ECED 3901: Assignment 1

Date: January 09, 2026
Due: January 21, 2026

Learning Outcomes:

The purpose of this assignment is to have you formalize the client's needs, take stock of your resources, and come up with a preliminary high-level design using risk analysis. It will also allow you to research and gain experience with the components in your design kit, including the Robot Operating System 2 (ROS2) software that will enable control of the remote robots.

Deliverables:

Answer the questions below relating to the design process and your design kit.

Submit one document with your team's assignment solutions. The work must be **your team's own original thoughts and answers**. Copying will not be permitted and will result in zero points for the entire team for the assignment.

Deliverables (5-pages max, questions equally weighted)

Question 1:

Reflect on client requirements and your current capability.

- What are the client's requirements and constraints?
- Given what you know, what R&D needs to be performed and what training will you need to deliver a viable solution?
- What resources do you have?
- What about the team?

  Be clear about your current strengths and weaknesses, areas of competency, gaps of knowledge and your available time. This will direct your future efforts. A SWOT analysis might be merited.

Question 2:

One way to help prioritize client requirements and focus our design efforts is to perform risk analysis. To do this, we need to identify stakeholders, create risk matrices, rank order the risks, and finally plan our design efforts to either mitigate or prevent the associated hazard.

a) List stakeholders. Identify their expectations related to the project.

b) For each stakeholder, list 2 risks associated with the project.

c) One risk is unsafe navigation that leads to damage to the robot and/or surrounding objects. Propose a simple 3x3 risk matrix, with associated criteria identifying the metrics for likelihood and severity.

d) Define what a risk tornado diagram is and how it can be used for design and project management. Make a simple half-tornado diagram of the challenge scoring and highlight your own top 3 risks for **marks awarded/deducted** based on technology elements in the challenge.

e) Using your risk-analysis answers, please articulate in a few sentences your plans to use simulation or other tools that will allow you to de-risk designs. Provide concrete tests to be performed on your top 3 technology risks, the criteria evaluated, and the results you will report.

Question 3:

What is the Robot Operating System 2 (ROS2)? What features in ROS2 can be used to help your design effort? What is a publisher and subscriber architecture?

Question 4:

Describe the interface with the robot. What are the ROS2 topics /cmd_vel, /odom, and /LaserScan (/scan for us)? What are each of these topics used for and will they give you adequate access to robot sensors and actuation? What others need to be added?

Question 5:

Find a design flaw in the ECED3901 robot. Explain why it is a design flaw and suggest how it might be resolved.