Assembly Line Sequence Optimization

SUBARU of INDIANA AUTOMOTIVE, INC.

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Project Background

About SIA: Subaru of Indiana Automotive (SIA) is a large car manufacturing plant in Lafayette, Indiana that produces many Subaru models.

The Trim and Final Assembly Shop is the last stop where each car is fully assembled. Each car goes through:

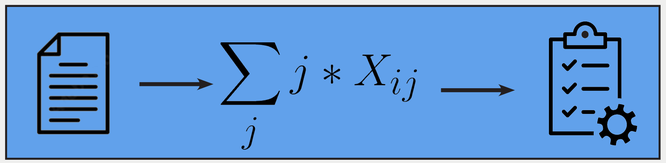
- 8,000 individual assembly processes
- 300 stations

Constraint Optimization: While organizing the processes into the stations, the engineers must account for a list of constraints. For example:

- Step 3 needs Step 1 and 2 to be completed before it can be completed.
- Our algorithm therefore needs to assign Steps 1 and 2 to stations earlier in the process than Step 3.

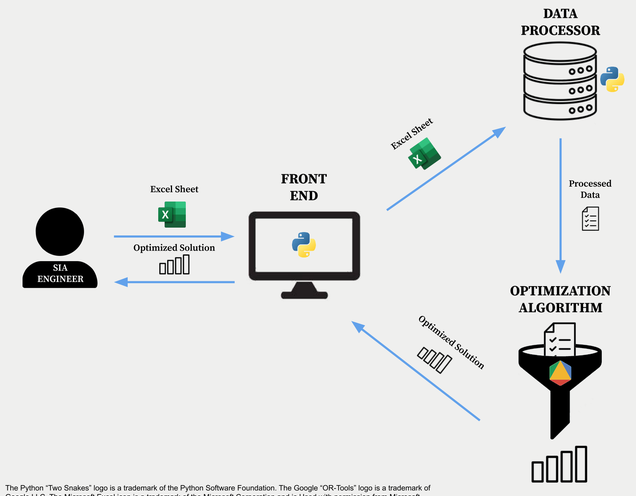
Project Goals and Approach

Overall Goal: Currently, the SIA engineers are in charge of manually assigning processes to stations. Our goal is to build a user-friendly app that automates this task to save the engineers valuable time and effort.



Project Approach: We used a technique called mixed integer programming. We first convert our constraints to a set of math equations. We then solve these equations with using constraint optimization and return a fully optimized solution.

Technical Architecture



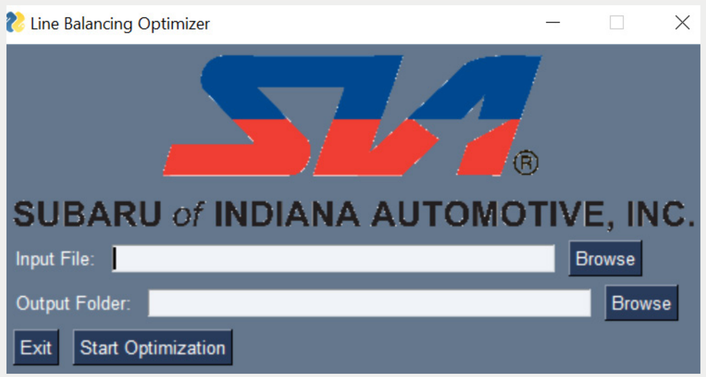
Project Components

Our technical implementation of this project was broken up into 3 interconnected components:

- **Front End:** Runs the program and the user interface that the SIA engineers will interact with.
- **Data Processing:** Interacts with the data inputted by reading the data from Microsoft Excel spreadsheets into Python files, handling errors and inconsistent data, sorting and cleaning data, and more.
- **Optimization Algorithm:** Organizes processes into workstations to maximize utilization while adhering to constraints.

Throughout our project, we made sure to use user-centered development. Every feature we implemented is designed in the most convenient way for the SIA process engineers to use.

Final App



App Steps:

1. Prompts for the input sheet and folder to store the output.
2. Starts optimizing. Displays progress and errors that occur.
3. Completes optimization. Saves file with full optimized line stations to directed folder.

Conclusions & Acknowledgements

Conclusions: Our final app improves the efficiency of SIA's assignment of processes to stations. The app automates the procedure and makes sure return the optimal assembly line sequence. This will allow the engineers to focus their time and energy on other important tasks in the plant.

Future Work: The optimization algorithm is fully portable to different datasets, however the data processing component may need to be tweaked slightly when using differently formatted assembly line data.

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