Deliverable D - Conceptual Design

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February 12, 2023

Table of Contents

Introduction of Fundamental Design and Systems

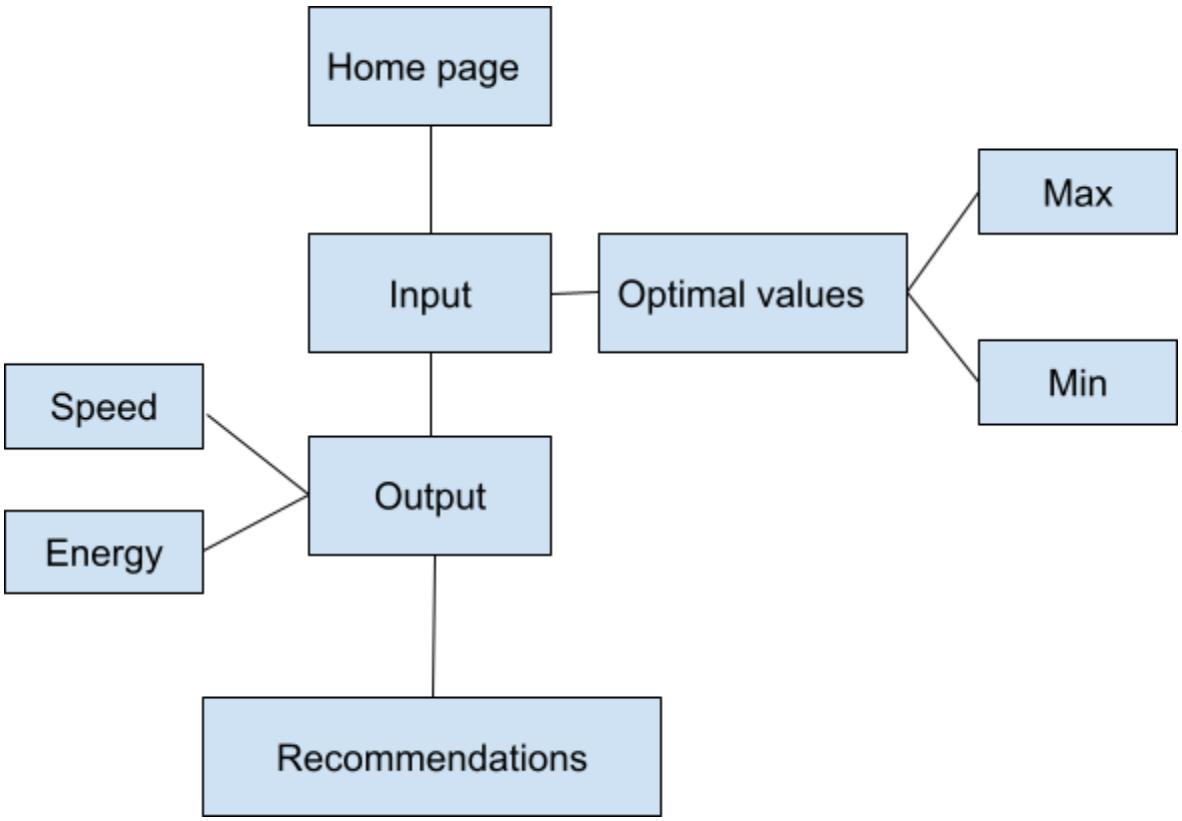


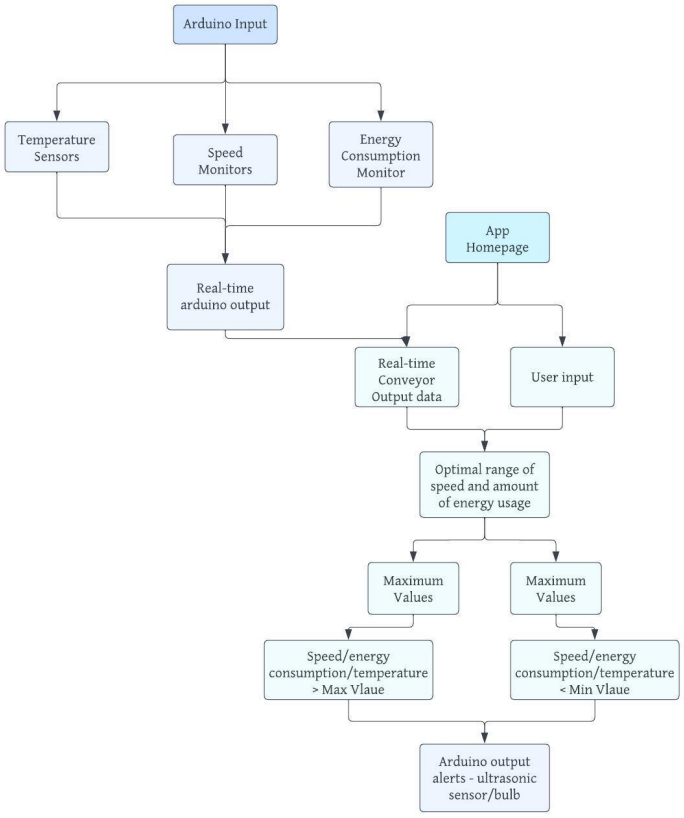
