Design Document

Project: MyWuff AR *App*

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Workshop: Tuesday, 12pm, Dr Shamus Smith

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Revision History

Date	Description	Author
11 Apr 2023	Outlining the document, adding notes, and title. Introduction.	T. Ota
15 Apr 2023	Listing research results in problem definition and people.	T. Ota
16 Apr 2023	Adding problem findings.	T. Ota
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20 Apr 2023	Adding solution goals.	T. Ota
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22 Apr 2023	Adding functionalities and technology. Updating introduction.	T. Ota

1 Introduction

Many people would like to own pets but face obstacles such as living situations and time limitations. A virtual pet simulator app can be an alternative way to enjoy the benefits of pet ownership.

1.1 Purpose of this document

This document provides details of the research and analysis for the development of the MyWuff augmented reality (AR) smartphone application. It identifies problems of people who cannot have a pet and analyses those people to establish a target user group for the app. It also discusses solutions the app can provide with the use of AR technology. In addition, it demonstrates design details including visual elements, and layout to convey the solutions in a user-friendly manner. This document is to establish the outline to develop the proposed app and to prepare for the prototype development in the next stage.

1.2 Scope of this document

This document covers the initial design concepts of the proposed virtual pet app and details of the problems that the app will attempt to solve. It contains findings from research and an analysis of the result. The user target and the functionalities of the app are defined from the findings and analysis. A survey and interviews are not included in the research and research findings are not specific to the proposed app. The designs and functionalities are defined to suggest some solutions to develop the app. A prototype of the app in the next stage may only contain some of functionalities mentioned in this document with partial implementations. The main purpose of the document is to explore possibilities and capabilities of technologies such as AR to solve problems.

2 Problem Definition

This section defines problems of people who cannot have a pet by detailing the findings from literature research and statical data about challenges and benefits of owning pets along with possible values that the app can bring.

2.1 Findings

Many people grow up with a dream to own a pet and most of them make their dream come true. While more than 68% of Australians enjoy the companionship and love that a pet can bring into their lives, 60% of people who don't have a pet have the desire to own a one, however, they face challenges to do so (Animal Medicines Australia, 2022). Owning a pet comes with responsibilities and consequences (RSPCA NSW, 2017) which can be challenging to overcome. The obstacles include dwelling environment, time, and finance. These constraints are listed below.

2.1.1 Financial inadequacy

The cost is the top reason that people decide not to own a pet (Animal Medicines Australia, 2022) (see Figure 1). Owning a cat or dog costs more than $3,000 for the

first year and it requires around $1,000 per year thereafter (Moneysmart, 2022). As the cost-of-living increases with inflation, pet owners are giving up their pets simply because they cannot afford them anymore (Liang & Miller, 2022).

2.1.2 Commitment and responsibility

Pets require care and commitment. Cats and dogs live up to 20 years and birds can live up to 80 years (RSPCA NSW, 2017). They all need feeding and dogs need regular walks. Time and commitment can become challenging factors for owning a pet (FOUR PAWS Australia, 2023). People with busy lifestyles face the reality of not being fit for pet ownership. Pet owners must secure someone to look after their pets when they are away for holidays or work. It can be difficult to find someone trusted.

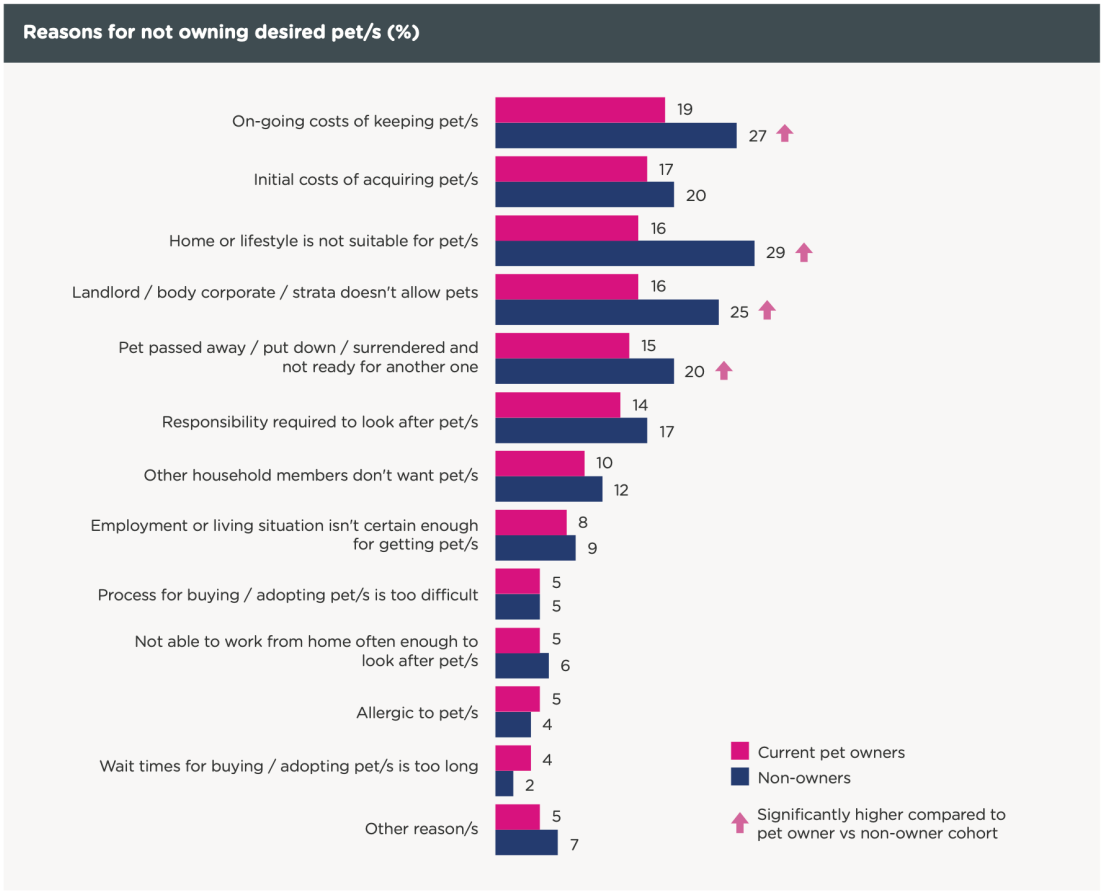
2.1.3 Living situations

Dwelling condition is one of the top factors that deter people from owning a pet (Animal Medicines Australia, 2022) (see Figure 1). 90% of pet owners live in detached houses (Hannink, 2023) and they have enough space for dogs or cats. People who live in an apartment are concerned about their space and in some cases, people are simply not allowed to have a pet by enforcement from a landlord or body corporate (Animal Medicines Australia, 2022).

