

University of Wales Trinity St David
School of Engineering

Project Planning

Tyler Powell

[2318809]

Mechanical Engineering

17/11/2024

Engineering Management, Innovation and
Sustainability

ACMA5007

Contents

1. Engineering Team	3
1.1. Team Members	3
1.2. Team Members Responsibilities	3
1.2.1. My Responsibilities Description	3
1.3. Belbin personal roles	4
2. Project Background	6
2.1. Competition Description	6
2.2. Project Requirements	6
2.3. Competition Requirements	7
2.4. Project Milestones	7
2.5 Project Gantt Chart	8
3. My Contributions	9
3.1. My Tasks	9
3.1.1. Task List with Time Estimates	9
3.1.2. Task Descriptions	9
3.2. Gateway Objective	10
3.3. Individual Areas of Concern	10
4. References	12

1. Engineering Team

1.1. Team Members

Tyler Powell 2318809

Sheunesu Ziki 2205423

James Minton 2204900

1.2. Team Members Responsibilities

Responsibilities	Team Member
CAD/Designing	James
Bill of Materials	Tyler
Assembly	All
Manufacturing	All
Programming	Ziki
Content Creation	All
Organising	James
Mechanics	Tyler
Vehicle Testing	Tyler/Ziki
Design Research	James/Tyler
Component Research	Ziki
Problem Identification/solutions	Tyler/Ziki

1.2.1. My Responsibilities Description

Bill of Materials: create a comprehensive list of raw materials, components, sub-assemblies, and quantities needed to manufacture the vehicle with associated costs.

Assembly: simply assembling or editing the physical model of the vehicle in the workshops or labs in the university.

Manufacturing: creating components from material such as the base for the vehicle in the workshops or labs in the university.

Content Creation: creating content for the VIVAs, video presentation, poster or group report.

Mechanics: calculating base values for the vehicle and calculating the vehicles theoretical success or failure.

Vehicle Testing: testing to see if the vehicle is working as intended and not malfunctioning and detect causes of anomalies.

Design Research: research for the mechanisms, design strategies and past winners' success.

Problem Identification/Solutions: identifying mathematical failures in the vehicle and creating solutions for those problems.

1.3. Belbin personal roles

Belbin Team Roles are a model developed by Dr. Meredith Belbin in the 1980s to identify different roles that individuals play in teams. These roles are based on behavioural strengths and weaknesses, helping teams understand how to balance their collective skills for better performance.

Section	a	b	c	d	e	f	g	h	Total
1	2	0	2	0	0	2	2	2	10
2	0	0	0	2	0	3	2	3	10
3	2	1	0	2	2	2	1	0	10
4	1	1	1	2	1	1	1	2	10
5	1	2	1	1	1	1	2	1	10
6	0	1	2	0	2	2	2	1	10
7	0	0	1	2	3	1	2	1	10

Section	IM	CO	SH	PL	RI	ME	TW	CF	Total
1	2	0	2	2	2	2	0	0	10
2	0	0	0	2	0	2	3	3	10
3	0	2	0	2	2	1	2	1	10
4	2	2	1	1	1	1	1	1	10
5	2	1	1	1	1	1	1	2	10
6	2	2	2	0	1	2	1	0	10
7	3	2	0	1	2	0	1	1	10
Total	11	9	6	9	9	9	9	8	70

I scored the highest on implementer and had a pretty even spread across all the other roles. Implementer is one of the action oriented Belbin roles. Implementers are the practical, disciplined, and efficient members of a team who turn ideas into reality. They excel at organizing tasks, creating structure, and ensuring that plans are executed effectively.

Strengths of an Implementer

- Strong Execution Skills – They ensure that strategies are implemented effectively.
- Dependable – Team members can trust them to follow through on tasks.

- Process-Oriented – They establish efficient workflows and eliminate inefficiencies.
- Stabilizing Force – Helps maintain order in a team, especially in chaotic situations.

