

G6 Internet Explorers



keeping plants alive.

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**Submitted to RMIT**

**<Insert Date>0**

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# Introduction

With the growth in high-rise living, balcony gardens are becoming increasingly popular. (*As the popularity of apartment living increases, downsizing a garden becomes a new challenge - ABC News (Australian Broadcasting Corporation)*, no date). Science recognises that plants contribute to reducing the amount of toxins in the air and provide benefits to mental health and reduced stress. Balcony gardens are entirely dependent on humans. (*How a pot plant or five is good for you | Pursuit by The University of Melbourne*, no date).

However, many urban dwellers struggle to keep their potted plants or balcony gardens healthy and alive. **This is why the world needs gardenMates.**

GardenMates is a mobile phone application that connects to one or more sensors which are placed in the soil of the pot or garden bed. The sensors measure soil moisture, soil ph, ambient light and ambient temperature and displays this information relative to the specified plant so that would be gardeners and the non-green thumbed can monitor optimum growing conditions.

In the following pages we introduce the members of the team working on this project.

The project details including deliverables and risks, as well as discuss the project management process we have implemented. The members of the G6 Internet Explorers team invite you to discover more about gardenMates.

# Team Profile

## Team Name

The Team name of G6 Internet Explorers was chosen to reflect our group numbers ie six and the fact that we would be using the internet to research our project. G6 also has connotations of an elite group such as the Group of Seven Organisation of Advanced Economies.

## Personal Information

My name is ***Brian Dean*** and my RMIT student number is S3831349 and I am a member of the G6 Internet Explorers Team. I was born in Brisbane, though spent much of my working life in Sydney. My wife and I are now living on the northern beaches of Cairns in a little spot called Yorkeys Knob, with our twelve year old ginger rescue cat called "Pumpkin", who shares by birthday day and month. I enjoy reading, mainly sci fi fiction, cooking and a spot of gardening. Currently self employed as a technology consultant to the hospitality and tourism sector, having worked in that industry and software houses for many years. I am enrolled in this Bachelor of I.T. degree to fill in the many holes in my knowledge and for accreditation for all those years of doing.

My name is ***Daria Sukonnova***, my RMIT student number is S3812576 and I am a member of the G6 Internet Explorers Team. I was born in the Russian city named Khabarovsk but then we moved to the Northern capital of Russia - St. Petersburg. I enjoy doing many things such as playing the piano or drawing. My biggest passion is reading books of any genre. My dream is to become an Artificial Intelligence Engineer. I find writing code quite enjoyable. My first program was a primitive game on Unity which was created with a tutorial. Since that time I really like solve code challenges on Python. Hope that in the near future I will develop the necessary skills to achieve my goal.

My name is ***Jeremy Naupay*** my RMIT student number is S3831039 and I am a member of the G6 Internet Explorers Team. I have grown up in the Sydney area since the day I was born. I love using my spare time to play around with different operating systems and brushing up on knowledge base. I have worked in I.T for over 2 years now as an IT Support Officer and looking forwards to be a Chief Information Officer in the future. Sometimes i do love to plan our model train sets as a hobby, but i also enjoy just playing video games and working on modding games in general.

My name is ***Shane Thacker***, and my current home is Toowoomba Queensland. My RMIT student number is s3827970 and I am a member of the G6 Internet Explorers Team. Born in Adelaide, I moved to Queensland when I was eighteen, where I got a job in the furniture industry. By twenty, I was going back and forth to Indonesia to train the suppliers on how to sand, prepare, upholster, assemble, glaze and upholster furniture for the Australian company I was working for. At twenty-one, I made the permanent move to Indonesia working for that company then eventually by the time I was twenty-two started my own teak outdoor furniture company. After the 2008 global crisis wiped out my customers, then me off the map, I worked for a European company managing their properties in Indonesia. When those properties were sold off in 2015, I joined an international school and became the school director.

My main interests are barbeque low and slow and fishing, both of which involve knocking back a few cold beers. I have three kids the youngest being six and extremely naughty, most likely because he is too spoilt. Flight simulation is my main “do on own” hobby, but I rarely find time these days.

I am working towards a Bachelor of International Business where I hope to move into

a management position of an international company within the next five years.

## Group Processes

At the time the work on the Assignment 2 began, the members of G6-Internet-Explorers group were not familiar with each other. However, this did not prevent the group from working cohesively and effectively, during the term of the assignment.

Cooperation was one of the strongest sides of our group (and it is still true).

Despite the fact that some of us live in different time zones, we were able to find time for regular conferences where we discussed the progress of our work. Everyone was respectful and organized. Passion for work is the key to success and our group have proved it.

Everyone had a huge amount of ideas and interesting visions of our work.

Our group process consisted of discussing our working plan on the regular video-conferences, chatting in Microsoft Teams and posting our work on GitHub.

All in all, our group worked really efficiently on Assignment 2. The change that we will introduce is even better communication as now we have further developed our group working skills.

## Career Plans

### Ideal jobs comparison:

Every member of our team has different experience, dreams and career plans. Though, that does not mean that there are no common elements in our future job plans.

