Group C7

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Introduction

Did you know?

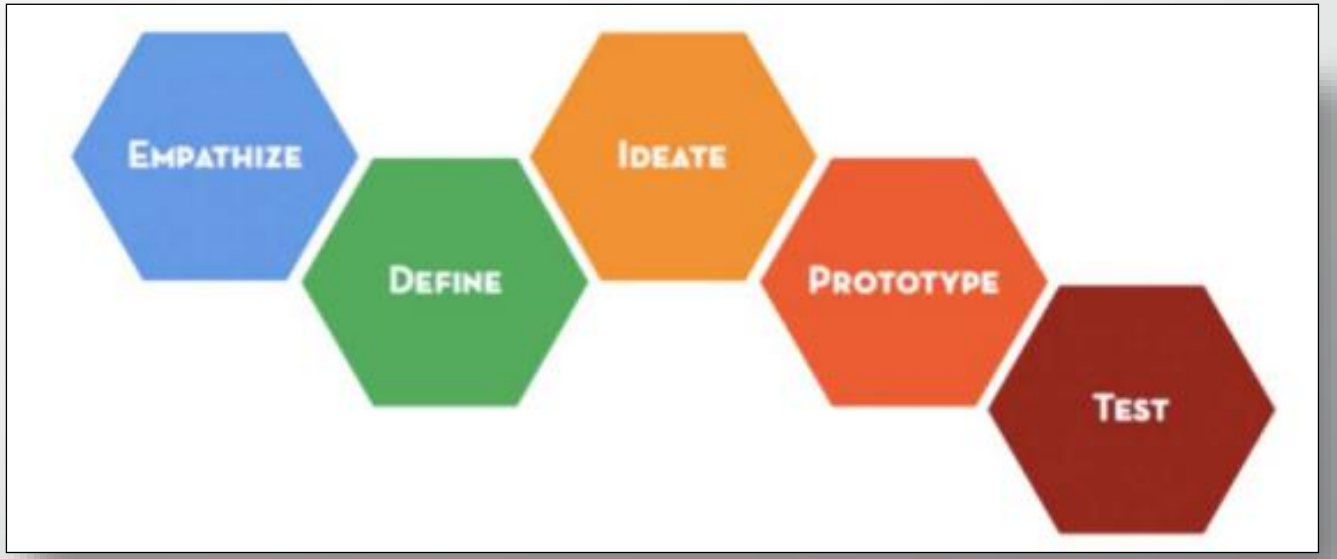
- Every year, companies lose 20-30% of revenue due to inefficiency issues
  - OEE (Overall Equipment Effectiveness)

How do we fix it?

- Implementation of software technologies
  - Data interpretation and comparison
  - Feedback and statistics for improvement

Introduction | General Design Procedure

- **Emphasize**: Identifying what features are required for the product.
- **Define**: Creating a problem definition that addresses the problem and indicates what the solution is should primarily contain.
- **Ideate:** Generating concepts of product models and sketches.
- **Prototype**: Developing specific and comprehensive prototypes encompassing key design criteria.
- **Test**: Testing the performance and fallibility of specifications in comprehensive prototypes.



Mill St. BREWERY

Empathize Process

- Gathering
- Interpreting
- Organizing
- Establishing Relative Importance
- Reflecting on Process

Client Needs	Prioritization
Product will be aesthetically pleasing	3
Product will display longevity	2
Product will increase overall process efficiency by a minimum of 2%	1
Product will be accessible offline	2
Product will be able to output operating speeds for all components of the process	1
Product will be able to provide information pertaining to the current efficiency level of their process	3
Product will require low maintenance from user	1
Product will determine efficiency statistics of the process using the V-curve theory	1
Product will be safe to operate	1

Note: prioritization range from 1-5: The highest priority being 1, whilst 5 being the lowest.