2.1.4 Other constraints

Other reasons why people cannot own a pet that are included in the report from Animal Medicines Australia (2022) are:

- Not being able to overcome from a tragedy of previous pet.
- Other people in the household don't agree to own a pet.
- Not clear foreseen future.
- Allergies to certain pets.



A10C. What are the reasons you do not currently have the pet/s you would like to have? Base: Prospective non-owners (n=436) and prospective current owners (n=1,491)

Figure 1 Reasons not to own a pet (Animal Medicines Australia, 2022).

2.1.5 Benefits of owning pets

There are many benefits that can come from owning pets which include both mental and physical advantages. 85% of pet owners perceive that pets brought a positive impact to their lives (Animal Medicines Australia, 2022). RAPCA Australia (2023) describes the benefits as following:

- Increased physical activities by walking a dog and playing with them.
- Pets can enhance mental health through motivation, companionship, stress relief, and healthy routines.
- Pets can serve as therapeutic aids for various disorders.
- Pets as social catalysts can mitigate loneliness and provide emotional support through communication and trust.
- Pets can contribute to youth's emotional, cognitive, behavioral, and social development by fulfilling attachment needs, easing anxiety, and furthering empathy.

These benefits match with the top reasons why pet owners got their pets which include companionship, mental health benefits and relaxation (Animal Medicines Australia, 2022) (see Figure 2).

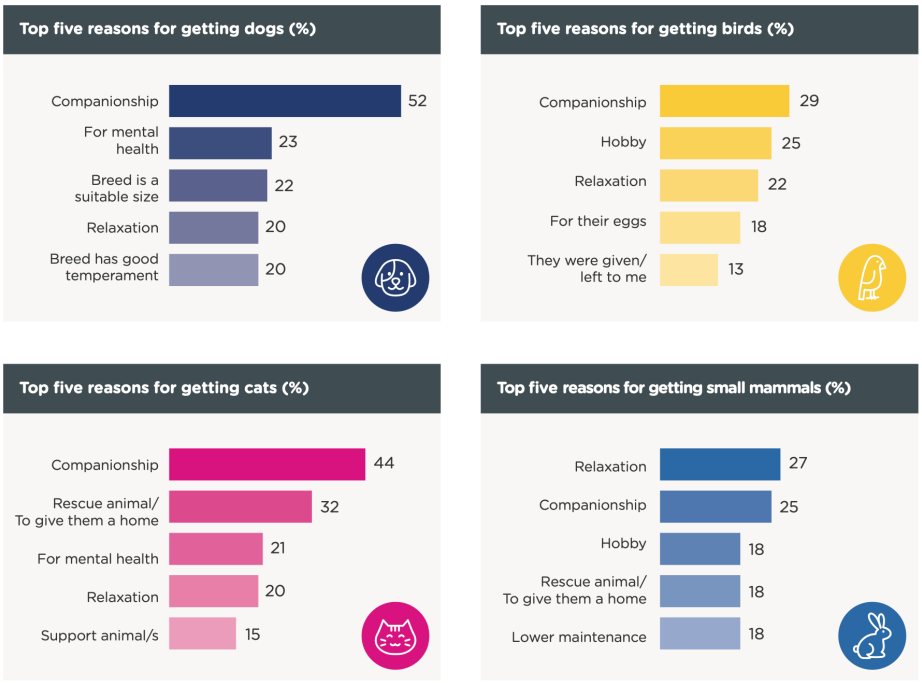


Figure 2 Top reasons for getting pets (Animal Medicines Australia, 2022)

2.1.6 Positive effects of virtual pets

There is evidence to show that the above-mentioned benefits of owning pets can be replicated through virtual pets using technologies such as virtual reality (VR) and augmented reality (AR). The findings are following:

- Healing, relaxation, and stress relief effects were higher from interactions with a virtual pet in a dog care simulation Nintendo DS game compared to other games and watching videos (Sato & Tsuneo, 2009).
- Interactions with virtual pets decreased negative emotions (Nakajima & Niitsuma, 2021). Moreover, some wanted to participate in more activities to see the virtual pets again.
- A virtual pet companion increased adolescents' engagements in physical activities (Ball et al., 2022).
- In a study using a virtual pet AR app, 66% of participants said that the app can replace pets (Chahyana & Yesmaya, 2020).
- In the same study, 80% of participants answered that the app can educate how to raise pets (Chahyana & Yesmaya, 2020).
- During Covid-19 pandemic, virtual pets replaced real animal in pet therapy and all patients were satisfied (Jung et al., 2021). Some even preferred it.
- Virtual pet interaction is suggested to be one method to treat depression clinically (Lindner et al., 2019).

2.1.7 Values of virtual pets in the proposed app

Based on the findings presented in the previous sections, pet ownership problems are matched to the solutions offered by the proposed virtual pet app as outlined below.

- They cannot afford to own a pet.
    - Virtual pets could cost almost nothing.

- They cannot commit to responsibilities to look after a pet.
    - No real responsibilities associated with virtual pets.
- They are not home enough to have a pet.
    - No need to be home to look after virtual pets. Virtual pets can be taken to anywhere even to holidays or business trips.
- They want to enjoy companionship.
    - Virtual pets can replicate companionship.
- They don't have enough living space to own a pet.
    - No space requirement for virtual pets.
- Other members in household don't want to have a pet.
    - No permission required as virtual pets exist virtually in a device.
- They want to get motivated to engage in physical activities with a pet.
    - Virtual pets can increase engagement in physical activities.
- They want to gain positive emotional effects from a pet.
    - Virtual pets can provide positive emotional support.

3 People

This section outlines people who have problems that are detailed in the previous section by defining a target user group and establishing their needs by utilising personas and problem statements.

