PROJECT SCHEDULE AND COST ESTIMATE

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Abstract

This document is meant to act as a guideline to cope with any shortcomings in our designs and defines our stopping criteria for our upcoming prototypes. It intends to specify our final proof of concept and the components required to build our prototypes, along with defining a project schedule for the remainder of our semester.

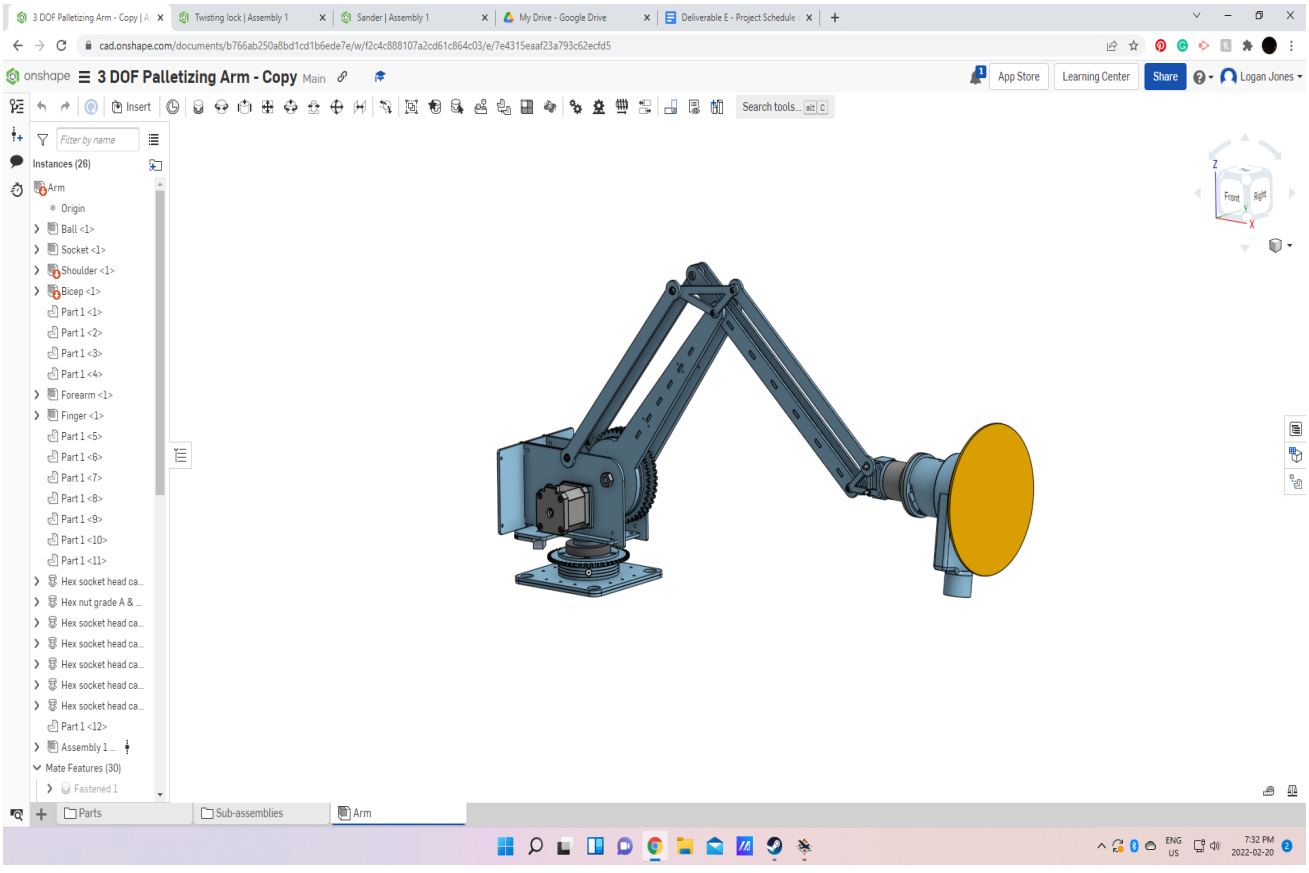
Table of Contents

Introduction

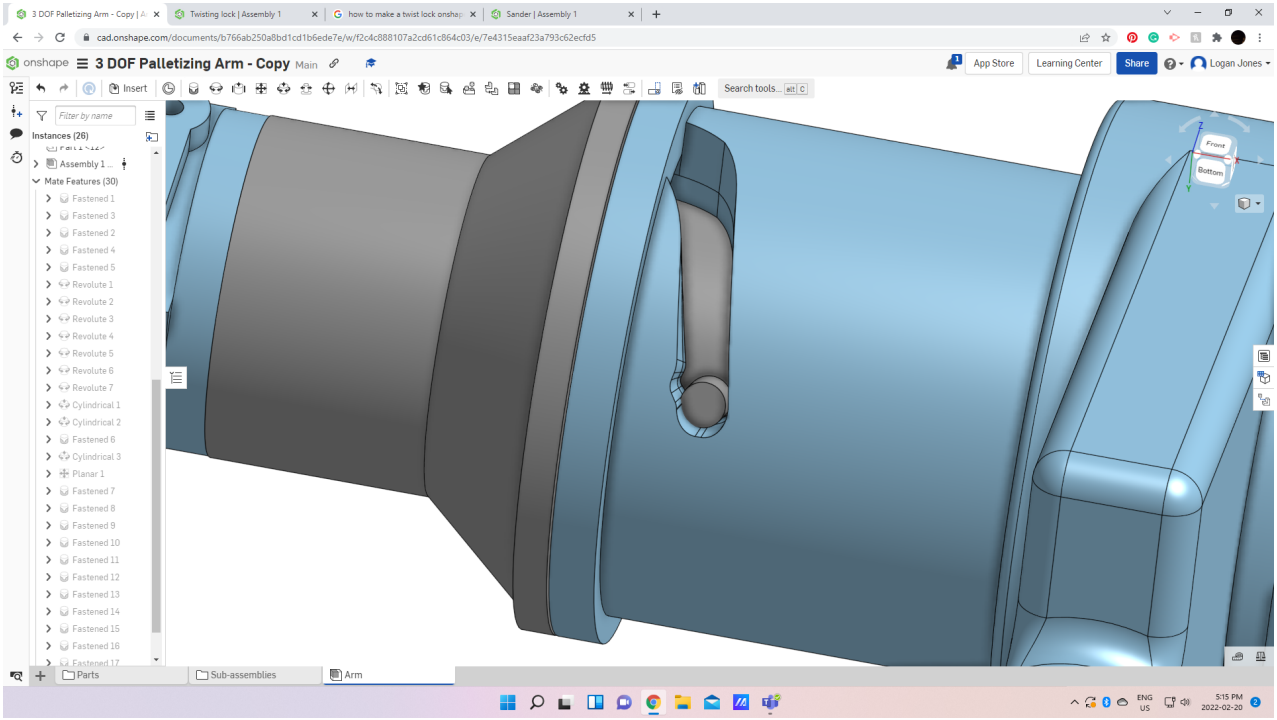
This document defines the stopping criteria for our upcoming prototypes, and intends to make clear our upcoming prototype test deadlines. The project schedule shows our updated task list. It also will make clear any risks associated with our project and our contingency plans to deal with such risks. A basic proof of concept is also shown to make clear what our final design would look like. A google sheet is attached to make clear our bill of materials (BOM), showing all of our individual components and their prices, and our equipment list showing components/software required to develop our prototypes.