#### Ideal jobs:

Jeremy - Chief Technology Officer

Brian - Solution Architect

Shane - Principal Data Insights Analyst

Daria - Artificial Intelligence Engineer

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| --- | --- | --- | --- |
| **What is the difference?** | | | |
| **Chief Technology Officer**  **(Jeremy)**  The main work of the Chief Technology Officer is making decisions for the overarching technology infrastructure that closely align with the organization's goals. | **Solution**  **Architect**  **(Brian)**  A Solution Architect is responsible for the design of one or more applications or services within an organization and is typically part of a solution development team. | **Principal Data Insights Analyst (Shane)**  A Principal Data Insights Analyst uses data analytics to develop tools that provide clear, accurate and insightful information. | **Artificial Intelligence Engineer**  **(Daria)**  An artificial intelligence engineer works with algorithms, neural networks and other tools to advance the field of artificial intelligence in some way. |
| **What is similar?** | | | |
| They need to have a deep IT knowledge and they should be aware of new and existing technologies and use their technical vision for a particular solution. | | | |

**Career plans comparison:**

Jeremy: “After finishing my bachelor’s degree, I am either thinking of doing a masters or moving into a degree in business. With these steps I am hoping it will lead me to greater opportunities of growth to then be in a CIOCIO position in the next 8-10 years.”

Brian: “Skills and knowledge I will need to acquire are in the areas of engineering and software architecture design, cloud development and IT architecture. Obtaining positions with companies developing and working with cloud technologies will provide real world experience. Importantly obtaining a degree in IT will be an excellent start to filling these gaps in my knowledge, as well as further learning of AWS services.”

Shane: “My primary career interest is working in the area of higher management for a multinational corporation. With my current experience as owner-director of an international furniture manufacturing and export company, global property management and managing an international school, I feel that my personal on the job experience is suffice. In the modern-day, however, I do require more skills and actual “black and white” qualifications. ForFor this reason, I am undergoing a Bachelor of International Business which I hope shall be acquired within the next three years.”

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| **What is the difference?** | | | |
| **Shane**  Shane relies on his previous career experiences as well as on developing more skills and getting an actual “black and white” qualifications. | **Brian**  In addition to obtaining a degree in IT, Brian is planning to learn AWS server. | **Jeremy**  Jeremy’s plan is to do masters or move into a degree in business. | **Daria**  Daria is going to develop necessary skills using online courses. |
| **What is similar?** | | | |
| To achieve their goals, everyone needs to get the necessary skills and education, that will take several years. | | | |

Daria: “In parallel with studying at the University, I will be studying Machine Learning in Python using online courses. After mastering the essential skills, I can get an internship as a data science engineer. My next step is working as a data science engineer for several years to get an experience and then find a work in an international company as Machine Learning Engineer”

## Tools

G6 Internet Explorers Team website:

<https://g6-internet-explorers.github.io/>

G6 Internet Explorers Team Repository:

<https://github.com/G6-Internet-Explorers/RMIT-Assignment-3>

The G6 Internet Explorers Team utilised Microsoft Teams available through our RMIT Office 365 account to manage online chat and communications. We also posted links to relevant videos and websites within the chat so as to provide context rather than uploading these to GitHub. Through this same platform we also trialled the use of OneNote and Microsoft planner, which we ended up not using to a great extent. Our Team meetings were held through zoom teleconferencing software which allowed us to discuss and contribute in real time as if we were in the same office. Zoom also allowed us to record the session, which allowed anyone not able to be present to catch up at a time that suited them. Zoom, while providing screen sharing capability also allowed for keyboard and mouse control to be switched to other team members during a meeting.

I do not believe the audit trail on the Git repository accurately reflects our individual contributions, as decisions to create or update folders and text or upload word and excel documents were often made and actioned during our teleconference Team meetings. As such the audit trail will show the username of the person hosting the teleconference rather than the team member who created the content. Additionally, with the problem of GitHub invitations apparently being blocked within RMIT email systems and subsequent delay in providing group access it is incorrect to attribute the initial flurry of activity to any one individual, as with appropriate access others would have contributed equally.

# Project Description

## Overview

gardenMates is a subscription-based mobile application package that you can purchase, which assists in the development of small to large scale agricultural development. This application package comes with a sensor device that can be added to a pot plant, or larger devices for a vegetable bed, to capture environmental data. This environmental data includes moisture content, soil type, soil requirements, soil characteristics and weather information. The information provided gives the customer live-data and life cycle assistance to ensure plant development is met in the best of conditions. So that the end result is a thriving agricultural environment giving quality produce or enjoyment.

The outcome for this project would be that we have a robust, reliable working application and system to suit the novice at-home gardener and students then be able to expand on that technology to cater for large industrial vertical farms to increase their maximum capacity using a minimal carbon footprint.

### Motivation

Our motivation for pursuing gardenMates as a viable project stems from very real personal experiences of having pot plants, herbs and vegetables advertised as easy to grow, end up dead or ravished by insects or disease. Feedback from friends and relatives shows that this issue is not unique to us. Gardening can be very calming and therapeutic, less so when there are poor outcomes, so keeping plants alive for longer assists mental health. Having access to fresh herbs and vegetables is also important to physical wellbeing. The combination of a remote sensor an IOT device and a mobile phone application is very much on trend in I.T. terms with home gardeners and time poor city dwellers. We believe that our project, providing an innovative, cost effective, easy to use solution to gardening dilemma’s will provide a future employer with a better appreciation of our capabilities, problem solving abilities and exceptional team co-operation skills.

