University of Waterloo
Faculty of Engineering
Department of Electrical and Computer Engineering

Brew It Yourself

An Automated Single Vessel Home Brewery System

Group Number: 2016.019
Consultant: Douglas Harder

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Scott Wood (20379649)
Steve Jung (20411563)

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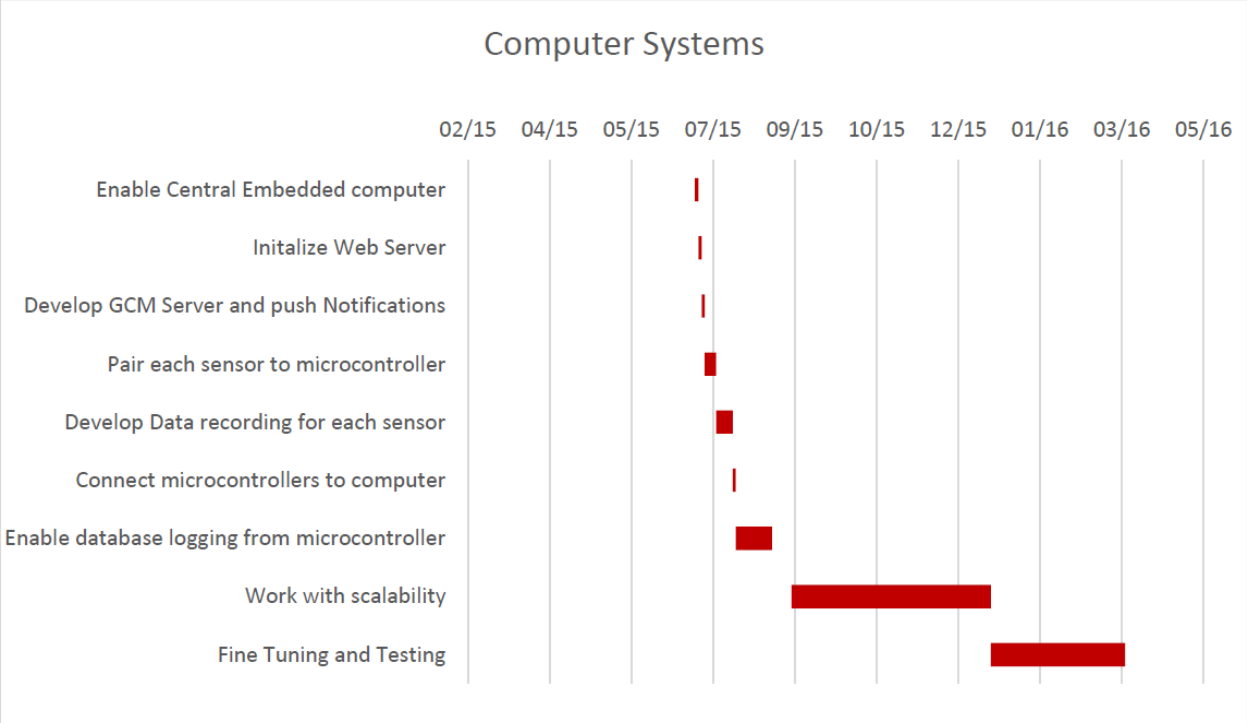
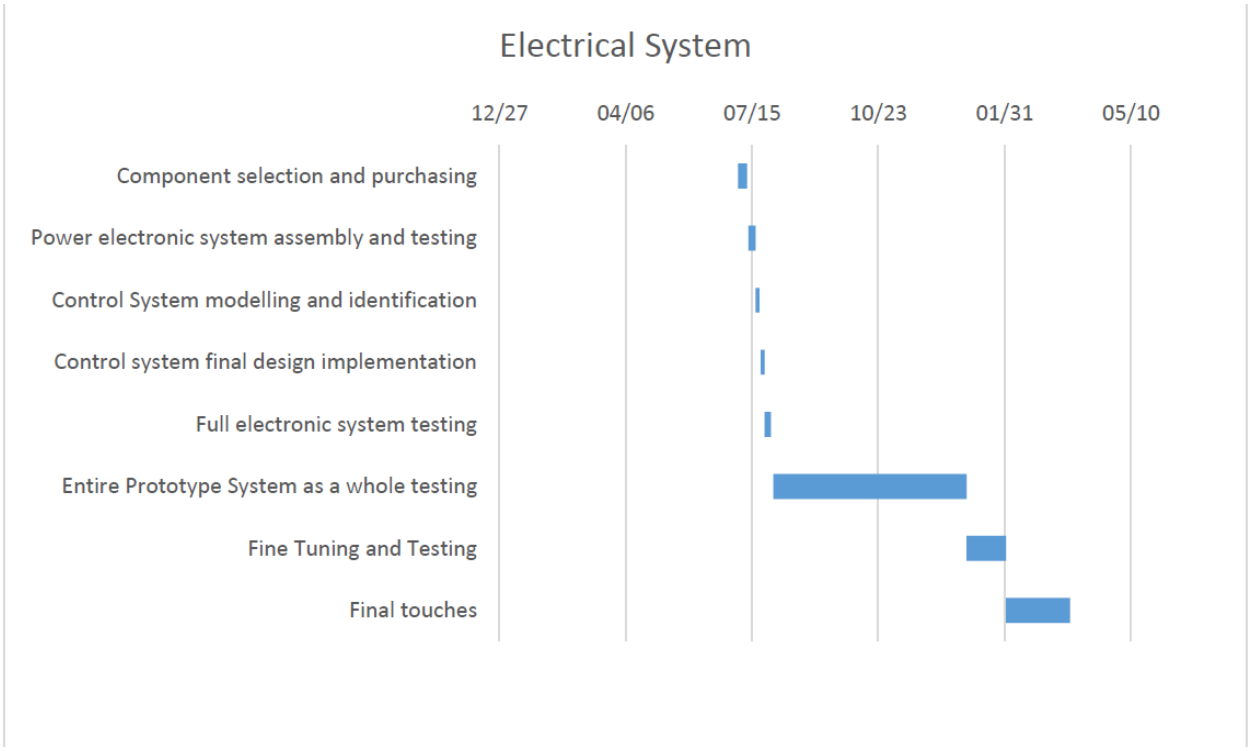
1. Overview of project

