Supporting a long-term health condition using a software application

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Abstract

During the research element of this project, the symptoms, causes, and coping mechanisms of both Generalised Anxiety Disorder (GAD) and stress were examined which were used for creating application features. The ethical issues of mental health applications were explored. Furthermore, key characteristics of high-efficacy mental health applications were identified. Similar applications were explored to obtain the non-functional requirements. Moreover, similar applications were manually reviewed to extract features of like-minded apps. The development process was discussed which involved designing the user interface to choosing the colour scheme of the application. Furthermore, the development difficulties that were experienced during the development process were addressed. Finally, the testing element of the project was conducted to alter the application's necessary elements to the user's recommendations.

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Final Year Project Proposal

Project Identifier: IR03

Project Title: Supporting a long-term health condition using a software application.

Project Description: This paper proposes to research Generalised Anxiety Disorder as a long-term health condition. This is due to Mental Health and anxiety becoming very evident over Covid-19 and its lockdown restrictions.

This paper proposes to research what can be used to control this condition and create a cross-platform application that may be deployed on Android or IOS. This will allow the application to target a wider audience. The research conducted will convey what is needed in supporting this condition. The research will include primary and secondary research. Primary research will consist of interviews. Secondary research will include academic papers, journals, articles, blogs, and comparing other, like-minded apps. After gathering all the information needed, user requirements and use cases will be created. Next, a product will be developed that will attempt to incorporate all necessary steps needed in supporting this condition.

1.0 Introduction

This paper will cover several components regarding mental health, delving deeper into Generalised Anxiety Disorder and Stress. In addition, the paper will cover what can cause anxiety and stress, and what mechanisms are helpful to carry out in order to reduce stress and anxiety.

Firstly, the paper will investigate Generalized Anxiety Disorder (GAD) and stress. This will include symptoms, effects on a person, diagnosis, and the best procedures on how to cope with anxiety and stress. This will be followed by researching already existent applications and generating use cases and user requirements from them. This involves reviewing the applications, reviewing user reviews, and extracting applications use cases. Lastly, the paper will include testing interviews with fellow students. The interviews will be used to refine the application to the user's preferences. Ultimately, an application will be developed which helps in supporting this long-term health condition for the vast majority of users.

1.1 Justification

The justification for undergoing this project includes mental health becoming very evident over Covid-19 and its strict lockdown measures. More and more people have reported mental health symptoms during the lockdowns. From a study conducted by Adolescent Mental Health, it is said that 66% of teenagers had been concerned about their mental health being affected by Covid-19 (Adolescent Mental Health, 2021). Anxiety has also become more evident in young people. According to a study carried out by OECD over the Covid-19 crisis, 30% to 80% of young people were more likely to report symptoms of anxiety than adults (OECD, 2021). It is also noted that support for young people regarding their mental health has been greatly disrupted (OECD, 2021). For this reason, it is evident that more supportive systems need to be developed that are easily accessible for all age groups among the population.

1.2 Problem Statement

There is a lack of free or low-cost resources available to people who suffer from anxiety and stress. Individuals diagnosed with any anxiety disorder had an estimated average total medical cost of $6,475 (Marciniak, M, 2005). There is a gap in the services provided for additional resources in this area. This research paper hopes to provide the user requirements for an application that may fill this gap.

1.3 Research Objectives

The primary aim of this research paper is to establish an application that can help people who suffer from anxiety disorders and stress in their daily lives. The following objectives were determined based on the aim.

1. Understand what anxiety and stress are.
2. Identify solutions on how to cope with anxiety and stress daily.
3. Create user requirements for the application.

2.0 Literature Review

2.1 What is Generalized Anxiety Disorder

According to a paper by Tryer (2006), anxiety can be defined under Generalised Anxiety Disorder (GAD) as "a chronic and prevalent disorder in which the patient experiences unfocused stress and anxiety that is unrelated to recent stressful events, but it can be exacerbated by particular situations". An additional definition includes "a condition of persistent anxiety and stress about a variety of events or notions that the patient recognizes as unnecessary and unreasonable is known as Generalised Anxiety Disorder" (BMJ, 2007). A more recent definition includes "over a long period of time, overwhelming anxiety about daily things, evading or looking for validation in circumstances when the outcome is uncertain, and being too anxious about things that could go wrong, this is Generalised Anxiety Disorder" (Andrews, G, 2018). It is illustrated that GAD is a chronic disorder in which over a prolonged period of time, a person suffers excessive anxiety and stress about unnecessary events unrelated to recent stressful events. Up to 33% of the world's population suffers from anxiety disorders at a certain time in their life, according to large studies (Guzman, S, 2018). Studies have shown GAD affects twice as many women as it does men (Healthline, 2020). In the US, GAD impacts 6.8 million adults' lives, although only 43.2% of those affected receive therapy or treatment (ADAA, 2021).

Anxiety does not discriminate. It affects people of all genders, religions, ages, nationalities, wealth, and statuses (Canada Helps, 2019). It can affect all people around the globe no matter how healthy they are or how much they have achieved. Tyson Fury, a British professional boxer, who is a two-time world heavyweight champion and one of the best boxers of his generation had this to say, "My anxiety was terrible. I believe anxiety is one of the worst things that anybody could have. It's the fear of the unknown. It's crazy" (The Guardian, 2021). This illustrates that anxiety and stress can affect anyone, even the toughest men on the planet.

