Deliverable H - Prototype III and Customer Feedback

Chanelle Menard
Elisha Khandaker
Jonathan Aguilera
Rachelle Choi
Sorosh Benvidi

March 26th, 2023

Table of Contents

Introduction

The objective of this deliverable is to complete the design and testing of the third and final comprehensive prototype. Through feedback that was given in prototype I and prototype II, we plan on following through with the third and final comprehensive prototype plan in order to determine if the prototype has successfully fulfilled all of its requirements in order to satisfy user needs. In this deliverable, we plan on identifying and providing justifications to the changes made in prototypes I and II in order to demonstrate responsiveness to feedback given by both the client and potential users. Most importantly, the third and final prototype will be completely finished and plans for design day will commence in order to present the final product. The overall objective of this deliverable is to provide critical evaluation for the third prototype's test plan and to provide justification for the changes made to the firsts and second prototypes in order to create the third and final prototype iteration.

Prototype III

Images and Description

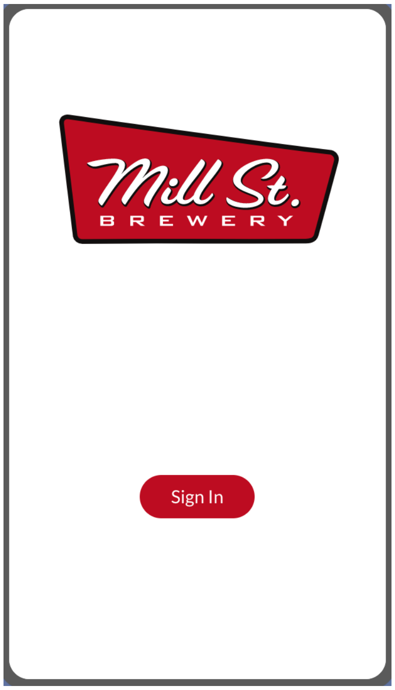


Figure 1. Welcome page