3.1 People: Background

As discussed in the previous section, there are people who desire to own pets but cannot because of constraints. This section analyses who they are and what characteristics they possess to determine a target user group and a possible platform for the app.

3.1.1 Characteristics of non-pet owners

- Animal Medicines Australia's report revealed 31% of Australians don't own a pet and 61% of them want to own one (2022).
- 50% of non-pet owners live in attached dwellings and 36% are renters (Animal Medicines Australia, 2022).
- 33% lives in urban inner-city (Animal Medicines Australia, 2022).
- 49% are one-person households and 36% are couples without children (Animal Medicines Australia, 2022).
- They are likely to earn less comparing to pet owners and 36% of them are households with incomes less than $100k (Animal Medicines Australia, 2022).
- The ages are likely between 25 – 45, or over 65 (Hannink, 2023).

3.1.2 Target user group

Age: 25-45
Income: Low to middle
Household: Single or couple without children
Living situation: Apartment living and/or renting in urban area

Although it is beneficial for the app to reach wider demographics, people over 65 years old are retired and have different lifestyles to younger group. The aging factor

will require special considerations for the user interface and useability (Kane, 2019). As limited resources available for the development, the older age group will be excluded from the target user in the initial stage of the app development. Regarding gender, women are more likely to own a pet (Infogroup, 2020), however, there is no data to show that men are wanting to own a pet more than women. Because the need to target one gender is less important in the app, the target gender is not specified.

3.2 People: Needs

Based on the findings in the precious sections, a persona was created to refine problems. Problem statements were also created using the persona to identify needs that can be solved in the app.

3.2.1 Persona

Primary user: Emily Taylor, 27-year-old single urban office worker who live in a studio apartment alone in an urban area (see Appendix A- Persona). Full-time worker.

3.2.2 Problem statements

Emily **needs** adorable gestures from her virtual pet **because** she wants to feel happy and reduce negative emotions.

Emily **needs** realistic dog care routines **because** she wants to learn how to raise a dog as well as enjoy the realistic feeling of owning a dog.

Emily **needs** her virtual pet to be personalised **because** she wants to feel it is her own dog not others' nor generic.

Emily **needs** an integration with her environment **because** she wants to feel her virtual pet exists in her world.

Emily **needs** an ability to take her virtual dog for a walk outside **because** she wants a companion to get motivated to continue exercising regularly.

Emily **needs** toys and accessories for her virtual pet **because** she wants to enjoy nurturing and spoiling them like a real pet.

Emily **needs** notifications from the app **because** she wants to feel that she is needed by her virtual pet.

Emily **needs** instant access to the app anywhere she goes **because** she wants to take advantage of being close to her virtual pet.

4 Solution

Problems and needs of people who cannot have a pet have been defined in the previous sections. Goals and functionalities of the app as solutions are described in this section.

4.1 Solution Goals

As a result of research and findings detailed in previous sections, the solution goals of the app are defined as the following:

The app must be accessible from almost anywhere and anytime. It shouldn't be restricted by living situations, locations, nor other commitments such as work.

The app must provide benefits of companionship that pets generally bring. Which include emotional support, closeness, and belongingness.

The app must bring positive emotions to users. They can be relaxing and healing, and bring stress relief, and happiness.

A virtual pet in the app must have some elements from real pets to be able to replicate the likability and adorableness. This will be the important factor to build an emotional connection with a user.

The app must provide features that replicate the main activities of caring for pets to be convincing and educational.

The app must contain features to personalise a virtual pet for increasing the individuality and building a personal connection.

Virtual pets in the app must interact with users via activities such as feeding, giving treats, and giving a command.

The app must have a functionality to mimic the benefits of walking a dog.

The app must have a capability to place a virtual pet in users' environment using technology such as AR.

The app must have a notification functionality to notify users to update their pet's statuses.

4.2 Application and Functionality

Users of the app will use Virtual pets in the app as a companion and it is important that it will be accessible anytime and anywhere as they need. The app will attempt to fulfil personal needs, thus how long the app will be used will differ from user to user. The app is designed to be personalised and customised as much as possible to cater to those different personal needs. The customisations will help build a better emotional connection between a user and their virtual pet. The app will equip capabilities and functionalities to achieve the solution goals to solve the target users' problems. Following are the core functionalities in the app.

4.2.1 Setup

Through the initial setup process, users can create their pet by selecting attributes such as animal type, size, breed, and colours to personalise. This customisation process will generate a 3D model object to be used as their pet in the app which will look unique and enhance the emotional connection between the user and the pet. Users can also select an accent colour to be featured in the app, and what level of engagement they seek with their pet to adjust the app to suite their personal needs. Notification configurations can be set in the process to customise what types of notification they want to receive. Users will then proceed to a process of scanning their environment. In this process, they will scan their rooms via the smartphone camera and generate a map of their environment with a GPS location data. The data

will be used in the app to process AR object mapping and a walk activity functionality.

4.2.2 Tools

Users can switch modes and control some features in the app. These controls will be accessible by opening the tools menu in the app.

4.2.2.1 AR mode

Users can turn AR view mode on and off. Most functionalities are designed to be enjoyed through AR view mapped in users' physical environment using their device camera. Users can turn it off when they are unable to use their camera for a privacy and security reason or when a battery level is low. By turning AR off, they can still see their pet to enjoy as a companion without mapping their pet in AR view.

4.2.2.2 Sound

Users can turn sound effects on or off to suit their situation.

4.2.2.3 Camera

Users can take a photo or video of their virtual pet through app's camera functionality. Photos and videos can be shared with family and friends or posted onto social media platforms.

4.2.2.4 Store

Inside the official store, users can purchase various gifts for their pet. They include toys, treats, clothes, accessories, furniture, and beds. Purchased items will be delivered as real physical products. They can be a paper card with a QR code or a real dog toy. This will be the main source of revenue of the app.

4.2.2.5 Bedtime

Users can turn the bedtime mode to go to bed. Their virtual pet will go to their bed or sleep near the user depending on a preference which can be set by users. Users can enjoy seeing their pet sleeping. This attempts to increase the belongingness and closeness.

4.2.2.6 Exit

Users can exit the app to take a break from the relationship with their virtual pet. This will help controlling emotional stress that they might have from caring their virtual pet. This feature can be also used when users want to focus on other commitments such as work. The state in the app will be paused and all notifications will be silenced.