Substance abuse such as alcohol or drug misuse may be a typical complication for anxiety and stress (Tryer, P, 2006). Not only can substance abuse cause anxiety in the user, but substance abuse can cause anxiety and stress to relatives and family members around them. According to a study carried out in Iceland, 36% of participants experienced moderate, serious, or severe depression, anxiety, or stress based on substance abuse in the family (Orjasniemi, T, 2018). GAD can have a variety of causes and risk factors, which include stressful circumstances which may be recent or over a prolonged period of time such as personal or family ailments, heavy

tobacco, or caffeine use, which can exacerbate already existing anxiety, a family history of GAD, or childhood abuse (Healthline, 2020). It is conveyed that GAD may be caused by a number of factors that are common in life ranging from substance abuse to childhood abuse.

GAD is a disorder that affects a large number of children and adolescents. It usually starts in childhood or young adolescence, where symptoms may get worse during stressful situations. GAD can cause serious social, academic, and personal problems. If it goes untreated, the illness can become chronic and foreshadow anxiety and depression in adulthood (Boston Children's Hospital, 2021).

So, it is clear, that GAD is a lifelong, chronic illness that proves harsh difficulties for an individual. It can affect every person on the globe and has a number of factors that can help contribute to GAD.

2.2 Symptoms and Diagnosis of GAD

GAD has several symptoms. Being easily exhausted, having trouble focusing, impatience, difficulty sleeping, and muscle tension are all symptoms of GAD (Tryer, P, 2006). Restlessness and an inability to relax, cold chills or hot flushes, numbness or tingling, muscles pains, feeling agitated, mentally tense, and trouble swallowing are other symptoms related to GAD (BMJ, 2007). GAD is an ongoing illness affecting people's lives daily.

GAD is diagnosed when a person has three or more symptoms and finds it difficult to moderate stress and worry for the majority of days over at least six months. This distinguishes GAD from typical worry that is triggered by a specific stressor event that lasts only a short time (ADAA, 2021). A GP may conduct a physical exam or blood tests to screen out other ailments that could be causing the symptoms (NHS, 2018). A doctor may also inquire into one's private life, psychological or physical symptoms and for how long one has experienced them, as well as any other concerns, emotions, or thoughts (NHS, 2018). A person might find it challenging to discuss their private life, emotions, or thoughts. However, it is essential that the doctor understands the symptoms correctly in order to provide an accurate diagnosis (NHS, 2018).

GAD conveys several symptoms that people suffer when living with chronic illness. The correct diagnosis needs to be made to move forward when treating GAD.

2.3 Treatment of GAD

According to an article by Medical News Today (2019), GAD is a chronic, life-long illness however, there are numerous ways to treat GAD and cope with it. GAD is a common disorder that is effectively treated. Persons who are concerned about their mental health should get treatment from a doctor or psychotherapist. The earlier a person receives treatment, the better his or her chances are of treating GAD. The intensity of one's symptoms and the presence of any underlying diseases influence treatment options for GAD. Counselling or lifestyle changes or a combination of treatments are required for many people to treat GAD. In some instances, medication may be required such as Buspirone, Benzodiazepines, or Antidepressants (Medical News Today, 2019).

Additionally, a doctor may recommend certain anxiety-related educational resources. Learning from a book or a computer program is the most common method. A person will be aided by a medical professional (HSE, 2018). Going on a group therapy course is another option. Every week, a person, and a group of other people with similar issues meet with a therapist in these classes. One may learn how to deal with their anxieties from how other people in the class cope with theirs (HSE, 2018). Managing their symptoms more effectively can be a result of working with a therapist (Medical News Today, 2019).

Cognitive Behavioural Therapy (CBT) for treating anxiety is frequently prescribed by doctors and mental health professionals as it is both safe and effective. According to studies, CBT lessens anxiety and worry in persons with GAD, with results that are comparable to medicines and are more effective 6 months after therapy completion (Medical News Today, 2019).

This paper will delve deeper into lifestyle changes when it comes to treating anxiety. Worries and concerns may be managed better and kept under control by making lifestyle modifications (Medical News Today, 2019). Some of these include:

- Regular exercise
- Consuming a healthy, nutritious diet
- Lowering exposure to stress stimuli
- Partaking in yoga, meditation, or mindfulness exercises
- Journaling can aid in the identification of anxiety triggers and coping mechanisms
- Minimizing or avoiding nicotine or caffeine, and avoiding alcohol and narcotics
- Getting consistent hours of 7-9 of sleep per night by abiding by a schedule (Medical News Today, 2019).

Lifestyle changes like these can help in treating and managing one's GAD. According to a study over two years. Regular to intense exercise, classified as more than two hours of exercise per week, was substantially related to reducing anxiety symptoms (Sarris, J, 2012). Exercise, as a form of therapy, was reported to be as beneficial as psychotherapy and nearly as efficient as medicine in treating self-reported anxiety symptoms, in a recent meta-analysis (Sarris, J, 2012). Exercise may aid in the reduction of stress and release of tension. Furthermore, it increases the release of serotonin in one's brain, which may boost one's mood (HSE, 2018).

