THE WILLIAM STATES LEE COLLEGE OF ENGINEERING

Company Information

Company Name	*TTI Floor Care- North America (Hoover, Dirt Devil, & Oreck)*	**Date Submitted**	*11/24/21*
Project Title	***Carpet Extractor Test Automation (TTI_CARPET)***	**Planned Starting Semester**	*Spring 2022*

Senior Design Project Description

Personnel

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

Company Overview:

[Techtronic Industries Company Limited](#) (the "Company", the "Group" or "TTI") is a fast-growing world leader in Power Tools, Accessories, Hand Tools, Outdoor Power Equipment, and Floorcare for Do-It-Yourself (DIY), professional and industrial users in the home improvement, repair, maintenance, construction and infrastructure industries. The Company is committed to accelerating the transformation of these industries through superior environmentally friendly cordless technology. The TTI brands like MILWAUKEE, RYOBI and HOOVER are recognized worldwide for their deep heritage and cordless product platforms of superior quality, outstanding performance, safety, productivity and compelling innovation.

TTI is a global leader in floorcare with our iconic HOOVER, VAX,ORECK and DIRT DEVIL brands. We are dedicated to creating and advancing innovative cordless cleaning products and carpet washing products for the home and the commercial user. Our strategic multi-brand approach, high-speed product development capabilities and cordless technology are redefining the floorcare industry.

Project Overview

The Floor Care business has robust design and test methodologies that meet or exceed industry standards and validate how well new designs will perform in a consumer's home. One of the test procedures provides a method for determining the relative carpet cleaning effectiveness of wet extraction cleaners or carpet cleaning formulas. The current test method is a manual process that takes a lot of time and has limits on the data that can be collected.

The goal of this project is to identify and execute automation to collect, export, and report test data. The output of this project should include:

- Design and prototype of equipment
- Design and proof of concept of data export and reporting including the programming and UI
- Parts list and costing for hardware and software (if applicable)
- Business case for project execution

Initial Project Requirements:

The test station shall perform the following:

1. Automatically perform colorimeter measurement readings utilizing standardized template readings based on the extractor nozzle width.
2. A test will consist of 4 or 6 carpets of size 18" x 36"
3. Carpet sets will be manually loaded onto a vertical tray mechanism with a maximum capacity of 18 carpets.
4. Depending on the requirement of 4 or 6 carpets the vertical tray mechanism can hold 3 or 4 ongoing tests at any given time. The system should be able to track the correct test based on user input data of a test request number.
5. Measurements will be captured with a Konica Colorimeter
6. These measurements will span 3 sets of measurements of 4 or 6 carpet (samples and will consist of measuring the following
   a. Virgin carpet – each carpet (4 or 6) consisting of 10 sample readings of each carpet from specific locations based on the nozzle width of the extractor used (user input data)
   b. Soiled carpet - each carpet (4 or 6) consisting of 10 sample readings from specific locations on the sample carpet based on the nozzle width of the extractor used
   c. Extracted carpet - each carpet (4 or 6) consisting of 10 sample readings from specific locations on the sample carpet based on the nozzle width of the extractor used
7. All readings will be imported into an excel sheet for automated reporting of results

The test station shall utilize:

1) Utilize Universal Robot for primary mechanical interface with dual use end effector for gripper and colorimeter

2) Labview and or Mitsubishi PLC / HMI for I/O and interface

2) The primary material used shall be 80/20 Aluminum.

The team will be required to visit TTi Floorcare North America for a demonstration of the current Cleaning Effectiveness test to better understand the test process and requirements.

The hardware and software costs required to complete this project are expected to be greater than the $3000 budget allocated. Therefore, additional hardware will be provided by TTI Floor Care North America

as required.

Expected Deliverables/Results:

1) Automated data collection method for the Cleaning Effectiveness for Carpet Extractor test
2) Bill of Material for the Test Station
3) Labview / PLC - HMI / Robot source code and executable
4) CAD models
5) Wiring Diagrams
6) Calibration and User's Manual

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.

List here any specific skills, requirements, knowledge needed or suggested (If none please state none):
Preferred experience in Labview Programming, UR Robot programming, Mitsubishi PLC programming, CAD imaging, CREO, Solidworks, and interest/passion for product development and industrial design!