Company Information

Company Name	*Schweitzer Engineering Laboratories Inc.*	Date Submitted	*10/31/2021*
Project Title	*Advanced Human Machine Interfacing Through The Use of Hand Gesturing in 3D Space* **(SEL_HAND)**	**Planned Starting Semester**	*Spring 2022*

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

Discipline	Number	Discipline	Number
Mechanical		Electrical	1
Computer	3	Systems	
Other ( )			

Company and Project Overview:

SEL invents, designs, and builds digital products and systems that protect power grids around the world. This technology prevents blackouts and enables customers to improve power system reliability and safety at a reduced cost. A 100 percent employee-owned company headquartered in Pullman, Washington, SEL has manufactured products in the United States since 1984 and now serves customers worldwide. Our mission is simple: to make electric power safer, more reliable, and more economical.

SEL devices are designed to operate with the highest level of integrity regardless of their installation environment. Many devices now feature a color touchscreen to allow the user full control over the device in addition to providing detailed reports, metering, and diagnostic information. The integration of touchscreen technology by SEL was a major leap in the power system industry for how customers interact with the devices that control the power grid. In an effort to continue to lead the industry, SEL wants to take the human-machine interface a step further by allowing customers to interact with devices by using hand gestures in 3D space. This technology would allow customers to control SEL devices by waving their hand directly in front of

the touchscreen without physically touching it. Not only would this be useful for customers wearing thick, protective gloves in the field, but it would also provide a safer, more sterile, environment for everyone.

Project Requirements:

3D gesture technology is new and its potential and practicality have yet to be determined. The current approach is to detect variations in an electromagnetic field with the use of sensors placed around the perimeter of the touchscreen. The objective of this project is to design a variety of sensor configurations to determine which designs are most reliable. Additionally, the students would help in identifying the limits of this technology, for example, broad sweeping gestures like swiping from side to side versus fine-tuned gestures like operating a virtual keyboard.

Expected Deliverables/Results:

- Analysis of various sensor configurations/designs
    - Which layouts provide the highest reliability for detecting most gestures
    - Which layouts are best for broad sweeping versus fine-tuned gestures
    - Which layouts provide the least false detection of gestures
    - Etc.
- Analysis of various gestures
    - Which gestures are detectable per a given design/layout
    - How accurately can each gesture be detected
    - How useable is a particular gesture with regard to navigating a screen
    - Etc.
- Define the limits of the technology
    - What can 3D gesture technology do well
    - What can 3D gesture technology never do
- UX – Usefulness, Design and Constraints of 3D gestures
    - Provide research-based evidence of the value
    - Given a list of pre-defined 2D gestures, identify corresponding 3D gestures
    - Investigate possible errors and constraints
        - Accidental gestures
        - Study environmental effects on gestures

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

The William States Lee College of Engineering (logo)

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):
- Knowledge and understanding of embedded software design
- Knowledge and understanding of user experience fundamentals