Mindfulness-Based Stress Reduction (MBSR) training program is an 8-10 week planned program which includes mindfulness meditation practice as well as mindful awareness. A study carried out on the efficiency of the program found that at the end of the program, the proportion of persons suffering from panic symptoms as well as general anxiety symptoms was shown to be dramatically reduced (Sarris, J, 2012).

Anxiety can be difficult to manage, and it frequently necessitates lifestyle modifications. According to Sawchuk (2017), although there are no dietary modifications that can cure anxiety, keeping a close eye on what one eats can assist in managing it. Carbohydrates are known to enhance serotonin levels in the brain, resulting in a relaxing effect. Whole grains, for example, are abundant in complex carbs. Simple carbs, such as sugary foods and beverages, should be avoided (Sawchuk, C, 2017). Consuming a diet of processed meats, pizza, sweets, and so on, was linked to an elevated risk of anxiety in both men and women. Dietary changes may improve one's overall mood or sense of well-being, but they are not a replacement for treatment (Sawchuk, C, 2017).

There is a well-documented link between anxiety disorders and substance abuse (Sarris, J, 2012). In the short term, substance abuse can help with anxiety symptoms. Tobacco and/or alcohol use, on the other hand, gives rise to anxiety over time by causing persistent withdrawal symptoms, decreased health quality, and other symptoms (Sarris, J, 2012). Alcohol and caffeine can also interfere with sleep which can lead to the development of anxiety (Sawchuk, C, 2017).

It is lifestyle changes like the ones discussed above which will be used to derive use cases for the development of the product. The product will aim to help those suffering from GAD to fulfil their lifestyle modifications in order to treat their anxiety.

2.4 What is Stress

The sensation of being overwhelmed or unable to deal with emotional or mental pressure is known as stress (Mental Health Foundation. 2021). Our bodies' reaction to pressure is called stress. Stress is a normal part of the fight or flight response, which is the body's response to danger or a threat. This response is used to ensure that a person is alert, focused, and prepared to deal with a threat (Barrell, A, 2020). The nervous system and certain hormones are activated in response to stressful situations (HSE, 2018). Stress is usually short-lived and occurs in response to a direct, perceived threat (Barrell, A, 2020). Stress can be caused by a variety of conditions or life events. When we encounter something new, unexpected, or when we believe we have little control, it is frequently activated (Mental Health Foundation, 2021). Everyone is affected differently by stress. What makes one individual stressed may not make another person feel the same way (HSE, 2018). Some people are more effective at coping with stress and recovering from stressful circumstances than others (NIH, 2021). Stress affects everyone globally as it is a normal occurrence in life (NIH, 2021).

Many factors can contribute to someone becoming overly stressed such as relationships, exams, abuse, moving to new surroundings, a traumatic event, illness, peer pressure, or unrealistic achievements set for you (HSE, 2018). Furthermore, stress can be caused by a variety of other factors, including divorce, job loss, or unanticipated financial difficulties (Mental Health Foundation, 2021). Work-related stress can also be detrimental to a person's mental health. Work-related stress causes people to miss an average of 24 days of work each year due to illness (Mental Health Foundation, 2021). Even life changes that are positive such as moving to a larger house, getting a work promotion, or going on vacation can cause stress (Mental Health Foundation, 2021).

Stress is a natural part of life and everyone from time to time suffers from stress, although some are better than others at dealing with it. Stress can be caused by a number of factors, normally circulated around a recent, stressful event or situation. It can be concluded that stress and GAD are very different but similar at the same time. Stress is caused by a direct threat or event and normally only spans over a short amount of time. Anxiety is normally unrelated to any event and is over a prolonged period of time. (See appendices 1.1 for image comparing anxiety against stress)

2.5 Symptoms and Diagnosis of Stress

There are tell-tale signs that a person is experiencing stress. A person may experience being afraid, anxious, angry, sad, frustrated, or irritable (Mental Health Foundation, 2021). A person may also experience faster breathing, faster heartbeat, anxious thoughts, moodiness, general unhappiness, or a feeling of being overwhelmed (Barrell, A, 2020).

A person suffering from stress might experience physical symptoms such as nausea, headaches, indigestion, sweating, hyperventilation, heart palpitations, aches, or pains (Mental Health Foundation, 2021). A person may also have difficulty concentrating and experience constant worrying (HSE, 2018). Stress can also affect one's sleeping. When people are stressed, they may eat too little or too much (HSE, 2018). When under stress, a person may find themselves drinking alcohol, taking drugs, or smoking more than usual (Mental Health Foundation, 2021). In some cases, long-term stress has also been linked to gastrointestinal conditions like stomach ulcers or irritable bowel syndrome, as well as cardiovascular disease (Mental Health Foundation, 2021). Long-term stress can lead to serious health problems like high blood pressure, heart disease, diabetes, and other illnesses, as well as mental disorders like anxiety and depression (NIH, 2021). Mild stress is thought to aid in the enhancement of cognitive function, particularly in the case of virtual or verbal memory. Nonetheless, if the level of stress exceeds a predefined threshold which varies from person to person, it can lead to cognitive problems, particularly in judgment and memory (Panahi, Y, 2017). Furthermore, it weakens the immune system by reducing the activity of cytotoxic T lymphocytes and natural killer cells. Severe stress can lead to malignant cell growth, genetic instability, and tumour progression, eventually leading to a possible cancer (Panahi, Y, 2017). It is important to learn to manage your stress to reduce the likelihood of negative health implications (NIH, 2021).

