

brew.ai Client Requirements

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1 Overview

Section 1.1 describes the scope of the requirements for the brew.ai project. Section 2 defines terms used in the document as well as terms that are normally used when discussing the project. Section 3 Introduces the purpose of this document. Section 4 outlines the project in a high level. Section 5 describes the requirements through user stories. Section 6 describes the stretch goals for the project.

1.1 Scope

brew.ai is a device that automatically brews mead and learns how to brew better over time. The scope of this document focuses on the specifications of the device as well as the steps to build a business around it.

2 Definitions

- Actuators - Electromechanical devices that allow the microprocessor to affect the fermentation process.
- Artificial Intelligence - A learned control policy which controls the microcontroller.
- AI - See Artificial Intelligence.
- Brewing Setup - The collection of brewing vessels where fermentation occurs.
- Microcontroller - A small, simple computer connected to sensors and actuators on the brewing setup.
- Sensors - A collection of electronic sensors which measure useful data, such as temperature and specific gravity.

3 Introduction

Broadly, this document serves to layout the requirements of this project. These requirements focus on both business and technological aspects. This document aims to assist in:

- Providing specific deliverables and deadlines for the developers.
- Define the initial scope of the project.
- Create a structure to advance the business possibilities of the project.
- Incorporating the mindset, wants, and needs of the user into the final project.

To this end, the document provides an overview of the project, followed by the specific requirements. The specific requirements will provide context for specific goals, and means by which to measure the attainment of the goals.

4 Overall Description

4.1 Product Perspective

This project is self contained, but it does use other projects to help create it. TensorFlow is a library created by Google for the development of Artificial Intelligence. TensorLayer is an extension on top of TensorFlow for Reinforcement Learning extensions.

4.1.1 User Interfaces

The Android user interface should be designed per Google material design guidelines. The Android interface should have two states: pre-brewing and post-brewing. The pre-brewing interface will allow users to select the taste of their batch. There will also be a section for advanced settings that allow the user to tune how the device will function during the brewing process. The post-brewing interface will have the user rate the batch based on predefined characteristics of the batch as well as a general overall satisfaction with the batch.

4.1.2 Hardware Interfaces

The Android software will interact with the brewing hardware through a microcontroller. The microcontroller will provide the Android software an interface for interacting with the brewing hardware; allowing the software to both modify brewing behavior and to gather telemetry about an ongoing process.

4.1.3 Hardware Devices

The brewing hardware will be a non-portable, fully-connected machine with storage containers and other apparatuses needed for brewing and fermenting. Each component of the hardware solution will have sensors and controllers relevant to the brewing state. The hardware solution will interface with the microcontroller solution, and the user will interact both with an Android app and directly with the hardware. Specifics on hardware design will be added to this document as development unfolds.

4.1.4 Memory

The microcontroller will have limited memory space for instructions and sensory inputs. Any process of complexity will need to be kept on the Android system or learning service backend.

4.1.5 Operations

The device will have three states: pre-brewing, brewing, and post-brewing. Pre and post brewing are characterized by inputs from the user. Pre-brewing will take inputs from the user either in a simple or advanced way. Simple inputs are how the mead should taste, and advanced inputs are technical details on how the device will make the brew. The brewing state will entail the device brewing the mead without input from the user. During the brewing state, the user only has the option to cancel the brewing process.. During the post-brewing state the user will have a menu that will have different sections on different aspects of the flavor. After completion of the short quiz, these menus will save the data and give it to the AI for analysis. Ideally data will be saved at every point in the operation so that when the machine is plugged in again, it can prompt the user if it wants to make the batch again or what the user thinks of the previous batch.

4.1.6 Site Adaptation Requirements

The brewing device will incorporate sensors and microcontrollers that are effectively housed in order to prevent any kind of water damage to sensitive parts.

4.2 Product Functions

The project will have two functions:

- Brew mead
- Learn from the user how the previous batch tastes

4.3 User Characteristics

User experience in the brewing process will range from absolute beginner to experienced brewer. These characteristics are reflected in the options given in the user interface.

4.4 Constraints

4.4.1 Safety Considerations

A major consideration for dealing with food or beverages is cleanliness. This project will incorporate safety measures so that when the device brews a batch it will be safe for human consumption. The device will have to be safeguarded to prevent injury of the user during operation.

4.4.2 Hardware Limitations

The hardware will be inexpensive as well as easy to incorporate into a singular device. The microcontroller will have to interface well with this device as well as the computer giving it instructions. The computer will need an interface for the microcontroller as well. When fully complete the hardware will be both modular and water resistant..

4.5 Assumptions and Dependencies

The AI will operate using the TensorFlow libraries designed by Google, and TensorLayer extension libraries for reinforcement learning.