Functional Needs	Non-Function Needs
Product will increase overall process efficiency by a minimum of 2%	Product will be aesthetically pleasing
Product will be accessible offline	Product will display longevity
Product will be able to output operating speeds for all components of the process	Product will be safe to operate
Product will be able to provide information pertaining to the current efficiency level of their process	--
Product will determine efficiency statistics of the process using the V-curve theory	--

Benchmarking

Technical Benchmarking:

- Some of the products that we benchmarked with were: LineView™ Solutions, ABB Ability™ Beer Maker
- For each product, we looked at their desirable features such as functionality, aesthetics, integration, etc. With this information, we were able to create a list of features our product should include

Benchmarking

An example of some of the features that one of our benchmarks, LineView™ Solutions, had:

- Claimed 10% OEE
- Friendly and intuitive user interface
- Recommended speeds

Problem Statement

Problem Statement:

- Mill Street Brewery needs a programmed interface that allows the user to impute system and conveyor speeds, resulting in the identification of various regions where the process isn't running optimally. The product should be usable offline, set production line speeds according to V-curve theory, and result in an overall efficiency increase of at least 2%. In addition, the product will display flexibility by allowing the user to switch between different types of brewery lines (can, bottle, and keg).

Design Criteria

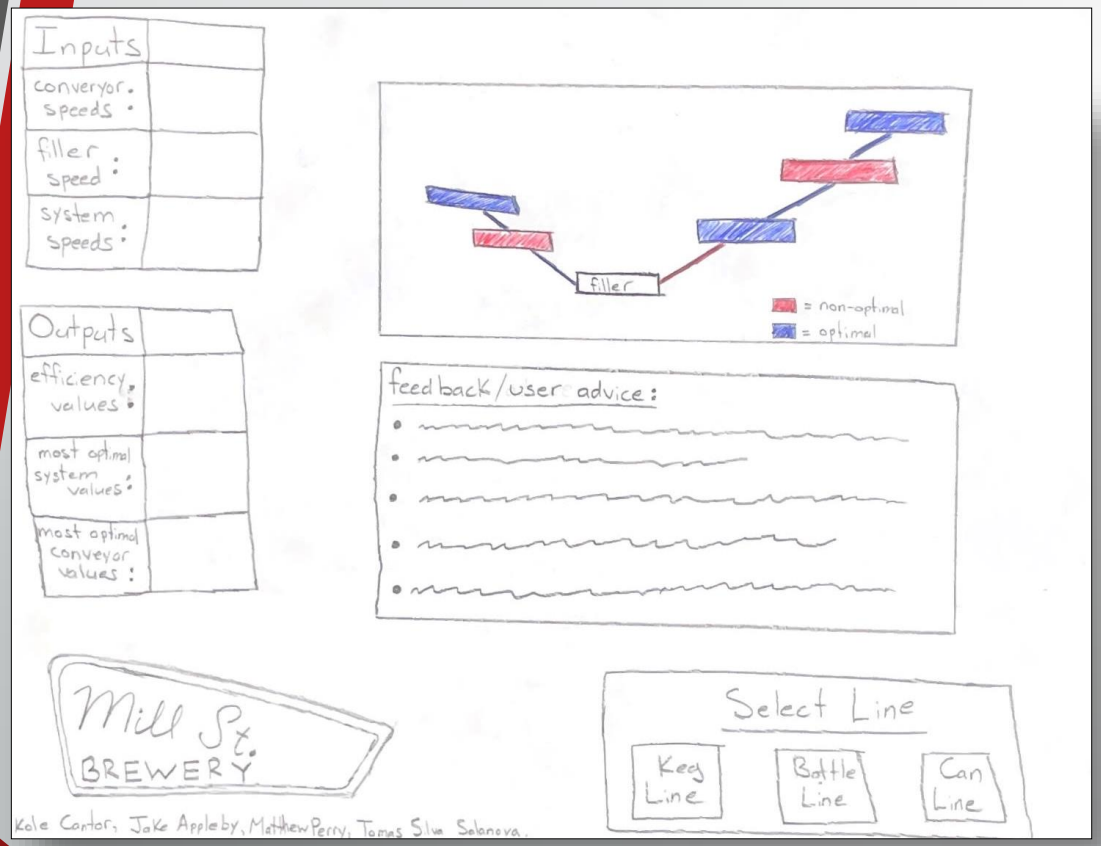
- Offline Flexibility
- Aesthetically Pleasing
- Easy to Operate/Learn
- Provides User with Data to Achieve +2% OEE
- Longevity and Low Maintenance