This illustrates that Stress and Anxiety are similar in the symptoms a person may suffer. At times, it can be hard to diagnose which one a person is suffering from, although there are more criteria to be diagnosed with GAD.

2.6 How to Cope with Stress

As stress is a natural part of life, there is no explicit treatment to deal with stress such as medication. But there are ways to manage and to cope with stress (HSE, 2018). People can become overwhelmed by stress at times. When this begins to happen, it can lead to the development of anxiety disorders or chronic stress. Anyone who finds that stress is interfering with their daily life should consult a physician (Barrell, A, 2020).

As with anxiety, making lifestyle modifications may help a person manage their stress. Some lifestyle changes include:

- Being observant
- Talking to a health professional
- Regular exercise
- Relaxing
- Setting realistic goals
- Speaking to someone
- Avoiding alcohol, caffeine, and smoking
- Breathing exercises
- Walking or running

(NIH, 2021).

Being observant and recognising indicators of your body's response to stress such as trouble sleeping, higher alcohol and other substance usage, irritability, low energy levels and feeling depressed can help in trying to reduce one's stress levels at an early stage. (NIH, 2021).

Exercise may be a very effective stress reliever. It aids in the release of built-up energy and might make one feel considerably more relaxed. Any form of exercise can be beneficial (HSE, 2018). Walking for 30 minutes a day can help one feel better and enhance one's health (NIH, 2021).

Looking into relaxation or wellness classes that include activities such as meditation, muscular relaxation, and breathing techniques can help reduce stress. Setting aside time for these and other healthy and calming activities on a regular basis helps in managing a person's stress (NIH, 2021).

Breathing exercises can help with relaxation and help manage stress by improving oxygen exchange, which lowers one's blood pressure, calms one's heart, and relieves any abdominal

strain (Calmer, 2021). Physical changes like this enhance one's state of mind, focusing on one's breathing may bring them into the present, allowing them to practice mindfulness (Calmer, 2021). Although breathing exercises are not a complete stress-management strategy, they have been clinically demonstrated to reduce stress and anxiety symptoms (Calmer, 2021).

Coping with stress, like anxiety, can be done by making lifestyle modifications. A big lifestyle change when it comes to dealing with stress is regular breathing exercises.

2.7 Mental Health Applications and How Useful They Are

Mental health applications for smartphones provide a unique potential to increase the access and quality of mental health care (Chandrashekar, P, 2018). According to a 2018 survey conducted by Chandrashekar, the number of mental health-focused smartphone applications has accelerated in recent years, 29% of mobile health apps focused on diagnosis, treatment, or support for mental health. Smartphone mental health applications have also been cited by public health organisations such as the National Health Service (NHS) in the United Kingdom as scalable solutions and cost-effective to the mental health treatment gap. Mobile applications offer a lot of potential when it comes to providing high-efficacy mental health therapies. Applications have developed as a feasible tool to address the mental health treatment gap, given the global scarcity of psychiatrists and the lack of mental health care access in rural areas. Technology has the potential to revolutionize the way mental health care is provided and consumed (Chandrashekar, P, 2018).

According to the same paper, mental health applications are available for a wide spectrum of psychiatric issues and come in a variety of designs and functions. The National Institute of Mental Health divides mental health applications into six groups depending on their functionality: cognitive enhancement, self-management, support networks, symptom monitoring, skill building, and passive information gathering are all examples of self-management techniques. According to a meta-analysis that looked at the impact of mobile phone delivered therapies on the symptoms of diagnosed anxiety disorders and found that utilizing anxiety treatment applications reduced overall anxiety (Chandrashekar, P, 2018).

2.8 Characteristics of High-Efficacy Applications

Chandrashekar (2018) cited that mental health applications must be evidence-based and precisely developed in order to be useful and help address mental health issues. The four features of high-efficacy mental health applications should be incorporated by developers. These are simple user interface and experience, high patient engagement, self-monitoring capabilities, and potential for cross-diagnosis.

- Simple user interface: Simple, straightforward user interfaces are emphasized in models of technology-based behaviour modifications to promote quicker behaviour change through lower cognitive requirements. Working memory is frequently affected in persons suffering from anxiety. Applications for this demographic must be created with a reduced cognitive load. A simple user interface decreases cognitive requirements and boosts learning capabilities. The use of visuals rather than text, shortened sentence lengths, and inclusive, nonclinical language are all features that lessen cognitive load.

- High patient engagement: Patients must be organically motivated to interact with applications because they are often used on their own time without clinical observation. According to a study, patient engagement may be increased by implementing gamified interactions, real-time engagement, and usage reminders (Chandrashekar, P, 2018).

