Prototype III and Customer Feedback

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Introduction:

This report outlines the third and final prototype, which is a fully functioning system. Since the last prototype, all the different panels have been linked together and the node MCUs have been connected and coded. Since being made, the system has been tested and evaluated by current users and staff in the workspaces. The feedback was useful to further improving Orwell before design day and in determining the next steps if further prototypes were to be made.

Prototype III:

Growth:

Several major improvements have been made since the second prototype. The coding for the scheduling system has finally been completed, the program can now successfully create and remove reservations and add user information. It can also indicate which machine is currently reserved or available for use through a color coded system. The inventory system, is communicating with Dashboard and the Node MCU has been coded to calculate the number of items based off the value received from a force sensing resistor (FSR). The machine monitoring subsystem has been coded and calibrated to time the duration between two presses on an FSR. This value is also being successfully sent to Dashboard. The various Dashboard panels have been linked together and the UI is cohesive and functioning. The NodeMCUs' have also been wired and soldered to their sensors.

Scheduling/Reservation Subsystem:

Figure 1: Schedule

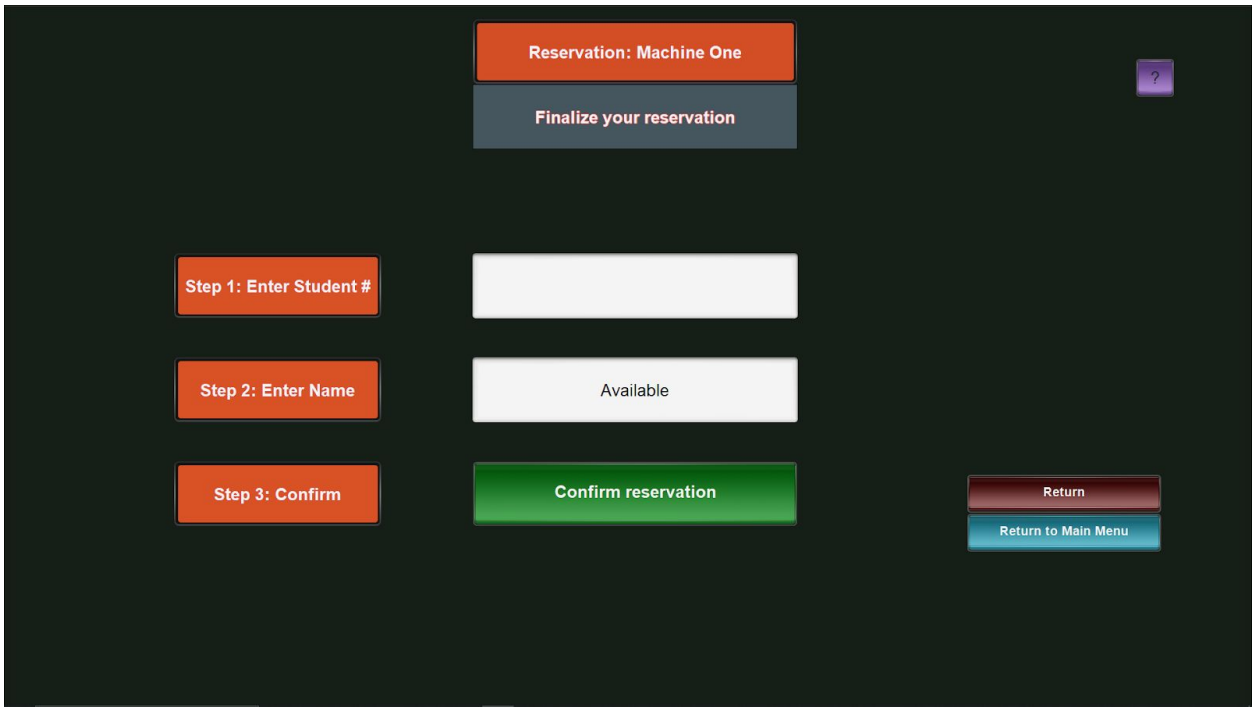

Figure 2: Confirm Reservation

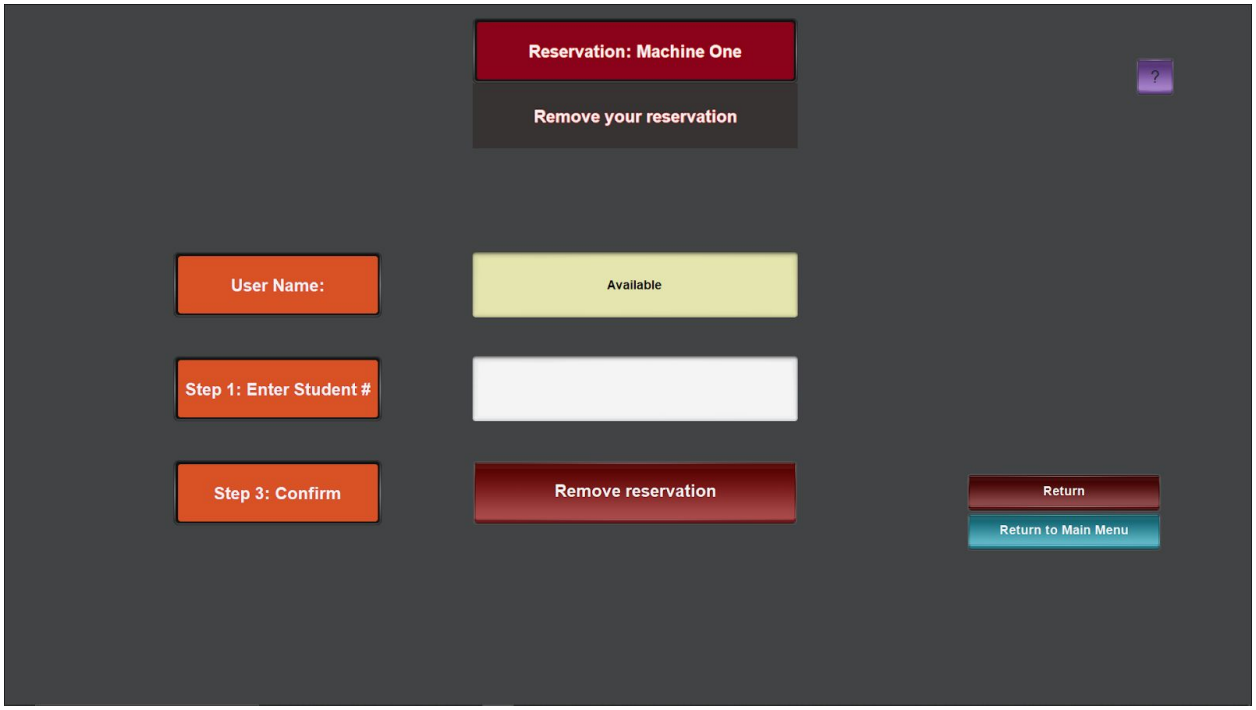

Figure 3: Remove Reservation

Inventory Management Subsystem:

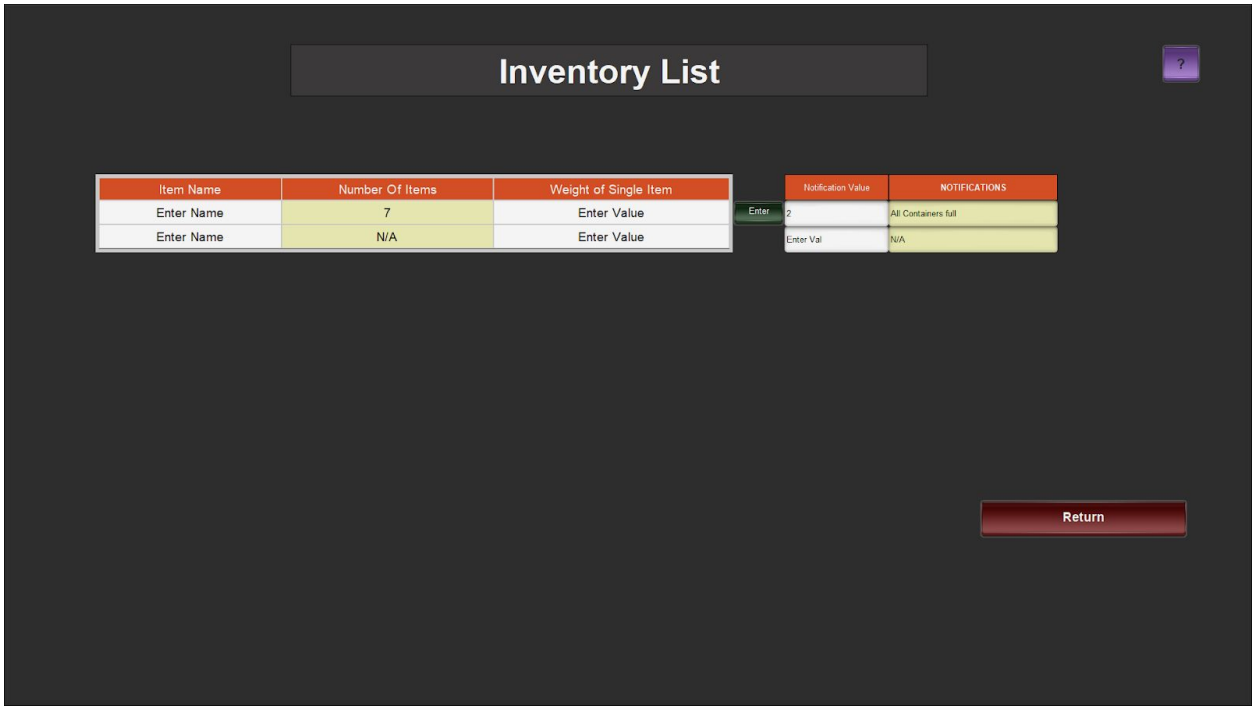

Figure 4: Inventory List

Figure 5: Complete Inventory Set-up

Machine Monitoring Subsystem:

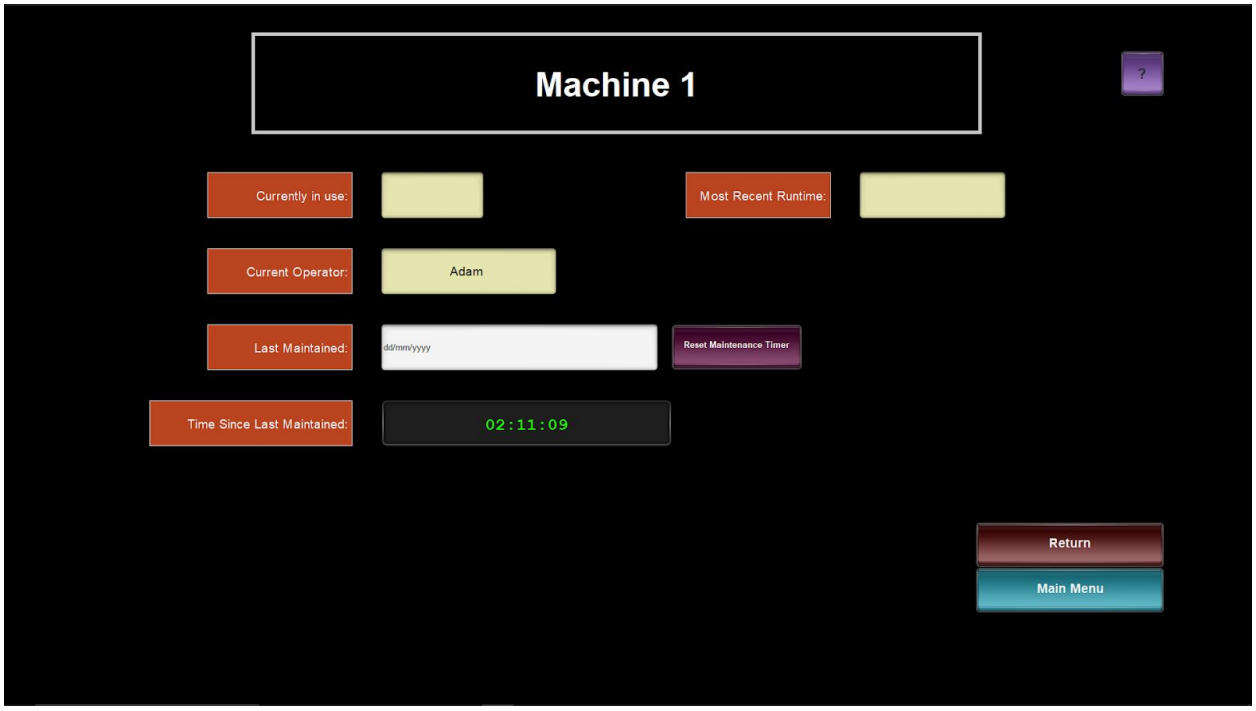

Figure 6: Machine Monitoring

Figure 7: Complete Machine Monitoring Set-up

Dashboard UI:

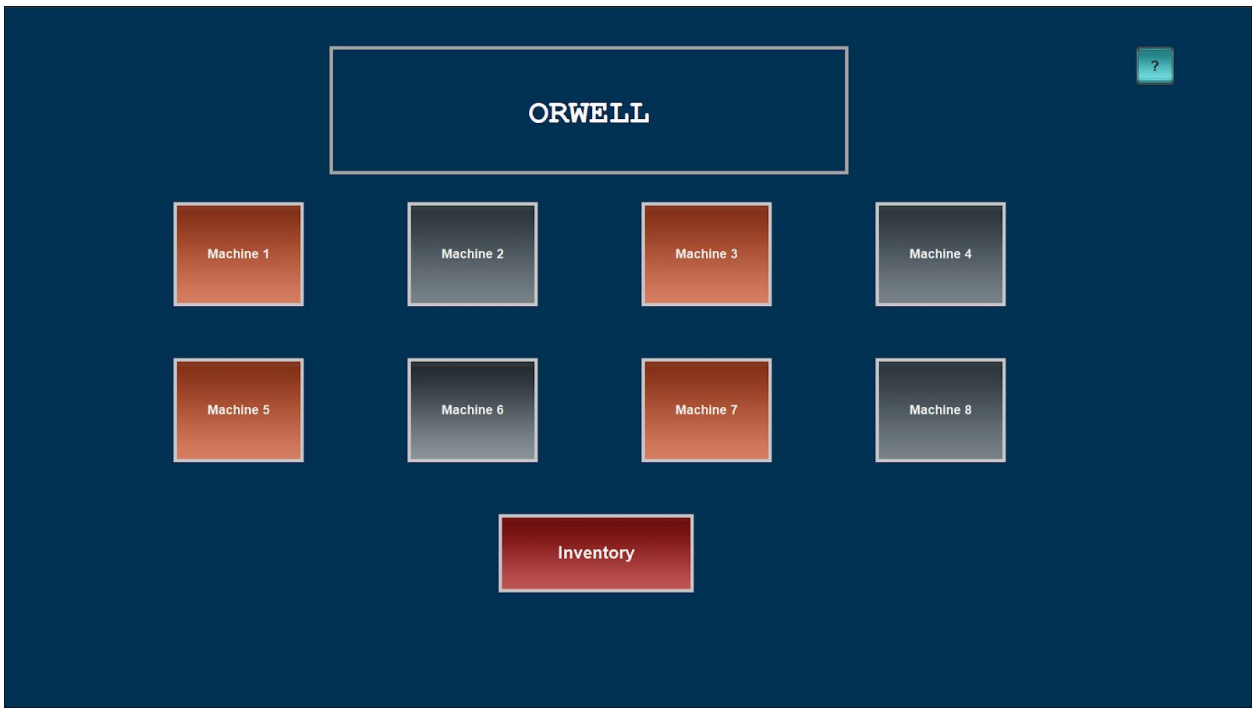

Figure 6: Home Screen

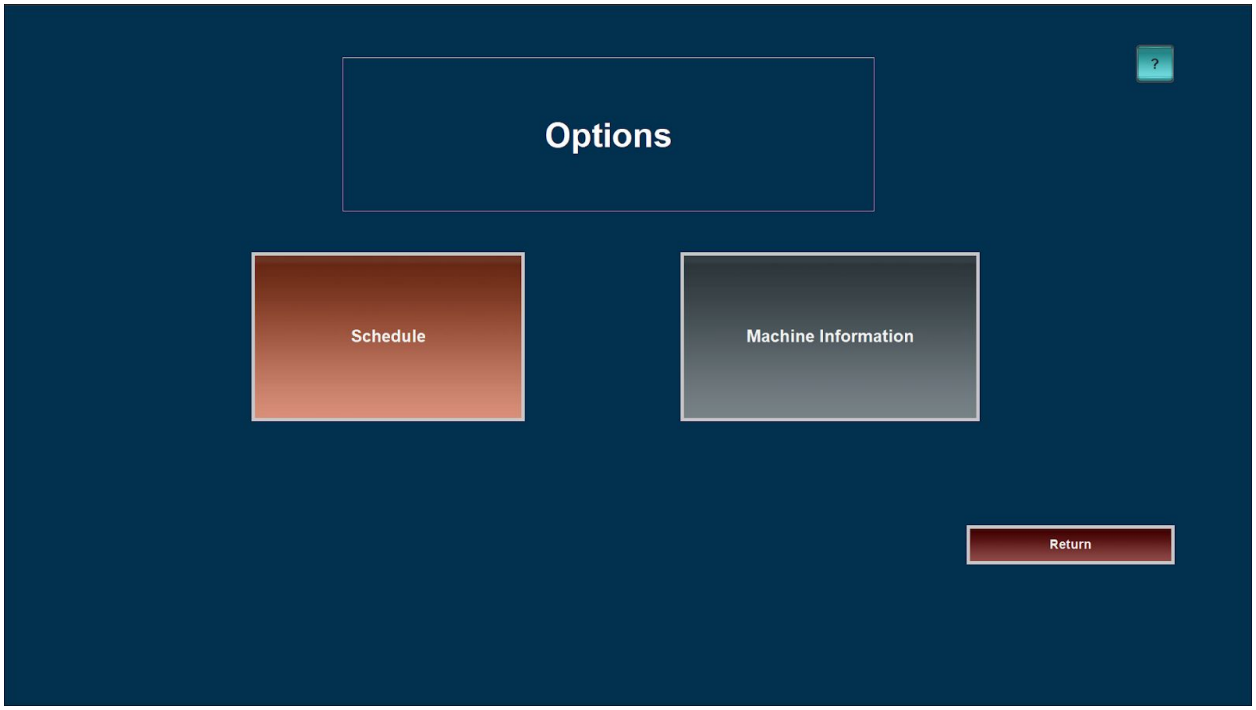

Figure 7: Secondary Screen

Prototype Description:

