GNG 1103 Project Deliverable C: Design Criteria and Target Specifications

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Objective

The team is required to define a list of prioritized design criteria, perform technical benchmarking, and determine target specifications which can be used in the development of a final solution.

Introduction

A detailed vision of a project is crucial in the formation of a better estimation of project costs/ time required to be expended etc., fulfilling user expectation, and ensuring the team's productivity. A method to know how a project will go about and what it must achieve is by defining a set of functional and non-functional requirements. The aforementioned can also aid in formulating targeted specifications that are suited for user needs all the while having knowledge of certain constraints/ unforeseen costs etc. so that the users can be better informed of the project's output and/or have better expectations set out. This results in a more in depth interpreted user needs along with its solution, and a robust action plan with quantifiable milestones.

Need	Importance (3 being of highest importance, 1 being lowest)
Low maintenance	2
Reliable	3
Remote	3
Cost effective	1
Easy to use	2
Accurate data	3
Real time information	2

Safety	1
System that functions with various machines and bottle/can types	3

Table 1. Ranked Design Criterias

Functional Requirements:

- Count number of units passing through each part of the assembly line (cpm, bpm and kph)
- Ability to report back any inefficient numbers and flag the source of error in the line
- On call data with minimal delay(s)
- Data to be stored
- Easily trainable (min)
- Will alert of any abnormalities in numbers
- Quick setup(s)
- Data is viewable within the facility at, a minimum, one location where it is compiled

Constraints

- Minimal interference with pre-existing machines(m^3)
- Cost($)
- Interface several different types of machines
- Parts are easily sourced and replaceable(original equipment manufacturing parts)

Non-functional requirements:

- Product lifespan (years)
- Reliability
- Aesthetics

Reflection

A second client meeting is deemed required by the team to have a better estimate of target specifications due to missing values such as efficiency, or any other pre-existing infrastructures

etc. Initially, there is a lack of clarification for the objective of the efficiency project based off of the slides - it is unclear whether the team is supposed to find ways to improve the efficiency of the entire production line. Because the objective seems to have a wide scope, the team did not know where to begin. The client meeting has proven to be beneficial as the clients themselves have helped outline the project's objective in a way that a couple sentences in a slide show fail to do so. The client has helped us develop some initial ideas of how to tackle our issue, they also provided us with more of a perspective into the production line that we will be working with. The newly outlined issue of finding a way to monitor the efficiency of the line and then the question period are greatly beneficial to our group in assessing needs and eventually marking target specifications. We are all looking forward to the next couple weeks of development and further conversation with the client now that we understand the magnitude of the problem. This will help us narrow down our focus and start to come up with more concrete ideas for what our next steps will be.

Summary of Benchmarks

1. IoT Solution Bottling Line Capper Head Calibration and Monitoring System

The use of a "Dummy Bottle" to calibrate the systems and improve efficiency.

- Mechanics are able to calibrate the capper heads accordingly using the dummy bottle
- Displays the data in real time on a GUI (graphical user interface), mechanics can make adjustments accordingly
- Uploads all data to cloud
- 9 different force and position sensors and WIFI interface
- Measuring the forces give insights to calibrating the production line and which then allows analysis of the quality of the capping operation to occur
- System starts the data acquisition automatically
- Application communicates with bottle and collects data in real time
- Production manager can alter the pre-configured thresholds if necessary

2. Domestic Beverage Plant - Filling Line Monitoring System

Increasing efficiency using a production control system performing monitoring and operation of filling lines in a beverage production plant.

