Project Schedule and Cost

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Introduction:

Team 7 has created a plan that forecasts the cost, prototyping, and design for the remainder of the project. The decided upon design is a three part system. The primary subsystem is a reservation and scheduling protocol, where users sign in and reserve the use of a machine for a set period of time. The secondary subsystem tracks the usage of a machine by tracking when the machine has been turned on or off and its runtime. The final subsystem tracks inventory through an items weight. The subsystem also notifies staff when the stock of an item is low. The initial prototype is due on October 31 and will be a proof of concept on critical components of the three subsystems. It will be very low cost and made primarily out of scraps found lying around. The second prototype is due on November 7 and will be focused on the most critical subsystems: the reservation and machine usage tracking. Ensuring that these subsystems will work properly is the purpose of the second prototype. The second prototype should be made out of low cost material since the budget for the entire project is $100. The third and final prototype is a fully functional version of the design, it will include all three subsystems and is due on November 21. It should be made out of purchased material costing a majority of the budget.

Project Plan, Ownership, & Task List:

As described in Figure 1 - 5, there are seven upcoming milestones: Prototype I, Prototype II, Prototype III, Final Report, Design Day, Presentation and the User Manual. The milestones have been split up as follows:

Prototype I:

- Simple Critical Analysis
    - Block Diagram (Ayesha, Adam)
    - Dimensions (Shoaib)
    - Volume (Mariyam)
- Proof of Concept Model
    - Physical Model of System and Components (Shoaib, Mariyam)
    - Pseudocode
        - Machine Monitoring (Ayesha)
        - Dashboard (Gurinderpal, Shoaib, Adam)
        - Inventory (Ayesha)
        - Scheduling/Reservation (Adam)

The first prototype is due on October 31. It will include majorly pseudocode acting as a replacement for the code that has yet to be written. The model will be focused around a computer. For the machine maintenance, buttons on the keyboard will represent turning the machine on/off. The reservation system is entirely software, so it will be on dashboard. The lockbox system will be users entering a code and the machine accepting/denying the entered code. There will also be a block diagram of the entire system and a model of the physical components. The physical model of the system and set up, as well as, the pseudocode should be completed by October 25, this allows the members to review their work before and submissions. The simple system analysis, such as the approx size and weight are dependent on the completion of the model, but by having the two models as parallel tasks the number of dependencies decrease. The remainder of the project is dependant on the first prototype, since the pseudocode, and models act as a basic blueprint of how the solution should be made.