Scheduling/Reservation Subsystem:

This prototype is a complete and functioning system, in the “Scheduling” screen there is a timetable with either someones name (meaning it’s already reserved) or “available” on each section. If the user wants to reserve a time, they will select an available time slot. They are then asked to enter their name, and enter their student number. They press accept and are returned to the main menu. the user will notice their name is on the time slot they reserved. If they wish to cancel their reservation, they click on the timeslot with their name and re-enter their student number. If the student number match, the reservation is canceled and the used is once again sent to the main menu.

Inventory Management Subsystem:

In this prototype, the system is fully functioning and can measure the weight of a large item placed on the sensor and calculate the number of items available. This information is being sent to Dashboard over a wireless server. The Dashboard Panel (figure 4) is complete and the user is able to view the current number of items, if the container needs to be refilled and insert the weight of a single item. Ideally this prototype would have been made using a load cell, however, since the load cell was found to be dysfunctional the sensor has been substituted with an FSR, as seen in figure 5. The force sensing

resistor (FSR), has been calibrated to function in a similar manner to how it would if the load cell was found to be functional. The physical set-up as seen in figure 5, has been completed. The node MCU has been coded, wired and soldered.

Machine Monitoring Subsystem:

In this prototype, the subsystem is a functioning system. The dashboard panel has been completed and is able to communicate with the node MCU. The FSR has been coded and calibrated to track the duration between presses in order to output the machine usage time. At this time the prototype is unable to export the machine usage information to a spreadsheet to be analyzed. This subsystem starts with the user pressing an FSR, which is placed on top of the start button of a machine, this starts timer. A second press stops the timer and the final measured duration is outputted onto dashboard. The node MCU has been coded, wired and soldered.

Dashboard UI:

In this prototype, all the panels have been designed and linked together. The home screen was created to optimize the user experience and ensure that navigation was simple. A friendly colour scheme was also chosen and labels have been placed where appropriate inorder to aid users who may be colour blind. All the buttons have been linked to their respective functions and pages.

Test Plan:

Why are we doing this test?

This will be the final round of prototyping and testing before design day and the final presentation. In the previous prototypes the goal was to learn about the system and how it would interact with the space. The information received before would allowed the team to improve the system to its final and most up to date iteration/prototype. This prototype will communicate and demonstrate how the system, Orwell, will function and its place in the Brunsfield workshop. It's purpose is to prove Orwell's value to potential clients/users.

Test Objectives Description

The specific test objectives will be to see if the subsystems are running as intended. The Scheduling/Reservation subsystem will be tested to see if the following tasks are completed:

1. Can the system successfully create a reservation?
2. Can a reservation be removed?

3. Can the user view which machines are in use?
4. Can the administration view which machines are being used?
5. Does the system have calibrated/set-up more than once?
6. Is the screen easy to understand?
7. Is there a troubleshooting/help button or option?

The Inventory subsystem will be tested to see if the following tasks are completed:

1. Can you send information to the Node MCU?
2. Can you send information to Dashboard?
3. Can the user view the available inventory?
4. Can the user edit the inventory information?
5. Does the information change as the actual weight does? (grams)
6. Is the number of items outputted accurately? (number of Items)
7. Is the system portable?
8. Is the screen easy to understand?
9. Is there a help/troubleshooting option or button?

The Machine Monitoring subsystem will be tested to see if the following tasks are completed:

1. Can you send information to Dashboard?
2. Does the system track the correct runtime? (Time (seconds))
3. Can the user view the runtime?
4. Is the runtime live/ does it update automatically?
5. Is the user able to view who last used the system?
6. Is the runtime labelled with a certain machine?
7. Is the system portable?
8. Is the screen easy to understand?
9. Is there a help/troubleshooting option/button?

The User Interface will be tested to see if the following tasks are completed:

1. Is the system simple and easy to understand?
2. Is the color scheme pleasant?
3. Is the system intuitive? (can someone navigate it without excessive training)
4. Does the system navigate through the panel smoothly?
5. Is the system efficient?
6. Can the system be used on any laptop/desktop?
7. Does the system have to be set up more than once?