- Flexible so that the customer can make their own adjustments to the system when improvements are required
- Remote monitoring features, can perform monitoring and operation from a building remote from the site, when equipment abnormalities occur, they can be quickly fixed
- Real-time alarm is displayed on monitoring screen when there are malfunctions in the equipment or system, supporting early discovery of abnormalities
- A trend display to to manage operational status and fault signals
- Trend display can show real time data as well as historical data

3. Utilizing IoT Solutions to Monitor Beverage Bottling Assets on the Production Line

- Smart mesh IP (data relay system)
- Using Wzzard nodes(takes sensor data and turns sends it to the gateway)
- C1D2 (safety system)
- IP 67 (waterproof)
- Scada and IIot solutions (real time updates)
- Uses lasers and photographic sensors on the line
- Funnels data through Advance tech SmartSwarm 342 gateway (live data updates to devices using wifi or ethernet)
- Nodes connected to 24v digital I/O ports
- Funnels data through

4. Keg Line Monitoring System

Increase efficiency of the keg line by monitoring various data of the whole production line.

- Monitor energy efficiency
- Detect pulse of filling line
- Measure filling volume and faults
- Measure status inside the keg like temperature and steam
- Display real-time data on a screen
- Data be transferred to PC through Bluetooth
- Easy to access through PC software application

5. *Real-time Monitoring of Can and Bottle Filling*

Using RFID system with an antenna produces an electromagnetic field and with tags on each can or bottle to be scanned by the scanner to monitor the motion and location of cans.

- ❖ Monitor the real-time motion of each can or bottle in the line
- ❖ Monitor the location and distance between each cans
- ❖ Make alerts when a can or bottle is missing or the distance is abnormal
- ❖ Check the shape of the cans or bottles to detect damages
- ❖ Enable tracing can or bottles moving in high speed
- ❖ Able to measure the filling level of cans or bottles to detect faults during filling

Wrike Summary

Below is an updated Wrike task board that includes changes made in estimated task duration, completed tasks/ responsibilities, additional dependencies, and tasks assignees etc. The availability of each group member alongside their personal important events is also shown in the project's calendar. For a detailed overview, see the additional attached reference link to an excel file.

