Deliverable C - Design Criteria and Target Specifications

Prioritized Design Criteria

Functional Requirements

1. The speed of the conveyors on the production line of the beverage packaging station is optimized, increasing overall production speed by at least 2%.
2. The application performing the conveyor analysis is capable of making recommendations for employees if speed is not optimal.
3. The application is able to interpret, analyze, evaluate, and make accurate recommendations for employees based on various operational data including: energy consumption, production output rate, and equipment performance.
4. The interface of the application is easily accessible for all employees.
    a. The application is easy to navigate.
    b. The application gives comprehensive alerts.
    c. The application's design prioritizes readability and clarity.
5. The application enhances the current design of the system in accordance with the V-curve theory.
6. The application is able to gather the inputs and outputs of all machines in the system, and is able to make suggestions based on these values.

Non-functional Requirements

1. The application prevents damage to products or potential harm to employees by providing warnings of when a system is operating at an unsafe rate.
2. The application is secure and prevents other parties from viewing data that is collected from the machine inputs and outputs. This avoids competitors from gaining an upper-hand in terms of production rate.
3. Should new machines and conveyors be added to the operation, the application is easily modifiable and adaptable to these changes.
    a. Thorough and extensive comments are written throughout the application.
    b. Proper programming practices are implemented to enhance readability.
4. The application is compatible with multiple devices and conforms to the layouts accordingly.
5. The application contains a large capacity in order to gather data from the system throughout the work day. This data may then be compiled into a separate area of storage to minimize overflow.

Benchmarking

Technical Benchmarking

Existing Products	Interpreted Need(s) and Product Description
● Overland Conveyor Company	Interpreted Needs Satisfied: 1. Satisfies number 3 under "Functional Requirements".

https://www.overlandconveyor.com/?gclid=CjwKCAiAxP2eBhBiEiwA5puhNWawLvmGSt7Fzf-dt1Dv-h3Sc0ZmXjXdLbBFapujXO46aWnK00Z94BoCVBoQAvD_BwE	Overland Conveyor Company provides "feedback for when starting and stopping may cause design issues" (Accurate & Easy Dynamic Analysis). This feature shows how this already created design is able to interpret, analyze, and evaluate the production output rate and recommend to the user a better production outcome based on when the conveyor belt starts and stops.
• Helix Technologies https://www.helixconveyor.com/App/THelp/helpWarnings	Interpreted Needs Satisfied: 1. Satisfies number 1 under "Non-functional Requirements". Helix Technologies provide Error Messages and Warning Messages. An example of Warning Messages with this design is "Belt Allowable Strength Exceeded" (Warning Messages). This notifies the employee to check the tension and selected belt because the design analyzes the system running at an unsafe rate.
• iBelt https://www.indurad.com/solutions/isolutions/ibelt/	Interpreted Needs Satisfied: 1. Satisfies number 1 under "Functional Requirements". iBelt "measures belt load, speed and misalignment with high accuracy in real time" iBelt "is used for production control, machine optimization and belt wear reduction" (iBelt Overview). iBelt measures volume by using a sensor that is installed over the conveyor belt, it also measures speed with the sensor from above and while it has a "clear view of the material stream".
• TrendMinder https://www.trendminer.com/conveyor-belt-optimization/	Interpreted Needs Satisfied: 1. Satisfies numbers 2 and 3 under "Functional Requirements". TrendMinder "set[s] up operating zone monitors to determine when performance drops, which indicates it's time to clean and perform maintenance" (Solution). This design analyzes the data and is able to make recommendations regarding cleaning and production performance.
• Webdyn https://www.webdyn.com/conveyor-belt-monitoring/	Interpreted Needs Satisfied: 1. Satisfies numbers 4 and 6 under "Functional Requirements". Webdyn's design includes space for 3 inputs and captures its data. The system compares and analyzes the data and it also sends out an alarm when something goes wrong such as before something breaks.

User Benchmarking

Existing Products	User Impressions of Existing Products	
	Positive User Experiences	**Negative User Experiences**
Overland Conveyor Company	• Considers multiple factors of the conveyor process and implements fail-safe methods in the algorithm. • Able to be used on larger conveyor operations (36-42'' wide, 500-15000 ft). • Provides training workshops for conveyor software.	• Cost ineffective - $1,000 - $10,000. • Focuses on larger companies. • Software not adaptable to potential changes in machinery. • Not easily implemented in a workshop - employees would have to attend training sessions in order to be well-versed in the software prior to using it.
Helix Technologies	• Dynamic analysis calculation that is easily adaptable to changes in machinery. • Able to give an accurate estimation for implementation of potential designs. • Able to produce complex calculations (ex. Calculate vertical curve radii and super-elevation angles for horizontal curves). • Provides free learning resources for users. • High storage depending on subscriptions - 500 GB - unlimited GB.	• Not applicable to mobile devices - this would potentially cause issues for employees as they would have to navigate between a computer and the main floor of the brewery to ensure machine functionality. • Cost ineffective for subscriptions that allow access to more features: 230 AUD - 900 AUD yearly.

iBelt	• Able to produce a wide range of analytics regarding conveyor performance.
	  ○ Load speed
	  ○ Belt misalignment
	  ○ Belt freeboard
	  ○ Density
	  ○ Volume
		• Aimed mostly towards very large-scale enterprises involving the mining industry (oil sands, coal, precious metal mining, etc…) - this design is not as applicable for a smaller scale business.

TrendMinder	• Quick trend displays, different methods to analyze, compare and predict • Ease of access to data • Convenient exploratory data analysis, custom calculations,	• Different organization system • Authentication and authorization is not great • Not very intuitive • Some tools are hard to find

	auto share conclusions ● Easy to learn	
Webdyn	● Has the capacity to anticipate failures and increase overall productivity. ● Monitors the status and use of a wide range of conveyors for a wide range of purposes (logistics, manufacturing, etc…) ● Utilizes inductive sensors which are an effective method of input collection.	● Designed to deliver information to employees stationed in an office away from the manufacturing facility. Therefore, the software does not come equipped with necessary urgent alerts that would be delivered to employees via pagers currently working the floor.

Target Specifications

Technical Specifications

- Input Collection Methods:
    - Inductive sensors
- Output Delivery:
    - Software interface via pager or smartphone carried by employees who are currently operating the machinery.
- Software Storage:
    - At minimum, 1 GB
- Produce analytics
    - Speed, misalignment, density, volume
    - Trends, compare, predict
- Monitors status
    - Anticipate and alert failures

Reflection of Client Meeting Impact on Design Development

The impact that the initial client meeting had on design development was significant. In addition to providing clarifying details regarding specifications about how the current design is currently unsustainable, the client was able to share their preferences for the operation of the improved design. Consequently, the curated design specifications and criteria were able to be tailored to the client as to more accurately fulfill their requirements. A greater understanding of the circumstance which necessitated the need for a restructuring of their current design was gained, leading to the ability of the team to cultivate ideas that are more relevant to the client's situation. The initial meeting with the client drove our initial design ideas in another direction entirely. Rather than potentially proposing a design that would implement an entirely new piece of machinery in the manufacturing facility, we were able to reformulate our approach and instead decided that software was the best way to implement our solution. The reason being that a software is more easily implemented into the structure of the company's operations, and can

easily be modified to account for changes in machinery. In conclusion, the first meeting with the client has a very significant impact on the development of our current design as it provided us with the means to effectively gain client data, insight, and reformulate our approach to ideate a potential solution.

2nd Wrike Snapshot:

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=9Hzl8FbuYITF9CayhumDB5peYdhhVwt3%7CIE2DSNZVHA2DELSTGIYA