Basic Proof of Concept

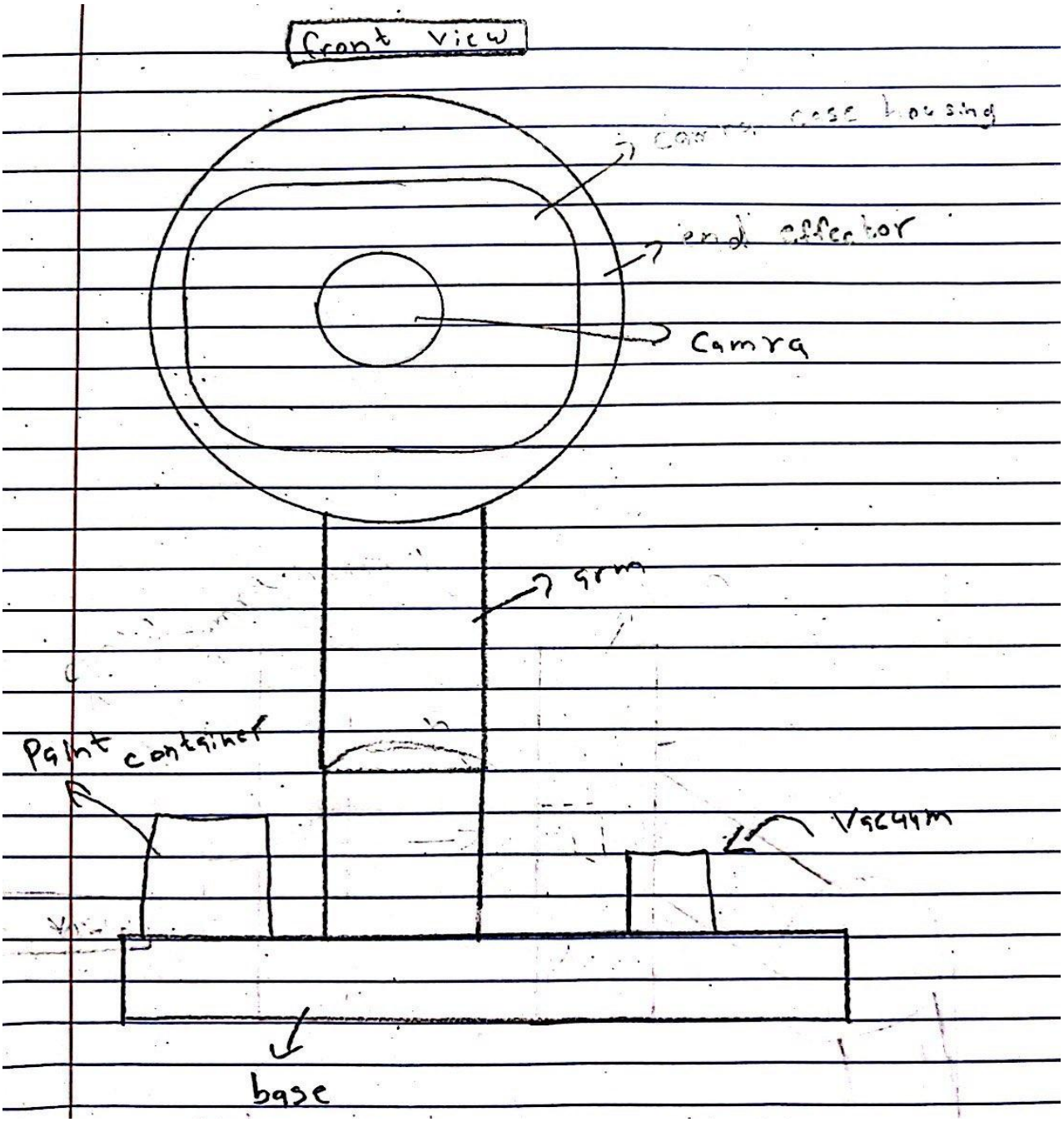
Sander + Arm CAD Model

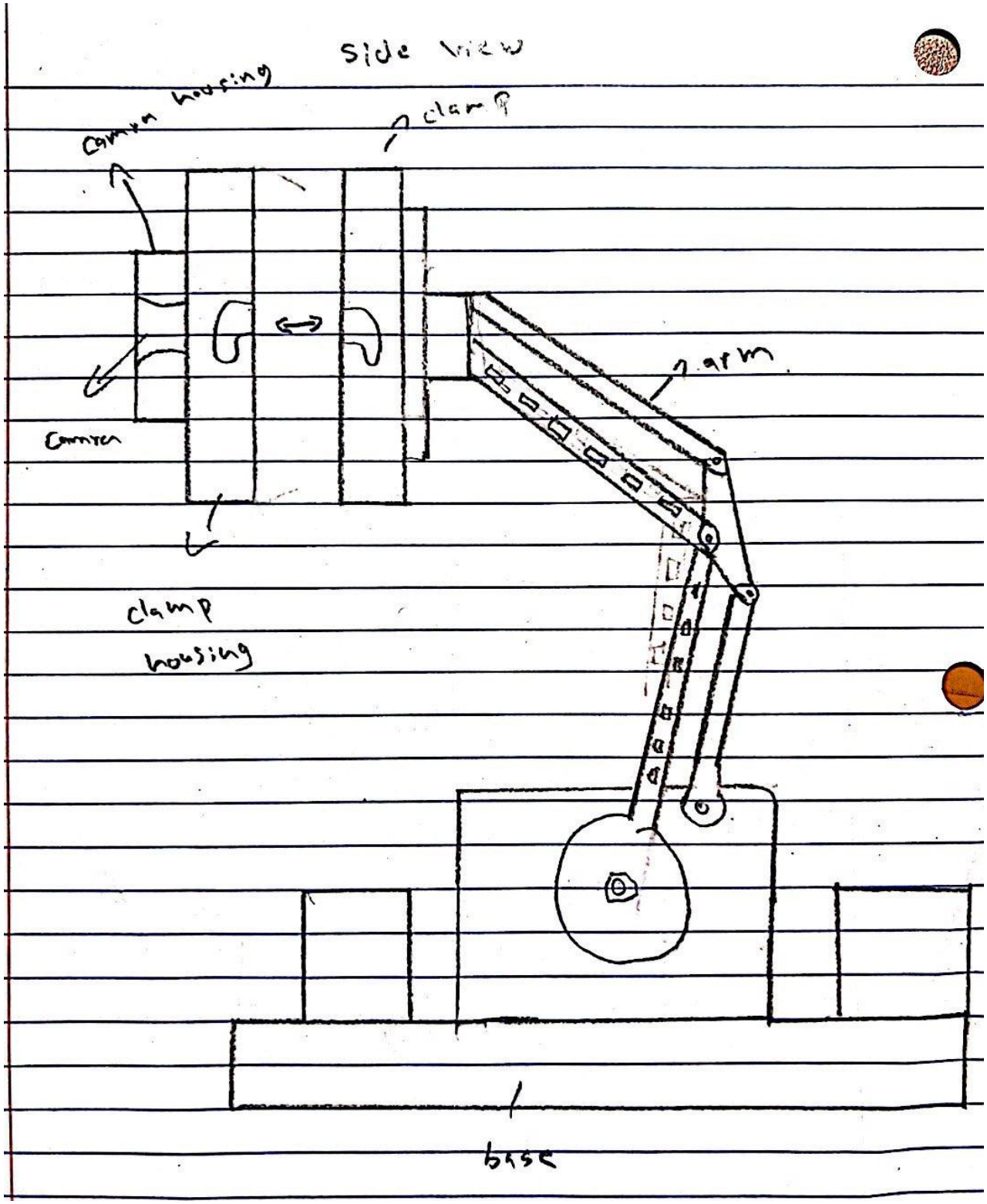


Locking system

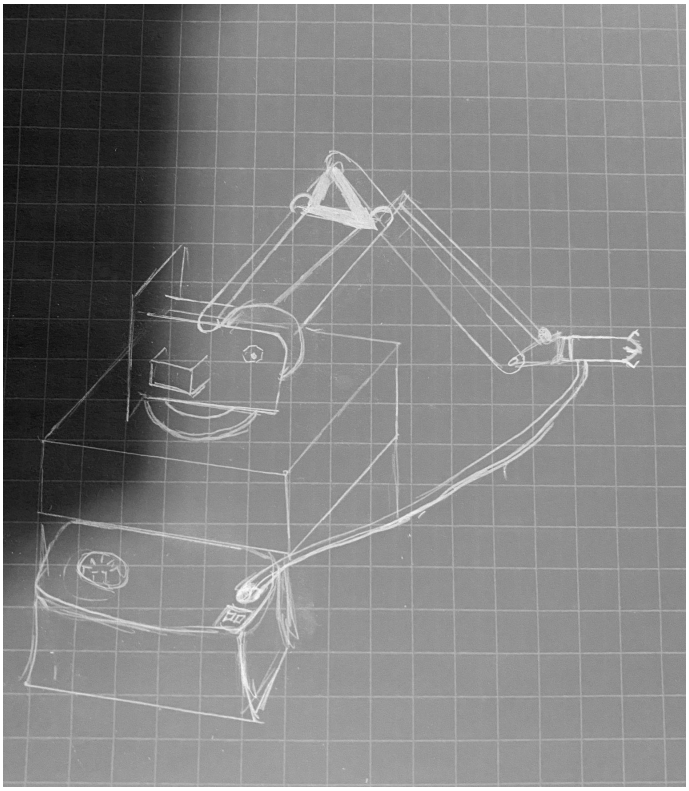


Camera + Arm sketch




side view
clamp
arm
clamp
housing
base

Paint gun + Arm with paint tank sketch



Project Schedule

PROJECT ACTIVITY	**DATE**
Prototype 1 Testing	March 1-5
Prototype 1 Presentation	March 6
Prototype 2 Testing	March 7-12
Prototype 2 Presentation	March 13
Final Prototype Testing	March 18-26
Final Prototype Presentation	March 27
Design Showcase	March 30
Final Presentation	April 5-8