### Landscape

There are a lot of different plant devices, some of them are similar to gardenMates. For example, a device which is capable of measuring soil moisture, temperature, and light and automatically water your plant with the built in water pump. Or another one, self-contained automatic watering pot consisting of a soil sensor as well as the water reservoir built into a cavity in the pot.

There is competition between automatic and non-automatic plant watering and monitoring systems. The most leading ones are PlantMaid and Parrot Pot. Garden Mates is quite similar to Parrot Pot but the distinguishing feature of it is a sensor device that can be added not only to a pot plant, but also to larger sized gardens making it available for micro agricultural projects.

Interestingly our research uncovered a kickstarter start up based in the U.K. that is almost a mirror of gardenMates. The main difference being their sensor is designed for indoor use only which is a limitation gardenMates intends to overcome. (Subscribe, 2019)

## Detailed Description

### Aims

The primary focus of the gardenMates project is to provide to the masses a technological assistant to assist in maintaining happy healthy balcony and indoor gardens. This will be achieved using a sensor that takes measurement of soil and location conditions. The sensor or sensors pair to a small hub which provides access to the internet and the gardenMates servers. The gardenMates servers are then able to feed a mobile phone application with notifications, tips and the sensor measurements for each sensor location.

### Goal 1

The initial requirement is a suitable sensor device. The sensor must be of rugged manufacture, waterproof and able to stand up to outside conditions as opposed to the competition which only provide indoor use sensors. Four different measurements are required.

* Soil moisture
* Soil ph
* Ambient light
* Ambient temperature

Requires either Bluetooth or ZigBee communication protocols.

### Goal 2

Of equal importance to goal 1 is the mobile phone application. This will allow sensors to be registered and named ie “Basil”, “Roses” etc and provide a visual representation on the application of the sensor measurements and general plant health. The application will have a small database to maintain local information and growing tips.

The application needs to allow for very easy wizard based configuration setups and sensor pairing.

### Goal 3

One major point of difference between gardenMates and the competition is the ability to monitor the plant/s and notify the user of plant wellbeing while the user is away from home for an extended time. This is made possible by providing cloud-based server technologies that receive information from the sensors even when the mobile phone is not in range. The cloud-based systems will also provide a plant library which will provide tips and tricks on keeping the plant healthy.

### Goal 4

Required for goal 3 to be successful is the ability for the sensors to communicate with the cloud systems irrespective of the proximity of the mobile phone. This requires a small powered hub that can communicate via Bluetooth to one or more sensors and Wi Fi to the home network to relay information to the cloud.

### Goal 5

Apart from having the right soil composition, moisture, with an appropriate temperature and sufficient light, other issues for plant health is disease and insects. It is important to be able to determine what is eating the plant or with what disease it is inflicted with. Both of which may spread to other plants nearby, so early diagnosis is key. gardenMates will have the ability to send a photograph of the afflicted plant to an AI housed within the gardenMates cloud servers and for that AI to determine through machine learning the most likely cause and to offer recommendations for treatment.

### Plans and Progress

How it all began:

The origins of this project came about we thought on how many times people have killed plants because of the lack of knowledge. Usually we hear about this complaint among friends who would buy numerous potted plants and then eventually saying that they died for some unknown reason or didn’t have the time. Then they would purchase another plant and the story would then again repeat itself. This is very costly and is quite common in the average household. Many people do not know how to properly look after their plants. Even if they wanted to, it would be hard to do so, as there is quite a bit of reading to go about it in order to understand the complexity of plant growth. The project seeks to bridge the gap for average people, but also giving the choice to go deeper into agricultural studies. We believe an application, which can assist in the education and automation of gardening.

This can be seen with reducing plant re-purchases, maintenance costs and time. Giving key resources to develop your garden further into automation by integrating with the smart home reality that society is moving towards. Where controlling key systems to tend your garden like the sprinklers, which can easily give plants what they need when you are not available. Learning how many benefits this can bring to not only the close friends we know, but to people we have not met yet. Giving us the motivation to develop this application and help change society.

Plans and Progress half page by Shane

Originally our team was not too sure on what project to choose. We thought we would choose from one of our projects as per assignment 1 and all work on that. Individually we could see different areas that would be of interest to us and hopefully the most valuable to the team. After our second meeting however, we realized perhaps we have bitten off more than we could chew as the project we choose had too many possibilities and too many technologies that we were not familiar with.

After some discussion we revised together each other’s assignment 1 projects. As we are all individual our projects were all quite different. One project however did have something that we all knew something about, gardening. The member who originally used that idea for their assignment explained more to us about it and his visions for where it could go. Our team was quickly excited, and we all had lots of ideas and input as to where we could take this.

On our next meeting we all put our individual ideas forward and found commonalities between them. We now had a project and a vision of where we could take it. We went over the assignment overview together and volunteered who would look after what parts, who would work together and assign due dates to the tasks. There was quite a lot of information that needed to be researched such as the sensors and how the sensors would talk to the application. Where some of us saw the project going in one direction such as commercial, some of us preferred to keep the project as a home-based product.