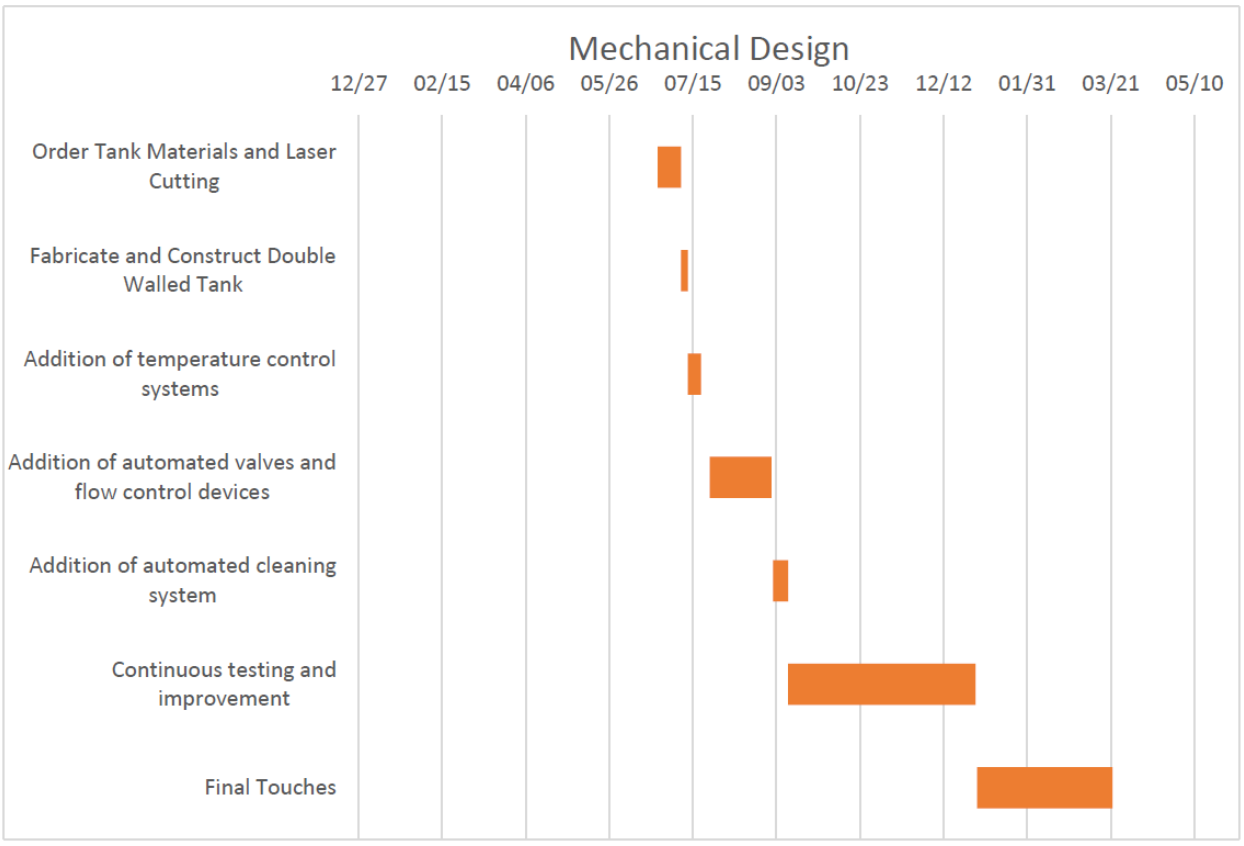
1.1 Revised Project abstract

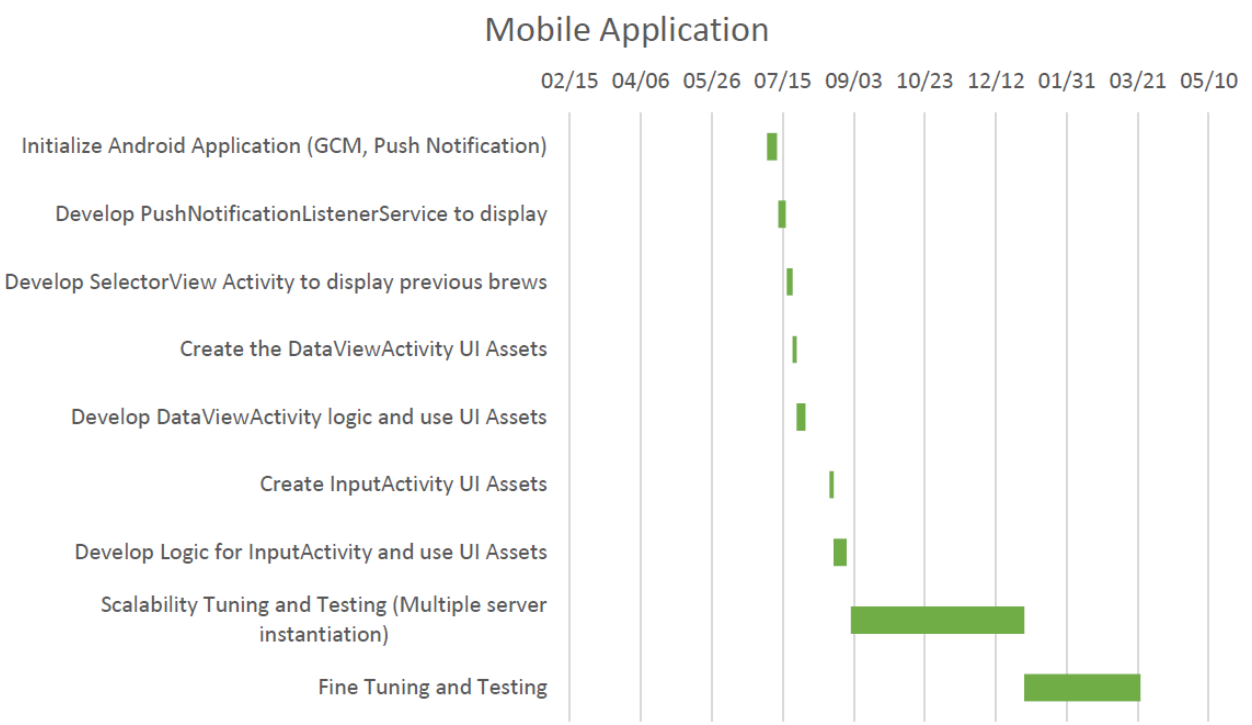
The art of home brewing has been steadily gaining popularity over the past 35 years alongside the rise of craft breweries in North America, so much so that in 2010 there were over 2000 craft breweries in the United States, after starting with only 8 in 1980. The objective of this project is to combine home brewing experience with engineering design, and construct a single vessel brewing system. By maintaining a strict control of key parameters, the brewing process is regulated using a combination of fluid mechanics, heat transfer, digital controls, power systems, embedded robotics and mobile development. The Robotics Operating System (ROS), allows for a design where sensors can be added to a modular setup and provide feedback. By receiving feedback from temperature readings, density measurements and capacitance monitoring, the brewing process can be accurately recorded, shared, and automated by the system. The single vessel design allows for reduced complexity compared to the traditional home brewing method which requires various components, constant monitoring and heavy maintenance.