Figure 1. This flow chart represents the fundamental subsystems involved in creating the application which will satisfy the specified customer needs.

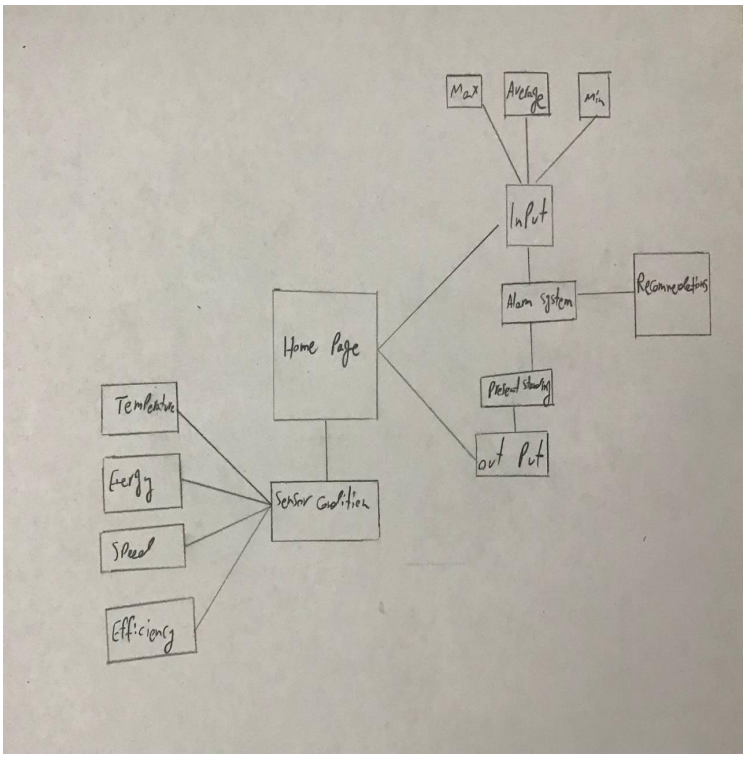
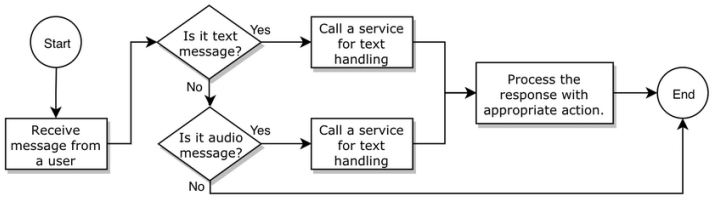
General Design Description

