GNG 1103 Project Deliverable E: Project Plan and Cost Estimate

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Objective

For teams to establish a concrete prototyping plan to develop next steps forwards. Budget all materials needed and develop contingency plans.

Introduction

The next part of the design process is prototyping. Before any physical prototypes can be made budgeting and prototype planning has to be made. There is a difference between focused and comprehensive prototypes. Focused prototypes work on select parts of the whole design, one subsection or just select attributes. Comprehensive prototypes recreate most if not all of the attributes of the complete design, this form of design is expensive and time consuming due to the amount of resources needed. Teams should be able to plan out their prototypes in advance to determine what is the most effective and efficient way to utilize resources while still creating effective test results that are relevant to the project. In every large scale design project there should always be risk assessment, there are many things that can go wrong and how you respond to them is worth time and money. Plans should be in place to address any possible issues.

Input system

Description

Hardware to read the number of cans going through the system. These numbers can then be uploaded and then put through calculations to determine the rates. The use of a laser tripwire is a simple and easily readable way to input data into a formula.

Required components

- **Photoresistor**
- **Laser diode**
- **Power source**
- **Solderless breadboard(as least for prototyping)**
- **Male to female breadboard jumper cables**
- **Male to male breadboard jumper cables**
- **Cans and bottles**
- **Resistor(ohms to be determined)**
- **Arduino UNO**
- **Container for micro board**

Red laser is connected to a power source and constantly on. Photoresistor is hooked up to the breadboard, using f-m cables, and then onwards to the arduino, using m-m.

Uploading system

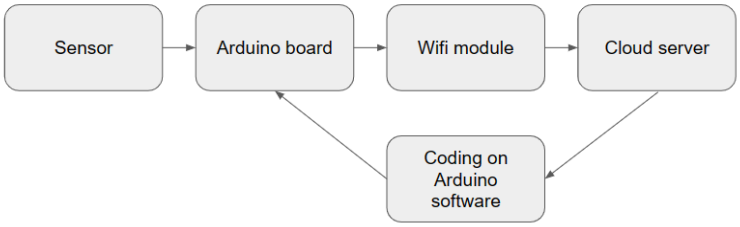
(Note: Take Arduino as an example only for building prototype, real situation may varies but the theory should also be applicable for other platforms)

Description

This uploading system integrates the raw data from sensor with microcontroller and cloud server. This system is based on the board and software of Arduino, and selected cloud server platform. The main

function of this system is to enable raw signals from sensors being processed by the microcontroller and sent to the cloud server through WiFi.

Block diagram



Process specification

- Sensor records the raw signal which can imply the status of the production line.
- Analog signal from sensor being sent to Arduino board through wires.
- Arduino microcontroller amplifies the analog signal and converts it into digital signal.
- Digital signal from the output of the Arduino board being sent to a WiFi module through wires.
- WiFi module converts the digital signal into radio signal and sends the signal out.
- Select a cloud service platform like Thingspeak or Google cloud.
- On Arduino software, install the libraries of selected cloud platforms and add related codes to enable the uploading process.
- The signal can then be sent out by the hardware and received by the cloud platform.

Required components

- Sensors
- Arduino board
- WiFi module
- Arduino software
- Cloud service platform like Thingspeak of Google cloud

Detailed Design Drawing

There is no need to create a detailed drawing of the laser and sensor since we are not designing or buying a new laser for this project. We will be using the lasers that are already in use at the Mill St. Brewery factory. Figure 1 displays the user interface of the website that can be accessed through a computer or a tablet. It will have the 3 following pages: the current data, historical data, and alerts (a new name for the 'Alerts' tab still needs to be determined). Figure 2 displays the Arduino UNO and the breadboard with a laser diode as well as a photoresistor that will be used for testing the code.