5 Specific Requirements

5.1 Customer User Stories

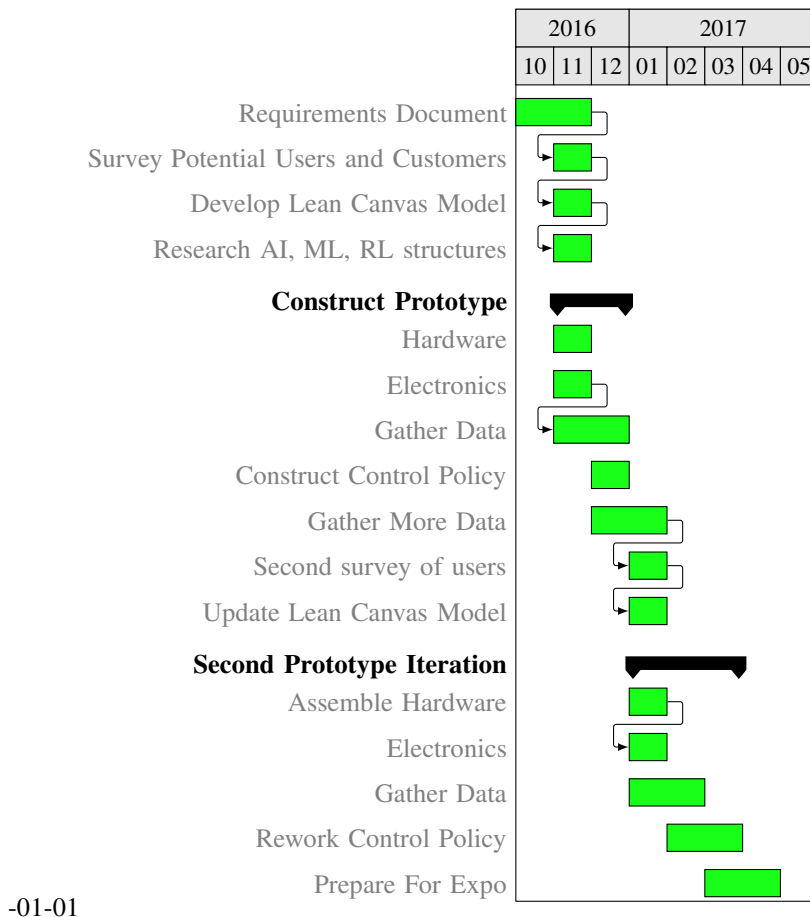
- Automated brewing will make brewing accessible to even amateurs. For those interested in trying brewing simply as an occasional hobby, quality results will be accessible with brew.ai. An easy to set up, fully linked automated brewing system can become an integral part of holiday cooking when brewing for the family.
- A backend learning service attached to the device can help two classes of consumers. The amateur brewer can utilize this service to effortlessly create simple and unique flavors of mead. The professional brewer can utilize this service to better improve recipes that undergo constant revision.
- A simple, preprogrammed microcontroller solution for controlling the brewing hardware helps keep the technology out of the way of consumers. Having less functionality on the microcontroller removes any necessity for updates on that level, and also makes the product more servicable as users can simply swap out hardware devices on their systems.
- An Android client provides a friendly and easy to use interface for the consumer. The nature of touch screen interfaces lends itself to an easy to use, but powerful layout. The ability to deliver over the air updates on the fly to Android applications allows for functionality to be tweaked after any potential hardware is put into production. The Android client provides simplified controls and guided instructions for the amateur brewer to brew with ease. The client also provides more advanced controls for more professional brewers with more knowledge of the various factors that go into a brew.

5.2 Technical Requirements

Based upon our own ideas of for the project, as well as the concepts from the user stories, the technical requirements can be summarized as follows. These requirements are presented in order of their completion. I.e., requirements must be completed in their presented order.

- Assemble a brewing setup.
- Acquire electronics hardware - microcontroller, actuators, and sensors.
- Gather data for training machine learning algorithm.
- Design learning structure for the control policy.
- Create the learning structure and control policy.
- Train the policy.
- Use the policy to automate the fermentation process.
- Create a user interface to monitor and control the brewing process.

5.3 Project Completion Guidelines



5.4 Business Requirements

As we develop this project we must treat it as if we are starting a business. The steps to start this process are:

- Develop a business plan using the Lean Canvas Model

- Interview businesses and homebrewers about their needs as brewers as well as what they want to change about their process.
- After developing a prototype, ask businesses and homebrewers about possible features to add to the device.
- Make a pitch deck.
- Pitch the idea at an event.
- Interview with 10 potential customers.

6 Stretch Goals

The stretch goal of the project is to implement beer brewing functionality. This would include modification of the hardware to include the usage of hops in the brewing process.