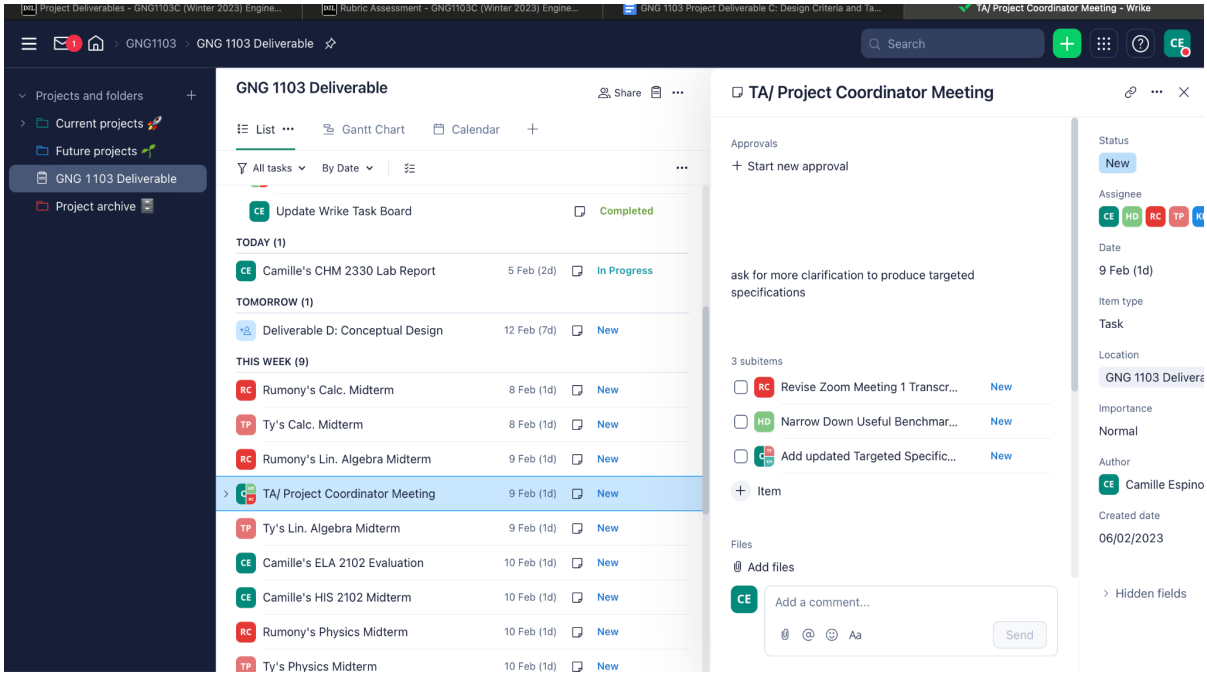

Figure 1. Future Tasks Overview

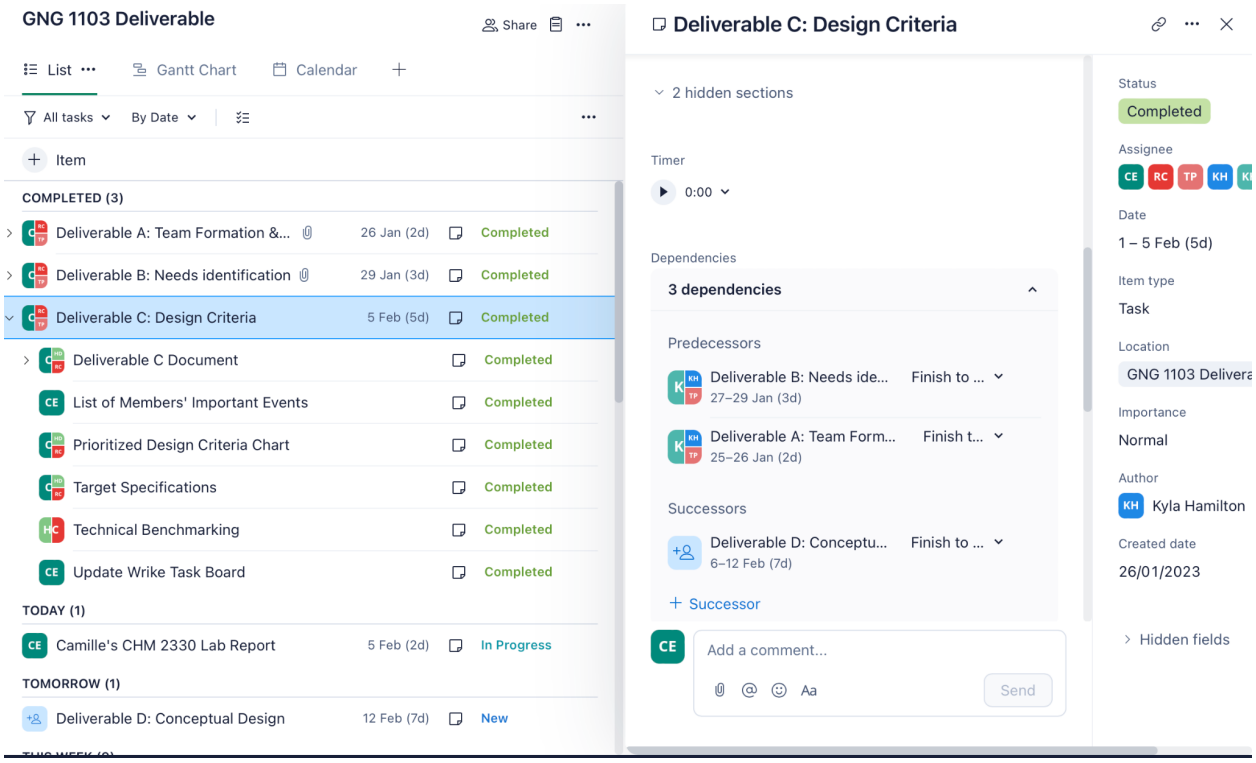

Figure 2. Project Progress Overview

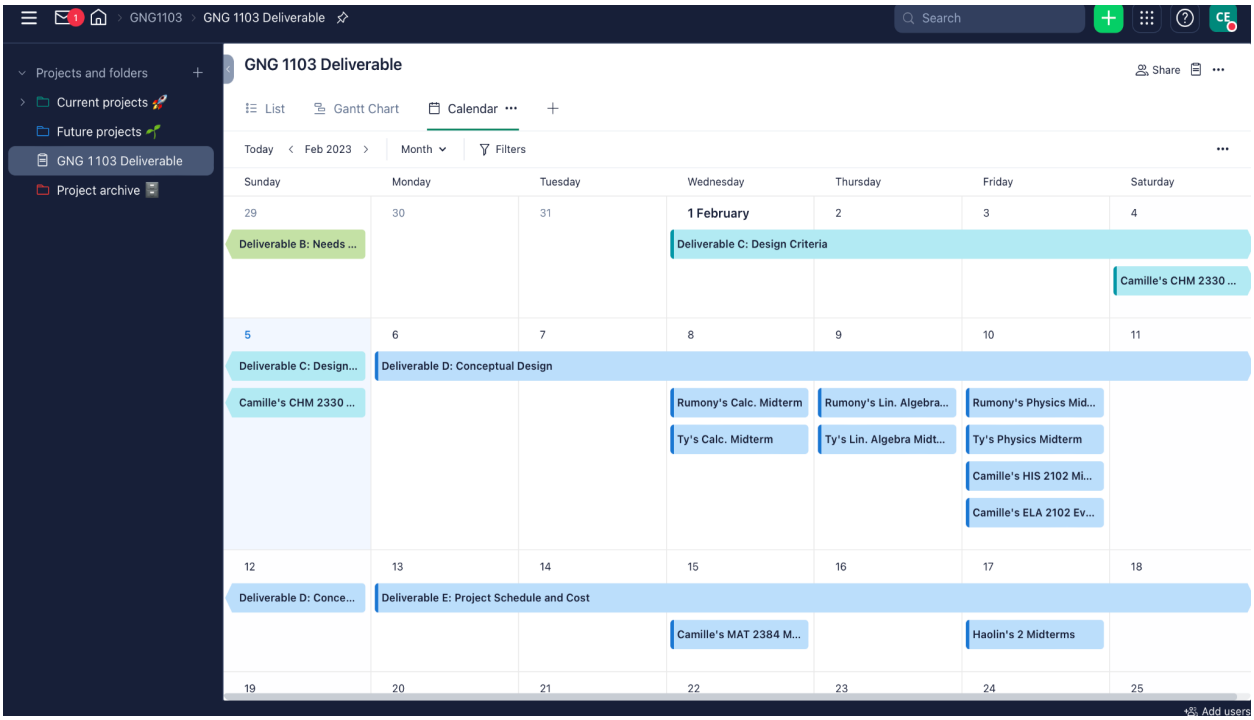

Figure 3. Project Calendar

Conclusion

Each identified user needs are facilitated with a design criterion that can be used in comparison with other proposed solutions to satisfy specific user needs - a ranked design criteria outlines the aforementioned key design parameters. It serves as an aid to define a set of functional and non-functional requirements that subsequently reveals project constraints so that the team will be better equipped to satisfy user demands. Lastly, Wrike is utilized to organize project tasks and/or important events that can help the team formulate measurable goals and take notes of relevant ideas/ solutions.

Resources

1. *Domestic Beverage Plant - Filling Line Monitoring System*
2. *Domestic Beverage Plant - Filling Line Monitoring System*
3. *Utilizing IoT Solutions to Monitor Beverage Bottling Assets on the Production Line*
4. *Keg Line Monitoring System*
5. *Real-time Monitoring of Can and Bottle Filling*