Design Assumptions

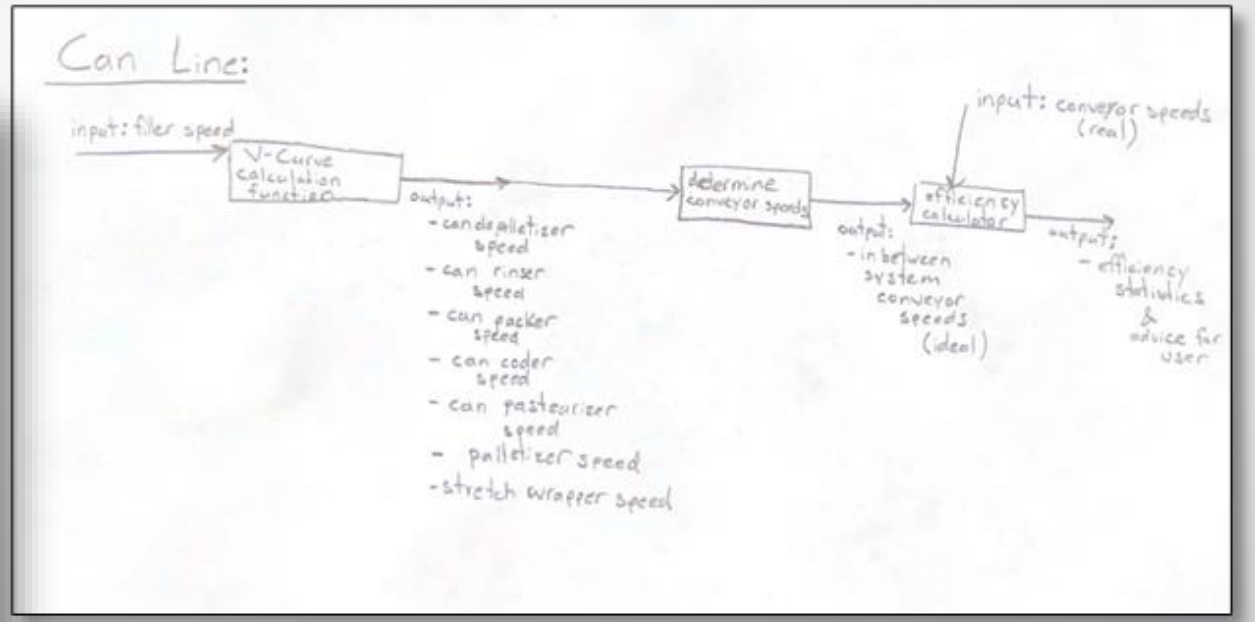
- Product will provide data-interpretation and feedback (not data gathering)
- All client data is considered real and V-Curve produced data is perfectly ideal
- Data nomenclature will be used to dictate conveyor speeds
- OEE will be calculated based on overall cpm error

Ideated Sketch's

Interface Sketch:



Block Diagram:

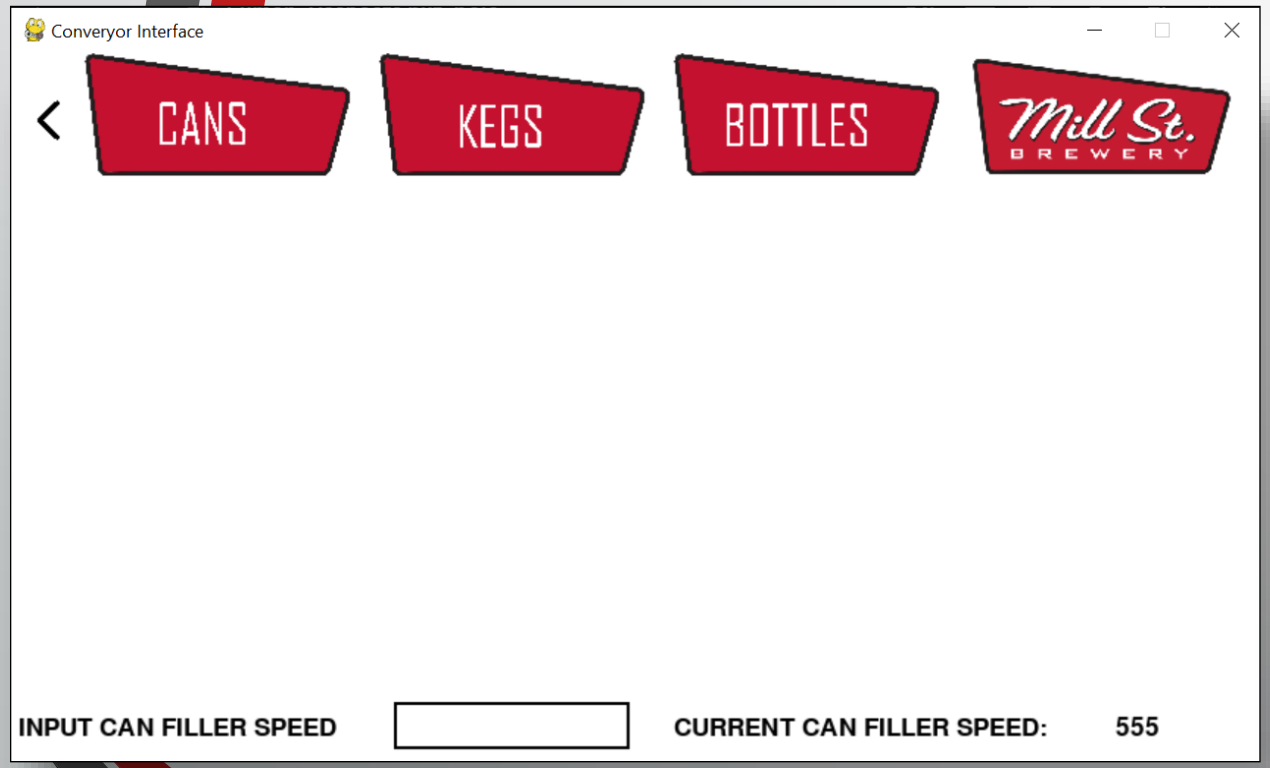


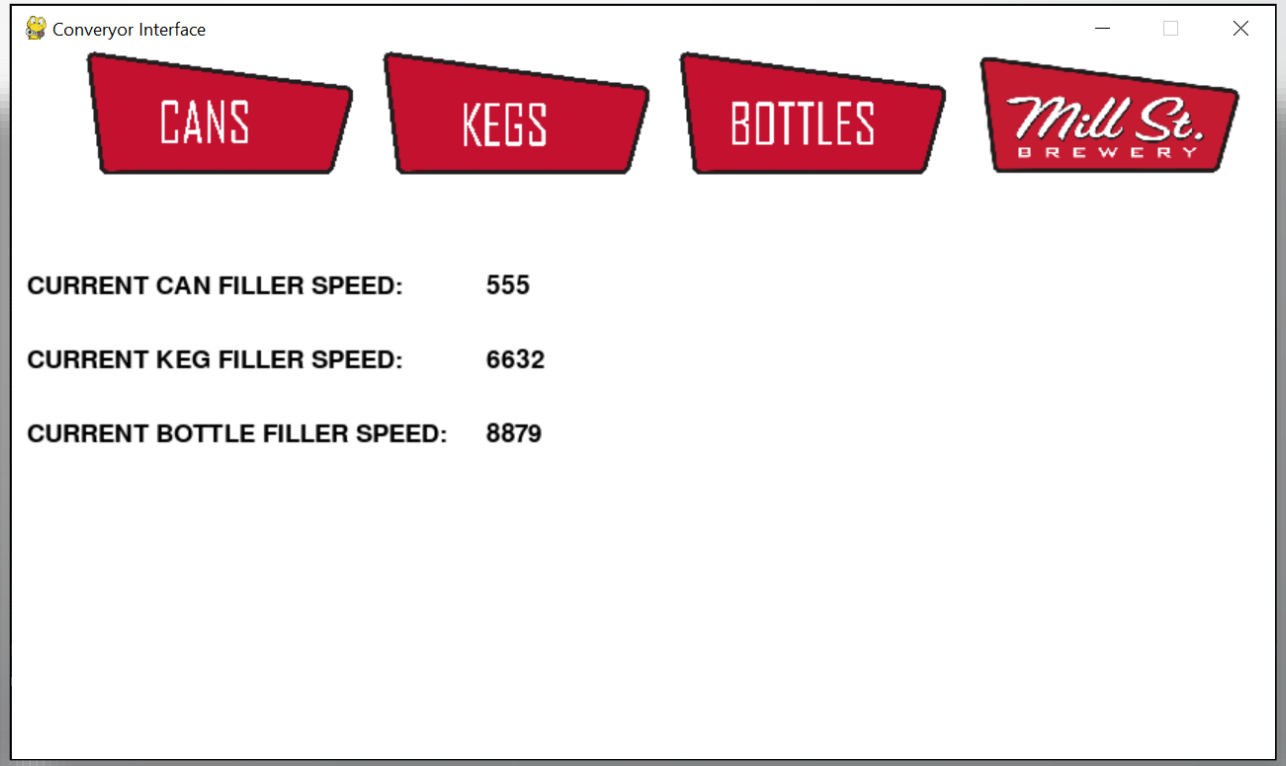
Sketch Evaluations

Using an Evaluation Matrix:

Specification	Weight	Design #1	Design #2	Design #3
Aesthetic	2	1	4	5
Efficiency	3	2	3	4
User-Friendly	3	2	3	5
Low Maintenance	2	2	2	3
Total		18	30	43

Prototype I | User Interface





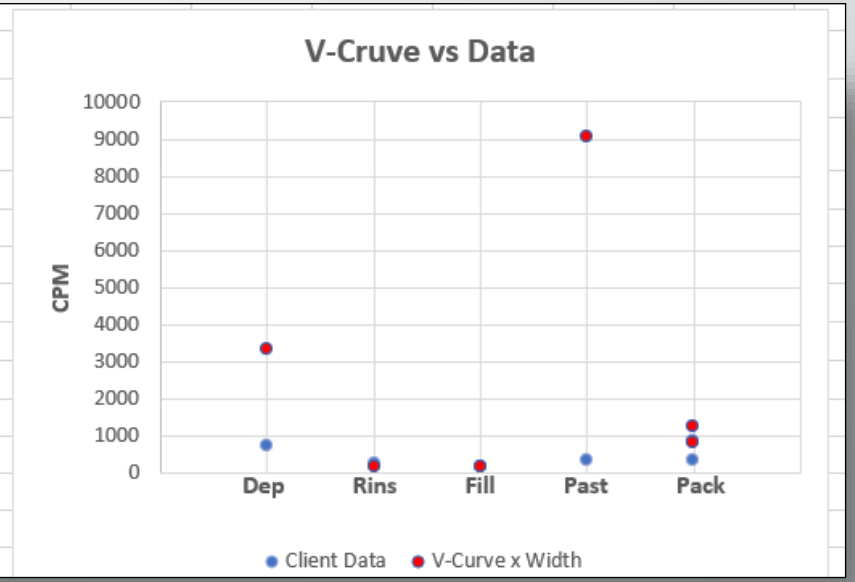
Prototype II | Excel Database

Filler Trial Speed	175	200
Can Depallietizer	**759.02064**	**1004.0352**
Conveyor Post Dep 1	290.346	339.42384
Conveyor Post Dep 2	245.8575	290.8143
Conveyor Post Dep 3	227.5938	272.5506
Conveyor Post Dep 4	456.5925	531.0522

V-Curve x Width	Percent Error	POI
3360	77.41%	Can Depallietizer
840	65.44%	Conveyor Post Dep 1
630	60.98%	Conveyor Post Dep 2
630	63.87%	Conveyor Post Dep 3
630	27.53%	0

OEE
88.50%
Intrest Threshold
50.00%
Insert Filler
175

Machine	Order in Line	Client Data	V-Curve x Width
Depallietizer	1	759.02064	3360
Rinser	2	288.0045	192.5
Filler/Seamer	3	175	175
Pasturizer	4	352.1616	9047.5
Mead Packer	5	360	840
Duo Packer	5	899.136	1260



