Brew Buddy

Project Proposal

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Team Members

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Executive Summary

Brew Buddy is an autonomous control system that allows home brewers and distillers to introduce automation to their set up, utilising their existing equipment. It is designed to be adaptable and scale able from small to medium sized home breweries. It will provide users with automation functions that are not currently available on the market, allowing them to not be tied to the tedious manual brewing process. It will achieve this with a far simpler implementation and at a lower cost than existing market products.

The Brew Buddy project will be completed in 8 Months and will be a viable Marketable product. This will be achieved through a well-documented project method and detailed schedule. The three project team members have 25 years of electronics experience between them and have worked together on many projects in the past, allowing for good team cohesion and communication.

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Terms of Reference

Project Purpose

Our project's aim is to develop an automated control system for hobbyist beer brewing and spirit distillation, minimising the requirement for user interaction as much as practicable. This system will interface with the users WIFI network and will be controlled through a mobile application which will be continuously updated with live sensor information and progress tracking. The user will input their desired recipe information into the mobile application, this will define the timings, temperature, P.H. limits, flow rates and specific gravity that the system will operate within. The system is intended to be semi-modular and to have the ability to interface with existing home brew setups.

Client

There is no industry client for this project as this is a self-proposed project. For the purpose of the software development aspect, the other team members will play the role of client in terms of expectations. At a higher level, the market will act as the client, specifically the Whenuapai Brew Club consulted when determining project direction.

Problem, Need, or Opportunity

Through our own experience and discussion together we discovered a market niche exists that adds modular automation to existing equipment, this was then backed up by consultation with fellow brewers.

Project Rationale

Background

Home brewing can be a tedious process which requires a great deal of time, experience and interaction. Automation is becoming popular among the brewing community with a bunch of new systems having some form of automation. Most of these systems that we have researched are only semi-automated and still require a great deal of user interaction. Existing autonomous systems on the market are also generally an all-in-one solution, where you essentially have to discard your existing equipment and purchase theirs in order to reap the added benefits of automation. We believe this is not an ideal solution as most home brewers already have a lot of expensive and familiar equipment. Our automation system is designed to add functionality, automation, and control to enable the brewer to get the most out of their existing equipment.

Market research

Market research was carried out among brewers to determine design areas for our product that current available systems do not provide.

Safety

The current status quo of lifting and moving vessels containing hot liquids is dangerous, a closed loop system with integrated cooling functionality will eliminate this danger.

Time

Brew days take 6-8 hours requiring a lot of focus, through automation we aim to make this process more hands off so the user can free up time to utilised elsewhere.

Further automation than what is currently available

Current “automated” systems on the market still require a lot of manual input, Brew Buddy will go beyond this with the goal of a start to finish brew with no user input.

Temperature Control

Maintaining exact mash and sparge temperatures is difficult in a manual system, this will be automated through sensors and element control.

Sparge automation

Usually, sparging is done with pre heated water poured over the grain. Our system will heat the water as it is pumped into the mash tun and utilise the fly sparge technique.

Cleaning Automation

Cleaning equipment after a brew is a lengthy and painful process. Using a tap connection our system will heat, cycle, and discharge water through all the equipment in order to clean it.

Scope and Objective

Scope Statement

Brew buddy aims to fill a market niche where home brewers want to introduce automation to their existing system, without the need to purchase an all-in-one system.

Project Goal

Over the next 8 months, our team wants to develop a fully operational autonomous brewing system that will adapt to our existing equipment.

High-Level Requirements (functional and non-functional) (App)

Functional

- Allow users to save recipes
- Allow users to set up and save brewing system configuration
- Push notifications at various stages of brew, requiring confirmation before moving to next stage
- Provide error checking and configuration warnings when inputting recipe
- Allow users to change settings (units, lead times)
- Allow users to view current sensor information and brew progress
- Full integration with system hardware
- Allow users to select and initiate one of the modes (Brew, Distil, Clean, Manual)
- Allow users to cancel/stop/modify/pause during a brew in progress

Non-Functional

- Retain system Wi-Fi/Bluetooth connection through power cycle
- Menus are easy to navigate
- Displays are visually pleasing and information easy to interpret
- The app shall be secure with any user input passwords
- The app must maintain good connectivity within range of the house

Envisaged Solution

This project will be achieved through a combination of software development and electrical engineering. The device will be controlled solely through an application on the user's mobile phone.

Key Milestones

Key milestones identified below, for full project overview see project schedule.