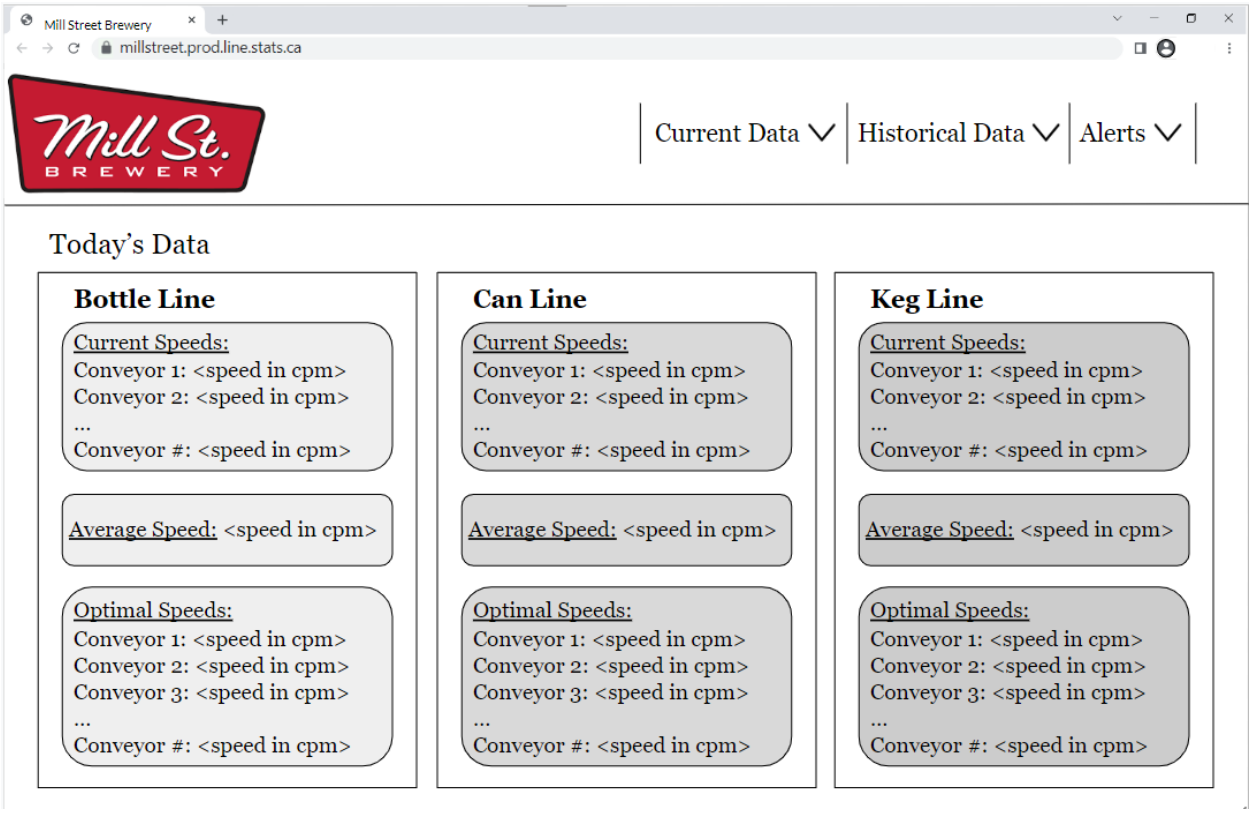


Figure 1. Website Design displaying the 'Current Data' tab.