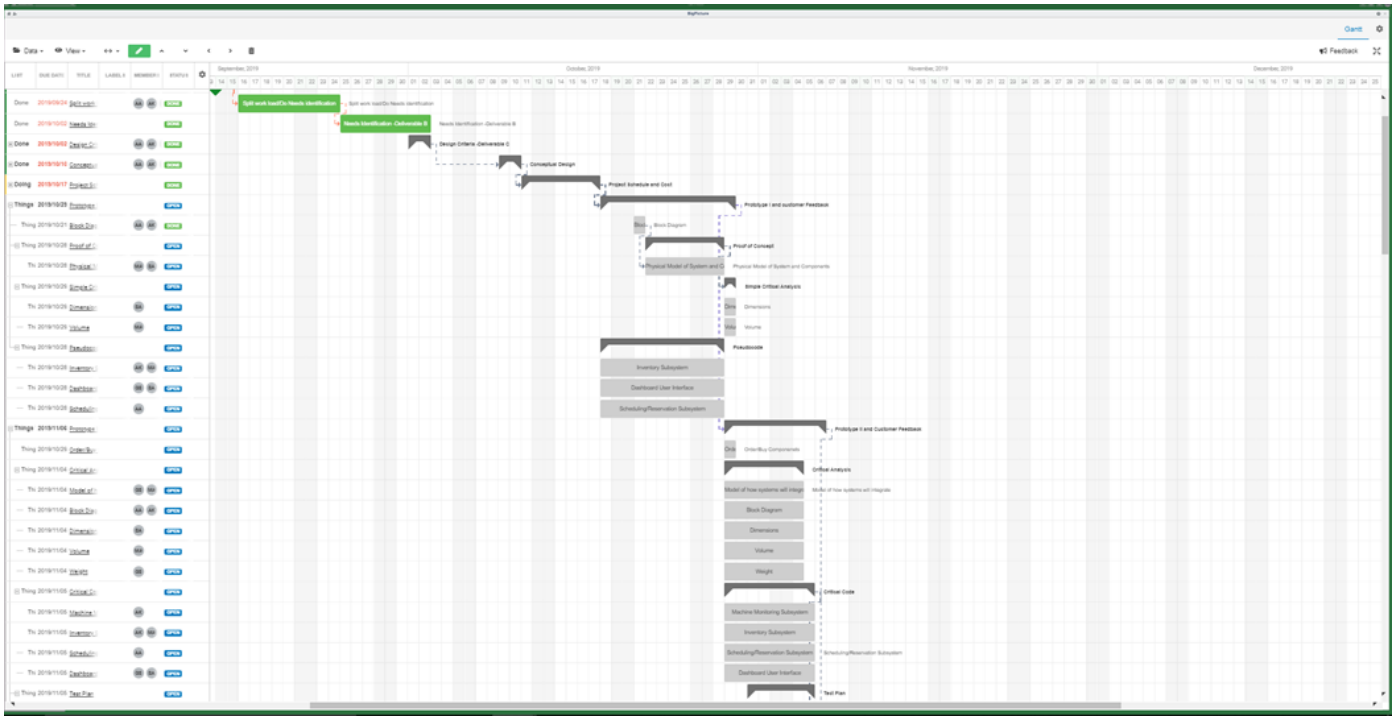

Figure 1: Gantt Chart Part 1

<u>Prototype II</u>:

- Critical Analysis
    - Weight (Gurinderpal)
    - Volume (Mariyam)
    - Dimensions (Shoaib)
    - Block Diagram (Ayesha, Adam)
    - Model of how systems will integrate (Mariyam, Gurinderpal)

- Order/Buy Components
- Critical Code
    - Reservation/Schedule Subsystem (Adam)
        - Dashboard Input
        - Computation
        - Dashboard Output
    - Machine Monitoring Subsystem (Ayesha, Mariyam)
        - Pressure Pad Input
        - Computation
        - Output to Dashboard
    - Inventory Subsystem (Ayesha)
        - Scale Input
        - Computation
        - Output to Dashboard
    - Dashboard Coding (Shoaib, Gurinderpal, Adam)
        - Input from Board
        - Organize information
        - Output to User/Interface

- Test Plan
    - What is being test? (Gurinderpal, Shoaib, Ayesha)
        - Test I (Basic Subsystem Input, computation, Output)
        - Test II (Subsystem Integration with each other and Dashboard)
        - Test III (Whole system over 100 inputs)
    - Why is it being test? (Maryiam)
    - Test Objectives? (Adam)
    - How is it supposed to work? (Adam)
    - When will the tests Occur
        - Test I
        - Test II
        - Test III
- Test Results (Collective effort)
- Customer Feedback (Collective Effort)
- Bibliography (Shoaib, Gurinderpal)

The second prototype is due on November 7, and works to improve the design from prototype I. The design will focus on the critical subsystems; Reservation, machine monitoring, dashboard and inventory. The scheduling is entirely software and is dependent on the input from dashboard. The inventory subsystem is not dependent on another system to work, it's output is

dependent on the dashboard interface. The same applies to the machine monitoring subsystem, whilst its input is independent, its output is dependent on the dashboard interface. The final code should be completed by November 5, to allow for the sections to be revised and improved further.