For my part of the project, for someone to take over my tasks now they would need to be continuing to assist in research, monitoring the risks and identifying new risks as they arose. Continue to monitor the testing phases, analyse the data and keep the team updated with these results.

#### The Sensor

Initial investigation suggested that a 4 in1 sensor marketed as Huahuacaocao Flower Care Smart Monitor by Xiaomi would provide the functionality required. In fact, it was the only commercial 4 in 1 sensor found. Initially the fact that this sensor only had Bluetooth communications caused some consternation as a point of difference between gardenMates and the competition is the ability to monitor plants (sensors) regardless of the proximity of the mobile phone app. This was resolved upon the discovery of a hub from the same manufacturer that offers Bluetooth, Wi Fi and ZigBee.

#### The Hub

XIAOMI Mijia Smart Multimode Gateway is a hub that is certified for WIFI, ZigBee and Bluetooth/Bluetooth Mesh. Currently supports 32 devices although recent information suggests this will be considerably expanded in the near future. Appears to be one of the few devices that supports all three communication protocols and as it is manufactured by the same company as the sensor integrates seamlessly.

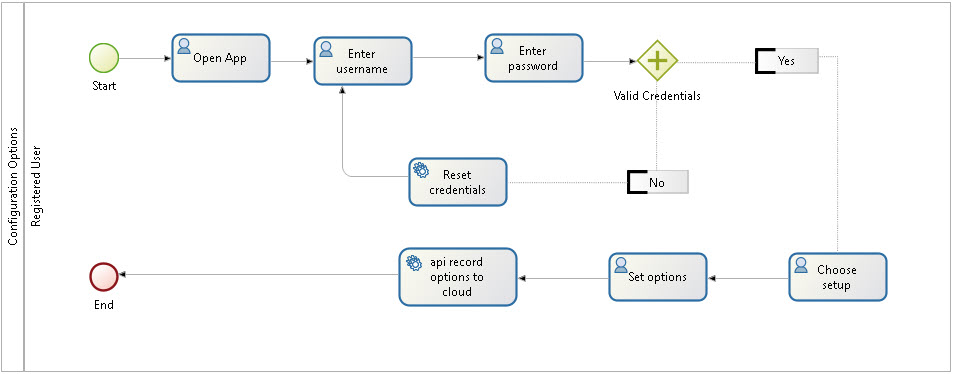
#### Mobile phone app

The following Business Process diagram outlines the steps for initial configuration of the mobile phone application once the application has been installed.

A close up of a calculator

Description automatically generated

The diagram below shows the requirement for username / password validation and that the application options should also be saved to the database.



Some design concept mock-ups have been prepared to provide an idea of the look of the mobile phone app.

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#### Infrastructure

All server technologies will be hosted in the cloud as outlined under the tools and technologies section.

### Background notes and dead ends.

**Development Environment**

The main goal of work on the development environment research was finding the most effective and economical software for developing a mobile application. This is quite a challenge, as really high-quality development software is often expensive. It was the first dead-end that I had to deal with when searching for software, because sometimes there were no satisfactory open source resources. So, I have decided to use a professional and even expensive tools like Sketch when it is necessary.

Mobile application development is divided into mobile app and backend creation. There are some variants of hosting backend: host it in the server or in the cloud. I have chosen the cloud, because it provides better quality of output in lesser time, extreme security, regular updates, integration and etc. The best cloud technology for our project is AWS, since it has a lot of benefits like flexibility, security and API.

Backend also needs a framework. To select a backend framework, it is significant to consider things like community and scalability. Therefore, I chose Django. It is very scalable and has an extensive community.

As our app has an Artificial Intelligence in it, it can’t work without a special framework which will provide primitives for defining functions on tensors and automatically computing their derivatives. TensorFlow is the best variant for our app, it is flexible, easily trainable and open source.

**Mobile app prototypes:**

Mockups are really important part of our project, as it demonstrates the appearance of our mobile app. It was a challenge to find a free application for my aim, so I had to seek it through the Youtube. I decided to create mockups in “Figma” because it is free and easy. I have also found a great website where different IOS icons can be taken from.

In researching competitors in this space, it was interesting to come upon FarmBot a robotic gardener that can tend a small garden bed. Believe it would be an interesting proposition for a larger scale product offing from gardenMates, sometime in the future (*FarmBot | Open-Source CNC Farming*, no date).

Reviewing documentation from Zigbee alliance, I was particularly interested in Green Power. Green Power is a feature of Zigbee that allows for energy-harvesting technology to be used directly with the Zigbee stack. Green Power adds convenience to smart home markets by relieving the pain point that is replacing batteries that consumers may have to put up with (*Green Power*, no date)

The chosen sensor is fitted with a button battery and there is insufficient time or money to build our own, however if we were to explore designing our own sensor in the future this is technology we should look to adopt.

An option for the back end database that could also provide a small footprint db on mobile devices that was considered is couchbase. It is supported by Amazon and has the ability for the mobile app to be offline and sync later. Couchbase unfortunately is not open source but a paid subscription which makes it a less desirable option.

The first time use of the sensor, hub and app has to be super easy with as much automatic configuration as possible, I have suggested incorporating ProbMe capability into the application. The use of a QR code on the packaging will provide the passkey for ProbMe(‘ProbMe Simplifies Thing WiFi Connection’, 2014).