4.2.3 Activities

Users can interact with their pet through activities built into the app.

4.2.3.1 Walk

The walk activity replicates pet owners' dog walking activity. Users can go for a walk outside and be able to see their virtual pet in AR view through their smartphone camera. The pet can be anywhere near the user to make them feel they have a companion while walking. The pet can also behave like a real animal and mimic behaviours such as urinating onto a pole if the pet is a dog. The user will be notified

via a notification and be able to see the animated event through the AR view. When the user arrives home, the app will recognise it via GPS location and notify the user a result of the walk activity such as time and calories consumed in the activity. The user can also see an animated movement of their pet as a reward to emphasise the achievement and positiveness of the activity.

4.2.3.2 Toy

Users can place a 3D toy object in their AR view to interact with their virtual pet. The user can move the toy around within their AR view and their pet which is placed in the AR view will react to the toy. The pet will chase if the toy gets thrown, or the pet will get frustrated if the owner holds the toy over them too long. These behaviours simulate real pets reactions and movements.

4.2.3.3 Gift

Users can select a gift which can be purchased from the app's official store. The gifts can be toys, beds, clothes, and accessories for virtual pets. This is designed to fulfil users' nurturing and spoiling desires. Each gift comes in a real physical object form such as a paper card or a real product. The object contains a QR code or a distinct graphic to be used as a marker which can be recognised by the app through a camera. Users can scan the purchased product through their camera and then they can place the scanned object in their physical environment. The app will track the object and use it as a marker to replace it with a 3D model in the AR view. Users can see the 3D model placed in their environment through the AR view on their screen. Their virtual pet will react to the newly placed model and start interacting with it. Users can also interact with their pet using the gift object through a command. For example, if the gift is a dog bed, a virtual dog pet will go and sit on the bed after a command "bed" input. The app will check users' purchase record to confirm legitimate products to mitigate a counterfeit use. The placement of a physical product will work as a reminder to users that their virtual pet exists in the environment together so it can bridge between physical world and AR virtual world. This is an attempt to enhance the companionship and reduce loneliness for users who live alone.

4.2.3.4 Feeding

Users can feed their pet and experience positive happy reactions from their pet. Depending on users' preference, users can receive a notification outside of the app to be notified when their pet is expecting a feeding session. Users can control their involvement level to mitigate the stress factor.

4.2.4 Voice input

Users can talk to their virtual pet by enabling the voice input functionality. The app will start listening to audio input through a microphone and recognise words. Through this voice input, users can give their pet a command to interact with them. Virtual pets can react to a command and perform an animated movement. Frequently used words will be listed as shortcuts. Text input mode can be accessed to switch to keyboard input interface to take text input instead of voice for situations when users prefer to type. In addition to commands, users can simply talk to their pet about their day and their pet will dedicate to listen as a companion.

4.3 Technology

The app will enhance capabilities of virtual pets by utilising AR technology delivered in smartphone app form. Benefits of the technology and justifications of decisions are detailed as the following:

- Most smartphones are capable of AR technology and many of the target users would own smartphones. No extra cost to buy a device for the app. VR devices are still not cheap and it is important to choose cheaper option for the app as one of the problems previously mentioned is cost.
- AR technology enables the app to be used almost anywhere. It is important that users can use the app anywhere and anytime. VR technology doesn't provide the assess ability.
- Smartphone as the app's device enables users to take anywhere even to a holiday. The capability is important to deliver the companionship capability of the app.
- AR technology used in the app will attempt to blur the border between users' physical world and the virtual world in the app to enhance the benefits of virtual pets. By introducing physical markers into users' physical environment, AR technology enables markers to link between both ends.
- VR technology comes with VR sickness and users won't be able to use the app for long time. The app should not have the time limitation.
- AR technology improves engagement and experience in an app compared to standard apps (Chahyana & Yesmaya, 2020).
- The target user group is already exposed to AR technology through use of apps such as Snapchat, and Pokemon Go. The understanding of the technology has already been established.
- Using the smartphone as the platform of the app, users will be able to learn how to use the app fast by following the design conventions and patterns of mobile apps.

4.4 Issues

The followings are possible limitations of AR technology.

4.4.1 Luck of immersive experience

AR technology does not provide the immersive experience that VR technology can bring. The immersive experience may increase the realism of virtual pets which may enhance emotional connection between users and virtual pets. However, the benefit of the immersive experience does not outweigh the benefits of AR technology mentioned in the previous section.

4.4.2 Limitation of suitable situations

AR technology uses device's camera to map objects in users' environment. Because of the use of camera, users may not be able to use the technology in some situation such as camera use prohibited for privacy or security reasons. The app has the capability to turn off AR and use it without camera vision.

4.4.3 Increased power consumption

AR technology may require more power than standard apps. The usage of the app may consume battery power of users' smartphone faster. The app has the capability to turn off AR to save power usage.

5 Design

The look and feel of the app will be designed to reflect the concepts and features of the app. Personalisation is the focus of the app and the app should easily blend in users' environments. Neutral colours, opaque, and drop shadows are utilised to achieve blending in. A feature colour will be customisable by users to deliver a personalised look. Design elements, screen layouts, and storyboards are prototyped to detail the design concepts of the app as follows:

5.1 Design Elements

5.1.1 App icon

App icon of the app will feature an illustration of a dog. The background will be multicoloured gradient to represent the personalisation capability in the app (see Figure 3).

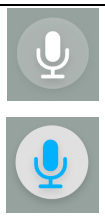
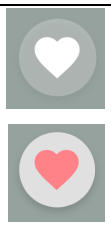
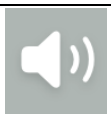
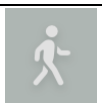
Figure 3 Sample app icon

5.1.2 Buttons, and icons

The visual elements in the app such as buttons and icons will feature rounded corners and circle shapes to create soft and gentle touches to match to the app's concepts and features (see Table 1). Apple's SF Symbols will be used for icons to create the unified cohesive look with the benefit of easy to understand the meanings (2022).

Table 1 Visual elements

Element	Description/Justification	Sample
Button	Button to trigger an action. Round cornered large rectangle. Sized for easy tap.	Done
Close button	Button to exit a process or close a modal box.	