Project Risks

- Components might not deliver in time (delayed, lost in transit)
- Source code might not be completed on time
- Incorrect calculations of dimensions might create a delay
- The project might not perform as well as initially expected due to unforeseen variables such as environmental shortcomings
- The project might go over the initial budget
- The project might take longer to finish than expected due to situations:
    - Some of the members live off-campus, making it difficult for them to attend meetings during inclement weather
    - Team members might slack-off or be busy (exams, test, other courses)
    - Group conflicts resulting in delays
- Accidents such as dropping the end-effector
- Mistakes such as using the wrong bolts/nuts
- The 3D printer might misprint, creating delays
- Inexperience with Python programming language might create some delays
- Obstruction recognition not up to par; system might be unsafe to use
- Insufficient knowledge of libraries may cause delays
- Paint lines may get clogged
- Vacuum hose may get clogged
- Sander might lose effectiveness due to low quality sanding disks
- Cables/wires may get tangled, therefore damaged
- Camera might suffer water damage

Contingency Plans

- If camera order fails to ship, we will replace the camera with an inexpensive depth sensor
- We will have to buy a more powerful motor if the sander does not have adequate performance
- If learning Python proves to be too difficult, we will have to resort to using the C programming language
- If deadline missed, an emergency meeting will be arranged for the development of missed deliverable
- Accident correction methods will be employed to fix any hardware/software damage
- Mistakes may cause design plans to be changed to cut down further costs
- Safety risks will be given upmost priority; design plans may be subject to change, ergonomics might be sacrificed
- Issues with 3D printing/laser cutting or budget may require contacting other groups for help
- Sanding disks replaced with a different brand
- Thicker hose/lines may be used for vacuum/paint; lower paint to water ratio might be used to make the paint thinner

- Wire management strategies such as cable tying will be employed
- The 3D printed cover for camera will be made tighter, using a waterproof stuffing

Prototype test plan

Test ID	**Test Objectives**	**Description of prototypes and basic test method**	**Description of results to be recorded and how these results will be used**	**Estimated test duration and planned start date**
01	Power on/off	Checking whether system starts up and shuts down properly	N/A	02/24/2022 15 minutes
02	Primary axes Locomotion	Accuracy of movement robot on all axes using inverse kinematics	If it fails to move accordingly, the inverse kinematics solution will be revisited	02/24/2022 2 hours
03	Stabilization	Once moved, the robot stays on those coordinates	If it fails to stay, the coding solution will be revisited	02/24/2022 1.5 hour(s)
04	Camera Clarity	Live feed with a clear picture	Goal is to reduce camera latency	02/24/2022 30 minutes

05	Input Latency	Delay between movement input and output	Time taken to satisfy a condition. Goal is to reduce time as much as possible.	02/27/2022 2 hours
06	Ease of attachment	Swapping in/out all attachments	Time taken to change an attachment; latch system will be revisited.	02/27/2022 1 hour(s)
07	Vacuum Efficiency	Amount of residue picked up	Difference in mass in grams of vacuum bag per hour	03/03/2022 2 hours
08	Sander Efficiency	Area cleared in a period of time along with accuracy and precision	Area in m^2 cleared per hour, difference checked between desired area and cleared area	03/03/2022 2 hours
09	Paint gun efficiency	Paint gun accuracy and precision; area covered in a period of time	Area in m^2 covered per hour, difference checked between desired area and painted area	03/03/2022 2 hours
10	Usability	Overall ease of use ranked by users	Comfortability with system; ergonomics and design checked	03/05/2022 1 hour(s)

11	Safety	Overall safety of system checked by obstruction testing	Safety and viability checked	03/05/2022 1 hour(s)
12	Cost-cutting	Prototype developed should be cost-effective; users will be asked about likes and dislikes of design	What to cut and keep on the designs using a poll	03/05/2022 1 hour(s)

Wrike Snapshot:
https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=Gbs4rHAIO6hWQ3cHD9mH9gScR3GZW6oy%7CIE2DSNZVHA2DELSTGIYA