This prototype will demonstrate how Orwell works and how well it completes the tasks listen above. This prototype will also help the team learn more about the prototyping and testing process, as well as, what to look out for the next time a product is being developed. Should the team choose to further develop Orwell, this prototype will provide information on how to further optimize and improve the system.

The tests will give both metric and non-metric values. The scheduling/reservation subsystem will provide a metric result, the system will output the time the user has reserved their machine or if the machine is available. The test will check to see if the reservation was cancelled after their reservation time has passed. The rest of the results will be non-metric and will consist of true/false results. The inventory system test will yield some metric results, the system will be tested to see if the correct weight (in grams) is being measured and if the correct weight (in grams) is being used to calculate the number of items.. The test will also check to see if the correct number of items is being calculated. The rest of the results will be non-metric and will have true/false results. The Machine Monitoring system will have a single metric result and the rest will be non-metric. The test will see if the correct duration (time in seconds) is being recorded and outputted. The rest of the results will be non-metric and will have true/false results. The Dashboard UI will have no metric results, during the tests notes will be taken on its functionality and whether or not if condition was met. Should the results for any of the tests for any system be false, notes on possibly why the condition was not met and what was missing will be taken.

Since this will be the final prototype, the test will help the team determine if the system is ready for presentation and if whether or not some parts/subsystems need to be removed. It will also help the team determine if whether or not other visuals will be needed for Design Day and the final presentation. A test will be considered a success if the all of the tasks with metric results match the expected values and if 90% of the tasks with non-metric results are completed as expected.

What is going on and how is it being done?

Prototype 3 is a comprehensive build of our entire project. Every subsystem is being refined and tested extensively. The reasoning is that prototype 3 is our final draft of Orwell, so every system must be perfect and error free for design day.

The testing for the four tests will be similar and the tests will be conducted by group members. The first test will be conducted on the Scheduling/Reservation subsystem. In this test, the tester will attempt to complete objectives 1 - 4 in under 2 minutes. Any issues encountered along the way will be noted, if the objectives have been completed in under 2 minutes the objective test will be considered a success. If the tester must ask for assistance more than once in the duration of the entire test or if it takes them more than 2 minutes to complete it, the test will be considered a fail. For tasks/objectives 5 - 7, the tester will verify if each characteristic (as described in the objective) is present on the display. This will be indicated by simply stating if each statement is true or false. If the test result is “false” then notes will be taken on what happened instead.

In the second test, the Machine Monitoring subsystem will be tested. For objectives 1, 3 - 5, the tester will try and find the listed characteristics in under 1 minute. Should the tester ask for help more than once in the duration of the entire test or if they are unable to find the characteristic in the time limit. The objective will be considered a fail, in the case of a failure notes will be taken on what happened and the tester will move on to the next objective. For test objective 2, the time (in seconds) recorded by the Node MCU should match a preset value of 20 seconds, which will be timed using an external timer. If the time recorded by the sensor matches the time recorded in the timer, the test will be a success. For tasks/objectives 7 - 9, the tester will verify if each characteristic (as described in the objective) is present

on the display. This will be indicated by simply stating if each statement is true or false.. If the test result is “false” then notes will be taken on what happened instead.

In the third test the Inventory subsystem will be tested. For objectives 1 - 4, the tester will try to complete the listed objective in under 2 minutes. Should the tester ask for help more than once in the duration of the entire test or if they are unable to complete the objective in the time limit. The objective will be considered a fail, in the case of a failure notes will be taken on what happened and the tester will move on to the next objective. For objectives 5 - 6, the tester will check to see if the values outputted on Dashboard match the preset expected values. If the values match then the objective will be considered a success, otherwise it will be considered a failure. In the case of a failure, the actual output will be noted. For tasks/objectives 7 - 9, the tester will verify if each characteristic (as described in the objective) is present on the display. This will be indicated by simply stating if each statement is true or false. If the test result is “false” then notes will be taken on what happened instead.

The fourth and final test will be conducted on the User Interface subsystem. In this test, the tester will verify if each characteristic (as described in the objective) is present on the display. This will be indicated by simply stating if each statement is true or false. If the test result is “false” then notes will be taken on what happened instead.

Each system has different values that need to be measured. The scheduling system doesn’t “measure” any data, it’s more of a database that will have to store user information and machine availability, so it will store those parameters. Machine monitoring, and the Inventory management system do measure information. Machine monitoring stores how long a machine has been in use for, so it measures time. The inventory system measures the weight of the objects on top of the pressure pad. When the amount of items on the pad reaches a level set by CEED staff an alert is sent informing staff that the number of items is low.

