Battery Submodule Assembly Line
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Client Introduction
Photon Automation utilizes high-performance automation and advanced manufacturing process to solve manufacturing tasks for its diverse customer base. The company was established in 2000 and has headquarters in Greenfield, IN. Some of Photon’s operation machines include:
- Welding Lasing Systems
- Robotic Assembly Arms
- CT Scanner Inspection Systems

Photon’s work spans several industries including automotive, battery manufacture, pharmaceuticals and healthcare.

System Model
Photon Automation’s current project is to design and construct an automated assembly line that can output a high-capacity battery pack every two minutes. The company has already created a plan for the line layout and major components of the assembly but has yet to build any physical systems yet. The battery packs are comprised of 4 submodules that each weigh over 200 pounds and contain 13 individual battery cells, endplates, and an interconnection board.

Problem Statement
Our team has been assigned the task of optimizing the submodule assembly process, with a focus on spool replacement, raw material and dunnage presentation, individual battery cell loading, and machine layout improvements. We will evaluate worker safety, recommend material flow and manpower logistics, and reduce assembly time while considering labor costs. By improving the assembly process, we hope to ensure the assembly line’s effectiveness, improve worker safety, and recommend the most efficient strategies to build the battery packs.

Methodology

- Safety procedures: Some hazards of adhesives and voltages used in the assembly include fumes, irritation on contacts, electrostatic discharge, and arc flashes. Safety procedures are based mainly on OSHA standards and chemical safety sheets.

- Cell loading station design: Based on station layouts produced by the client, we evaluated timing requirements for operators and machines. The team also created several dunnage staging suggestions in order to make the area efficient and accessible to operators and forklifts bringing product in and removing waste.

- Dunnage replacement: Several pieces of the submodule are packaged in spools and must be regularly changed out. The amount of material on each spool is not finalized, but the client wanted to get estimates of how long each spool will last. An adaptive Excel sheet was created in case the dunnage changes.

- Packing waste calculations: Battery cells are used rapidly at the loading station. An Excel sheet and design files were used to estimate the dunnage waste over time.

Results

- Safety Procedures
- Wear insulated gloves and boots. Add electrostatic mats if possible.
- Wear proper masks and ensure area is well ventilated.
- Insert splash guard shield and wear appropriate gloves

- Cell Loading Station Design

- Dunnage Replacement Frequency

- Packing Waste Calculations

Discussion
Much of our work can form the foundations of future planning, testing, and evaluation of the assembly line. Through this project, the team has gained understanding of the form and function of assembly line creation. We have gotten to see the level of detail and breadth required to create successful designs that consider every aspect of the process.