Potential Weaknesses

- Resistant to Change – May prefer sticking to tried-and-tested methods rather than adapting to new approaches.
- Less Innovative – Focuses more on execution than brainstorming creative ideas.
- Can Be Inflexible – Might struggle with sudden changes or unconventional methods.

I believe implementer fits the role needed to conduct my individual tasks well as they require a key sense of analytics. During the group project I should aim to be on look out for potential implementer weaknesses in my character and step back and resolve them.

2. Project Background

The project is for the group project module of my second year of the mechanical engineering course. It is to show the development of our group's progression in an extracurricular competition for the IMechE.

2.1. Competition Description

The competition is to have an autonomous vehicle move from target 1 to the wall, where the vehicle will contact the wall within a designated zone and simulate charging. From this point it will move back towards target 1 and back to the wall again, but this time engage some sort of lifting mechanism for the point that will contact the wall, to reach a higher point on the wall and again simulate charging. Then finally it will from the wall to target 2. Each target has varying sized circles branching from the centre of the target, each granting different amounts of points, increasing the closer to the centre of the target. We are also awarded points based on our other deliverables too, such as the video presentation, poster and bill of materials. The more points scored by our team in the regional competition in Swansea, the higher the likelihood we can progress to the finals in London.

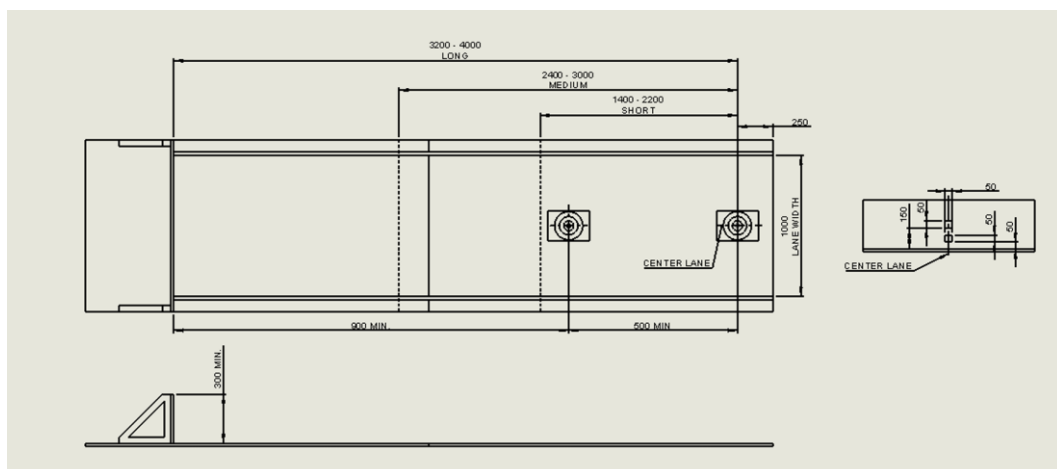


Figure 1: Diagram of the course with potential dimensions – IMechE brief

The targets and wall are all aligned with each other; therefore, steering may not be necessary.

2.2. Project Requirements

Based on our development for the competition, our group needs to produce an end of project report of each members contribution and produce and present presentations for an interim group VIVA and an end of project group VIVA.

2.3. Competition Requirements

For the competition we need to produce the following deliverables for the IMechE competition:

Autonomous vehicle – that can complete the competition course.

Group video presentation – highlighting our groups development and challenges faced and how they were overcome.

Group poster – highlighting our groups vehicle and development.