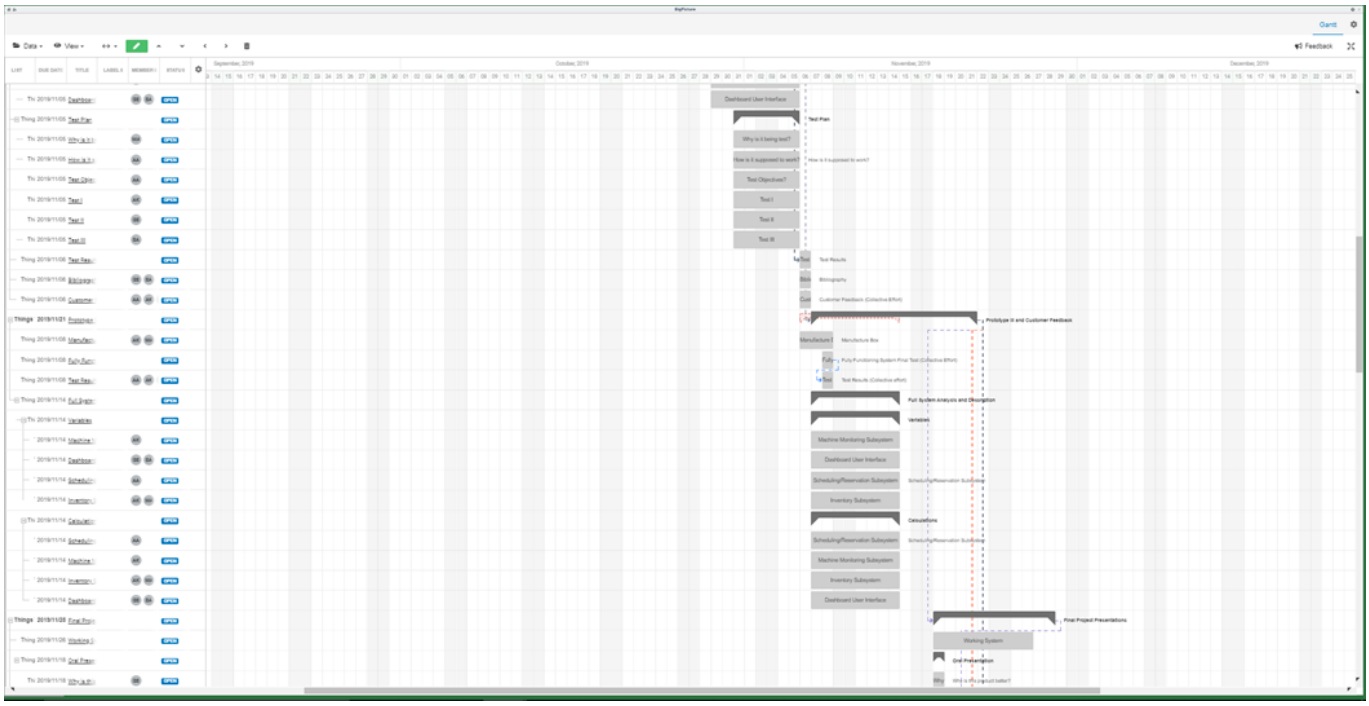

Figure 2: Gantt Chart Part 2

<u>Prototype III</u>:

- Manufacture Box (Ayesha, Mariyam)
- Fully Functioning System Final Test (Collective Effort)
    - Test Results
- Full System Analysis and Description
    - Variables
        - Machine Monitoring (Ayesha, Mariyam)
        - Inventory (Ayesha)
        - Scheduling/Reservation (Adam)
        - Dashboard (Gurinderpal, Shoaib, Adam)
    - Calculations done in the code
        - Machine Monitoring (Ayesha, Mariyam)
        - Inventory (Ayesha)
        - Scheduling/Reservation (Adam)
        - Dashboard (Gurinderpal, Shoaib, Adam)

The third prototype is due on November 21, and will be a fully functional system. The code for each subsystem will be completed and error free. This entire prototype is dependent on the quality of the previous prototypes and models. The building of the physical components is dependant on the arrival of the materials and the system analysis and specifications are dependent on a complete system. The final design should be completed by November 13, so that any problems can be fixed and adequate time is given to the other parts of the prototype.