1.2 Original Project Timeline




Electrical System
12/27
04/06
07/15
10/23
01/31
05/10
Component selection and purchasing
Power electronic system assembly and testing
Control System modelling and identification
Control system final design implementation
Full electronic system testing
Entire Prototype System as a whole testing
Fine Tuning and Testing
Final touches


Mechanical Design
12/27
02/15
04/06
05/26
07/15
09/03
10/23
12/12
01/31
03/21
05/10
Order Tank Materials and Laser Cutting
Fabricate and Construct Double Walled Tank
Addition of temperature control systems
Addition of automated valves and flow control devices
Addition of automated cleaning system
Continuous testing and improvement
Final Touches



2. Current Status of Project

2.1 Prototype Completion

Upon the demonstration of the prototype to Professor Harder, it is considered to be about 50% complete. This is because each member was in charge with one major component of the project. While individual components of the project (Electrical, Mechanical, Computer System and Mobile Application) are mostly complete, the components need to be combined with one another to make a truly automated system. While the more complex electrical and automation components have not been added to the device, all of the specialized manufacturing requirements and thus the longest lead times are now out of the way. All further additions and modifications to be made to the system can be added with the use of basic hand tools and do not need to be outsourced. Extensive testing and modification will be required before the product can be presented at symposium. The alterations that must be made to sensor feedback, power supply, and automation are large in quantity but may be completed easily with resources that the team readily has at its disposal. In terms of the Embedded Computer component, the Raspberry PI was initialized with various microcontroller and sensor pair, and is able to record data. In terms of the mobile application component, the backend server along with the Database and the GCM

architecture is initialized and is able to send and receive data from the mobile application component.

2.2 Student hours

The group focus for this term has been to work parallel between the electrical and mechanical components. The goal of the mechanical component this term was to construct the physical entity that is the fermenter. This will be the building block to which all heating/cooling, sensory, and automated systems will be added.

Table 1: Total Hours

Group Member	Hours
Kevin Nause (20413332)	123
Mathieu Tremblay (20420813)	122
Scott Wood (20379649)	118
Steve Jung (20411563)	119.25

3 Discussion

The group is confident that the project will be completed by the March symposium in ECE498B. Each member of the group is on schedule based on the timeline, and has all if not most of their components finished. The main focus of the group for the following months will be to combine the components with one another. The consultant feels that our project is challenging since it involves components from various backgrounds.