Tool menu icon	Icon to open a tool menu. The opaque grey to blend into the AR view field. The drop shadow effect gives a subtle contrast.	
Voice input icon	Icon to activate the voice input functionality. Microphone indicates that it will use voice. The opaque grey to blend into the AR view field. The drop shadow effect gives a subtle contrast. When active, it turns to blue.	
Activity icon	Icon to open the activity. Heart symbol indicates that it contains fun activities. The opaque grey to blend into the AR view field. The drop shadow effect gives a subtle contrast. When active, it turns to pink.	
Sleep icon	Icon to enter sleep mode. Bed symbol is used.	
Store icon	Icon to move to the official store. Cart symbol is used.	
Camera icon	Icon to open camera to take photo of a virtual pet or record a video to save or share with others.	
Sound icon	Icon to turn on/off sound. Speaker symbol is used. When the sound is off, it turns to grey and no waves will be displayed next to the speaker.	
AR icon	Icon to turn on/off AR functionality. AR letters are used as there is no standardised symbol to indicate AR. When it is off, it turns to grey.	
Walk icon	Icon to start the walk activity. Walking man symbol is used.	
Toy icon	Icon to start the toy activity to play with a toy. Teddy bear symbol is used.	
Gift icon	Icon to activate gift giving activity. Users can place an object purchased from the store into the AR environment. Gift box symbol is used.	
Keyboard icon	Icon to switch to keyboard text input from voice input.	

5.1.3 Colours

Neutral colours will be used for elements in the AR field view to blend into users' environment (see Table 2). Outside of the AR views, relaxing and warm colours will

be favorable, however, users will be selecting an accent colour through the setup procedure to emphasize the importance of personalised environment in the app.

Table 2 Colours

Colour	Use and Code (Hex code)	Description/Justification
	Pink (#FF8080)	The colour is used for activity feature when it is activated.
	Blue (#2FA5FC)	The colour is used for voice input feature when it is activated.
	Text and icons: Dark_grey (#6A6A6A)	This colour is used for parts that are needed to have readability with a white background.
	Background colour: Light_grey (#F4F4F4)	This colour is used to have a subtle contrast with a white background.
	Background and text: White #FFFFFF	This colour is used for text and icon colour in AR field views. Some items are opaque and cab blend into a background environment. Drop shadow effects are used to have a contrast.

5.1.4 Virtual pet objects

Virtual pet will be represented by 3D low polygon objects (see Figure 4). They will have several different movements to communicate and interact to users' commands.

Figure 4 Sample virtual dog objects (Biscode, 2023)

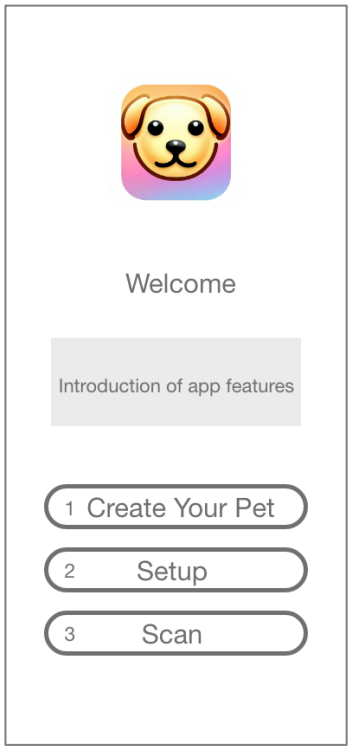
5.1.5 Font

Helvetica Neue font family will be used to emphasize the modern and clean look and feel in the app (see Figure 5).

Figure 5 Helvetica Neue font sample

5.2 Layout

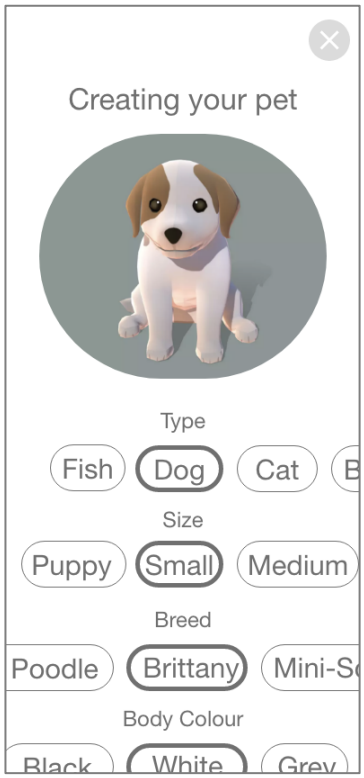
The following screen designs were created to exhibit the layouts of main features in the app. The screen mock-ups were generated by utilising Adobe XD prototyping tool. The design conventions are followed to deliver easy to understand interface designs for the target users.



Screen 1 Landing

Landing screen

Introduction of the app and initial setup steps are listed as buttons for user to tap in the landing screen (see Screen 1). The layout followed the design conventions for users to understand the interface easily.



Screen 2 Create your pet

Create your pet screen

In the creation of a pet, a model of the pet will be updated every time an option is selected to reflect the change (see Screen 2). User can scroll horizontally to see more options for each attribute. Options are framed in a round shaped rectangle. Close button is placed at the top right corner in the screen.

Screen 3 Tools

Tool menu screen

In the main section of the app, a cog icon is placed at the top right corner (see Screen 3). A sub menu will open by tapping the cog icon. In the sub menu, several icons are placed for turning on/off some functionalities and switching to another mode such as store, and sleep. Tapping the cog icon or outside of the menu closes the menu.

The three main icons on the screen are placed in corners to maximise the view area for AR.