- Self-monitoring capabilities: Emotional self-awareness, which has been linked to anxiety, and substance misuse, can be increased via application-based features that allow users to self-monitor their state by monitoring their thoughts, behaviours, and actions on a regular basis. Emotional self-awareness, or the ability to recognise and comprehend one's own feelings, has been found to lessen mental illness symptoms and enhance coping abilities.

- Potential for cross-diagnosis: While psychological diseases are frequently concurrent, few mental health applications expressly employ transdiagnostic strategies to address symptoms that are common across two or more disorders. Considering comorbid disorder therapies are often similar in terms of execution and material, transdiagnostic apps can improve user involvement and treatment efficacy by minimising the time and effort required to interact with various mental health disorder apps (Chandrashekar, P, 2018).

2.9 Ethical Issues and Risks

According to Kleftaras (2014), when developing a product for a mental health application, risks and ethical issues that may arise should be made aware of and kept in mind. One of the most prevalent concerns is the limitations of electronics as a platform, such as faulty devices and communications technologies, battery issues, and an inconsistent or unpredictable internet connection, to name a few. Furthermore, when important data such as therapy sessions and invoicing notes are not stored in a readily available secondary location, there is always the risk of theft, loss, or malfunction of the smartphone, which could have serious consequences (Kleftaras, G, 2014).

Most fitness and health apps encourage users to provide a significant quantity of personal information, such as their phone number, name, age, email address, and gender, in order to collect a wide range of demographic and medical data. Applications may also keep track of information about their lifestyles, such as food intake and exercise routines, as well as information on their diagnoses and treatments (Kleftaras, G, 2014). This illustrates there should be vast privacy protection implications in check to keep user personal, sensitive information and data protected.

Kleftaras (2014) also noted a further issue, that it may be challenging for older users to access and comprehend the information and usage offered by these mental health applications. Furthermore, keeping in mind that while adopting new technologies, it will not be able to completely replace the face-to-face therapy sessions. It does however have the potential to deliver better equipment for fostering an improvement in the quality of treatment and support when it comes to anxiety (Kleftaras, G, 2014).

2.10 Application Reviews

- **Happify:** Happify attempts to increase emotional well-being by reducing stress, anxiety, and negativity. Users register an account and fill out a brief assessment, which allows the app to recommend a "course" for them. "Courses" are collections of activities and games that assist the user in achieving their objectives, whether it is stress management or relaxation. Professionals build these courses which are based on psychological wellbeing, mindfulness, and principles of cognitive behavioural theory to assist users in reaching their goals. App users can opt to access free courses or pay a membership fee to have access to more courses and features. These features can include data analytics that can be used to track progress. There is also an AI trainer on hand to assist users. Furthermore, users of the application may join the Happify community via public messages and forums (One Mind Guide, 2021). A study in 2018 sampled 1051 new Happify users. The participants ranged in ages but were primarily females. It was found that after using the Happify application for a suggested period of time, anxiety symptoms were notably reduced compared to the lower usage of Happify. Furthermore, it was conveyed that resilience was considerably improved in suggested usage of Happify in comparison to the low usage (One Mind Guide, 2021). Happify is available for Android, Windows, and iOS. Happify also is available for a number of languages including French, German, and Japanese. (One Mind Guide, 2021).

Some pros of Happify include that there are more than 60 courses with evidence-based activities created by professionals in the industry. Blind or visually impaired people can avail of the service due to their accessibility features. Happify combines a number of different applications into just one (One Mind Guide, 2021).

Some cons are the subscription model costs $14.95 a month of avail of Happify's services. Happify users can only gain access to metrics and progress, i.e., self-monitoring, using the subscription model (One Mind Guide, 2021).

- **Headspace**: Headspace is a meditation application which aims to facilitate the concepts of meditation and mindfulness into the application users' daily life, with the goal of improving attention, reducing anxiety, and improving mood. A user may try out ten free sessions before committing to a membership that gives them access to a broad range of programs and courses. Children's meditations and animated mediations are among the activities available in the Headspace collection. Users may select from a variety of programs and go at their own speed through Headspace. Recording your practice stats, meditation reminders, and encouraging a friend to join and meditate with you are all included in the application (One Mind Guide, 2021). According to a study in 2017, 95 random participants were assigned to either a brain training application called Lumosity or Headspace. In the mindfulness training group, there were large decreases in mind wandering and substantial improvement in dispositional mindfulness compared to the brain training group (One Mind Guide, 2021). Another study conveyed that Headspace users showed there were substantial improvements in emotional self-awareness and a reduction in depressive symptoms (One Mind Guide, 2021). Headspace can be found on iOS and Android. French, Portuguese, and Spanish are some of the languages available on the app (One Mind Guide, 2021).

Some pros of Headspace include that there is a 10-day free trial where the user can feel a use for the application. Headspace consists of a smart, user-friendly interface with material that may be customized. Concepts are explained through entertaining and engaging animations. Headspace meditation sessions can be downloaded so they can be used offline. Headspace mindfulness is done in a contemporary, practical, and rational way that is scientifically supported. Headspace also contains "Headspace for Kids", so it is family and child friendly (One Mind Guide, 2021).

Some cons of Headspace include that a user must pay a membership to gain access to additional modules. To see results on Headspace, it requires time commitment and discipline to practice regularly (One Mind Guide, 2021).