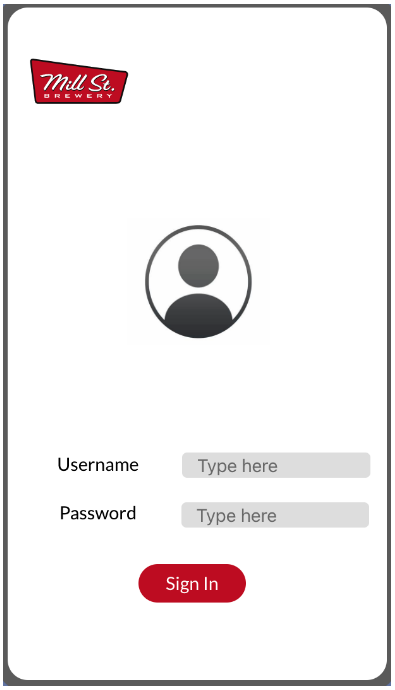


Figure 2. Sign-in page

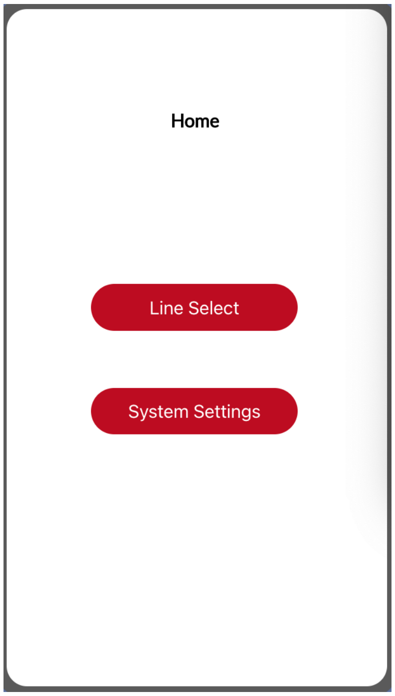


Figure 3. Home page

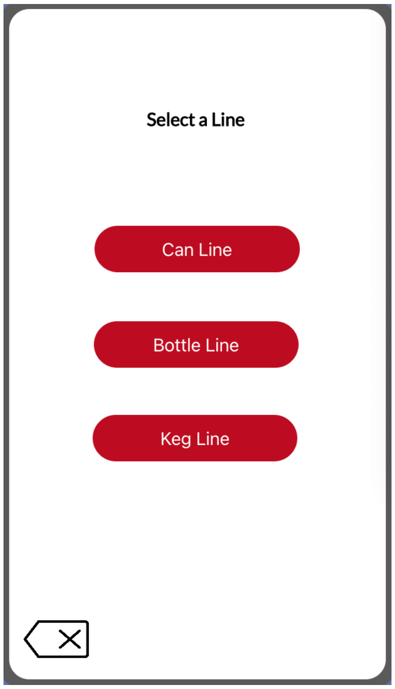


Figure 4. Line Select

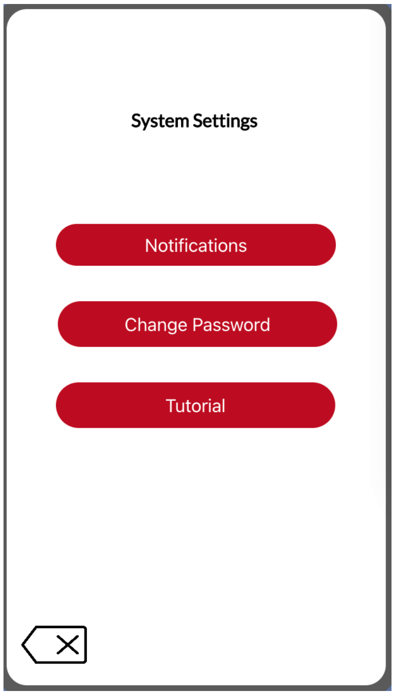


Figure 5. System Settings

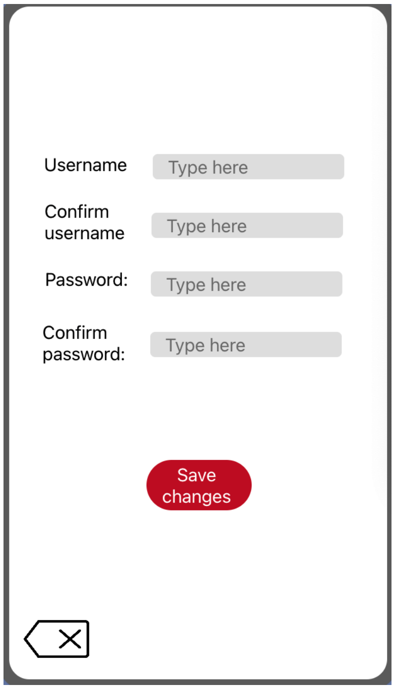


Figure 6. Password Change

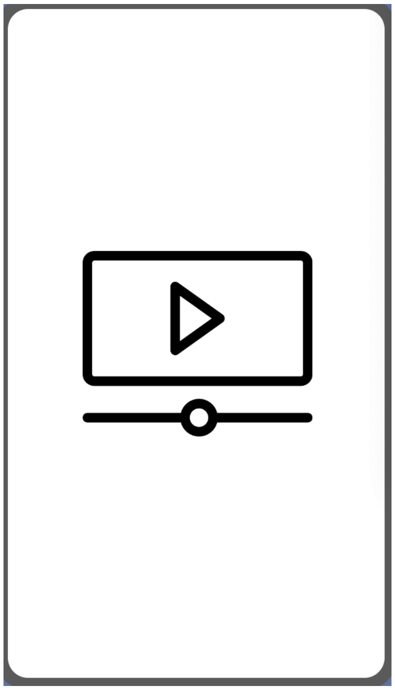


Figure 7. Tutorial

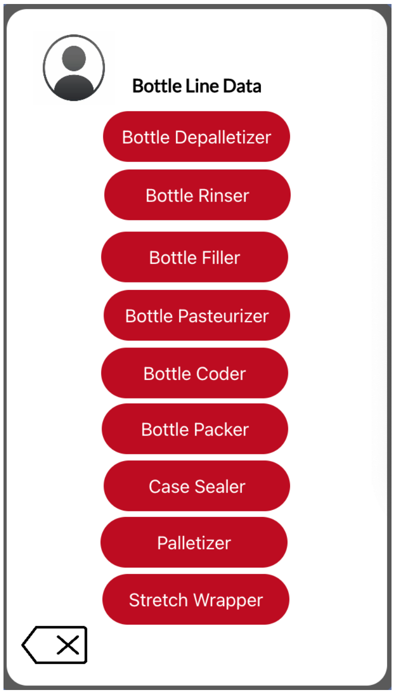


Figure 8. Bottle Line Machine Select

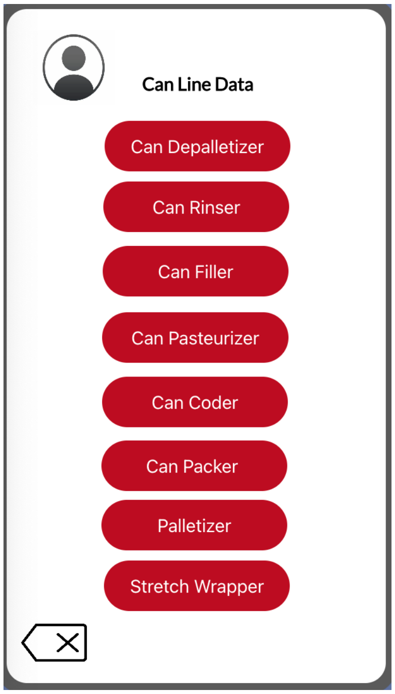


Figure 9. Can Line Machine Select

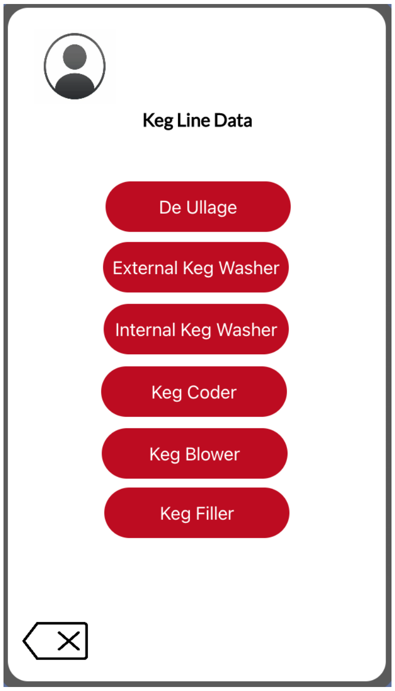
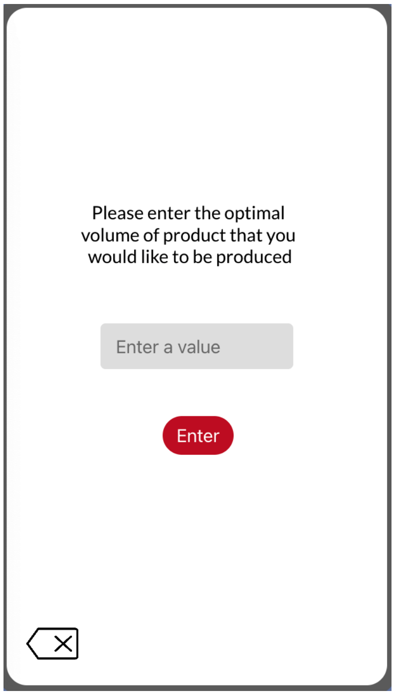