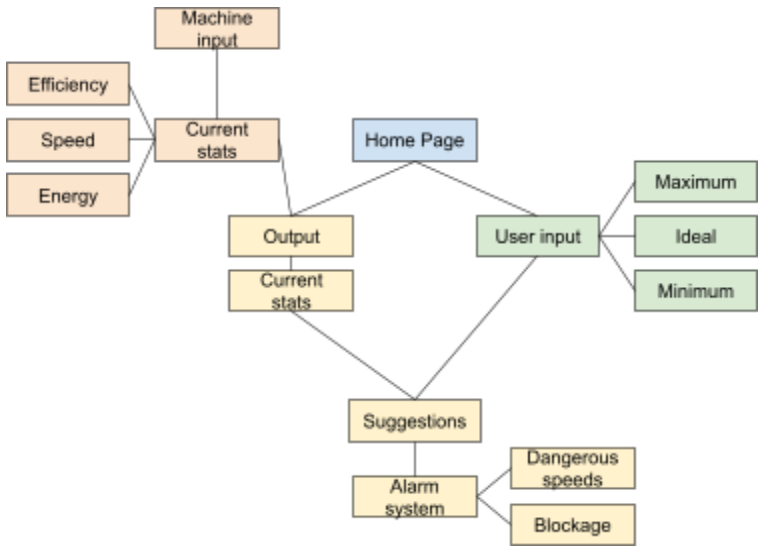
System	Description
Homepage	The homepage of the application is a default page where the user will begin their experience using the app. This page will exhibit the different pages that the user will be able to access upon opening the app. These headings will include: input and output.
Input	The input page will prompt the user to input the ideal amount of product they would like to produce within a given amount of time. This input value will then be put through an algorithm that will determine a range of values for both maximum and minimum energy consumption and speed. When the machine operates within this range of values, the employee will receive no alerts. The optimal value range will be determined through verifying how much energy the production line uses, the speed at which normal operations take place, and how much product is produced as a result of this.
Output	The output section of the app will be able to provide real-time data to the user.

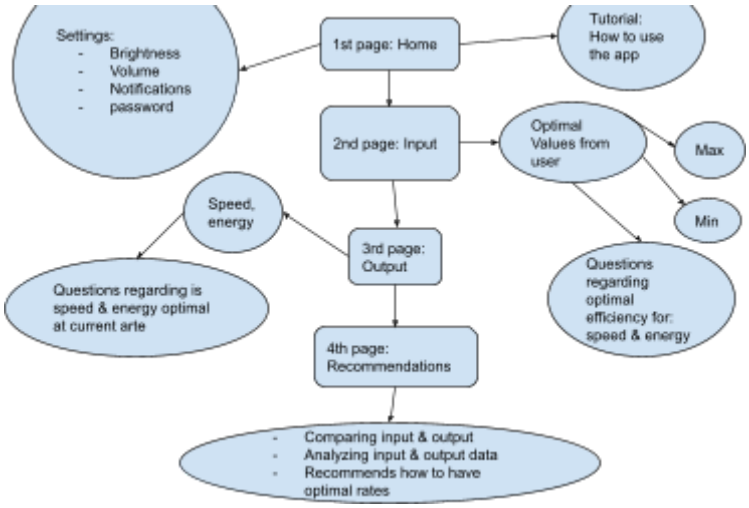
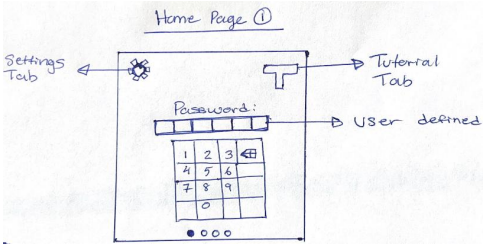
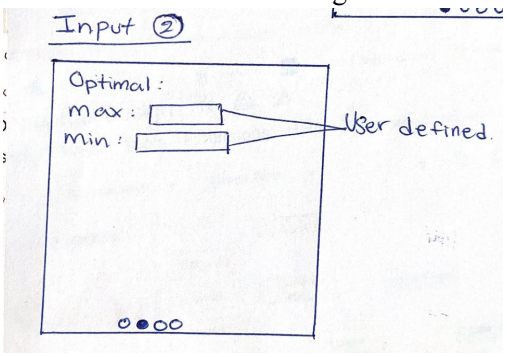
	This data will primarily consist of information regarding speed and energy consumption.
Recommendations	From the user input, the app will execute an algorithm to decide an optimal range for both speed and energy consumption. This range will be determined by considering safety regulations for employees in addition to minimum operating capacity that must be executed in order for the desired amount of product to be made.