Screen 4 Activities

Activity menu screen

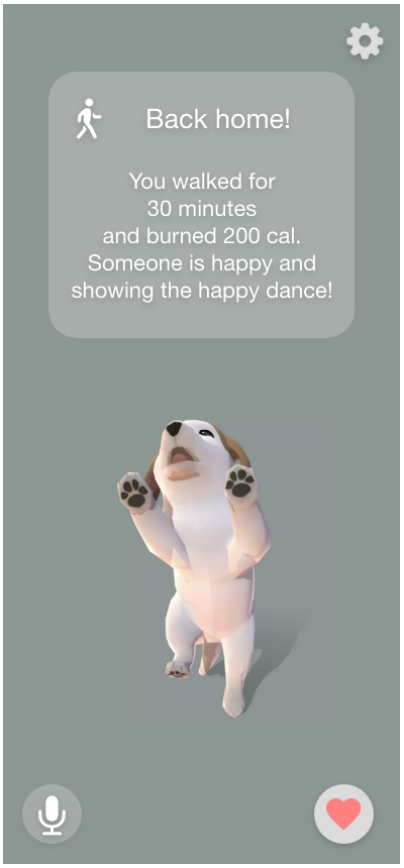
In the main section of the app, a heart icon is placed at the bottom right corner (see Screen 4). The position enables users to reach to the icon easily with just one hand. The activity menu is expected to be used most frequently among three icons on the screen.

A sub menu will open by tapping the icon. In the sub menu, several icons are placed for activating an activity. Tapping the heart icon or outside of the menu closes the menu. More icons can be displayed by scrolling horizontally.

Screen 5 Voice input

Voice input screen

In the main section of the app, a microphone icon is placed at the bottom left corner (see Screen 5). Voice input will be triggered by tapping the icon. Frequently used commands are listed near the voice icon. A keyboard icon is also placed to switch to keyboard typing mode when it is inconvenient to speak.



Screen 6 Walk result

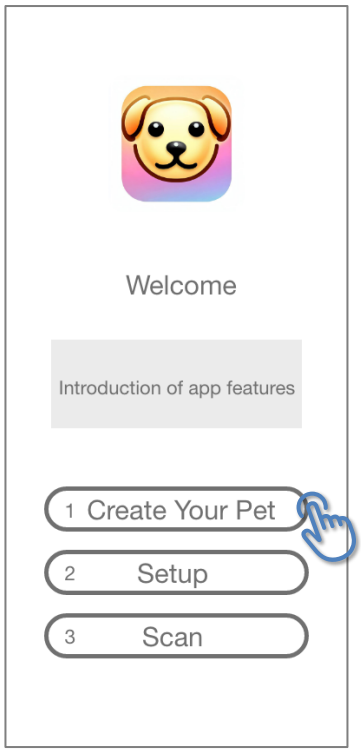
Walk result screen

When user arrives home from a walk activity, the result of the activity appears (see Screen 6). Time of the walk and estimated calories burned from the walk are displayed in a round cornered rectangle box.

5.3 Storyboards

The following storyboards are created to demonstrate how the app interacts with a user in some of features.

5.3.1 Create a pet



Storyboard 1 Landing

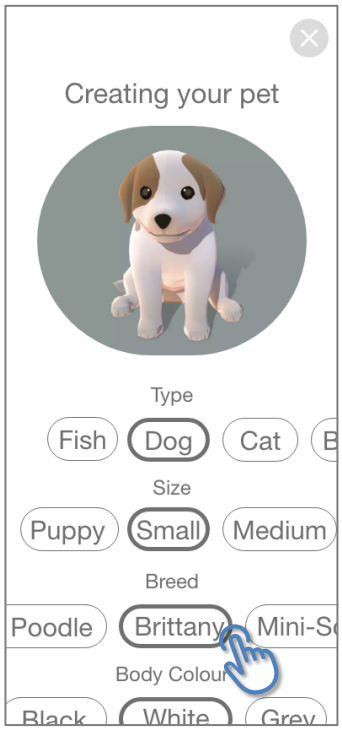
1. Landing

Initial launch of the app, a landing screen comes up. User tap the create your pet button.

Input: Tap a button.

User selection: Create your pet.

Audio: None.



Storyboard 2 Create a pet

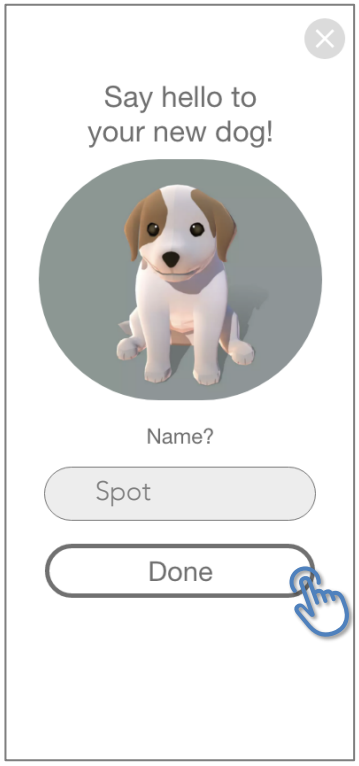
2. Create your pet

User can build a pet by selecting options for attributes. A model of the pet will be updated every time an option is selected to reflect the change. User can scroll horizontally to see more options for each attribute. User taps a option to select. User scrolls vertically to see more attributes. User can quit the process by tapping the close button at the top right.

Input: Tap a button, drag to scroll.

User selection: Select options, or close.

Audio: None.



Storyboard 3 Input name

3. Input name

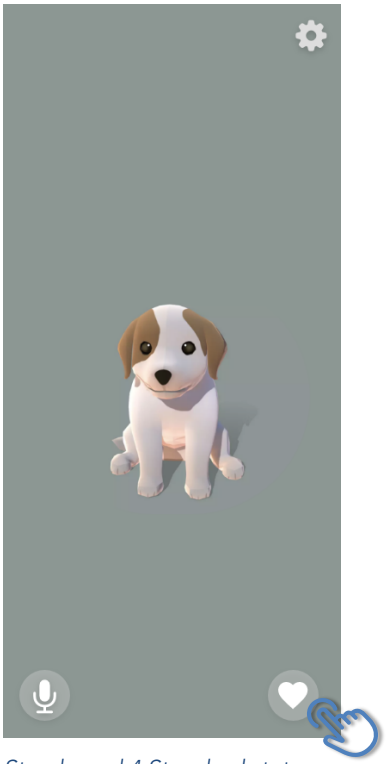
User input a name for their new pet. User taps the done button to finish the creation of their pet.

Input: Type text, tap a button.

User selection: Select done, or close.

Audio: A sound that represents the type of pet will be played when user select done to emphasise the excitement. For a dog, a barking sound would be the sound.