Prototype Test Plan

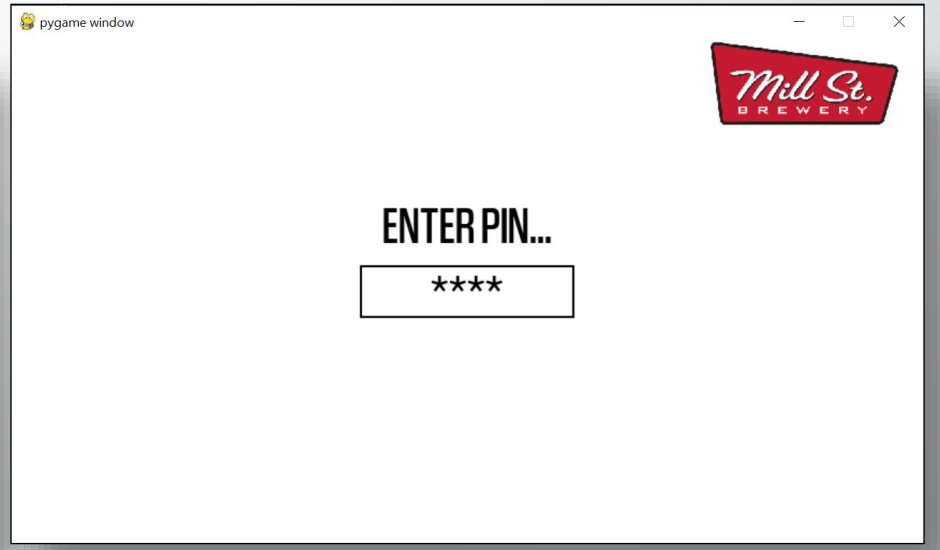
Test ID	Test Objective	Description of Prototype used and of Basic Test Method	Description of Results to be Recorded and how these results will be used	Estimated Test duration and planned start date
1	Create a simple main menu with all the different lines	To test the interface, we will make sure all the menus are working, and seeing if there are any errors in the code	Checking any errors and comparing test results to theoretical results to determine whether it is good enough to be used	Testing already complete
2	Create an interface with no main menu and instead have always one of the lines showing, and being able to change between them	Testing will be very similar for all prototypes. It will involve using the interface and testing all possible scenarios to try and find bugs in the code.	Depending on how the interface performs relative to the other prototypes, the best aspects of it will be recorded (in terms of code).	Test already complete
3	Create a graphical program than can plot system speeds according to V-curve theory	Prototype will be made using excel, test will have user unput filler speed, with a resulting output of all ideal system speeds plotted on a dot chart	Result will be recorded when test successfully outputs desired values. These results will then be recoded for python and used in the final product	Test already complete
4	Create a comprehensive prototype the encompasses all aspects of the final product	Prototype will be made using python and tested for errors in code and calculations	Results will be used to make any final adjustments to the final product	Test duration: 1 hour Planned start date: March 15th

Testing & Feedback

- Feedback:
  - "Have students give feedback on the aesthetic of the user-interface"
  - "Create a login screen for the interface for security"
  - "Live tracking and data collection system?"

Student Number	Rating out of 10
Student #1	7/10
Student #2	8/10
Student #3	7/10
Student #4	6/10
Student #5	9/10
Student #6	7/10
Student #7	7/10

Table 1: Student Feedback on User-Interface



Average Rating: 7.3/10

Prototype III | Design Day

- Prototype III: comprehensive prototype that encompasses all aspects of a final product
  - Combination of Prototypes I and II
  - Interface + Database
- Testing Methods:
  - Error Trapping
  - Maneuverability

Conclusion & Takeaways

- Lessons Learnt:
  - The basic engineering design process (Empathize, Define, Ideate, Prototype, Test)
  - Constant communication with client is important
    - Client expectations can alter throughout a design process
  - Consistent team communication is important
    - Organization, Meetings, Completing Tasks

"Do what you say you'll do, when you say you'll do it"

Questions?

References

- *https://avitusgroup.com/accounting-services/biz/5-costs-of-operational-inefficiency/#:~:text=Inefficiency%20costs%20companies%20anywhere%20from,You're%20not%20alone*.
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- *GNG1103C course material, David Knox.*