Progress report 1: Conceptual design report

Goal: Present 3 feasible options for the robot with analyses of performance and costs of each so that a decision can be made about the "best" option to take forward and develop further. To meet this goal, each of the 3 concepts should be complete robot, developed to a suitable level that enables a robust analysis and comparison between options. Each concept should present a different approach to meeting the requirements of the project.

This report will demonstrate the use of mechatronic system design techniques taught in the first semester of ENMT301 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 complete robots that are feasible, with enough detail to make initial comparisons/evaluations and a recommendation for further development.

Page limit: Max 15 pages (not incl. Title page, Table of Contents). You can use up to 6 additional pages for appendices to present calculations, testing etc 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.

Individual component: Each member of the group needs to take responsibility for writing up one of the concepts in the report. Each person in the group will receive an individual grade for their section, in addition to an overall grade for group report. Given that this is a group project, I do expect that you will help each other in this aspect and if the group is working well together, you will probably all receive very similar grades.

To allow us to assign these individual component grades, please ensure that the responsible person's name is listed with the concept name.

The individual grade component will be worth 30% of your overall grade and the remaining 70% will come from the group grade for the rest of the report.

Some sections that you might consider having (feel free to develop a better structure of your own):

Executive summary: Very brief summary of the main findings/recommendations of the report with some justification. Not a verbose table of contents!

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 will need to develop the system requirements from the vague description you have received (the rules etc.) – this is not 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.

Proposed concepts: (This section is required for the individual grade component): Present your 3 options using good quality sketches, solid models etc. 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, 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).

This section should include some *relevant* quantitative results from testing/calculations or estimates of costs, forces, power requirements, available computation and memory etc to enable evaluation of the concepts against each other. The details of testing, calculations etc can be in an appendix, but the important numbers should be described and discussed.

Concept evaluation: 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. If you cannot directly quantify some aspect, consider an appropriate surrogate. For example, number of moving parts might be a good surrogate for complexity of the system.

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.

Some things to note*:*

Teams with 4 members should present 4 concepts and can use an additional 2 pages over the prescribed limit.

Please don't hand in your first draft! You've had some really good lectures from Jacqui about writing, so we expect these reports to be well structured and well written. Poor writing will result in a low grade.

Try to ensure that the individual sections are written in a way that is consistent with each other and with the rest of the report – remember, the report has to be coherent as a whole.

A good example of a report presenting three developed concepts is the 2014 report by Group 1 (*2014 Progress Report 1 Group 1.pdf* - available on Learn). However, there is still room for improvement, particularly around testing and quantitative, objective comparisons between concepts.