2.4. Project Milestones

Project Milestones	Estimated Completion Date
Project start	10/2024
First project VIVA	12/2024
First physical prototype created	01/2025
Final design created	03/2025
Group report	03/2025
Final project VIVA	03/2025
All deliverables sent off	04/2025
Regional competition	05/2025
Finals competition	09/2025

2.5 Project Gantt Chart

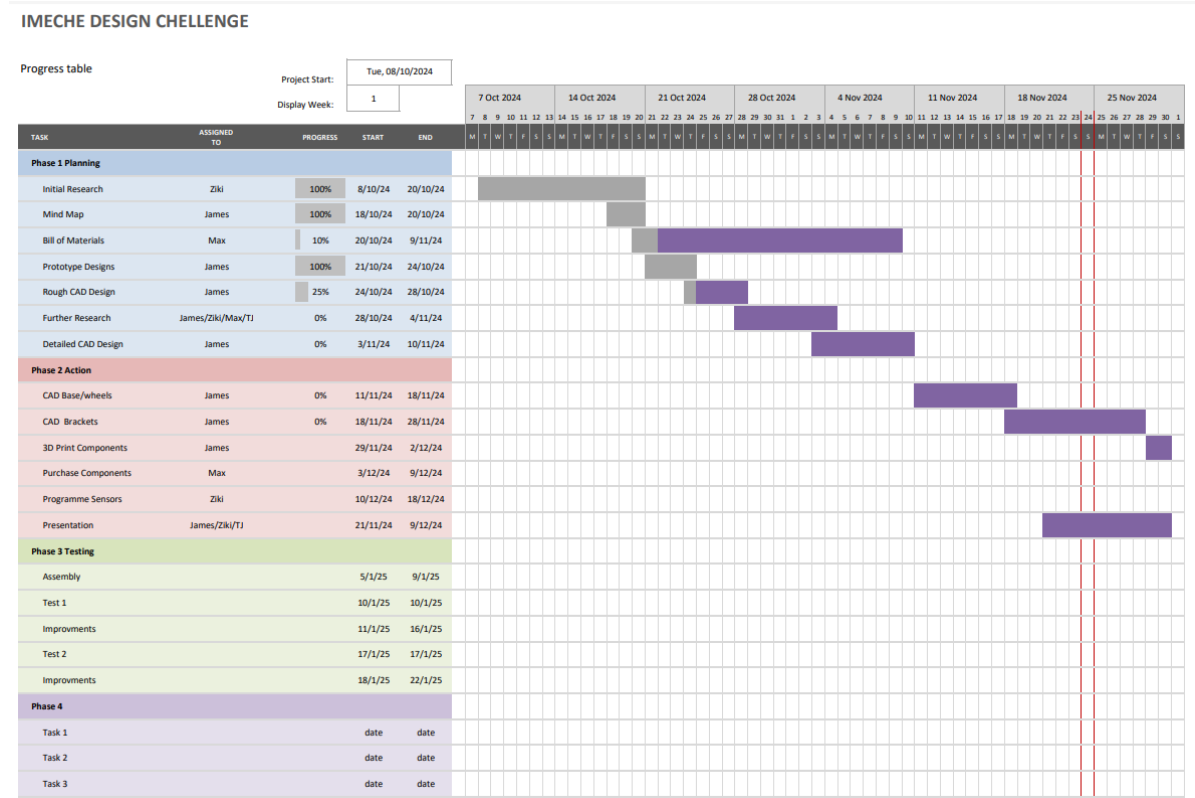


Figure 2: Group Gantt chart - Sheunesu Ziki

3. My Contributions

3.1. My Tasks

3.1.1. Task List with Time Estimates

My Tasks	Estimated Hours Associated
Wheel research	2-3 hours
Initial calculations	1-2 hours
Wheel designs	1-2 hours
Prototype calculations	2-3 hours
Prototype solutions	10-15 hours
Group meetings	1-2 hours a week
Presentation preparation	2-4 hours
Report writing	5-15 hours
Prototype manufacture and assembly	10-20 hours
Poster creation	1-2 hours
Presentation video	1 hour
Project VIVAs	2 hours
Create bill of materials	2 hours

3.1.2. Task Descriptions

Wheel research – conduct research on past competitors and generalised wheel aspects.