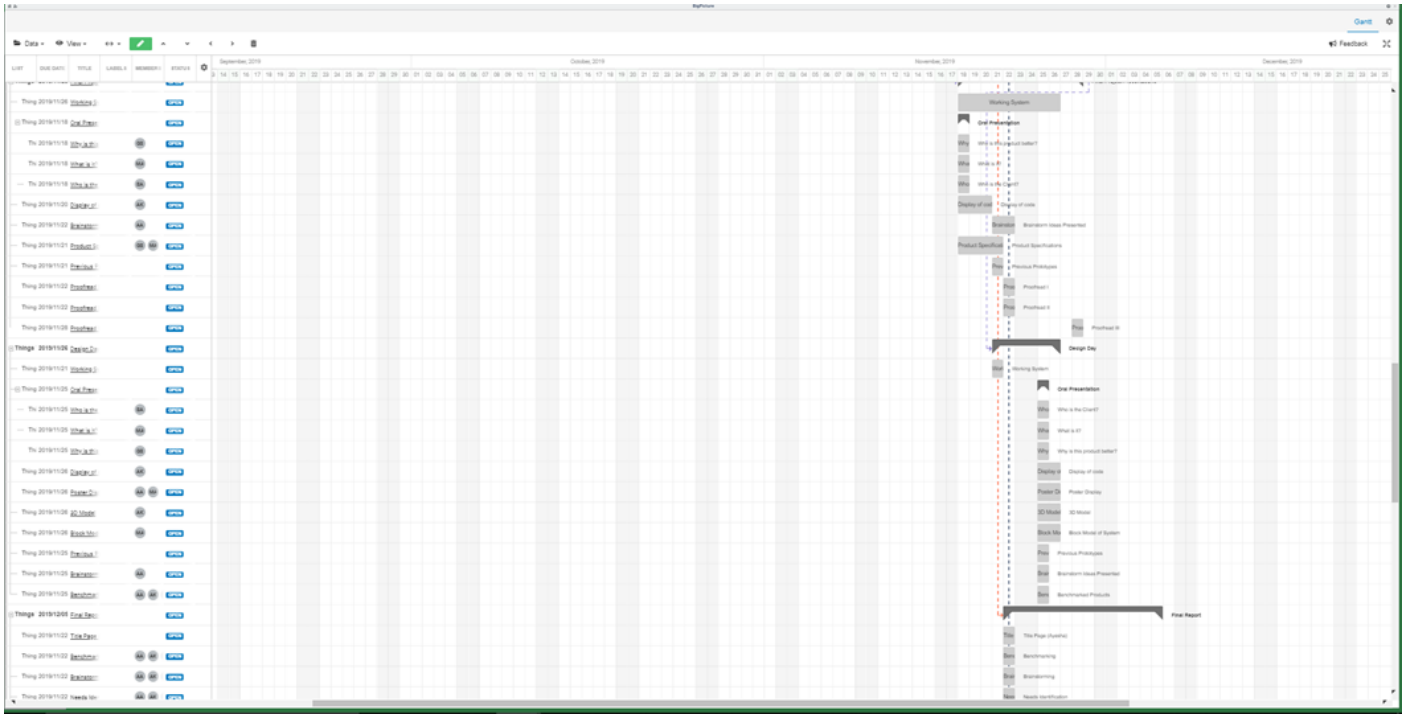

Figure 3: Gantt Chart Part 3

<u>Presentation</u>:

- Working System
- Oral Presentation
    - Why is this product better? (Gurinderpal)
    - What is it? (Mariyam)
    - Who is the Client? (Shoaib)
- Display of code (Ayesha)
- Brainstorm Ideas Presented (Adam)
- Product Specifications (Gurinderpal, Mariyam)
- Previous Prototypes
- Proofread I
- Proofread II
- Proofread III

Design Day:

- Working System
- Oral Presentation
    - Why is this product better? (Gurinderpal)
    - What is it? (Mariyam)
    - Who is the Client? (Shoaib)
- Poster Display (Adam, Mariyam)
- 3D Model (Ayesha)
- Block Model of System (Maryiam)
- Previous Prototypes
- Display of code (Ayesha)
- Brainstorm Ideas Presented (Adam)
- Benchmarked Products (Collective Effort)

