Progress report 1: Conceptual design report

Goal: Present 3 feasible options for the robot (incl. strategy) with brief analyses of costs and benefits of each so that a decision can be made about the "best" option to take forward and develop further. These 3 options should represent different approaches to meeting the requirements of the project.

This report will demonstrate the use of mechatronic system design techniques taught in the first semester of 301 to generate, elaborate, evaluate, and compare concepts. Think of this report as presenting several possible options to a client who has engaged you to develop this robot. We don't want to see every possible sketch you came up with, but 3 that are feasible, with enough detail to make initial comparisons/evaluations and a recommendation for further development.

Page limit: Min 10 and max 15 pages (not incl. Title page). You can use up to 3 additional pages for appendices to present calculations that feed into concept evaluation.

We expect reasonable font sizes and margins. We want to see concise, thought-out design reports, not a compendium of every possible piece of information you could scrape together. You don't need to use every design method ever conceived, but choose some techniques that you feel are appropriate – say why.

Some sections that you might consider having (in no particular order):

Executive summary: Very brief summary of the main findings/recommendations of the report with some justification.

Introduction: Briefly describes the project (provides context for the report) and outlines what the reader can expect to find in the rest of the report.

Requirements specification: You'll need to develop the system requirements from the vague description you have received (the rules etc.) – this isn't simply copying them down, but converting them into formal requirements that your design can ultimately be measured against (tested). For example:

"*The robot actuator arm shall be able to lift an object weighing greater than 1.0kg*"

Note: These requirements are those that are general to the project. There will be additional requirements depending on the strategy you eventually decide to follow, which you will develop later. For example, a robot designed primarily to prevent the competition gathering weights will have some shared and some different requirements to a robot designed to gather as many weights as possible while ignoring the competition.

Design space and concept generation: You should describe the boundaries of your robot/solution in terms of hardware, different strategies to beat opponents, the competition environment, etc. You could mention/describe the equipment you have been provided. Very briefly describe how you came to these ideas – i.e. using methods that we spoke about in class (brainstorming, concept tables etc)

Proposed concepts: Present initial sketches, models, and descriptions etc of your 3 options. You need to show that you have thought through high-level system design of these concepts, using some techniques such as – Context diagrams, functional architecture diagrams, N2 charts, behavioural flow chart, FSM graphs. (Not all of these, but choose a couple that you think are appropriate to indicate how your concepts would work and be put together).

Concept evaluation: Need some basic/approximate calculations or estimates of costs, forces, power requirements, available computation and memory. Evaluate/compare the concepts – FOM table.

This doesn't need to be exquisitely detailed or accurate at this stage – just provide enough to be able to evaluate and compare the concepts in a relatively objective manner.

Briefly discuss/comment on these 3 concepts in the context of the competition and specs – factors such as robustness, reliability, ease of build and maintenance between rounds, modularity, and cost.

Conclusions and recommendations: Based on your evaluations, make a recommendation for one of the concepts to be developed – back this up by summarising its benefits or why you chose it. While we won't hold you to this design, we would expect that your final form be based on what you present in this report.

Contribution statement: Briefly describe the specific contributions of the team members in the project up to this point. For example:

Howard Wolowitz:

- *Requirements specification*
- *FOM calculations for concept 1 and 2*

Leonard Hofstadter:

- *Sketching concepts*
- *FOM calculations for concept 3*
- *Report writing*

Sheldon Cooper:

- *Room-mate agreement*
- *Making tea*