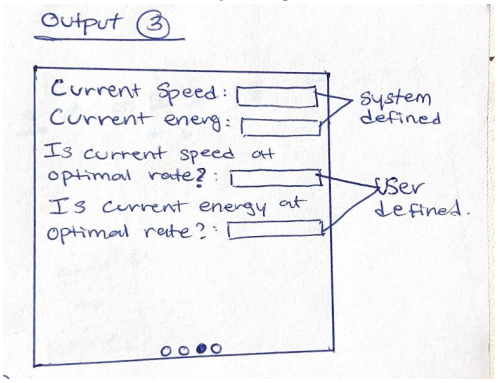
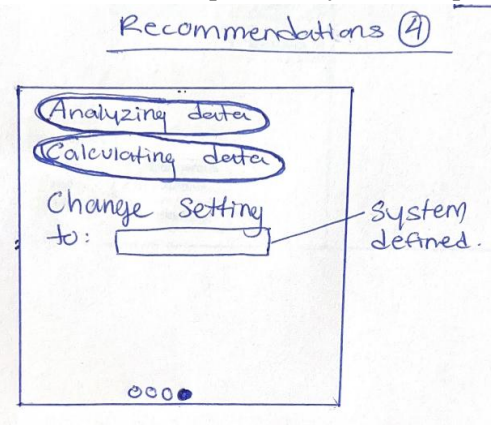
Divergent Design

Member	System Diagram	Description of Diagram
Rachelle		**Arduino Input** This input is delivered to the app via arduino sensors. These sensors are made to monitor temperature, speed, and energy consumption. Speed is the critical component of the machine's performance that must be optimized. However, for a thorough analysis of the machine's performance, other components also must be monitored. The temperature sensor ensures that the machine is not overheating, potentially risking damage to the design. The energy consumption monitor ensures that the company is not wasting finances on too much energy. Together, these monitors contribute to the real-time conveyor output data that may be accessed through the app. **App Homepage** The app homepage consists of two subsystems - the real-time conveyor output and user input. The user input is where the user will be prompted to input the amount of product that they would like to create in a given amount of time. Using a combination of the conveyor output data and user input, the app will then be able to deliver the optimal range of speed/temperature/energy consumption. **Maximum/Minimum values** The optimal range of speed and energy values will consist of minimum and maximum values for speed/temperature/energy consumption. If the maximum values for any of these

		features are exceeded, an alert will be given to employees via ultrasonic sensors and flashing bulbs. A similar protocol will be executed, if the values drop below the designated minimum value.
Sorosh		**Home page:** The home page is the default page screen and access to it can be limited by password or fingerprint authentication. There are three tabs on the home page: the first one on the top left which is **input**, the second one on the top middle which is **sensor condition** and the third one on the top right which is output. **Sensor condition** represents **Temperature**, **Energy speed** and **Efficiency**. **Max**, **Min** and **Average** are the three possible input The **output** represents **present standing** and potentially an **Alarm system** could alert as a notification with a **recommendation** afterward.
Jonathan Aguilera		An app can retrieve the best user input by incorporating the following points: 1. User-friendly interface: The app should have a clean, intuitive, and visually appealing interface that is easy to navigate and use. 2. Clear and concise instructions: The app should provide clear and concise instructions on how to use it, and what the user needs to do to provide the best input. 3. Customizable input fields: The app should allow users to customize the input fields to their preference, so they can input information in a way that is most convenient for them.