### Roles

Several roles are required for the GardenMates project. These are as follows:

1. Chief Technology Officer / Product manager (position filled by team member Jeremy) – The role of this person is the know the total scope of the project from start to finish, inside and out. This person will oversee every aspect of the project and ensure that each component has been achieved to expectations. Most likely, the PM will be one of the team members and the individual for this position may change as the project evolves and if it takes different directions.
2. Developer – This position would be best suited to a software engineer. The primary responsibility for this position is to create the code, test the code on various devices and find any bugs.
3. Solution Architect (position filled by team member Brian) – to work closely with the product manager/ Chief Technology Officer, developer and designer to ensure the app functions as expected and to steer the design to have maximum business earning potential.
4. Designer – This person would be working closely with the Developer to ensure the interface of the app is easy to navigate and aesthetically pleasing and conforming with branding. The designer would also need to develop a logo and company colours/branding.
5. Artificial Intelligence Engineer (position filled by team member Daria)– to develop the initial AI database that would be used in our app for diagnostics and advice received from the plant/soil data and user interface data when users are typing questions or uploading a photo of a sick plant.
6. Sales and Marketing and Customer Service – All team members would initially fill this position for our particular project, but down the track, as development goes farther, we would need a tech-savvy team with excellent communication skill to take the position full time looking after customers, reporting bugs to the team, moderating forums, organising advertising and promoting upgrades with offers and subscriptions.
7. Principal Data Insights Analyst (position filled by team member Shane) – to be continually monitoring that the application is functioning in a profitable way. To identify cost saving and other potential earnings. This person would also pinpoint where the project has room for expansion and establish the applications strong and weak elements.

### Scope and Limits

An integral part of the gardenMates project is the sensor and we are pleased to have been able to source a commercially available one that should be sufficient for most balcony gardens.

Paired with the sensor is a hub from the same manufacturer which will provide a link between one or more sensors and the gardenMates servers.

The mobile phone app is in the business process workflow stage, with several mockups of various options of the app being created to give some idea of concept and look.

The database chosen to provide server and mobile phone synchronisation is CouchDB, an open source NoSQL database from Apache.

Hosting will be through Amazon AWS.

Options for AI and machine learning for plant and disease / pest identification are being explored but will not be included in the initial release. It may be easier and more cost effective to use an API to access an existing system for plant and disease identification and recommendations.

Several open source plant libraries and databases are available with API connectivity to provide tips on growing selected plants. The most suitable option has yet to be determined.

An address checker API that can work in all of the target market countries for easy registration is required and has yet to be determined.

A payment gateway solution to record subscription payment options and be fully PCI compliant is required that will work in all of the target market countries. The most suitable for our purposes has yet to be determined.

### Tools and Technologies

**Mobile app (IOS, Android):**

**Technologies:**

* Mobile app prototype - demonstrates how a product will function. The purpose of a prototype is to communicate a product’s design and navigation flow to maximize the efficiency of development.
* IDE - an integrated development environment is a software application that provides comprehensive facilities to computer programmers for software development.
* Coding language – development programming language.

**Mobile app prototype:**

Mobile App Prototyping Tool – Sketch. Sketch is a lightweight tool with a simple interface, leaving designers free to focus on the task at hand. It enables the user to transition seamlessly between design screens (artboards), add animations, and create working prototypes with a couple of clicks.

$99 for full version

**Android app:**

IDE - Android Studio. Android Studio is an Android development Software built by Google. Its implementation editor is very useful for Android developers. Android studio provides shortcuts for coding and designing and its layout designer makes it very easy to use, which helps reduce time spent on coding. Android studio also provides drag and drop features to design the layout of your projects. It is a free software.

Language – Java/Kotlin.

For play market publication need a Google Play Developer Account - $25 (pay the one-time)

**IOS app:**

IDE – Xcode. Xcode is one of the best IDE for iOS app development that features automatic completions and full syntax highlighting for Swift. It is integrated with the Cocoa Touch frameworks. It has an assistant button which splits the editors into primary work document & the assistant editor.

Language – Swift.

For Appstore publication need an Apple Developer Account - $99 (annual fee)

Another important step is to buy **GitHub private account** - $9 per month

**Backend:**

**Technologies:**

* Coding language - development programming language.
* A database - is an organized collection of data, generally stored and accessed electronically from a computer system. Where databases are more complex they are often developed using formal design and modeling techniques.
* Frameworks – is a software library that provides a fundamental structure to support the development of applications for a specific environment.
* Cloud hosting - is the process of outsourcing an organization's computing and storage resources to a service provider that offers its infrastructure services in a utility model.

**Coding language:**

Python - is an interpreted, high-level, general-purpose programming language. The main language of AI and ML. With its strong process integration features, unit testing framework and enhanced control capabilities contribute towards the increased speed for most applications and productivity of applications. It is a great option for building scalable multi-protocol network applications.

**Database:**

Apache CouchDB - is an open source NoSQL document database that collects and stores data in JSON-based document formats. Unlike relational databases, CouchDB uses a schema-free data model, which simplifies record management across various computing devices, mobile phones, and web browsers.

**Framework:**

Django - is a powerful and flexible toolkit for building Mobile App.