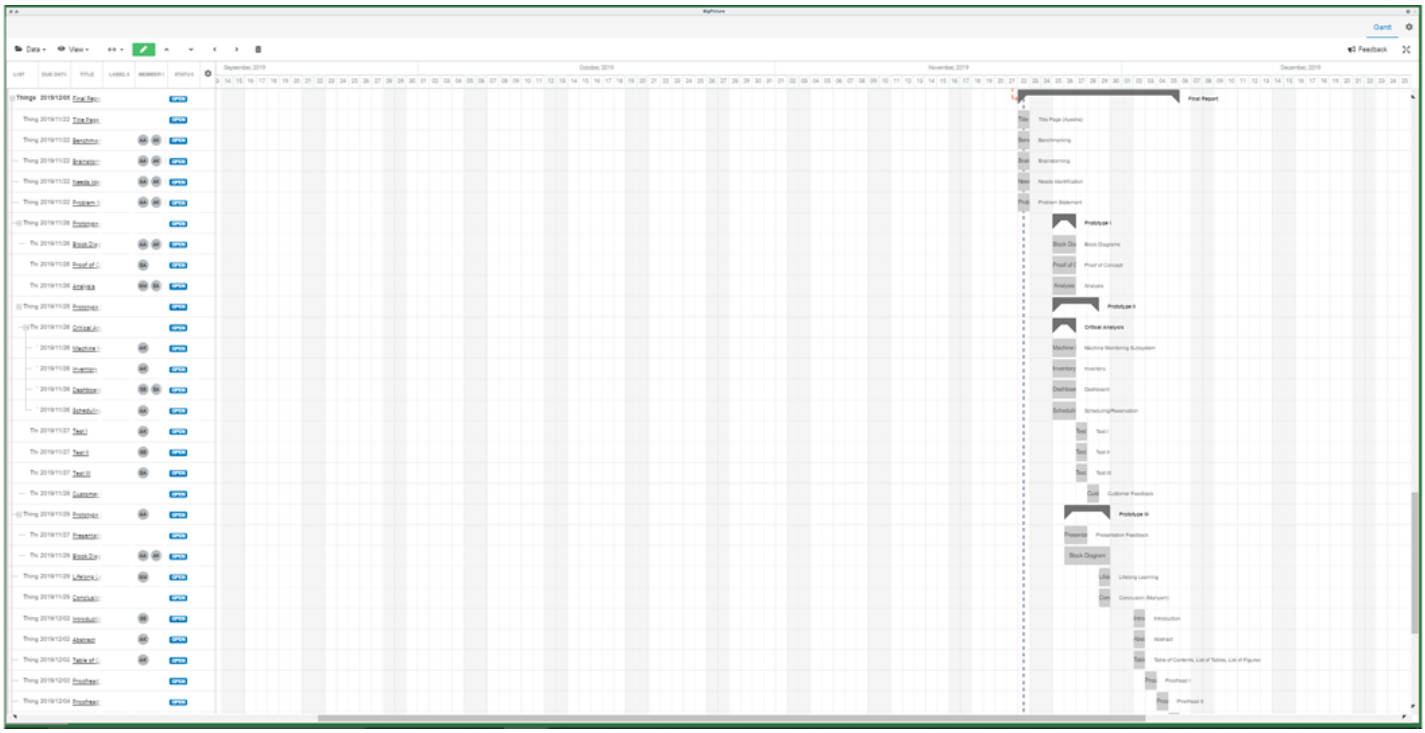

Figure 4: Gantt Chart Part 4

Final Report;

- Title Page (Ayesha)
- Table of Contents (Ayesha)
- List of Tables (Ayesha)
- List of Figures (Ayesha)

- Abstract (Ayesha)
- Introduction (Gurinderpal, Adam)
- Needs Identification (Collective Effort)
- Problem Statement (Collective Effort)
- Benchmarking (Collective Effort)
- Brainstorming (Collective Effort)
- Prototype I
    - Proof of Concept (Shoaib)
    - Block Diagrams (Ayesha, Adam)
    - Analysis (Shoaib, Mariyam)
- Prototype II
    - Critical Analysis
        - Machine Monitoring (Ayesha, Mariyam)
        - Inventory (Ayesha)
        - Scheduling/Reservation (Adam)
        - Dashboard (Gurinderpal, Shoaib, Adam)
    - Test I (Ayesha)
    - Test II (Gurinderpal)
    - Test III (Shoaib)
    - Customer Feedback
- Prototype III (Adam)
    - Presentation Feedback
    - Block Diagram (Ayesha, Adam)
- Lifelong Learning (Mariyam)
    - Difficulties encounter
    - Conflict Encountered
    - Solutions that were found
    - Lessons to be Learned
- Conclusion (Mariyam)
    - Problem Statement
    - Restate solution
    - Why it’s Better
- Proofread I
- Proofread II
- Proofread III