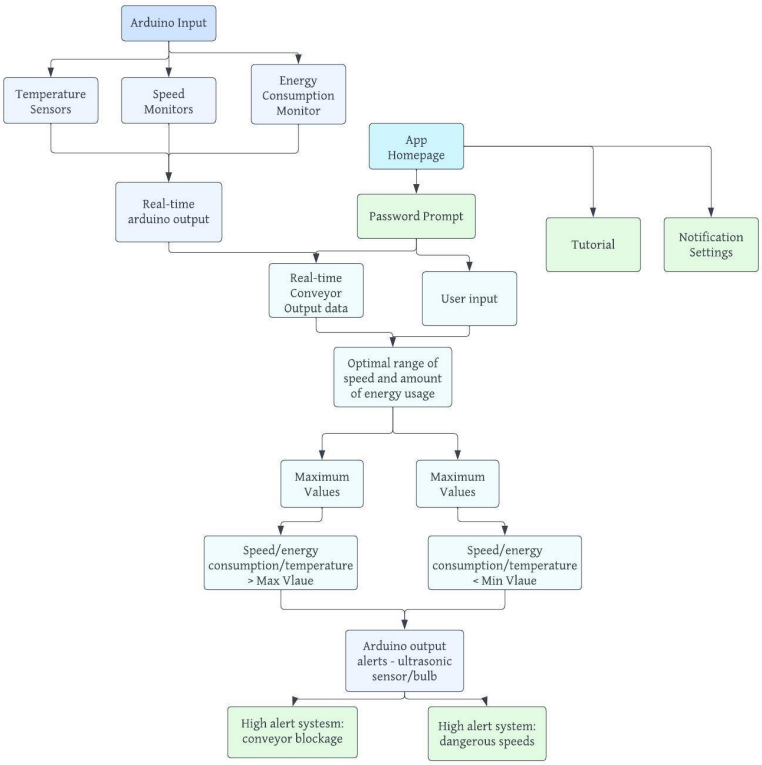
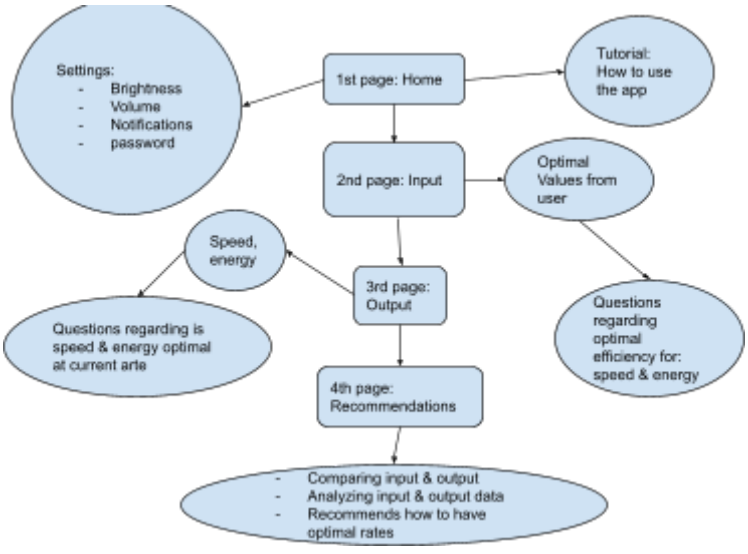
		4. Validation and error checking: The app should validate the user's input and provide error messages if necessary, to ensure that the user provides accurate and complete information. 5. Progressive disclosure: The app should provide information in a way that gradually increases in complexity, allowing the user to build their understanding and confidence in using the app. 6. Real-time feedback: The app should provide real-time feedback to the user about the quality and accuracy of their input, allowing them to make adjustments as necessary. 7. User testing and feedback: The app should be tested with real users, and their feedback should be used to improve the app's ability to retrieve the best user input. By incorporating these elements, an app can provide a better user experience and increase the chances of receiving accurate and valuable input from its users.
Chanelle		Machine input: Some type of sensor would be attached to the machines that need to be monitored. The information gained by these sensors such as speed, efficiency, and energy used would be sent to the app. Home page: Could be locked by password to prevent people outside of the group getting access to the information. Has different tabs for input, output, suggestions, and possibly settings User input: Here the user would input all of their optimal, max, and minimum values for the production line. Output: Would display all current stats. Could have graphs and tables of data over the past day, week, month.

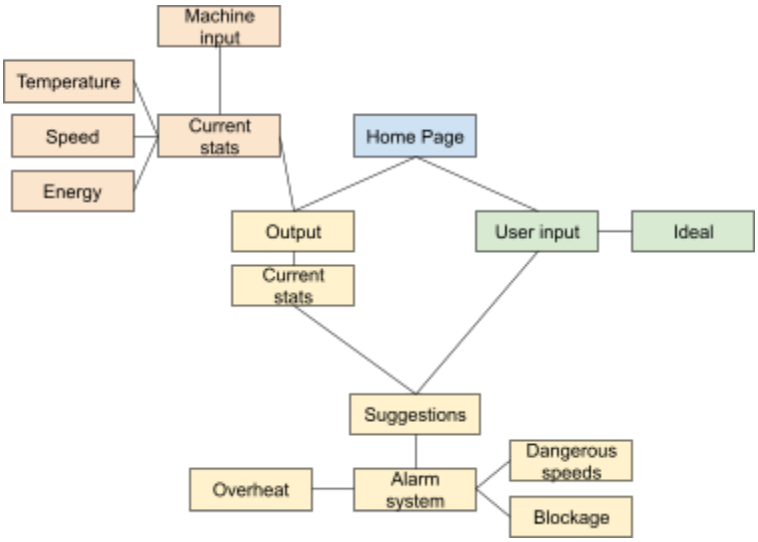
		Suggestions: Compares current stats to desired stats then gives a report on what the user can do to improve the current stats. Could also include an alarm system that would alert the user via notification and a system in the factory itself (bells, flashing lights) when machines are running at dangerous speeds or moving too slow indicating a blockage.
Elisha Khandaker		1. 1st page: home a. The design will include a settings tab to control things such as brightness, volume, and setting up/changing passwords. As well as a way to change the system once the app makes recommendations. b. The design will also include a tutorial tab to teach users (employees) how to use the app. c. The home page will also include a password to make sure data is kept safe and available to employees only.  2. 2nd page: input a. This page is meant for the user to input all optimal values they want the system to be running at. 