TensorFlow - is a free and open-source software library for dataflow and differentiable programming across a range of tasks. It is a symbolic math library and is also used for machine learning applications such as neural networks. It is used for both research and production at Google.‍

**Cloud hosting:**

Google Cloud - is a provider of computing resources for deploying and operating applications on the web. Its specialty is providing a place for individuals and enterprises to build and run software, and it uses the web to connect to the users of that software.

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##### Hardware

Huahuacaocao Flower Care Smart Monitor by Xiaomi – required sensor. Commercial terms not yet negotiated. No member of the team has used this device.

XIAOMI Mijia Smart Multimode Gateway – required hub. Commercial terms not yet negotiated. No member of the team has used this device.

##### Hosting

Amazon EC2 instance for database. Commercial terms not yet negotiated. No member of the team has prior experience with cloud hosting for a commercial product.

Amazon S3 storage. Commercial terms not yet negotiated. No member of the team has prior experience with cloud hosting for a commercial product.

##### Software

Apache couchdb server – open source – desirable from research, however no member of the team has direct knowledge.

TensorFlow – Free and open source - recommended, however no member of the team has direct knowledge.

* Team Messenger – Slack version 4.2. starting price - $ 6.67/month/user
* Static analysis of code – SonarQube Community. Free
* Issue Tracker - Asana Basic. Free

Our team uses this tool for our Garden Mates project.

* CI/CD - Travis CI Startup. $118 USD per month billed annually

Docker – Freemium software – containerisation. Desirable from workplace discussions, however no member of the team has direct knowledge.

Jenkins - Free and open source - automation server. Desirable from workplace discussions, however no member of the team has direct knowledge.

Address checker API – suitable product yet to be sourced.

Payment Gateway API - suitable product yet to be sourced.

Plant Library API - suitable product yet to be sourced.

### Testing



#### Stage 1 – Inhouse Testing

1. Front-End testing - ensuring the app is stable on both IOS and Android devices. Several different devices using each operating system such as handphones and tablets would be used. This can initially be performed using emulators.
2. Ensuring all features are functionable and communicating with the server and database.
3. Ensure advertising banners are functioning correctly
4. Back-End testing ensuring that updates can be pushed to the application on above platforms/devices.
5. Ensure the application is functionable with all screen sizes.
6. Ensure application is functionable with both WLAN and mobile networks.
7. Testing the sensors in extreme conditions such as putting them in a refrigerator, freezer, oven and submerging in water for different periods and that the sensors are still functionable within predetermined preset levels.

#### Stage 2 – Preparation

1. Create end user licenses, warnings, permissions, privacy statement, support pages.
2. Upload the application to Google Play and App Store not in public to test user downloading and installation.
3. Agree on versioning and pricing structure.

#### Stage 3 – Usability Testing

1. Our initial testing would be by using the teams family members and supplying them with a working prototype and the application. The reasoning behind this is that using people that are close to us, should there be an issue it would not be discussed in public, possibly causing negative press or social media hype.
2. Family members would range from an older group such as grandparents to a younger audience such as our brothers, sisters and cousins.
3. These age ranges also have diverse interests in gardening and using electronics and smart apps, so we would also be able to gauge the interest and usability of the product.
4. We would also test with a few people that do not speak English. The feedback from this would be how simple the app is to use and how informative the icons and navigation.
5. The compiled feedback from these individual groups would be an excellent indicator of bugs, navigation, and usability.

#### Stage 4 – Initial Real Testing Points

1. Ease of installation
2. Data requirements
3. Memory
4. Application speed
5. Conflicts with operating systems
6. Conflicts with other applications
7. Communication issues
8. Signup and Login
9. Error messages
10. Online and Offline usage

#### Stage 5 – Quality of Product

1. Statistics obtained from initial testing.
2. Security testing.
3. Data and storage usage at server level.
4. Testers personal feedback
5. Code review
6. Product meets acceptance criteria

#### Stage 6 – Beta Public Testing

### Timeframe

| Course Week # | Brian | Shane | Jeremy | Daria | Full Stack Developer |
| --- | --- | --- | --- | --- | --- |
| Week 7 | General research on project topic | General research on project topic | General research on project topic | General research on project topic | Not currently employed |
| Week 8 | Formulation of ideas | Formulation of ideas | Formulation of ideas | Formulation of ideas | Not currently employed |
| Week 9 | Investigate database options | Begin wireframing application | Investigate sensor suitability and availability | Investigate software development applications | Not currently employed |
| Week 10 | Create user stories for app to test business logic and workflow | Create user stories for app to test business logic and workflow | Create user stories for app to test business logic and workflow | Create user stories for app to test business logic and workflow | Not currently employed |
| Week 11 | Brainstorm user story and experience | Brainstorm user story and experience | Brainstorm user story and experience | Brainstorm user story and experience | Not currently employed |
| Week 12 | Finalise Project Documentation | Finalise Project Documentation | Finalise Project Documentation | Finalise Project Documentation | Not currently employed |
| Week 13 | Finalise business process workflow based on brainstorming sessions | Finalise business process workflow based on brainstorming sessions | Finalise business process workflow based on brainstorming sessions | Finalise business process workflow based on brainstorming sessions | Review Application concepts and back end requirements |
| Week 14 | Review plant library database API and provide recommendation | Document subscription model and pricing | Draft licence agreement | Investigate open source API to AI/ML plant disease diagnosis | Begin coding |
| Week 15 | Research payment gateway options. | Draft subscription agreement | Draft user agreement | Report if suitable option or need to develop our own. | Continue Coding |
| Week 16 | Investigate weather forecast options API | Draft unsubscribe requirements | Draft unsubscribe requirements | Document QR Code requirements | Continue Coding |
| Week 17 | Document unsubscribe process | Draft Privacy agreement | Draft Privacy agreement | Investigate address checker API | Continue Coding |
| Week 18 | Draft marketing concepts | Draft marketing concepts | Draft marketing concepts | Draft marketing concepts | Continue Coding |
| Week 19 | Review business process workflow | Investigate suitable in app ads | Investigate suitable in app ads | Review business process workflow | Continue Coding |
| Week 20 | Test and document Alpha app and back end | Test and document Alpha app and back end | Test and document Alpha app and back end | Test and document Alpha app and back end | Deliver Alpha app and backend |
| Week 21 | Review all aspects of app and back end | Review all aspects of app and back end | Review all aspects of app and back end | Review all aspects of app and back end | Plant Library API |
| Week 22 | Test app and back end | Test app and back end | Test app and back end | Test app and back end | Make changes to app and back end per feedback. |

