INDUSTRIAL SOLUTIONS LABORATORY

Department Project Information

Department Name	*Systems Engineering*	**Date Submitted**	*04/21/2023*
Project Title	*Designing and Optimizing an Agile Supply Chain System Using Robotic Automation* ***(UNCC_SE_AGILE)***	**Planned Starting Semester**	*Fall 2023*

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	
Computer	1	Systems	4
Other ( )			

Project Overview:

Agile supply chain is a concept that emphasizes flexibility, adaptability, and responsiveness in managing the flow of goods and services from suppliers to customers. One of the key components of an agile supply chain is the ability to quickly and efficiently retrieve items from a warehouse, especially in situations where demand is uncertain or fluctuating. Robotic automation has become an increasingly popular solution to improve warehouse efficiency and agility. In this project, you will learn how to design and optimize an agile supply chain system using robotic automation.

Project Requirements:

Students are required to conduct a series of tasks listed below:

- Assemble a scaled down mock warehouse using small shelves provided in Cameron 158.

  31" Stackable Shelves (12)

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- Make robots with arms using kits provided.

  ROSMASTER X3 PLUS ROS Robot (4)

- Program ROS (robot operating system) to retrieve items from the warehouse using various strategies such as FIFO, LIFO, and random. Python programming is required.
- Create various scenarios of warehouse settings and develop an optimization scheme for a set of given data.
- Conduct experiments under various stocking/unstocking scenarios, such as adding/removing items from the warehouse, changing the layout of the shelves, and adjusting the robot programming parameters.
- Collect data from the experiments, such as the time and accuracy of item retrieval, the frequency of collisions or errors, and the energy consumption of the robots.
- Analyze the data to identify bottlenecks, inefficiencies, and opportunities for improvement.
- Improve the performance of the system by optimizing the robot programming, adjusting the layout of the shelves, or introducing new sensors or algorithms.

Expected Deliverables/Results:

- A functional mock warehouse with robots that can retrieve items.
- A report or a presentation that describes the design and optimization process, the experiments

conducted, the data collected and analyzed, and the performance improvements achieved.
- A demonstration of the system in action, showcasing its agility, flexibility, and responsiveness.

Disposition of Deliverables at the End of the Project:

Hardware and software assembled/developed are the property of the mentor and department. The work product is displayed at the last Expo then immediately returned to the lab.

List here any specific skills, requirements, specific courses, club affiliation, knowledge needed or suggested (If none please state none):

- Python programming skills
- Experience with Raspberry Pi
- Experience with AI programming (desired)