Figure 10. Keg Line Machine Select



Please enter the optimal volume of product that you would like to be produced

Figure 11. Optimal Product Volume Input

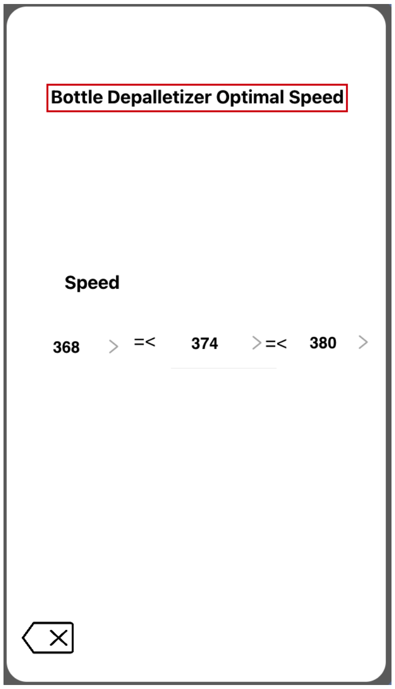
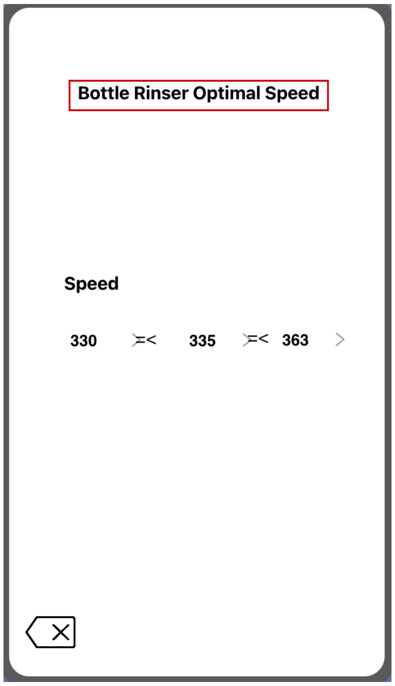
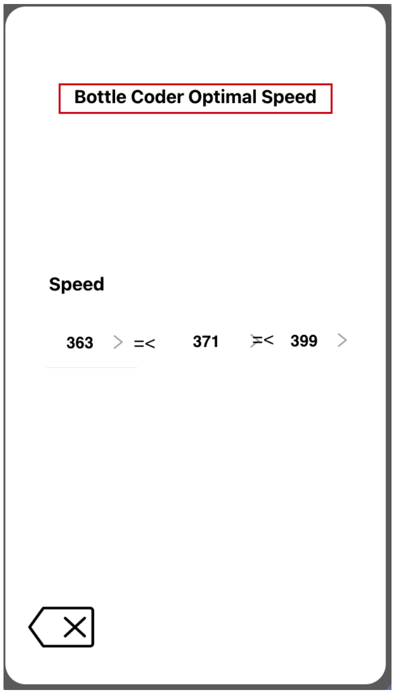
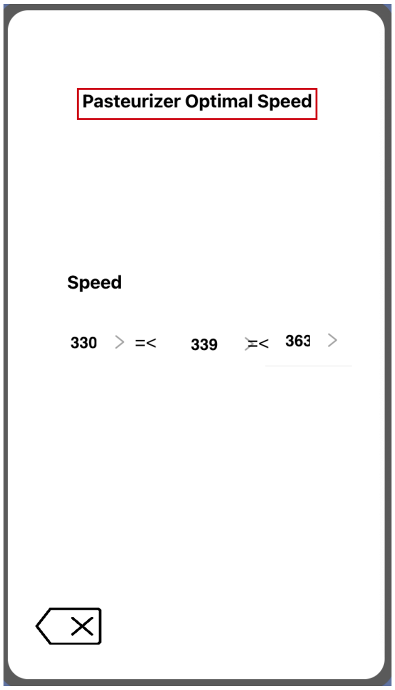


Figure 12. Bottle Depalletizer Optimal Speed

 Bottle Rinser Optimal Speed Speed 330 >=< 335 >=< 363 >	 Bottle Coder Optimal Speed Speed 363 > =< 371 >=< 399 >	 Pasteurizer Optimal Speed Speed 330 > =< 339 >=< 363 >
Figure 13. Bottle Rinser Optimal Speed	**Figure 14. Bottle Coder Optimal Speed**	**Figure 15. Bottle Pasteurizer Optimal Speed**

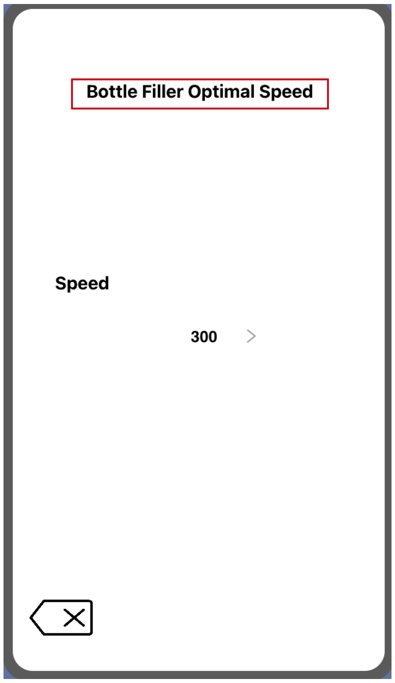
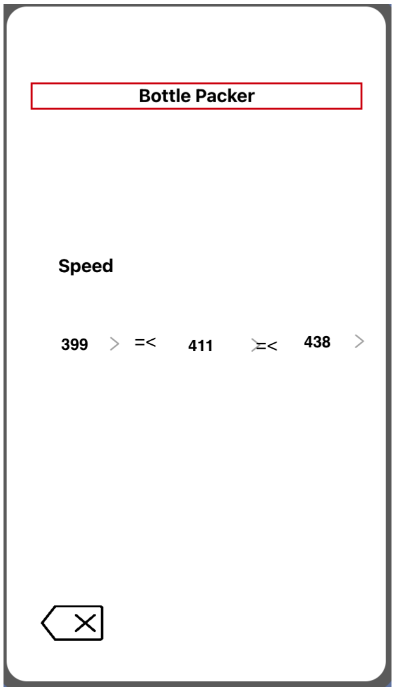

	

Figure 16. Bottle Filler Optimal Speed	**Figure 17. Bottle Packer Optimal Speed**	

Additional pages regarding the can and keg machines are available through the select line page.