5.3.2 Play with a toy



Storyboard 4 Standard state

1. Standard state

A typical standard screen. The pet that user created is placed in the user's environment using AR. The background is a live image captured from user's rear camera on their smartphone. The pet could be anywhere in the environment much like a real domestic pet. User taps to select activity button.

Input: Tap a button.

User selection: Open activities.

Audio: None.

Storyboard 5 Select an activity

2. Select an activity

A sub menu to display activities opens. The activities could be walking, playing with toy, grooming, gift giving, and treats. User can select one of them by tapping an icon.

Input: Tap an icon.

User selection: Select toy activity.

Audio: A sound that resembles a positive emotion of the pet plays when the activity selected. For a dog, a short light barking sound.

Storyboard 6 Toy activity selected

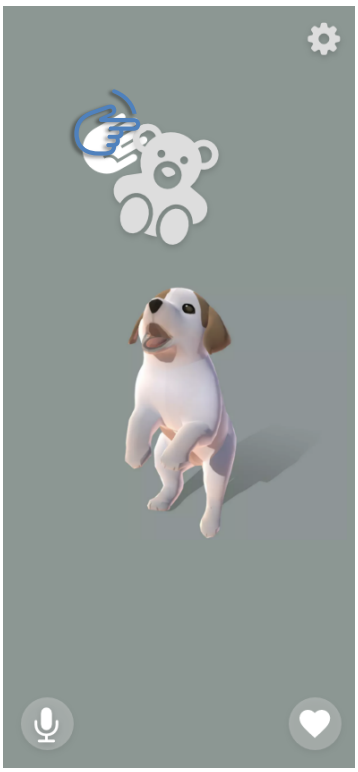
3. Toy activity selected

A toy object appears at the bottom of the screen. User drags the toy to move around as instructed by the text message around the top of the screen.

Input: Drag toy object.

User selection: None.

Audio: None.



Storyboard 7 Play with toy

4. Play with toy

User can drag the toy object to interact with the pet. The pet would chase the toy and try to catch it. User can also throw it by dragging the toy and lift their finger off the screen.

Input: Drag toy object.

User selection: None.

Audio: Sounds that resemble emotions of the pet play according to states of the interaction. For a dog, a short light barking sound for when the dog is happy or growling sound when it is frustrated to the user holding the toy too long.

5.3.3 Voice interaction

Storyboard 8 Activate voice input

1. Activate voice input

User taps the voice icon at the left bottom of the screen to activate the voice input. The app starts listening through the microphone. User can also select one of frequently used commands that are appeared near the voice icon. User also has an option to switch to keyboard typing when it is inconvenient to speak.

Input: Tap the voice icon.

User selection: Activate the voice input.

Audio: A sound plays when the voice icon is selected to indicate the voice input is activated.

Storyboard 9 Voice input

2. Voice input

User speaks to input a command to give to their pet. The recognised words are displayed around the top of the screen to give feedback.

Input: Voice a command.

User selection: A command.

Audio: A sound plays when the voice input ends.

Storyboard 10 Command response

3. Voice command response

Result from user's voice command displayed around the top of the screen. The pet reacts to the command and an interaction occurs. In this case, the dog shows its belly.

Input: None.

User selection: None.

Audio: A sound might play depending on a command interaction.

5.3.4 Gift activity

Storyboard 11 Git activity

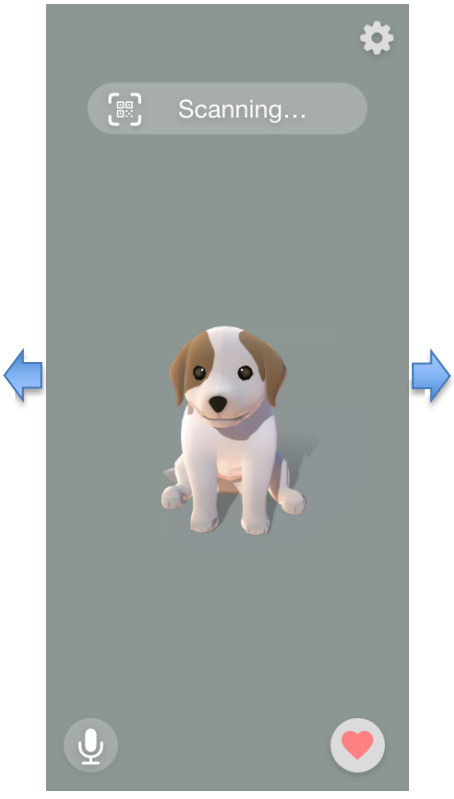
1. Select git activity

A sub menu to display activities opens. User selects gift by tapping the gift icon.

Input: Tap the gift icon.

User selection: Select gift activity.

Audio: A sound that resembles a positive emotion of the pet plays when the activity selected. For a dog, a short light barking sound.



Storyboard 12 Scanning

2. Scanning

Scan begins to search a marker in the user's environment. Text message around the top of the screen indicates that scan happening. User would start placing a marker and try to capture it by panning the view field.

Input: None.

User selection: None.

Audio: None.

Storyboard 13 Marker found

3. Marker found

A marker is placed within the AR view field. It can be a QR code or an image tag purchased from the app's official store. The app checks the legitimacy of the marker and recognise which object to insert. The found marker is highlighted with coloured dotted lines to give feedback.

Input: QR code or image tag.

User selection: None.

Audio: A sound to indicate a correct match plays.

Storyboard 14 Object placement

4. Object placement

The matched object is placed in the AR view field on the screen where the marker is placed in the environment. In this case, a dog bed is placed and the dog is responding to the event.

Input: None.

User selection: None.

Audio: A pop sound to indicate a placement of the object plays.

Storyboard 15 Command

6. Command

By activating voice input, user gives a command. The bed command was recognised.

Input: None.

User selection: None.

Audio: A sound plays when the voice input ends.

Storyboard 16 Interaction with an object

7. Interaction with the object

The dog jumps onto the dog bed object. It shows a positive emotion.

Input: None.

User selection: None.

Audio: A sound that resembles a positive emotion of the pet plays.

5.3.5 Walking activity

Storyboard 17 Walk activity selected

1. Select walk activity

A sub menu to display activities opens. User selects walk by tapping the walk icon.

Input: Tap the walk icon.