- **Calm:** Calm is a mindfulness meditation application. A key feature of Calm is the home page. The home page features a soothing nature scene that may be changed according to the user's taste. Music, Sleep, and Meditation are among the key sections of the application. Calm offers a free trial to users which includes one 2-to-30-minute meditation session every day, as well as concentrated music tracks set to picturesque photographs. Users have unlimited access to targeted meditation sessions, sleep tales, and personalization choices when they buy a membership. Daily meditation reminders and user meditation statistic tracking are some of the other additional features (One Mind Guide, 2021). Calm is an impactful method of delivering mindfulness meditation to stressed college students in order to reduce stress and improve mindfulness and self-compassion (Huberty, J., 2019). According to a study where 88 participants of college students were involved, Calm was useful in reducing stress for the majority of students in the intervention group, and most said they would use it again (Huberty, J., 2019). Calm is available for numerous languages such as French, Korean, and German and can be found on the Apple App Store and Google Play (One Mind Guide, 2021).

Some pros of Calm include that Calm provides a 7-day introductory program which includes additional content for free. Calm includes meditation statistics and tracking as well as daily meditation reminders. Calm has "Daily Calm" which is a new meditation that is made available each day. With "Calm Kids" material, it is appropriate for families and children. It includes a well-rounded curriculum that includes stories to aid sleep (One Mind Guide, 2021).

Some cons of Calm include the access to Calm content and information beyond the initial introductory sessions is only available through a subscription. To obtain outcomes and result, users must be engaged and committed to Calm (One Mind Guide, 2021).

- **MoodMission:** MoodMission is an application that is design for people who are suffering from stress, depression, or anxiety. Depending on how the user is feeling, the application offers different tasks. A user selects whether they are worried, depressed, or stressed at a given moment, and how strong their feelings are. The application then provides five tasks and an explanation of why this activity may assist in lessening the user's feelings. Tasks can be behavioural such as sewing, physical such as exercise, emotional such as breathing mediation, or mental. A user can accept a task, complete, and score the task at the end regarding to how the feel after completing it and score how useful they find them to be (One Mind Guide, 2021). The application also has a tasks log which lists all the completed tasks of the user as well as numerous achievements they have been awarded. An achievement can be awarded for the number of tasks completed by the user. As a user moves through the applications tasks, the user is awarded rankings (One Mind Guide, 2021). Based on both a study conducted by MoodMission and how using brief Cognitive Behavioural Therapy procedures would improve mental health results, users of the application discovered that use of an application that gives CBT procedures boosts mental wellness coping efficacy when it comes to anxiety or depression (One Mind Guide, 2021). MoodMission is made available for iOS and Android, but it is only available in English (One Mind Guide, 2021).

Some pros of MoodMission include that it helps to address anxious and depressive emotions. There are a numerous task options with explanations that accompany them. MoodMission has a design that is appealing. The majority of the content on MoodMission is free, only having customisable content available for a fee (One Mind Guide, 2021).

Some cons of MoodMission include that it is possible that MoodMission won't be as effective at times of extreme anxiety or crisis. Some of the proposed tasks may be unfeasible in some situations or need planning ahead of time. Since some of the written explanations are small in size, some users may find them difficult to read. The application may require to sign-in each time you use the application and push notifications on iOS are unreliable (One Mind Guide, 2021). MoodMission now costs €4.99 on Android and $7.99 on iPhone to access.

- **SuperBetter:** SuperBetter is a game-based application that aims to assist users to develop resilience. SuperBetter's mission is to assist users in keeping track of their ambitions and successes while also educating them on the relevance of each task. SuperBetter allows users to establish a totally personalized "Secret Identity" that they may use to complete tasks, acquire power-ups, and battle "Bad Guys". Users can complete tasks that have been demonstrated to improve general health and well-being to complete a real-life "quest." Drinking water, contacting an old acquaintance, going for a walk, and exercising "self-care" are examples of "Quests" and "Power-ups" (One Mind Guide, 2021). SuperBetter's "Allies" feature allows users to challenge others to join their quest, and users may tailor their quests, challenges, and "Bad Guys" to deal with a range of real-life problems, including mental health, general wellbeing, and social connection. Users may also obtain "PowerPacks," that are supposed to aid those with chronic pain, depression, and anxiety problems. Goal setting, gratitude tracking, and evaluating accomplishments are among the other features (One Mind Guide, 2021). A scientific research study of 283 adult SuperBetter users published in 2015 indicated that 10 minutes of application activity for six weeks reduced anxiety and depression levels compared to a control group (One Mind Guide, 2021). SuperBetter is only available in English and can be found on the Google Play Store and Apple App Store (One Mind Guide, 2021).

Some pros of SuperBetter include that it is free. It caters to a wide range of requirements and needs. SuperBetter's usage is supported by a controlled trial (One Mind Guide, 2021).

Some cons of SuperBetter include the minor setup is required to suit specific user requirements. Rather than focusing on instruction and education, SuperBetter focuses on action. People who do not have pre-existing social support will find the application less helpful (One Mind Guide, 2021).