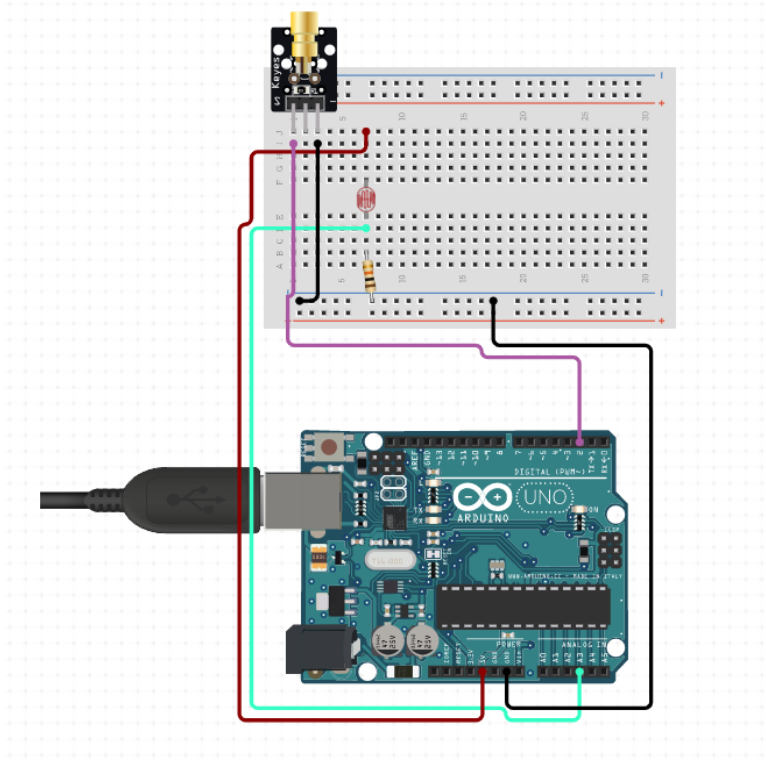


Figure 2. For prototyping

Prototyping Break Down and Test Plan

Test ID	Test Objective	Description of Prototype used and Basic Test Method	Description of Results to be Recorded and how the results will be used	Estimated Test duration and planned start date (when)
1	Test Laser(1) -verifying feasibility	Laser trip wire set up and connected to the laptop. Obstruct beam, check results are coming out.	Alter light level strength of the photoresistor to just pick up on laser beam. Iron out kinks in initial code.	0.5 hour
2	Test Laser (2) -verifying feasibility	Laser trip wire set up and connected to the laptop. Push various widths of cans and bottles (several across) through the wire to determine whether it is still drawing results.	Determine how far the laser can be from the photoresistor before it stops drawing results. Stronger laser? Bigger photoresistor?	1 hour

3	Test Laser(3) -system integration -verifying feasibility	Laser trip wire with the addition of the wifi node. Basic obstructions could be a hand or a can.	Determine if data is being uploaded and in what form it is being uploaded. Iron out kinks in code.	1-2 hours(much setup will be necessary) beforehand
4	Cloud and laser test (1) -system integration -verifying feasibility	Remote upload of data, single can at a constant rate. Cross reference with cloud service. Manually count cans and seconds as well.	Determine whether data being uploaded is accurate. Make adjustments as needed.	2-3 hours
5	Cloud and laser test (2) -verifying feasibility -reducing uncertainty	Attempt "cloud and laser test(1)" but with the addition of more cans across and bottles. Adjust code or algorithm to compensate for the multiple cans. Manually count cans and bottles and times as well.	Determine whether data being uploaded is accurate. Make adjustments as needed.	1-2 hours
6	Cloud and laser test (3) -verifying feasibility	Cloud and laser test (2) with the addition of an inputted benchmark for the filler rate.	Cross reference input data with the benchmark set for the filler. Check if the system is flagging data correctly.	3-4 hours