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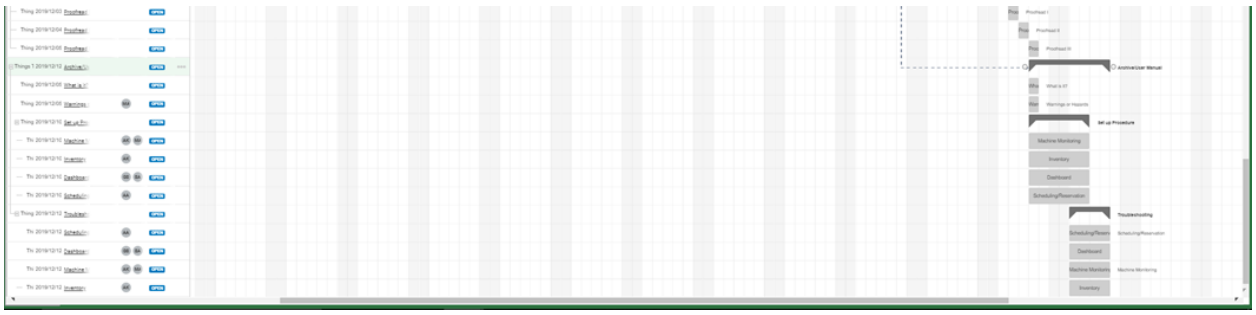

Figure 5: Gantt Chart Part 5

User Manual:

- What is it?
    - Machine Monitoring (Ayesha, Mariyam)
    - Inventory (Ayesha)
    - Scheduling/Reservation (Adam)
    - Dashboard (Gurinderpal, Shoaib)
- Warnings or Hazards (Mariyam)
- Set up Procedure
    - Machine Monitoring (Ayesha, Mariyam)
    - Inventory (Ayesha)
    - Scheduling/Reservation (Adam)
    - Dashboard (Gurinderpal, Shoaib)
- Troubleshooting
    - Machine Monitoring (Ayesha, Mariyam)
    - Inventory (Ayesha)
    - Scheduling/Reservation (Adam)
    - Dashboard (Gurinderpal, Shoaib)

As seen in figures 2 - 5, a plan has also been made for the Final Report, Design Day, Presentation and the User Manual inorder to account for any other dependencies or risks. The prototypes must be completed and functional for any of these milestones to be reached. A substantial amount of the information used (i.e. block diagrams) will be already made available and will only require to be updated. These items have been listed as a collaborative effort, since they are mostly proofreading. As seen in the figures, many items are given a one day duration and that is because the assignments have been split into multiple shorter sections to ensure there is as little confusion as possible. Each subsection is designed to be as independent of others as possible. For example, since by the time a manual is written the members will be familiarized by troubleshooting and the set up procedure enough for them to be written in parallel.

Contingencies and Feasibility:

Team 7 has designed a system that will track machine usage at the Brunsfield workshop. Users will be able to reserve the types of machines they will be using and the duration of each use. A pressure sensor on the power switch will track the machine usage as users activate it when turning the machine on. The information will be stored on Dashboard which will be accessible by the CEED staff, they will be able to use the data to schedule machine maintenance accordingly. In addition, Team 7 has also designed a system to track inventory at the Brunsfield workshop. This system will consist of a scale or pressure pad which will keep track of the small tools by logging the weight of an individual item and multiplying it by the amount. The scale will keep track in the decrease of weight as tools are signed out. The CEED staff will be able to restock the tools as needed by checking the status of the weight which will allow them to see the number of items that have not been returned.