- **Woebot:** Woebot is an application that employs an AI-powered chatbot called Woebot which utilizes Cognitive Behavioural Therapy concepts. Woebot assists people in coping with troubling feelings and thoughts. Users may communicate with Woebot through the application after registering an account. Woebot asks users to input their feelings and mood to describe their current mood, Woebot then answers by recommending resources, activities, and tactics to assist. Users may also examine a graph of their mood input over time in addition to messaging. Guided activities such as "challenge negativity" and "challenge stress" are also available to users. Users are asked to review the quality of their conversations with Woebot at the conclusion of each conversation. Woebot is not expected to help people deal in times of crisis or to be used in an emergency (One Mind Guide, 2021). According to a study, where Woebot was compared to a mental health eBook called “Depression in College Students”, the sample of participants in the Woebot group had a substantial reduction in depressive symptoms over the course of the study. Furthermore, participants also saw a significant reduction in anxiety (One Mind Guide, 2021). Woebot can be found for both iOS and Android but is only available in the English language (One Mind Guide, 2021).

Some pros of Woebot are that it includes skills and lesson that are based on research. In addition, the AI in Woebot has response that are both empathetic and validating. Emojis, videos, texts, and gifs are among the various kinds of responses that the AI offers. Woebot is both password-protected to keep your conversations with Woebot confidential and private and is also free to everyone (One Mind Guide, 2021).

Some cons of Woebot include that it has the inability to make significant corrections in reaction to free text. Furthermore, it is possible to get stuck in a feedback loop with regards to questions and answers.

2.11 Product Environment Research

React Native is a JavaScript framework that allows one to create real-time, natively rendered mobile apps for iOS and Android. (Eisenman, B., 2016). It's built on React, Facebook's JavaScript toolkit for creating user interfaces, although it's designed for mobile platforms rather than the web (Eisenman, B., 2016). Web developers can now create mobile apps that look and feel fully native, all while using a JavaScript framework they're already familiar with (Eisenman, B., 2016).

React native is quickly becoming utilized by organisations all around the globe to develop cross-platform phone applications with a single code base. React native can quickly and easily build an application that runs on both iPhones and Android phones without rewriting the application to its specific native language (ProTech, 2021). Additionally, unlike online applications that run through an adapter or translator, these applications run natively and may be distributed through the Apple AppStore or Google Play store. As a result, they are more efficient and dependable (ProTech, 2021).

React Native is an innovative framework that allows web developers to build strong mobile apps using their existing JavaScript skills (Eisenman, B., 2016). It allows for speedier mobile development and more efficient code sharing between Android and iOS without compromising the overall user experience or the quality of the of the application (Eisenman, B., 2016). The flaw with React native is that it is new and still underdevelopment. Overlooking this hurdle, will allow for the development of a mobile application that is native across multiple platforms (Eisenman, B., 2016).

3.0 Research Methodologies

When researching this Final Year Project, a number of different methodologies were utilised to gather user requirements and information on the topic.

3.1 Research Method 1

The first research method I used consisted of using Google Scholar. I learnt about this research method in third year when I was partaking in CS4187, Professional Issues in Computing. I chose this method as I was familiar with the process, and it would allow me to extract significant pieces of information, which could be used when writing my research paper. Furthermore, I chose this method as I had hands-on experience. This technique previously conveyed to me how powerful and useful this method was in extracting useful information.

Essentially, I would go to Google Scholar. I would then type in a paper heading that I am looking for, i.e., "What is generalised anxiety disorder". After the results would appear, I would filter the papers according to date. "Since 2017" is what I would normally choose so only recent relevant papers would appear. When the papers would be filtered out, I would then look at the number of citations the paper has. A general rule of thumb I followed when selecting papers was to choose papers that have over 10 citations. This would convey to me that these papers were found to be useful by others researching the same area.

Another rule of thumb I would use is I would pick three to four papers on the topic I researched. I would then read all the abstracts of said papers. Having read the abstracts, I would decide if the paper was relevant to my research topic. Normally, I would narrow down the three to four papers to around one to two papers. Finally, from these finalised papers I have chosen, I would pick four to five interesting, relevant points. These points would be used to base and write my research on.

3.2 Research Method 2

The second research method I used, consisted of using the Google Search Engine. Since a young age I have used Google to search for things. Having great experience of the search engine, I knew which keywords to use to find what I was looking for.

I would type a keyword such as “Coping mechanisms of stress” into the search bar. I would then select the top five links that were returned. Out of these five I would select the most important and significant data which related to my paper. I would select the three most interesting points from each website whether it is an information site or a blog. After selecting these points, I would then try and incorporate them into my paper. This second research method was not as effective and reliable as the first so I could not use as much information as I did from the first one.

4.0 Findings

4.1 Happify

Overview: On first glance of Happify, the application seems to be full of rich features to help maintain and manage your anxiety and stress. The application offers the user to get a happiness score by taking an assessment. After the assessment you get a happiness score but to unlock more statistics you are required to purchase a subscription. The home screen of the application shows the current track you are partaking in, and the progress made on it so far. Furthermore, it shows the users stats such as Savour, Thank, Aspire, Give, Empathize and Revive. Happify offers a good way to help reduce and manage anxiety and stress as it is a high-efficacy application having the four characteristics although some of the characteristics are only available to subscription users.