Cost estimates

Excel Sheet Link: Cost estimates

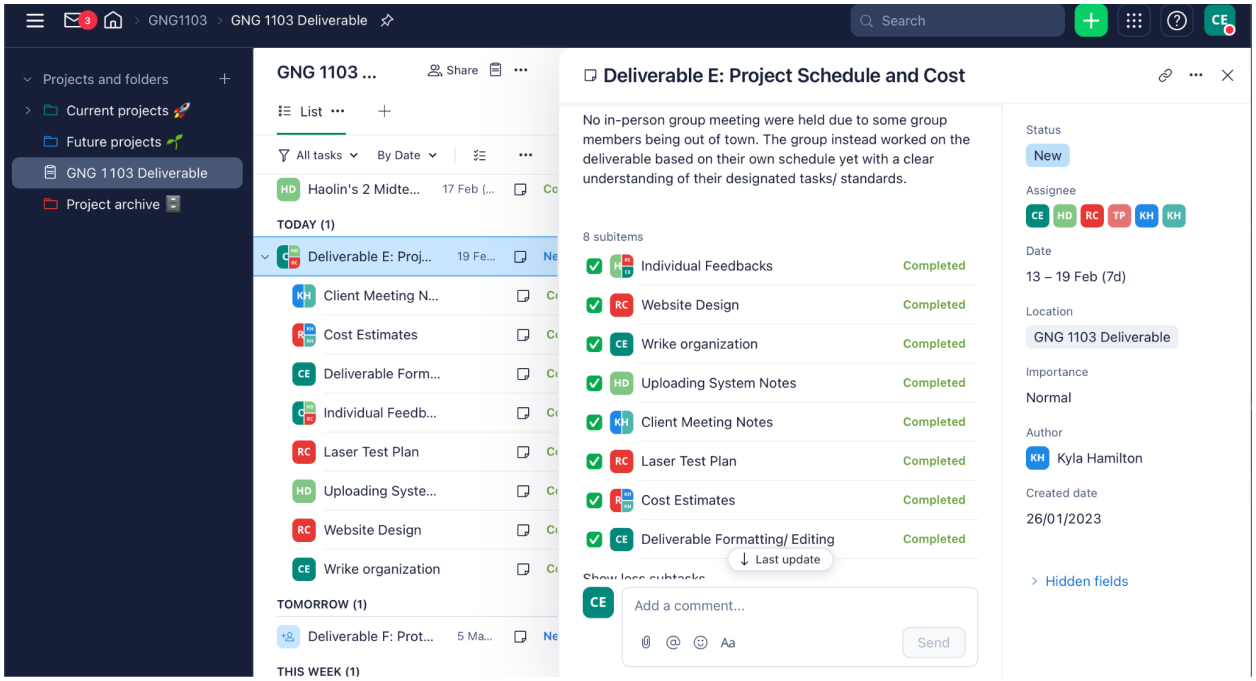
Significant Risks and Contingency plans

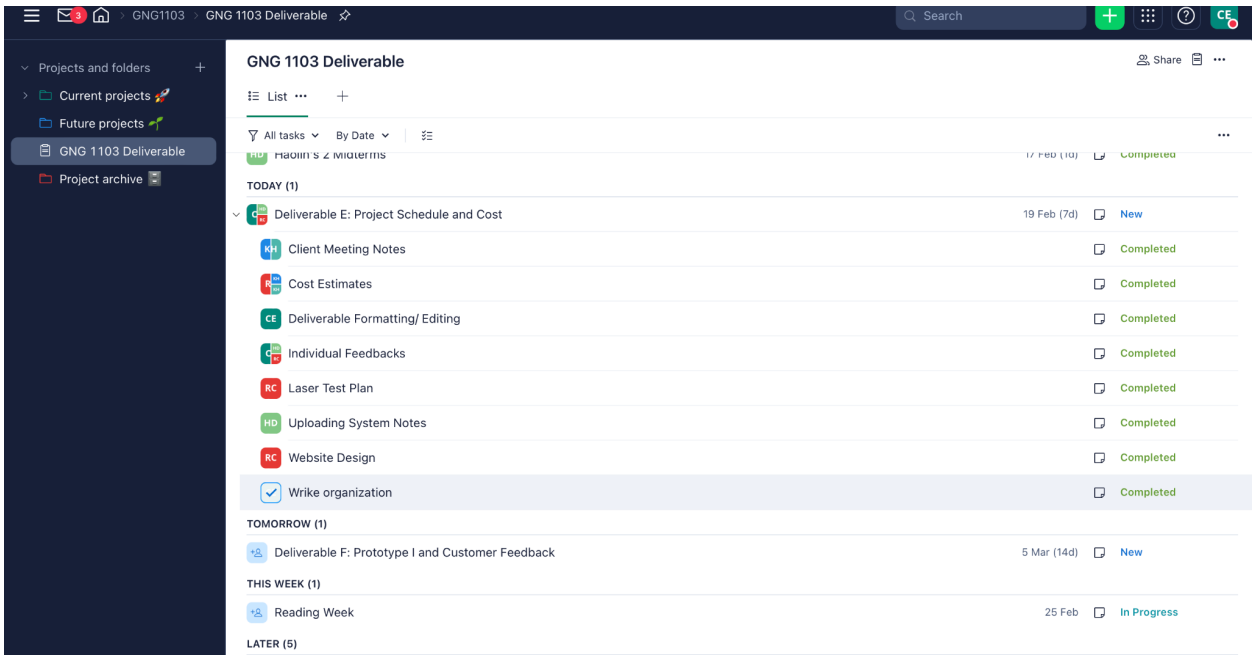
There are not many major risks for this project other than an obvious few:

- New tech- many of the group members have little to no experience with any of this technology. There will be a steep learning curve and we must rely on each other to learn and grow together to cover for each other and build
- Equipment shipping times- many of the pieces of hardware need to be shipped with varied wait times. If we order the wrong equipment there might be a tight turn around with time restrictions
- Time- there are a lot of moving components that need to be coordinated as there are many parts of the production line to be accounted for. Work should be started as soon as possible to leave room for any changes that need to be made in the long run.
- Lasers- there is always a chance that this is not the counting method that works for this project and we have to restart with a different method. There were many other ideas that have been hypothesized previously during the brainstorming stage that could replace the lasers.

Wrike Summary

Below are screenshots of an updated Wrike task board that includes changes made in estimated task duration, completed tasks/ responsibilities, additional dependencies, and tasks assignees etc.





Conclusion

Various types of prototypes are learnt along with their scopes and a risk assessment. The group is able to lay out their prototypes in advance in order to determine effective usage of resources whilst producing useful test findings for the project. With this deliverable complete, the team should be able to effectively move forward and begin prototyping further in an efficient manner.