Prototype Test Plan II Results and Analysis - Rachelle

<table>
<tr><th>Objective</th><th>Stopping Criteria</th><th>Unit of Measurement & Acceptable Fidelity/Simplifying Assumptions</th></tr>
<tr><td>To gauge user perception of the overall app.</td><td>For the third and final prototype, it is essential that user perception of the overall system is positive. The test that will be conducted to evaluate this component will consist of an interview with a potential user that has been engaged throughout the entirety of the prototyping process. An appropriate stopping criteria for this component will consist of a short survey given to the user. If the user rating is above 70% by the time survey results are given, then the stopping criteria will be deemed to have been successful. This test will evaluate mainly non-technical components such as the aesthetic of the system, and overall functionality. The user will be given time to look over and navigate the app before being given the survey.</td><td>● **Unit of measurement**: The user’s overall rating of the app collected via the survey.
● **Fidelity**: This is the third and final prototype of the systeem, and therefore, it should be fairly similar to that of the final product, therefore there should be very little fidelity. Considering that the app is being tested by an employee of the Mill Street Brewery, this test should very closely resemble the impression of another employee.</td></tr>
<tr><td colspan="3">**Results and Analysis**
Through a survey that was given to potential users, it was determined that the overall user perception of the app is positive. After interviewing a total of ten potential users, the average rating that was given to the app based on functionality, design, and user interface was 8.7/10. This rating correlated with 87% positive user perception of the app. This exceeds the outlined stopping criteria by 17%, therefore allowing us to draw the conclusion that the app was successful. This test provided us with information that allowed us to further gauge user perception on the app. Notable positive comments received from the potential users regarded the app’s navigable and easy to use interface, and the cohesive color scheme which added to the overall aesthetic of the app. Some arrears of improvement that were stated by the potential users noted that there were some errors when a value was input into the app. This brought attention to a potential issue if a user were to accidentally input a value that was too large. There was no preparation for this event prior to the app being tested, so we were not prepared for a very large volume of product to be entered. This allowed the team to be more responsive to potential user mishandlings of the app, and the appropriate contingency plans were implemented accordingly. This test was very significant in highlighting last-minute changes that needed to be made to the product.</td></tr>
<tr><td>To analyze the input of information and how the system is able to handle different volumes of information for different machines.</td><td>This test will analyze how the input of information into the system is taken, and processed. The efficiency of this intake of information will be tested based on how the app is able to deliver an accurate notification output given certain file inputs with varying information that indicates that different machines are not operating at optimal capacity. This is a continuation of test II from the prototype II test plan in which the test had failed as a result of the sheer magnitude of information that had to be output. In order to circumvent the same outcome, changes will be made to the overall method in which the system takes in, and outputs information.</td><td>● **Unit of measurement**: the amount of test cases passed.
● **Fidelity**: The frequency of information being passed to the system is still unknown and will have to be verified with the client. Until then, the system will be receiving information at a consistent rate which may be different in a real-world instance in which information will be passed to the system sporadically.</td></tr>
<tr><td colspan="3">**Results and Analysis**
In these tests, the app was given spreadsheets with different ranges that produced random numbers that would be expected in a real life implementation of the product. In these different spreadsheets, certain values were expected to set off the notification system by</td></tr>
</table>