### Risks

1. Unwanted App – We run the risk that users don’t actually want an app to look after their plants. Although our team has personal experiences and feel positive that our product will improve peoples (and plants) lives, there is the possibility that the gardening community prefer to garden without technology.
2. The Application Too Popular – Contrary to the above, there is the risk that the product will become too popular. This could cause the team to quickly run out of money, run out of resources, not have enough people working on the project and the possibilities of overloading servers and resources.
3. Denied Hosting – There is a major risk that App Store or Google Play may not want to host our application. Users would be very wary to download and use an app that has not been vetted by these hosts as being secure.
4. Excessive Data – there could be the risk that the application and abundance of users creates too much data. This excessive data such as forums and user groups could also overload the user’s device or data plan causing them to lose interest in the app and uninstall it.
5. Wrong Development Partner – We have chosen AWS to be our hosting service for the gardenMates product, based on research and support in target market countries. The team’s unfamiliarity with using this or other cloud based hosting services in a commercial sense may lead to misunderstanding all aspects of the service offering, resulting in subscribing to an incorrect solution. AWS for example might provide enough resources on the interim, but other hosting such as Azure may in fact offer a better solution.
6. Security Breaches – There could be issues such as cross site forgery, insecure communications and insecure storage flaws. The risk of assuming native apps are inherently secure could cause us to overlook correct security measures. Hardware from China may be perceived in some markets as a potential security risk.
7. Supply – Our chosen commercially available sensor is produced in China and any of the following would seriously impact our ability to supply product. A trade war, shipping embargo, or a situation of manufacturing being closed down because of a pandemic such as Novel Caronvirus.
8. Investing in Wrong Platform – Similar to developers that spent a lot of money and resources developing apps for Blackberry, there is the risk that a newer or more popular platform takes the place of where we have invested.
9. Timing Risks – Shifting trends and newer technology could cause our product to be obsolete. A newer all in one product at a cheaper price with free delivery could become available prior to our product launch. A plant disease could quickly spread across the country and consumers may not want to buy plants or gardening products. Launching the product just after a major frost or hailstorm could cause users to question the positives of our product.
10. Marketing Risks – Selling our product too cheap could cause consumers to think that it is inferior and selling too expensive could cause consumers to question the purchase of our product.
11. Market Trends – There could be a brand new hobby, game or product to take the world by storm. Example: The Rubik’s Cube, Planking, Hover Boards to name a few. Consumers could possibly be swung by these trends and have a declined interest in gardening or our product.
12. Brand Risk – Our product “GardenMates” could possibly not be accepted by the gardening community. Where our team feels that the word “mates” is friendly and colonial Australian, our target consumer may feel the term is not appropriate for a product that they would buy or have in their home.
13. Reputation – A bad review on App Store or Google Play could seriously damage the products reputation and consumer confidence. There is also the risk that a competitor could give multiple false comments and ratings.
14. Appealing Design – Users may in fact not like our icons and the flow of the application. They might not understand the help and support pages or not like the language. The colour scheme albeit might appeal to our team, could in fact be a negative for us as users may find certain colour schemes more appealing.

### Group Process and Communication

We have found that communications have been as per previous assignment, very smooth and productive. The tools we used mostly were Microsoft Teams and Zoom Cloud Meeting. Our team members would poll for a time that was suitable for everyone and fortunately we would all be able to come together once per week.

This assignment however our communication was slightly different to the last one as previously our assignment was taking place over Christmas and New Year. This assignment however was more demanding on communications for us as the majority of our team members had to return to demanding work commitments and some members were dealing with getting children back to school or returning home from holidays.

Most often during our cloud meetings we would close by agreeing on a time for the next meeting. In the beginning once tasks were divided it would we would meet once a week but towards the final three weeks, often enough we would try to meet every three days to check on each other progress or assist each other if there were difficulties.

Our team agrees that because this was a new project, ideally to meet in person at a conference table and sketch the plans, our ideas and notes on a whiteboard would have been the most effective. Communicating via web conferencing once the project is up and running is fine, but the initial in person meeting would unquestionably have gotten us started of much smoother.