User selection: Select walk activity.

Audio: A sound that resembles a positive emotion of the pet plays when the activity selected. For a dog, a short light barking sound.

Storyboard 18 Walking outside

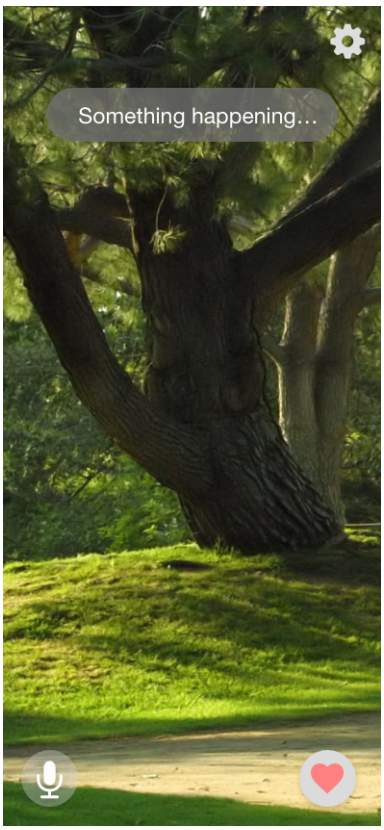
2. Walking outside

User goes outside for a walk. The dog can be observed through user's AR field view. It can be anywhere around user and placed in the environment.

Input: None.

User selection: None.

Audio: None.



Storyboard 19 Event while walking

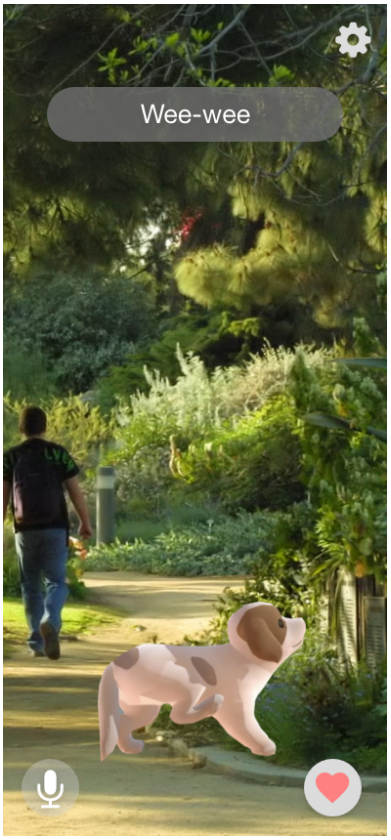
3. An event happens while walking

User is notified by a message to indicate something happened. User starts to pane the smartphone to look around to find the dog.

Input: None.

User selection: None.

Audio: A notification sound plays to alert.



Storyboard 20 A surprise event

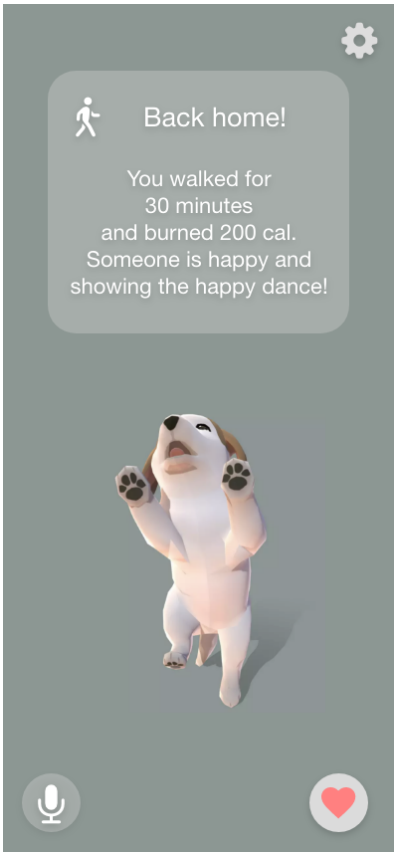
4. A surprise event occurred

User found the dog and it is doing its business. The dog would run toward the user after finishing to show an excitement.

Input: None.

User selection: None.

Audio: A sound of water.



Storyboard 21 Walk finished

4. Walk finished

When user arrives home, the result of the activity appears. Which includes time and calories from the walk. The dog dances for the user as a reward.

Input: None.

User selection: None.

Audio: A music track for the dog dance.

Dog images source: https://assetstore.unity.com/packages/3d/animations/dog-full-animations-brittany-spaniel-247465
Dog bed image source: https://image.shutterstock.com/shutterstock/photos/255070519/display_1500/stock-vector-dog-bed-255070519.jpg
Park image source: https://www.robinkiashek.co.uk/wp-content/uploads/2018/12/bigstock-Walk-In-The-Park-76994.jpg

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7 Appendix A: Persona

7.1 Emily Taylor - Young single urban office worker

Emily is a 27-year-old female full-time worker who lives in an modern studio apartment in West End, Brisbane by herself. She works at a marketing agency in CBD on weekdays from 9 am to 6pm.

She has always wanted to own a dog but never had a chance to do because she is not home enough, and her apartment is too small. Her dream is to own a dog one day when she can afford a house. She often works long hours and wants to relax and forget about stressful work when she comes home. She doesn't have a hobby, but she wants to start walking as a regular exercise.

She spends most of time on social apps on her iPhone when she is home but she doesn't particularly love them. AR technology is not new to her as she has used Snapchat and PokemonGo before.

Key Characteristics:

- 27 years old
- Single, live in an apartment alone
- Annual salary: $70K
- Interests in dogs
- Don't have hobbies
- Frequent user of mobile apps
- Have used AR technology and have positive attitude
- Never used VR before
- Doesn't play computer games but enjoyed some easy mobile game apps
- Uses Snapchat and TikTok

27 years old, Female
West End, Brisbane, Australia
Full-time, marketing agency

Persona Type: Primary

Motivations:

- Filling spare time after work
- Relaxing or take mind off work
- Filling the desire of owning a pet
- Going for a walk more often
- Learning how to look after a dog
- Replacing social apps with something more personal

Goals:

- Wants a companion like a dog
- Wants to look after a dog without time commitments
- Wants to get positive emotions at home
- Wants some encouragement to go for a walk
- Wants to learn about raising a dog