deliberately exceeding the maximum or succeeding the minimum value. In these instances, the system was tested on its ability to send notifications appropriately for the machines that were falling out of the range of values. The results from this test demonstrated that there were issues that arose when multiple machines were falling out of their optimal range of values. This was problematic as it modeled a very real potential issue that may occur, as one machine falling out of the range of optimal values will have a snow-ball effect in which the machines following that machine will also fall out of their optimal range of values. In order to mitigate this issue, more extensive coding will be done in the app to ensure that it can compensate for pushing multiple notifications at once. The method in which multiple notifications will be delivered will need to be orderly, so it will be ensured that the notifications are sent sequentially, starting at the root machine so the employee is able to address the problem in the most efficient way possible. Overall, these tests were very insightful and allowed us to make changes to our final product in order to ensure that it is fully functional in all circumstances.		
To analyze the integration of all subsystems within the app.	This test will analyze how all the systems in the app will work together to create a cohesive product. This is a continuation of prototype II test III. This test was unsuccessful as the calculations that are implemented to connect the user-entered optimal amount of product they would like to be produced during that day and the input of the files for machines regarding their speed/temperature/energy consumption were not compatible. In this test case, the calculations will be reviewed and reevaluated to create an equation that is able to produce an optimal range of values. The stopping criteria will be when the values create a reasonable range of values for the temperature, speed, and energy consumption to fall under, as verified by the client.	● **Unit of measurement**: range of optimal values. ● **Fidelity**: The files provided by the client with the information regarding energy consumption, temperature, and speed increase the fidelity of this test exponentially, so there is very little deviation from this test with comparison to the actual test real-world implementation of this system.
Results and Analysis In this test, the integration of all app subsystems were tested. This test was a continuation of the third test in the second prototype test plan. This test plan was overall unsuccessful as the calculations were not considering client input and input data to give optimal value recommendations. Resultantly, the optimal range was not accurate. In order to mitigate this issue, extensive troubleshooting was done in the form of watching tutorials and consulting online forums in order to gain more insight from experienced users of the software Thunkable. Through this trouble shooting, this final test was able to be successful and accurate optimal ranges were calculated and displayed to the user. In order to test the success of this implementation, test files that were used in the second prototype test were reused to ensure that the optimal value range was accurate. All test cases passed, demonstrating data that was consistent with optimal data given by the client. Overall, this test strengthened the app's overall performance by ensuring that the information that was being given to the user was accurate.		

Feedback from Potential Users

1. **How easy was it to navigate through the prototype?**
- The navigation was very straightforward and intuitive, and I didn't have any trouble finding my way around.
2. **Was the layout of the prototype visually appealing?**
- Yes, I thought the layout was visually appealing and easy on the eyes.
3. **Did the prototype provide all the necessary information you were looking for?**

- Yes, the prototype provided all the necessary information, and I felt well-informed.

4. **Did you encounter any technical difficulties while using the prototype?**

- : No, I didn't experience any technical difficulties or glitches while using the prototype.

5. **Was the app used in the prototype user friendly?**

- Yes, the app used in the prototype was very userfiendly and easy to understand.

6. **Did the prototype adequately address your needs and expectations?**

- Yes, the prototype met my needs and exceeded my expectations.

7. **Was it easy to find what you were looking for in the prototype?**

- Yes, I found it very easy to locate the information I needed within the prototype.

8. **Was the prototype responsive and fast?**

- Yes, the prototype was very responsive and fast, and I didn't experience any lag or delays.

9. **Did the prototype provide a good user experience?**

- Yes, overall I had a great user experience with the prototype.

10. **Would you recommend the prototype to others?**

- Absolutely, I would definitely recommend this prototype to others.

Updated Design

Updated Target Specifications - Elisha

- User Needs Statement (Derived during Deliverable B):
    - There exists a need for the Mill Street Brewery company to increase production speed by 2% across all machines by implementing a device that is able to identify stations that are not performing at optimal rates, make recommendations for these stations, and provide accurate real-time operational analyses of energy consumption, production output, and equipment performance.
- Receiving feedback overall was most beneficial when it came directly from the client. As well as considering outside sources such as our professor and the PM's. Overall the target specifications for the final prototype are as follows:
    - The app should be user friendly.
        - The app now does include the tutorial tab, a small amount of clicks is used to get to the vital information, and a single username and password has been implemented.
    - Each of the lines (bottle, can, and keg) should be considered separately.
        - Each line in the app has its own button, where each line's respected machines appear to view speed analyses.
    - The app should just portray speed analyses and data.
        - Each machine shows speed data in the app now, there are no more temperature and efficiency analyses at this time.
    - Another target specification would be having a design that tracks live data.
        - Our app implements a simulation where it takes data from a file, so essentially the client would put the live data in the file so the app could read from it.