We did not have any group members not responding other than the two members as previous assignment that were uncontactable. It was easy to see via Microsoft Teams that members were checking messages at least once a day and being involved in the discussions and problem solving. As per previous assignment, we had already agreed that if for some reason a member was not responding, the tasks would be divided up and each member would volunteer to take on the task.

### Skills and Jobs

Manager(Project Lead)

As detailed in the section on roles earlier in this document the Project Lead would be the CIO, with skills and qualifications as outlined below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Title:** | Chief Information Officer | **Job Category:** | Technical |
| **Group:** | G6 Internet Explorers Team | **Salary Range:** | Neg. |
| **Job Description** | | | | |
| **Roles and Responsibilities**  In this role you will be required to run the IT team in developing strategies to benefit the vision of Garden Mates. You will be reporting to the CEO on a regular basis providing up to date IT development strategies. Providing a valuable service in the strategy and vision of where the company will head towards. Keeping up to date with advancing IT technologies and business practices.   * Produce development goals and strategies ensuring infrastructure and solutions is meeting expectations and demand with advancing technologies. * Effectively prepare and communicate IT guides and practices * Deliver major IT solutions within a timely manner * Automate roles and responsibilities influenced by IOT trends * Direct existing and new IT systems   **Qualifications and Educational Requirements**   * Bachelor’s Degree in Computer Science * At least 7 years in IT cloud management and business development   **Preferred Skills**   * Strong Oral and written communication skills * Communicate effectively across cultural boundaries * Planning and budgeting skills * In-depth leadership skills in forming decisive teams   **Additional Notes**   * Work collaboratively | | | | |

For such a detailed project that spans multiple technologies, cloud computing, software and hardware, a Solutions Architect, with skills and experience as outlined in the following position description would be desirable to work collaboratively with all project team members.

|  |  |  |  |
| --- | --- | --- | --- |
| **Title:** | Solution Architect | **Job Category:** | Technical |
| **Group:** | G6 Internet Explorers Team | **Salary Range:** | Neg. |
| **Job Description** | | | | |
| **Roles and Responsibilities**   * Analysing the technology environment * Analysing enterprise specifics * Analysing and documenting requirements * Setting the collaboration framework * Creating a solution prototype * Participating in technology selection * Controlling solution development * Supporting project management   **Qualifications and Educational Requirements**   * At least eight years of working experience in one or multiple IT areas. * Experience in IT infrastructure and cloud development. * Experience in engineering and software architecture design. * Business analysis * DevOps * Project and product management.   **Preferred Skills**   * Excellent communication skills. * Deep analytical skills * Project and resource management skills   **Additional Notes**   * Influence and negotiate * Work collaboratively | | | | |

The ability of gardenMates to interpret images of unhealthy plants or insect damage, which is a point of difference to any competitor requires a Machine Learning Engineer.

|  |  |  |  |
| --- | --- | --- | --- |
| **Title:** | Machine Learning Engineer | **Job Category:** | Technical |
| **Group:** | G6 Internet Explorers Team | **Salary Range:** | Neg. |
| **Job Description** | | | | |
| **Roles and Responsibilities**   * Design machine learning systems * Research and implement appropriate ML algorithms and tools * Select appropriate datasets and data representation methods * Run machine learning tests and experiments * Perform statistical analysis and fine-tuning using test results * Train and retrain systems when necessary * Extend existing ML libraries and frameworks * Keep abreast of developments in the field   **Qualifications and Educational Requirements**   * A basic understanding of the fundamentals of Python programming * Additional programming skills in R, C++, and Octave * Ability to grasp some advanced mathematical concepts, including linear algebra, calculus, and graph theory * An understanding of data modeling * Experience in data analysis * A solid understanding of statistics and probability * A fundamental level of data visualization skills   **Preferred Skills**   * Physics * Communication Skills * Problem-solving skills   **Additional Notes**   * Time management * Strong focus on constant learning | | | | |

Principal Data Insights Analyst

A Full Stack Developer is required for the project team to develop deliverables. Currently none of the existing team members have these capabilities. The requirements for the position are outlined below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Title:** | Full Stack Developer | **Job Category:** | Technical |
| **Group:** | G6 Internet Explorers Team | **Salary Range:** | Neg. |
| **Job Description** | | | | |
| **Roles and Responsibilities**  In this role you will be required to develop and maintain both back-end and front-end systems. You will be required to incorporate a number of designs and processes, which support the Garden Mates vision as an application-based platform for household plant development. Streamlining the processes for excellent customer satisfaction through our platform.   * Develop Backend and front-end application architecture * Design and develop critical APIs * Meet technical needs as required * Develop interactive user interfaces on different applications   **Qualifications and Educational Requirements**   * At least 3 years of experience in producing complex systems * Computer science degree * Extensive understanding on HTML Javascript * Familiarity with NoSQL databases and database design. * Expertise in python, React Native. * Experience in REST API’s. * Experience in Containerisation essential.   **Preferred Skills**   * Excellent in both written and verbal communication skills * Familiarity with Adobe PhoneGap would be highly desirable. * Familiarity with Jenkins is desirable.   **Additional Notes**   * Work collaboratively | | | | |

## Group Reflection

# References

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