		3. 3rd page: output a. This page will show the current values the system is running at i. For speed and energy b. This page will also ask the user if the current speed and energy is good enough before it recommends anything to the user.  4. 4th page: recommendations: a. This page will analyze the input and output data. b. This page will calculate recommendations based on the input and output values. c. This page will recommend what the settings should be changed to so the system is running at the most optimal rate based on the users inputs and systems outputs. 

Convergent Design

Global Designs

Global Design	Diagram Description
	**Design Advantages:** The advantages of this design is that it covers every base that is required in order to maximize the performance of the equipment in the brewery. This system prioritizes user experience, in addition to ensuring that all functional requirements are satisfied. The diagram also includes non-functional requirements that contribute to the overall functionality of the design. The system considers real-time output using arduino which is an application that the team has practiced in class and is familiar with, therefore optimizing potential success of the product. Additionally, the system exhibits failsafes to prioritize employee and machine wellbeing. **Design Disadvantages:** The drawbacks of this design would be that it does not consider user functionality very well. The app does not have a lot of room for variability which may be problematic in future scenarios when the employee needs to consider a new machine that has been added to the floor. This was one of the user specifications that was created when the client meeting was conducted.
	**Design Advantages:** This design prioritizes user experience above all else which, in turn, enhances its functionality. The functionality of the final product is dependent on how well the users understand the product and this design does a very good job at that. The design also prioritizes user safety and information. In addition to maximizing output, the design is able to give attention to the machinery functionality and employee wellbeing. Rather than asking the user for optimal speeds, the improved design only asks for an ideal number of products so the employee does not have to do as much work or calculations themselves. **Design Disadvantages:** The design could improve in its functionality. Rather than implementing different setting designs for both the home page and the recommendations page, it can

	instead be condensed into one. Also, the frequency of password input is not specified. As a result, it is unclear whether or not the user will be inputting the password every time the application is opened. This will reduce overall efficiency.
	**Design Advantages:** This design is very efficient and is able to perform the desired functionality of the final product in a very simple way, therefore increasing its overall simplicity and efficiency. In addition to this, the design makes necessary complex decisions in order to prioritize the wellbeing of the users using the design. As a result of its simplicity, the app is very adaptable to change and is a good candidate for the final design. **Design Disadvantages:** The disadvantages of the design also stem from its supposed simplicity. In spite of the easily variable interface, the design may be so simple that it does not satisfy all potential situations for the customer and will therefore need to be enhanced in some way during the creation of the application.

Decision Matrix

- Rankings are on a scale of 1-5
  - 5 = satisfies the conditions precisely
  - 4 = satisfies the conditions mostly
  - 3 = satisfies the conditions satisfactorily
  - 2 = barely meets the conditions satisfactorily
  - 1 = does not satisfy the conditions