For the scheduling subsystem, the test will observe if the system can store user information like their name, student number, and if the reservation will remove itself after its time slot has expired. The tests will also check to see if the inventory system will notify the user/staff when stock is low, and if the values being outputted on to Dashboard are correct. The test will observe if whether or not the usage time is being outputted automatically and correctly. Each test result will be noted down and notes on how the system fairs during the tests will be noted extensively.

For this prototype, 20 ft of wire, 2 pressure pads, a 1kg load cell (with a HX711), 2 types of screws with nuts and 3 wooden boxes were purchased. All of the materials were used, except the TA accidently ordered 15 ft of wire instead of 3 ft. The total cost of the prototype and materials was, 59.12 CAD.

For physical building, the Node MCUs have to be soldered with the pressure sensors and connected to Dashboard to send signals back and forth. For software programming, each subsystem has varying amounts of coding that must be done. The inventory system needs to program sending the weight of the object on it, have Dashboard determine how many items are currently on the pad, and send an alert when the minimum number of items has been reached. The machine monitoring system will have to connect the pressure pad to the Node MCU like with the inventory system, but will have to code a timer

that turns on and increases when the pad is activated, and turns off if the pad is activated again. The scheduling system does not need to be connected to a Node MCU, it is entirely built in Dashboard. Coding consists of creating a timesheet where users will enter their name and student number, the program must store their information, and keep it until their reservation time has passed. The information will be deleted at that time.

When is it happening?

Each system will take 15 minutes to test, except for the machine monitoring system which will take 17 minutes to test. The machine monitoring system will be run for 1 minutes to ensure that the system tracks the usage correctly.

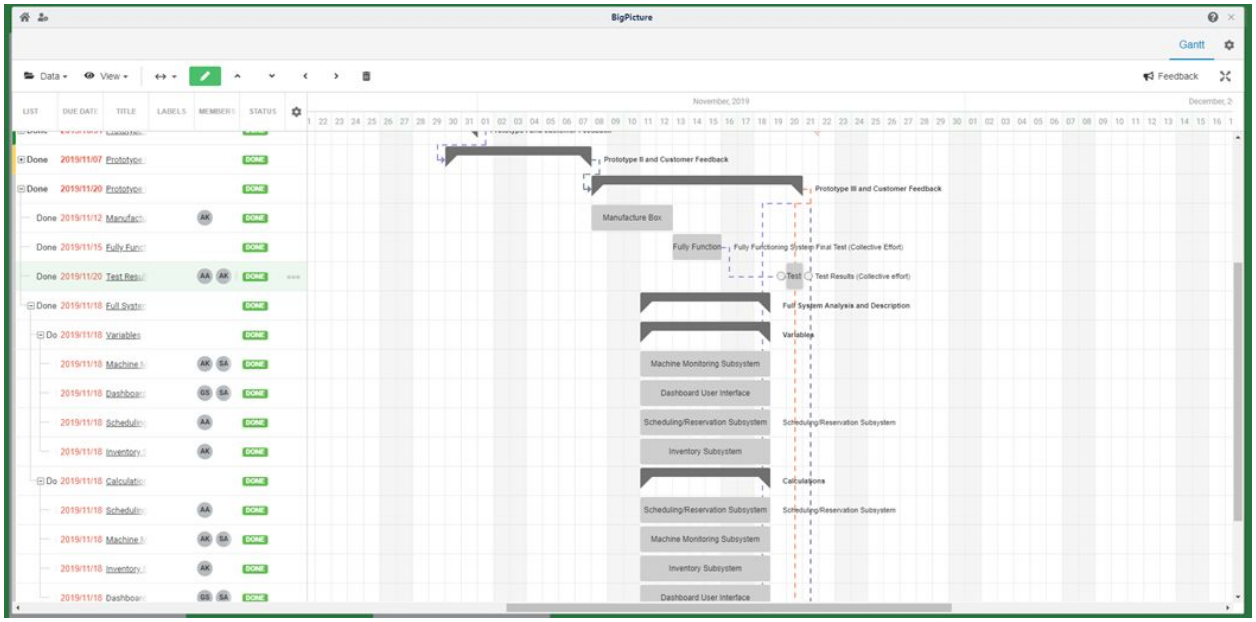

Figure 8: Gantt Chart for Prototype III

The test results will be required by Monday the 20th at the latest, the final presentation (November 20th) and Design Day (November 28th) presentation depending on the completion and testing of the final prototype.

<u>Prototyping Results</u>:

Test 1: Scheduling/Reservation Subsystem

Goals:

1. Can the system successfully create a reservation?
2. Can a reservation be removed?
3. Can the user view which machines are in use?

4. Can the administration view which machines are being used?
5. Does the system have calibrated/set-up more than once?
6. Is the screen easy to understand?
7. Is there a troubleshooting/help button or option?