Updated Detailed Design

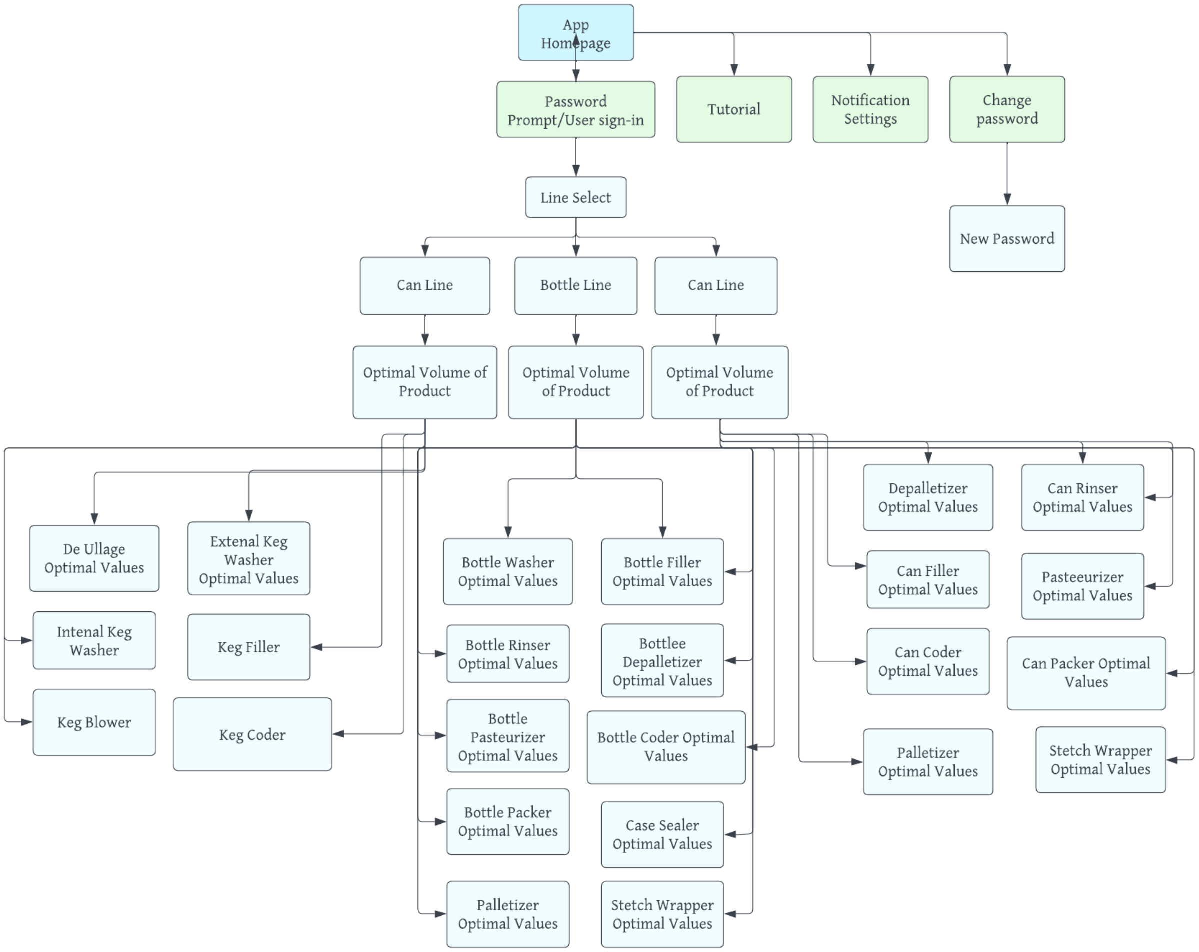

App Homepage
Password Prompt/User sign-in
Tutorial
Notification Settings
Change password
Line Select
New Password
Can Line
Bottle Line
Can Line
Optimal Volume of Product
Optimal Volume of Product
Optimal Volume of Product
Depalletizer Optimal Values
Can Rinser Optimal Values
De Ullage Optimal Values
Extenal Keg Washer Optimal Values
Bottle Washer Optimal Values
Bottle Filler Optimal Values
Can Filler Optimal Values
Pasteeurizer Optimal Values
Intenal Keg Washer
Keg Filler
Bottle Rinser Optimal Values
Bottlee Depalletizer Optimal Values
Can Coder Optimal Values
Can Packer Optimal Values
Keg Blower
Keg Coder
Bottle Pasteurizer Optimal Values
Bottle Coder Optimal Values
Palletizer Optimal Values
Stetch Wrapper Optimal Values
Bottle Packer Optimal Values
Case Sealer Optimal Values
Palletizer Optimal Values
Stetch Wrapper Optimal Values

