**Aims & background material (student)**

This final year project (FYP) will build on the outcomes of a research project that I conducted in the summer of 2018. The goal of the earlier project was to devise a decentralized control algorithm for autonomous cooperative transportation of a payload (CPT) by two unmanned aerial vehicles (UAVs). The proposed algorithm relied on one UAV as a ‘leader’ agent and the second UAV as a ‘follower’ agent. Over the course of the placement I formulated a mathematical model of a simplified CPT system (constrained to motion in two dimensions), developed a simple PID controller, and simulated its operation using MATLAB and ROS-Gazebo. Work remains to be done in executing more complicated maneuvers, managing more than one follower and incorporating greater robustness to the environment.

For the FYP I wish to build on my previous by developing a more complex CPT system. The title of the project will be ‘A Decentralized Multi-Agent Scheme for Cooperative Payload Transportation’. I have decided to pursue ROS-Gazebo simulation testing only, due to time and budgetary constraints. The core operational objectives will be to introduce trajectory optimization and real-time optimal control for each agent. Secondary objectives include executing motion control in three dimensions, safely managing hardware failures and avoiding inter-agent collisions.

By the end of the project I hope to complete a working simulation in the ROS-Gazebo environment. The platform will be used to test the performance of both the optimized control scheme and a simple PID controller as benchmark.

**Student Summary of project deliverables, fallbacks & extensions (student)**

**Deliverables**:

By 17 November the literature survey will be completed. The findings will be summarized in an annotated bibliography that will be shared with Professor Eric Kerrigan (EK) and Ian McInerney (IM).

By 24 November I will develop an initial mathematical formulation for the optimization problem. I will discuss this with EK and IM and make improvements as necessary.

By 15 December I will develop an interface between the ICLOCS optimization package (MATLAB environment) and the ROS-Gazebo environment. This will be used to demonstrate trajectory optimization for a simulated aerial drone flying between two points. I will also share documentation of my work with EK and IM.

By the middle of Term 2 I will have integrated the optimal control algorithm into the ICLOCS-ROS-Gazebo simulator. This will be used as the platform for achieving the secondary objectives listed above.

The Interim Report is due on 28 January, 2019. The Final Report is due 19 June, 2019. Presentation of the project findings will occur in the final week of Term 3.

The tentative timeline aims to complete a large portion of the research and problem formulation in Term 1. The timeline is less specific in Term 2, however I expect to use the available time for iteratively refining the problem formulation and further simulation.

**Comments on project deliverables (2nd marker)**

The tasks devised look more or less reasonable; however, the timescales for the first part look a bit unrealistic to me (several unrelated tasks being completed at a rate of one task per single week). There's little detail about the work in the Spring term as well.

**Summary of Risks (student)**

My primary concern is that the timeline is ambitious, so a continuous work effort and a flexible time schedule will be necessary. There will be challenges with the problem formulation and the simulation development, possibly leading to delays in fulfilling later project work.

Weekly progress meetings with EK and IM will take place to provide me with an opportunity to regularly reflect on achievements and setbacks.

I will also need to ensure that I regularly consult the project guide published by Dr Thomas Clarke, to be sure of the exact requirements for project work.

Finally, in the weeks before the submissions of each report, I will need to set aside time to write drafts in parallel with the simulation development and testing.

**Assessment of Risks (2nd marker)**

Some of the text in this section reads a bit generic and could be applied to almost any final year project. Some detail about the specific risks of this project, potential project extensions and fallback plans are better reported in the section about "aims and background".

It is important to discuss what a reasonable expectation of the outcome of this project would be, what can go wrong and may suggest to drift from the original plan and what could be done if the whole project takes much less time than originally anticipated (which is unlikely, I suppose).