INDUSTRIAL SOLUTIONS LABORATORY

Company Information

Company Name	Robert Bosch Tool Corporation	**Date Submitted**	11/07/2022
Project Title	Manual Packaging Station Design Improvements **(BOSCH_PACK)**	**Planned Starting Semester**	Spring 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	3	Electrical	
Computer		Systems	2

Company and Project Overview:

The Power Tools Division of the Bosch Group is the world market leader for power tools and power tool accessories. Bosch Tool Corporation's plant in Lincolnton, NC focuses primarily on the manufacturing of power tool blades such as circular saw blade, reciprocating saw blade, and other accessories such as sander belts, Dremel bits and other rotary tools. Bosch Lincolnton's products are heavily used in the DIY and Industrial markets for North America. This project involves carbide tipped circular saw blades which are sold at The Home Depot under the Bosch brand "Diablo". The project is to set up an efficient, ergonomic and flow orientated packaging station to bulk pack the saw blades 10 pieces per carton (i.e. small pizza box) then master packing 5 of these cartons into a box that will contain a total of 50 blades. This packaging concept is relatively new and the demand has exceeded expectations. Due to the volume, Bosch is looking for a complete re-evaluation of the packing work cell and a design for a more efficient and ergonomic process. The total scope of the project will exceed what one Senior Design team can do, so this project is envisioned to have a follow-on Phase 2 to complete the work. This Phase 1 team will develop the overall architecture for the re-designed packaging work cell and implement a portion of their design that is mechanical or purchased product. The Phase 2 team will develop the portions of

the work cell that implement automation functions designed and built by the Phase 2 team using the architecture plan from the Phase 1 team.

Project Requirements:

Individual blades are delivered to the work via a standard cart used in the factory. They leave the work cell in a box that has 5 individually packed boxes, that have 10 blades per box. Each blade is previously labelled for individual sale. The operator also labels the 10 pack boxes for sale and the box with 50 blades is also labeled for sale. So, the packaged delivered can be scanned and sold in units of 50, 10 or singles. The following paragraphs provide the current flow and pictures of the current work cell.

Current State Flow:
Current status: carbide delivery cart to packaging table (blades are manually lifted to the table). These carts are a standard cart used in the factory. Team should consider how this base cart can be re-imagined to make the first step more ergonomic.

All components (blades, labels, divider sheets, boxes) are manually pulled out of boxes and scattered onto the operators' work benches. There is very little organization, and all aspects of the process are completely performed manually by the operator. This causes rise to mix and matching of components and a lack of overall efficiency. As stated, the scope of this project is to improve the overall efficiency and reliability of our manual packing process. This focuses heavily on the organization of the area, ergonomics of the area, and overall efficiency.

Current status: Inner pack cartons are manually assembled and stacked on the packaging table

Current status: blade insert is added to the carton then manually count 10 pcs and manually place a sheet protector / between each blade. Manually verify count by weigh counting with scale, visually check the presence of the UPC and warning label.

Current state: manually close the carton, pick tape from the auto dispenser, tape close and slide the carton over to the master pack table.

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Current state: Manually erect the master carton, apply the SKU label on the carton, pack 5 inter pack cartons into the master and tape it shut and place on shipping pallet.

- Bullet list of all deliverables that the team is to provide to the supporter at the end of the project. Be specific here to avoid misunderstandings.

Project Deliverables

- Develop an architecture design to improve and automate the operation to improve productivity, ergonomics and quality. Define what work will be part of Phase 1 (mechanical fixtures, tools, purchased parts) and what part will be Phase 2 (team design and built automation). Architecture to include:
  - (Design a cart for delivering the saw blades to the packaging table considering ergonomics and positioning for the packaging operation.
  - Automate the box erecting and design a dispensing unit for the carton at the packaging station.
  - Incorporate a blade count verification and UPC / warning label presence into the process (currently uses a weigh scale and visual check).
  - Create a new layout with material flow and replenishment features into work center.
  - Calculate the overall improvement in cycle time (cost savings)
  - The design & layout of the workstation needs to be adaptable to full automation as a future project.

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, specific courses, knowledge needed or suggested (If none please state none):

- Interest in process improvements, factory automation and optimization
- SEGR 3102 (System Simulation, Modeling, and Analysis) for SEGR students