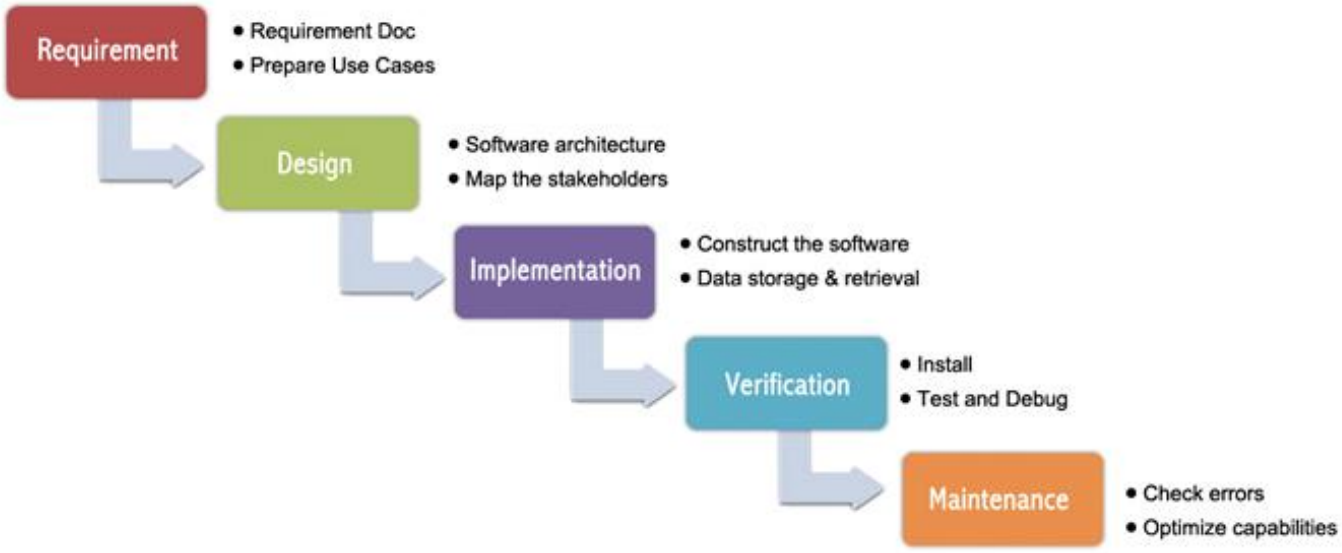
1. Kick-off meeting
2. Project Proposal
3. Market Research Completed
4. Mid-Project Review
5. Project Poster
6. Final Presentation
7. Reflective Report

Project Method or Approach

Introduction

For this project we have chosen to go with the Waterfall development approach.

The waterfall method follows a linear approach to project management. Each phase is completed in a sequential order, where the next phase cannot begin until the previous phase is completed. It is based around 5 phases.



Justification

Waterfall is a methodology predominantly used in engineering projects. Whilst this project contains both Electronic Engineering and Software Development components, we decided that overall, it falls in the realm of an engineering project. The Software aspect of the project (the app) is not feature driven, rather it is designed around the electronic hardware. There will be some iterative design elements in terms of the user interface but did not consider this major, instead I have broken development of the app into two stages, initial development and then revision development after testing of the system. The success of Scrum relies on all team members having an understanding of the method and its ceremonies, the other two members have not used Scrum before.

I considered using two separate project management approaches, waterfall for the over all engineering part, and Scrum for the development of the app but decided that this would be unnecessary seeing as I am the only one working on the software. If there were more team members with the project split into two teams then this solution would be considered.

Trello board will be used for tracking project management.

Project Plan

Schedule

DESCRIPTION	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT
KICK OFF MEETING	◆							
PROJECT PROPOSAL	◆							
SURVEY BREWING CLUB								
BCIS PROJECT PROPOSAL			◆					
RESEARCH/DEFINE REQUIREMENTS			◆					
BCIS UPSKILLING								
SELECT & ORDER PARTS								
EXPERIMENTATION								
SCHEMATICS								
INTERIM REVIEW & PRESENTATION			◆					
PCB DESIGN								
DEVELOP SOFTWARE APP								
PROGRAM MICROCONTROLLER								
BUILD, TEST & DEVELOPMENT								
REVISE APP								
REPORT WRITING & DOCUMENTATION								
IMPLEMENTATION & VALIDATION								
PROJECT DEMONSTRATION								
POSTER PRESENTATION								◆
FINAL PRESENTATION & REPORT								◆

Resources Needed

- Engineering design applications
  - Altium Designer
  - Atmel Studio
  - VS Code
  - SolidWorks
  - Google SketchUp
- Software development applications
  - Visual Studio
  - VS Code
  - Xamarin
  - Eclipse IDE
- Soldering equipment
- 3D printer
- Laser Cutter
- Technical Support
- Brewing and distilling equipment

Techniques to be applied

- Research
- Circuit design

- PCB design
- Programming Microcontroller
- Website/app development
- Engineering management
- 3D Design