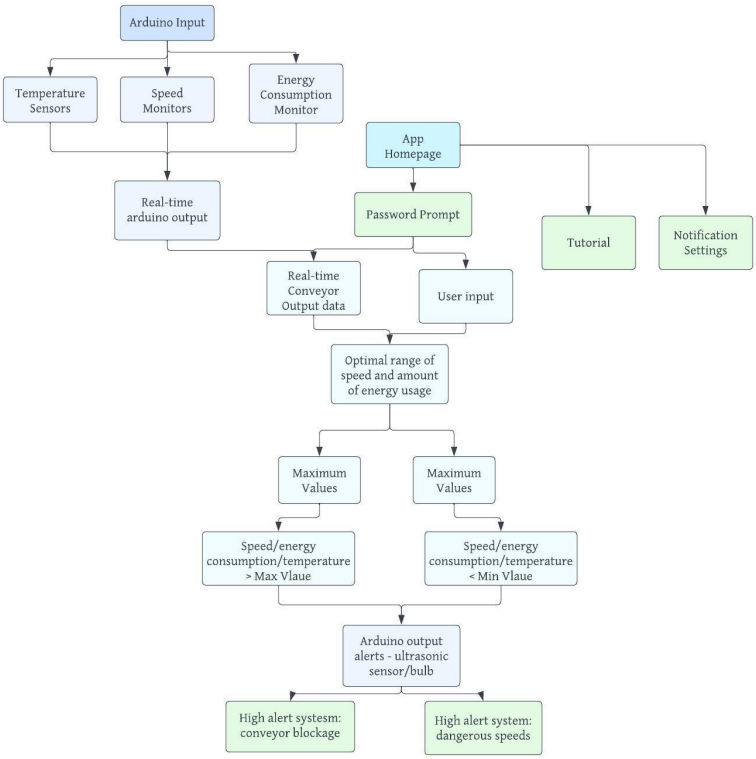
	Functionality	**User Experience**	**Variability**	**Simplicity**	**Overall**
Design 1	5	4	3	4	**8**
Design 2	4	5	2	2	**6.5**
Design 3	3	4	3	2	**6**

Final design and Further Development

Inherited Subsystems:

- Tutorial tab - Elisha

- Notification adjustment - Elisha
- Password protected - Elisha + Sorosh
- Alarm speed and blockage alert system - Chanelle
- Arduino input + outputs - Rachelle

Finalized Design	Description
 **Further development** In order for the design to be improved for further development, the design must be made to be more variable, and enhance user experience through the prioritization of user understanding. Adding the tutorial component is a good addition, but this component must be elaborated on during the design process. The tutorial must provide an efficient and comprehensive description of how to use the app in addition. In addition to this, the system itself must become more adaptable to potential changes in machinery that exists on the floor of the brewery. In this instance, the headings must be made more clear so that constant systems never change whereas their subsystems are easily changeable based on what kind of new machine has been implemented. Overall, the design is very promising and satisfies all user specifications to a certain extent. In further developing this design, we are hopeful that the design will meet all design specifications entirely.	**Password prompt**: Upon accessing the app through the user's device, they will be prompted to enter a password. It has been decided that the information regarding the company's energy usage, and speed of production should be protected to prevent this sensitive information from being shared with competitors. This password will be created and shared only with employees using the app. The password will have to be entered every hour to ensure protection while ensuring efficient access to the software through the day. **Tutorial**: In order to circumvent long periods of employee training to get them familiar with the interface of the app, a tutorial section will be created for the purpose of allowing employees to have information about the functionality of the software with ease. **Notification settings**: In order to maximize the user experience on the app, a notification center will be provided on the app so the volume of alerts and brightness of bulbs may be altered as per the employee's preferences. **Conveyor Blockage Alerts and Dangerous Speeds/Temperatures**: In the event that a blockage occurs on the conveyor which may attribute to damaged equipment or harm to an employee, a high alert alarm system will be activated. This system will override volume and brightness preferences set by the employee and instead maximize these settings to prioritize the wellbeing of the employees and the machines. The same alert system will be executed if the conveyor reaches a speed or temperature that is greater than the maximum defined by the software.

Conclusion

Through amalgamating the group's system designs into one finalized design, we were able to encapsulate the required user needs for the project. We have considered the principle functionality of the product and considered other collateral components which will contribute to the overall performance of the product. The user experience, potential risks, and overall purpose of the product were all considered in order to formalize the system diagram. It has been decided that arduino sensors and output devices will be the primary source of inputting and outputting information to the user while the method of analyzing information will be through algorithms that the team will create when creating the project. Overall, we are confident that the final product is a comprehensive product that embodies all user specifications and requirements.

Wrike Snapshot

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=UwZv3481aERIlYtmEkQ7S9jAJaHvvx2h%7CIE2DSNZVHA2DELSTGIYA

Appendix

Other Potential Solutions