Mid Term Proposal Instruction

Important Dates

- The proposal is due on **05/12**.

Instructions

- Your proposal should **at least** include the following sections:
    o **Title Page** with your group members' names and affiliations.
    o **Overview**, including **mainly** motivations and tentative specific aims.
    o **Literature Review**. You are not required to complete the literature review for the mid term proposal. But you should include some keywords you are going to survey and a plan on how to complete the literature review, e.g., what main topics you are planning to focus on, which databases you are going to use, etc.
    o **Timeline and Contributions**. You need to provide a tentative timeline on the aims specified in the **Overview** Section as well as a description of each group member's expected contribution (if your group consists of only one member, you can skip the last part).
- Each group need to discuss with me first before submitting the proposal. Here are some suggested steps you can take.
    o Talk with your classmates and use Canvas in order to find people who share similar interests with you. I would suggest you to talk to as many people as possible, not only those who are in your research group for instance. Groups consisting of people from multiple departments or multiple fields or multiple grade levels are highly encouraged.
    o There are two ways that you can choose your topic, <u>one</u> is to selected one from the list provide in the **Suggested Project Topics** section and <u>the other one</u> is to come up with your own topic (ideally related to your own research but **must** overlap with the materials that have been covered or will be covered in the course). If you choose your own topic, please add a subsection titled "Current Work" in the **Overview** section and describe what you have achieved so far. Here are some of the steps that can help you to consolidate your topic:
        ▪ Start from an interesting application, e.g., autonomous delivery of heavy equipment, UAV-assisted search and rescue missions, and autonomous infrastructure inspection. Ideally you also want to choose an application that is of societal and economic significance.
        ▪ Identify one key technical challenge for the particular application that you have chosen. For instance, if you choose infrastructure inspection as the application. One technical challenge could be how to schedule to path of a UAV (or a group of UAVs) given that you only have partial knowledge about the task, e.g., you know the layout of the pipelines but not the locations of the potential leaks.

- Since this is a course project, it might also be helpful to start to think about what assumptions you need to add in order to make the project feasible. For instance, for the autonomous infrastructure inspection example, you can assume that your UAV(s) is equipped with a differential GPS, thus the positioning error is negligible.
  - Meet once or twice and decide on a specific topic and come up with a tentative plan.
  - Send me an email with "MAE 275 Group Meeting" in the title **before 05/05** to arrange a meeting. Please send me the email as early as possible to make it easier for me to arrange the meetings.
  - During our individual meeting, we will discuss your plan to check whether it is feasible or not. I may have some suggestions on the topic that you choose or provide a list of key words or papers that you can read.
  - After the meeting, you can start to write the proposal. You will need to submit your proposal electronically via Canvas.

Criteria

- Title Page (5 points)
- Overview (50 points)
- Literature Review (20 points)
- Time and Contribution (10 points)
- Report Quality (15 points)

Suggested Project Topics

1. **Autonomous delivery of heavy equipment or goods**. One interesting scenario is the equipment is of comparable weight and is attached to the UAV via a cable. If you want to make the project more challenging, you can think about how to deliver the equipment from one end of an L shaped valley to the other end.

2. **Autonomous landing on a slope.** The autonomous landing problem with external positioning aid has been solved by the GRASP lab at Upenn. One realistic scenario you can tackle then is to only equip your UAV with a GPS (thus subjected to large positioning error). Or you can solve the landing problem in windy conditions.

3. **Autonomous tracking of a moving target in GPS denied environment.** An application corresponding to this is surveillance inside buildings. Since your UAV cannot rely on GPS to access its own position as well as the position of its target, you may need to think about some other ways to acquire the positions, e.g., via a camera.

4. **Autonomous inspection of critical infrastructures.** If you assume you know *a priori* the layout of the infrastructure, e.g., pipelines, as well as the locations of adversary events, e.g., leaks, this is not an interesting problem. But you can make it more interesting by adding some realistic elements, e.g., unknown event locations, winds, and UAV swarms.