

(10)

stop



gear idea

Change direction

measure distance

Other Ideas which are not chosen and why

1st Idea (air propellsion)

Advantages
- cheap
- simple

Disadvantages
- not accurate
- too weak (unable to move to)

2nd Idea (motor)
- cheap and simple

Disadvantages
- ~~work~~ unclear ~~mechanism~~ mechanism

Group meeting three

- Discussion of selecting idea
- to consider possible improvement

The Final design is by Takuya

by advantages of :
- Clarified mechanism
- Less weight
- stability

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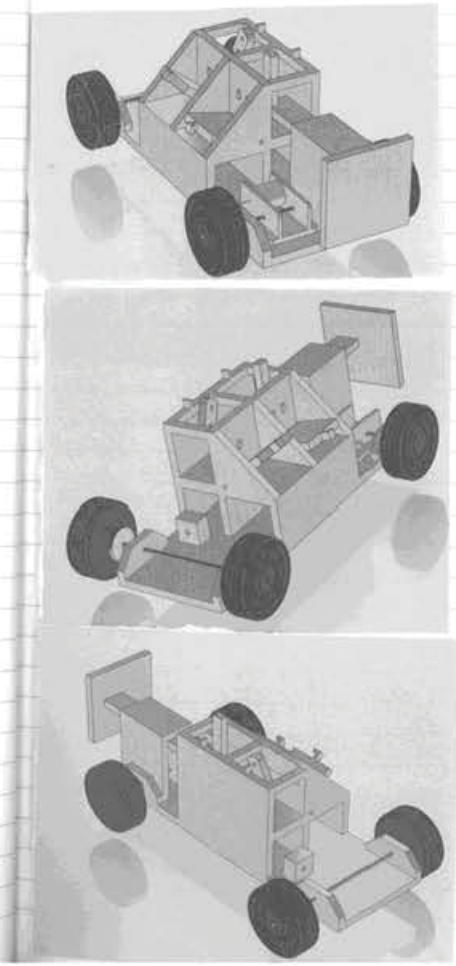
To improve ~~the~~ those disadvantages might be considered
- weak strengths of three
- error occurance due to three weakness

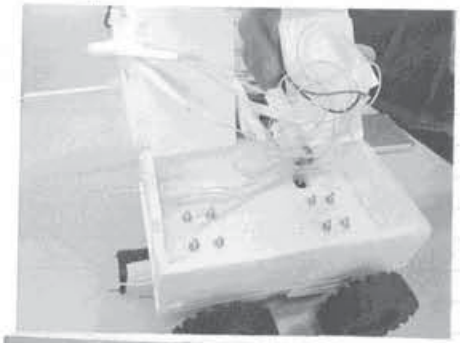
Group ~~meeting~~ 4

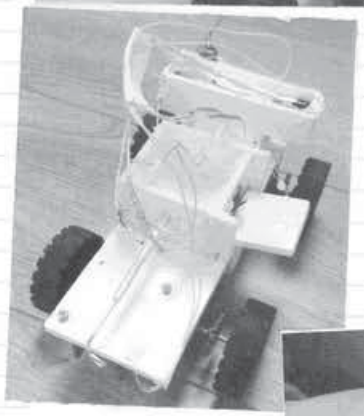
- 3D CAD
- Utility Materials
- Calculate cost
- presentation and power point

3D CAD design (~~draft~~ Basic concept)



making.





CAD