Figure #. A flowchart depicting how the app's pages relate to one another

Updated Bill of Materials

Material	Cost
Thunkable(pro subscription)	$45
Tri Fold Poster Board	$10.03

Development and Changes made to Prototypes I and II

Development of Prototype I

Changes made to Prototype I	Prototype III and Justifications

Prototype I of a generalized line of machines for every production line. All production lines including the keg, can, and bottle lines were condensed into a single line for the sake of simplicity as this design was meant to demonstrate the fundamental functionality of the app.	Prototype III takes all three main production lines into consideration, with the exception of the repack line as this process has not been automated. The three lines taken into consideration include the keg, can, and bottle lines which all have information pertaining to their specific machines readily available for the sure to access once they have signs in. This feature added to the third and final prototype maximizes the functionality of the app and prioritizes the user experience as it provides information to all vital machines on the production line.
The color scheme of the software changed to be completely red - a trademark symbol of the client's brand which demonstrates uniformity and cohesiveness of the user interface,e therefore providing a better overall user rating.	The change in color scheme demonstrates responsiveness to feedback given by potential users and the client. Having all features on the app be one color allows the app to be more navigable and cohesive, therefore creating a more intuitive design for the user. This also promotes the functionality of the app as faster navigation through the app allows for the production lines to be optimized at a faster rate.
Prototype I featured live tracking of three separate components using arduino boards with their appropriate sensors and components. These components included temperature, energy usage and speed.	The third and final prototype saw the elimination of all three hardware arduino input sensors for the purpose of cost efficiency and the adaptability of the system - two crucial components of the design that were issued by the client. It was paramount that these components were considered in the final design of the product as it would fulfill user requirements to their full extent.
The first prototype allowed all user profiles to be visible upon signing in. This feature was implemented as a way to have thee sign-in process be more accessible to users who wanted to access the information within the app.	The third prototype removed this feature as it poses a risk of security breaches if someone were to have the password of another user. The previous system made it simpler to log into another user's account by simply having their password. Removing this feature enhances the security of the app since it requires both the username and password of a user to be known prior to signing in.

Development of Prototype II

Changes made to Prototype II	Prototype III and Justifications
The second prototype did not take specific production lines into consideration, similarly to prototype I. This was because the method that would be used to gather data was not yet decided upon. At this stage, it was decided that arduino inputs would not be used, but we had also not yet received any files with input data from the	The third prototype found that we would be able to use client-provided information in order to simulate the environment of a conveyor on the floor of the production line. This method was implemented using spreadsheets that provided constantly updating data within a set range. This information was then input to the app which was given instructions to update in the same interval that the spreadsheet data was updated.

client. Resultantly, the way in which information would be received was undecided.	
The second prototype still took the primary component of speed into consideration as well as the collateral components of temperature and energy consumption. It was decided that the third prototype would only consider speed as per the recommendation of the client.	The third prototype only displays the optimal speed of the machine on the conveyor. This decision was made based on client recommendations during the second and third client meeting. The reason this decision was not made immediately is because the client's initial reaction to tracking both temperature and energy consumption was vague and did not allude to his exact opinion on this design choice. The third client meeting fortified his opinion on mainly being able to focus on speed, and this was implemented accordingly in the third prototype, therefore demonstrating responsiveness to our client's needs.
The second prototype did not yet implement the notification system, nor the tutorial page.e this was simply because the prototype was not yet at a stage to implement these systems as a result of not being complete.	Prototype three demonstrates the final product comprehensively. As a result, the tutorial page and the push notifications setting has been implemented.

Wrike Snapshot

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=6VC7wa6CzHXWxrzfJhCTnf3CRP1t9FKZ%7CIE2DSNZVHA2DELSTGIYA

Conclusion

In conclusion, the feedback from the user on the third prototype has been utilized to inform future design choices and improve the solution. The testing plan, analysis, and results have been carefully documented, and feedback from potential clients/users has been incorporated into the design. The objectives of the prototype have been clearly defined, including the establishment of stopping criteria, and an analytical, numerical, or experimental model has been used in the design. The prototype had a targeted objective with specific tests and measurable results, and had been updated based on the feedback and test results obtained. The outlined prototyping test plan has enabled us to build the prototype, with a focus on achieving the testing objectives and defining acceptable fidelity based on the prototype's objectives. Overall, the feedback and testing process has resulted in a more refined and effective prototype, and the outlined testing plan will facilitate continued progress towards achieving the project's goals.