Initial calculations – calculate base dimensions based off vehicle estimates, calculating the initial wheel radius and motor torque.

Wheel designs – design wheels considering different design strategies for increasing traction and friction.

Prototype calculations – based of measurements of our prototype, calculate whether the vehicle will theoretically be able to complete in the course in the given time.

Prototype solutions – create system solutions to theoretical or physical problems with the vehicle, ranging from minor alterations such as gear ratio and wheel diameter to power supply changes.

Group meetings – attend meetings discussing each members current contribution and any problems discovered.

Presentation preparation – create slides showcasing my contributions for our group VIVAs and video presentation.

Report writing – create my section of the group report highlighting my contributions to the overall project and any issues occurred and how they were resolved.

Prototype manufacture and assembly – any sort of required to create or assemble the vehicle, depends highly on what the group decides as we progress.

Poster creation – make some sort of contribution to the poster needed for the competition, contribution to this will be flexible between all group members.

Presentation video – record my sections of the presentation, discussing the areas I was the most familiar with within the project and highlight problems and their solutions.

Project VIVAs – present alongside my other group members a detailed presentation each of our contributions to the project at that point in the development, we are expected to have 2 of these VIVAs, one at the midpoint and one at the end of the project.

Create bill of materials – create a bill of materials that is acceptable for the competition, highlighting all the required information in the competition brief. This also includes somewhat keeping track of the costs of the vehicle.

3.2. Gateway Objective

My gateway objective is to determine whether the vehicle is actually capable of completing the longest possible course in the allotted time. To determine this, I will be using the current dimensions and aspects of the vehicle at each design iteration to calculate whether it is possible. When it is not possible, to find a solution, I will be first theoretic changing easily alterable parameters of the vehicle such as the wheel diameter or gear ratio. If a solution still is not found still, more major changes will be theoretically tested such component changes such as the motor and power supply and find an ideal combination of changes to make sure the vehicle can complete longest possible course in a suitable time.

3.3. Individual Areas of Concern

One area of concern for one of my areas is the wheels traction, too much or too little and the wheels or gearing will slip, causing the vehicle to be unaligned with the course and causing us to lose many points by not being as centred as possible on the targets or potentially even failing the course by being fully off course and being unable to continue. To combat this, I will be doing extensive research and calculating traction minimums for the current system or calculating torque minimums from the traction of the wheels, will depend on how the development progresses.

The last area of concern I have for the project is keeping the vehicle within the budget of £90, outlined in the competition brief. This would typically be appointed to team leader,

however as I am responsible for the bill of materials, I am responsible for keeping track of everyone's spending for their respective parts of the project. My concern is that some miscommunication could occur, or certain aspects could be forgotten and then I am left chasing after people at the end to find out costs to then find out we are not in budget, and we have to make cutbacks and design changes which we may not have time for. To avoid this potential and to be as cautious as possible, I will aim to keep track of everyone's spending very closely every week at team meetings and via Microsoft Teams group messaging.

4. References

ImechE.org. (2024). *Design Challenge 2024 Regional Final results*. [online]
Available at: <https://www.imeche.org/news/news-article/design-challenge-2024-regional-final-results>

[Accessed 22 Oct. 2024].

ImechE.org. (2021). *2021 Design Challenge Greater London Region 2nd Year Final results*. [online] Available at: <https://www.imeche.org/news/news-article/2021-design-challenge-greater-london-region-2nd-year-final-results>

[Accessed 22 Oct. 2024].

www.youtube.com. (2021). *IMechE Design Challenge 2021 - Repeatable Vehicle - UCL CD6 - 1*. [online] Available at: <https://www.youtube.com/watch?v=uJSg-b7ysQc>.

Vehicle Dynamics Theory and Application by Reza N. Jazar, 2017. [book]

Available for purchase at: <https://www.amazon.co.uk/Vehicle-Dynamics-Application-Reza-Jazar/dp/3319534408>