SE423 Final Robotics Project Overview

Your final robotics project will be completed in **teams of 4 to 6 students**. This capstone assignment is an opportunity to showcase your skills in robotics, control systems, sensing, and software integration. Each team must **propose and execute a unique robotics project**, designed, built, and tested over the next **three weeks**.

The first week will focus on your **project pitch**, where you will define your goals, assign roles, and begin your system design. This will be followed by two weeks of development, testing, and iteration.

Project Requirements and Roles

Each team must include the following core components in their project:

- **Path Planning**: Design algorithms for navigating the robot from one location to another, with or without a predefined map.
- **Sensing and Perception**: Use LIDAR, a camera color, or camera AprilTag vision to help the robot perceive its environment and make decisions in real time.
- **Control Systems**: The implement control loops (e.g., PID) to manage motor behaviors is already done for you.

Each component should have 1–2 members assigned. Teams of 6 are required to explore more advanced tasks.

Sample Project Idea

An example project could involve **autonomous hallway navigation**, where your robot:

- Follows hallway walls using sensor input.
- Avoids obstacles using LIDAR or vision.
- Collects small objects (e.g., golf balls) using the collection system from Lab 7.
- Returns autonomously to the starting point.
- Outputs live position and obstacle data to LabVIEW.

Sample Advanced Feature Ideas (Optional)

Consider implementing creative or advanced features to enhance your project:

- Improve localization by fusing LIDAR and camera data.
- Use A* path planning and adapt to newly discovered obstacles.
- Explore an entire hallway before returning to the start.
- Live obstacle mapping into LabVIEW, logging, and presentation of performance
- Trigger speech or audio responses (via LabVIEW or onboard) when people are detected.
- Use shape, color, and AprilTags to recognize specific objects (e.g., a trash can).
- Deliver objects to multiple pre-known locations with return to a loading zone between each delivery.
- Render the known image based on where the robot drive using LabVIEW.

Milestone Timeline

Week 1: Pitch & Planning

Pitch Due: Tuesday, April 29 at 17:00

- Submit your project proposal.
- Define project goals and component responsibilities.
- Begin hardware setup and initial code testing.
- Outline system architecture and initial plan.

Week 2: Subsystem Development & Integration

Milestone Due: Tuesday, May 6 at 17:00

- Demonstrate individual subsystem functionality (e.g., object collection, path planning, etc).
- Show integration of position reporting to LabVIEW.
- Document progress and challenges.

Week 3: Final Testing & Presentation

Final Demo Day: Thursday, May 15, 11:00–14:00

- Full system integration and final testing.
- Prepare live demonstration for Demo.

- Capture photos and videos for your report.
- Submit final report (due one day after Demo).

Note: Demo end time is flexible for those attending the ISE Senior Design Final until 13:00 on the same day.

Final Report Requirements

Due: Friday, May 16, 17:00

Create a web-based final report that includes the following:

1. A written summary of your project's strategy and how your team used the robot's sensors.
2. Photos and videos of your robot in action (instructor videos from Demo day will also be provided).
3. A downloadable zip file with all **commented** project source code:
    - C code
    - Linux code
    - LabVIEW files
4. Team photo(s) and full names of all group members.
5. Please use **Hackster.io** to host your report, if possible.

Grading Criteria

Your grade will be based on:

- **Individual Effort**
- **Completion and quality of the final report**

Note: Your final grade is **not dependent** on your robot being fully functional on Demo day — effort and documentation are what count most.