Result:

1. Yes it can.
2. Yes.
3. Yes.
4. Yes
5. No.
6. No, the way that you create and remove a reservation isn't entirely intuitive.
7. Yes, there it.

Notes: Over all, this test was a success since 6/7 objectives were reached.

Test 2: Machine Monitoring Subsystem

Goals:

1. Can you send information to Dashboard?
2. Does the system track the correct runtime? (Time (seconds))
3. Can the user view the runtime?
4. Is the runtime live/ does it update automatically?
5. Is the user able to view who last used the system?
6. Is the runtime labelled with a certain machine?
7. Is the system portable?
8. Is the screen easy to understand?
9. Is there a help/troubleshooting option/button?

Results:

1. Yes, you can.
2. No, the system does track the runtime, however, the timer has to be recalibrated since it's a little slow.
3. Yes.
4. Yes.
5. No, there is no user history.
6. Yes it is.
7. Yes, however, the box needs to have someway to be mounted
8. Yes it is, everything is labelled.

9. Yes there is.

Notes: The system is an overall success since 7/9 objectives were achieved.

Test 3: Inventory Subsystem

Goals:

1. Can you send information to the Node MCU?
2. Can you send information to Dashboard?
3. Can the user view the available inventory?
4. Can the user edit the inventory information?
5. Does the information change as the actual weight does? (grams)
6. Is the number of items outputted accurately? (number of Items)
7. Is the system portable?
8. Is the screen easy to understand?
9. Is there a help/troubleshooting option or button?

Results:

1. Yes, you can.
2. No, not yet.
3. Yes they can.
4. Yes they can.
5. Yes it does. (however, a load cell is not being used)
6. Yes it is.
7. Yes, the box needs to have the ability to be mounted.
8. Yes it is, everything is labelled, however, the panel would benefit from colour coding.
9. Yes, there is.

Notes: The test was an overall success since 8/9 tasks were completed.

Test 4: User Interface Subsystem

Goals:

1. Is the system simple and easy to understand?
2. Is the color scheme pleasant?
3. Is the system intuitive? (can someone navigate it without excessive training)
4. Can you navigate through the panels smoothly?
5. Is the system efficient?
6. Can the system be used on any laptop/desktop?

7. Does the system have to be set up more than once?

Results:

1. Yes, it is.
2. Yes, the colour scheme is easy on the eyes.
3. The system is intuitive, everything is labelled.
4. Yes you can.
5. Yes it is.
6. Yes it can, however, the Dashboard would have be calibrated for each device.
7. The system has to be calibrated for each device.

Notes: The test was an overall success since 6/7 objectives were completed/achieved.

Customer Feedback:

Client Name: Jim, Post-graduate student

Notes:

Jim suggested that the User Interface incorporate the CEED and Brunsfield colours and scheme. He also suggested that having the machines be displayed in a map style layout would be beneficial to the user experience. He also suggested having a mount implemented onto the machine monitoring sensor so that it could be mounted onto or beside a machine.

Client Name: Amanda, Student

Notes:

Amanda suggested having a dedicated tutorial screen, in order to orient any staff using or setting up the system for the first time. She thought the system was very user friendly, but wanted to ensure that anyone who could have difficulty using Orwell.

Client Name: Leslie, Student

Notes:

Leslie thought the system would greatly benefit Brunsfield. She also thought that having a possible online platform so that users could create and remove reservations. This would allow users to make edits without coming to Brunsfield. She also suggested adding a panel or screen where you can make reservations possibly day or days in advance.

Improvements:

After reviewing the feedback, the team has determined that Orwell should would benefit from incorporating a map into its display. A dedicated tutorial or help screen would also help orient first time users/staff. Hopefully, in the future Orwell will incorporate an online platform inorder to allow users to create and remove reservations remotely. The team will also try and make the colour scheme/layout match or resemble the CEED and Brunsfield workspaces. If a fourth prototype were created, the team would aim to try and export and analyze the data collected in the inventory and machine monitoring subsystems. The inventory subsystems would be recalibrated using a working 5kg load cell. These improvements would allow Orwell to achieve its next level of improvement, thus allowing it to get one step closer to becoming a final product.

Conclusion:

Team 7 has created a third and final prototype for Orwell, this prototype is fully functioning and has underwent thorough testing. The tests revealed that although the systems do function, they are far from perfect and would always benefit from further improvements After receiving client feedback, the team was able to determine possible shortcomings to the system that they did not think of before. The improvements have been documented and should there be a fourth prototype, the necessary improvements will be made. The test results indicated that the system was ready to be presented at design day, but not ready to be sold as a final product.