Risk management

In this project the following hazards will be encountered. The level of risk has been rated from 1 (minimal) to 5 (severe):

TYPE OF RISK	LEVEL OF RISK	REMARKS
HIGH VOLTAGE	**5**	
HIGH TEMPERATURES	**4**	
ALCOHOL VAPOR	**3**	
ALCOHOL	**3**	
SPILLS	**3**	
SOLDERING	**1**	
USE OF HAND TOOLS	**1**	
COMPUTER WORK	**3**	

For each of the risk factors rated 3 or more, these procedures will be followed in order to minimise risks:

1. High voltage circuity will be designed and tested in collaboration with project supervisors / technicians. Group members are all first aid qualified and will be aware of appropriate isolation procedures and emergency phone numbers. High voltage testing will only be carried out with at least two people present.

2. High temperatures are an inherent part of the brewing / distilling process. This be in the form of hot elements, liquid, gas or equipment. Group members are all familiar with the brewing process and are aware of what components provide a high temperature risk and at which stages to avoid them. Hight temperature components will be physically isolated form any ignition sources and mounted securely when in use.

3. We will utilise commercially available distillation equipment designed to safely contain volatile fumes. Distillation will be carried out in a well-ventilated area with all potential sources of ignition removed or adequately isolated. Group members will be made aware of when a hazard due to the presence of volatile fumes exists.

4. Drink responsibly and in accordance with government guidelines. Further project work is not to be carried out after sample evaluation.

5. Vessels containing liquid will be placed on a secure surface (benchtop etc) and at an appropriate distance to any edges. Electrical equipment will be secured in positions where a spill would not affect them. In the event of a spill, all personal in the vicinity are to be informed and the spill is to be cleaned up as soon as practicable to minimise the potential of slips / falls occurring.

6. Adequate breaks / stretching are to be carried out whilst conducting prolonged periods of computer work. Adequate lighting is to be utilised along with an ergonomic “office” set-up.

Skills Analysis

The following skills and knowledge have been identified as necessary for this project and have been ranked according to my level of expertise.

Quite a bit of upskilling is required in the areas of app development using Xamarin and related tools such as C#, SQLite, and MS Azure. A small amount of refresher upskilling will be needed in the circuit design elements. The rest of the skills are at appropriate comfort levels, with HR and project management skills being well developed.

GROUP	SKILL EXPERTISE	SCORE (1-5)
ENGINEERING DESIGN SKILLS	PCB Design	**3**
	Circuit Design	**4**
	3D Model Design	**3**
	3D Printing	**4**
	Laser Cutting	**4**
	Soldering	**5**
	Test Equipment	**4**
ENGINEERING DESIGN TOOLS	Altium Designer	**3**
	Atmel Studio	**2**
	SolidWorks	**2**
	Google SketchUp	**4**
LANGUAGES / DEVELOPMENT TOOLS	Java	**4**
	C	**2**
	C++	**4**
	C#	**1**
	Visual Studio	**4**
	VS Code	**3**
	Xamarin	**1**
	Eclipse IDE	**3**
WEB TECHNOLOGY	JavaScript	**3**
	PHP	**3**
	HTML	**4**
	Node	**3**
	MS Azure	**1**
	GitHub	**4**
DATABASE	SQLite	**1**
	MySQL	**3**
PROJECT MANAGEMENT TOOLS	MS Teams	**4**
	Trello	**4**
	MS Project	**3**
MULTIMEDIA	Adobe Photoshop	**1**
	MS Visio	**2**
	MS PowerPoint	**4**

HR SKILLS	Project Management	**4**
	Leadership	**4**
	Values	**4**
	Time Management	**2**
	Communication	**3**
	Learning and Development	**5**
	Health and Safety	**5**

Cost Estimation

Hardware

There is an estimated upfront hardware cost of $200 per team member for additional brewing equipment in order to build the product. These parts will be funded by the students and ownership will remain with them.

The University allows each student an allocated budget of $250 and any parts ordered through this system belong to the University.

Brewing and Distilling hardware - $600

Circuit board components - $500

Consumables - $200

Total hardware cost: $1300

Software

All Software required are either free, available on the AUT machines, or under a student license.

Total software cost: $0

Labour

It is estimated the Mentor will be required for two hour per week. This covers any meetings, email advice, and reviews. This project has two mentors and there is 22 weeks in total.

Mentor - $142/hour

$142 x 2 x 22 = $6,248

Student requirement for the project is 300 hours each. This project has three students in total; however, I am essentially undertaking two project components.

Student - $50/hour

$50 x 4 x 300 = $60,000

Total labour cost: $66,248

References

Appendix

As we do not have an industry client for this project, a disclaimer is not required.