List of risks:

- Delayed Materials
- Incomplete Task/dependencies
- Poorly Completed Tasks
- Broken Materials
- Too expensive

The materials will be purchased from various locations by one team member to make payment returns easier. Inorder to ensure that there are minimum delays, most of the materials have been sited such that they can be bought in store. Any materials that must be ordered online will be ordered as soon as possible. The budget accounts for extra materials in case there is a malfunction or part of the system breaks and needs to be repaired. Each team member is assigned a role in constructing the prototypes and it is their responsibility to finish their part by the agreed upon due dates. The parts have been split up into smaller subsections to ensure that each member can keep track of their progress. This will ensure that members are aware should they run into any difficulties. Individual parts will be done wherever the member feels is best suited, however, group parts will be done in the Makerspace. While working in the Makerspace, the group will have access to 3D printers and laser printers if needed. Group meeting will take place twice a week, if there is an issue with the schedules then as a contingency plan, additional meetings will take place online or others days. If a group member is not able to finish their part by the due date assigned to that subsection, then they should let the group know so the group can assist them. All due dates set by the team are a couple of days prior to the actual due date, incase any problems with the work or team members arise. The early due dates also allow time to proofread any work before submission to ensure that they meet the decided standards. Team 7 will be receiving a base amount of $100 to purchase all the materials needed for all three prototypes. The essentials for the system should remain equal to or below $100. In case there are any extra costs (i.e.

shipping, tax, etc.) each group member has agreed to contribute $10 to $25 toward the design to ensure that it contains everything needed and is completely functional. Furthermore, the bill of materials accounts for items we may or may not need so that there are no surprise costs.

Team 7 believes that this project will be successful in achieving its goal which is to track machine usage and inventory at the Brunsfield workshop. The group's contingency plans in place account for various risks. By creating a project schedule that is specific and simple, they have a blueprint set out for how the coming weeks should operate. Every member is also aware of the expectations set and motivated to complete this project. Therefore, the team believes that this system is not just a dream, but is actually feasible.

List of Materials and Cost:

Materials	**Cost (CAD)** **(Retailer)**
Arduino Uno	$22.00 per piece
Pressure sensor/Pad	$14.96 per 1.5sq inch.
Copper Wire	$0.55 per meter 14 AWG
Solder wire	$9.49 per 113g 50/50
Scale	$48.55 per piece
RFID Reader	$10.99 per piece
Arduino ESP8266 wifi module	$6.95 per piece
Sheet Metal (Aluminum)	$6.19 per Sq ft
Wood beam 1x2x8'	$1.45 per piece
Plywood ¼' thick 4x8'	$8.35 per piece
Black Spray paint	$4.97 per can
Screws 1-¼ inch square head	$7.46 per 100 pack
Bolts	$0.39 per piece
Hex Nuts	$0.15 per piece
Total Cost:	$142.45 minimum

Table 1: List of Material and Cost

Conclusion and LifeLong Learning:

In conclusion, Team 7 has created a feasible roadmap towards completing our tasks on schedule and within budget. This schedule illustrates what what task should be completed in the upcoming weeks, and what is expected of each team member. The final cost is totalled at 142.45 dollars, but as stated previously, the funds provided by the University shall be supplemented by group members providing their own capital towards the project. The dates for sections of the Project plan were set before the actual due dates in order to allow for time to proofread and improve the work as a team, since sections will be primarily done individually, time to review and improve the work as a group is required. The group has split the workload by either volunteering to do a section, stating what they'll have trouble completing the section or it was their idea and they will continue to work on it. Each risk has a contingency plan in place should things go awry. The project plan ensures that every task is completed on schedule and of a high quality.

In creating this schedule, the team has learned the importance of taking time to organize and breakdown large projects into smaller, more manageable tasks. They also learned that organizing and creating subtasks is very time consuming and time should be set aside before each project to create said subtasks. Furthermore, when assigning ownership of the various tasks they learned about what each member was not only capable of doing, but what they were willing to do. By thinking ahead, they will hopefully be able to avoid conflict while expanding on what tasks each member is comfortable doing. The team learned that a lot of thought and time goes into deciding what belongs in the list of materials. The team would often debate about what did or did not belong, this helped give light to other potential options. Certain items have not been added to the list of material since the team is uncertain about how the design will change as the prototypes are developed. Certain materials will be decided upon as prototypes are completed and the project is further developed. Whilst creating the system, the team hopes to become better at estimating how long something will take to complete. They also want to improve their ability to better predict what materials will be required when creating an initial project plan. They hope to further their knowledge and develop their skills.

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