UI/UX: Happify has a simple user interace that is easily navigable. The colour scheme of the app is bright using white as the primary colour and orange as the secondary colour. The user can navigate through the application using the hamburger icon in the top left of application. This allows the user to navigate to different areas of the application such as Instant Play, Explore Tacks, Happify Daily, Community, and Profile. The user experience of the application is also good with smooth transitions between features of the application. One problem identified with the UX is that there is a slow response time to transitioning between features of the application and this is something to avoid when creating a product.

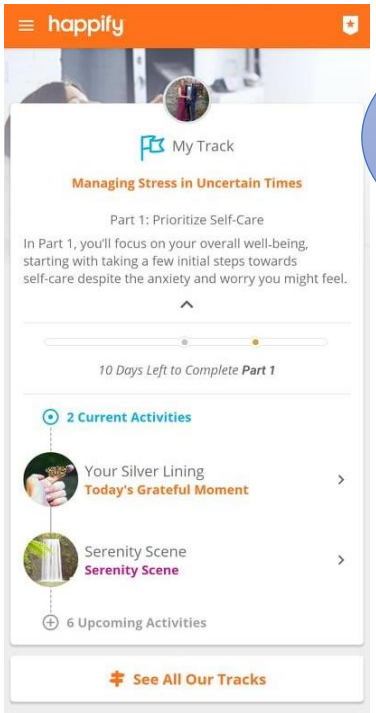


Figure 1: Application Home Screen

This is the home screen of the application. It gives me an idea when designing the product.

This is the affirmation screen of the application. A feature which I should include.

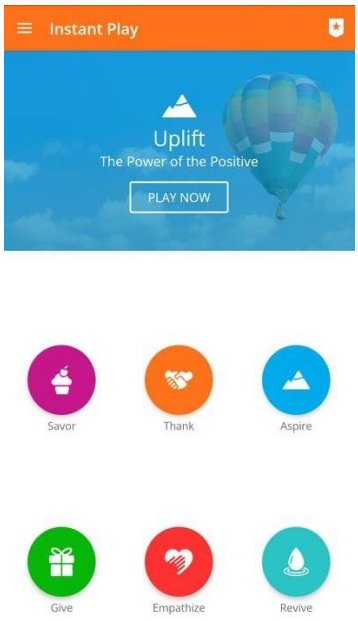


Figure 2: Affirmation Section

The audio track screen shows the audio files the user can access.

Something similar to this feature could be implemented in the product.

Figure 3: Audio Track Screen

Figure 4: Community Screen

Features: There are a number of features when it comes to Happify, unfortunately most are only available to subscribed users. The Instant Play section of the application allows the user to take notes down in the application as well as upload photos. Notes can be taken on something you plan to savour, something you are grateful for, something you are looking forward to, something you want to give to someone, and lastly, someone you empathize with. Each activity has its own benefits for the user, for instance, noting something you are grateful for helps reduce stress and boosts happiness. Furthermore, there are a number of games and meditation activities such as breathing exercises.

In addition, there is an Explore Tracks feature. These tracks are audio courses that talk about a number of topics in life such as relationships, family and kids, work, and money, and many more. These tracks are developed to help manage and reduce the user's stress. Most of the available tracks require a subscription model with only a handful being free.

Happify Daily consist of a number of articles that promote positivity and try improving mental wellbeing. Information can be found here such as "How Food and Family Meals Impact Our Happiness". There is also a community section where the user can post, interact with other posts, and also follow other people. Lastly, there is a profile section where the user can edit their profile and view a number of settings.

Notes: Some notes when using the Happify application. Firstly, the user is required to sign up or login using Facebook or other login services. When developing the product, this feature will not be required as access to the services should be free, quick, and easy and a sign up and login takes away from this. Furthermore, there is an assessment that has to be completed by the user. This is due to the application being tailored to a number of mental health disorders such as depression, anxiety, stress, and many more. This also will not be required in the product being developed as the product will only be tailored towards anxiety and stress. A feature I did not like in the application was the navigability. To navigate to different pages of the application the user would have to use a hamburger menu in the top left. A menu bar on the bottom of the screen with icons is much easier for navigability and ease of use of the application. Some features that were excellent were the note taking activities and this is something to include in the product.

Summary:

- A feature to include in the product is the daily affirmations section where a user can write something that they are grateful, looking forward to, or plan to accomplish, etc. Notetaking is a great way to help reduce stress and anxiety and must be included in the product.

4.2 Headspace

Overview: On opening the application, the user is able to pick what is on their mind such as sleeping better or staying focused. The mediations and features available on the application will differ depending on which one the user selects. The application is then loaded into the home screen whcih recommends videos to watch as well as mindfulness exercises to partake in. The user also can move to different areas of the application such as meditation, sleep, move, and focus using the navigation bar.

UI/UX: Headspace's user interface is very clean, crisp, and simple. The UI consists of dark blue colours which are found to help reduce stress in the user. The style of the UI is very animated, and cartoon like with the majority of the graphics being cartoon like which invites simplicity and is welcoming to the user. The UX of the application is also very good with the application being fast and easy to navigate through consisting of smooth transitions throughout the application. The user can navigate to different features of the application using the navigation bar at the bottom of the screen which also promotes usability which is an important non-functional requirement.

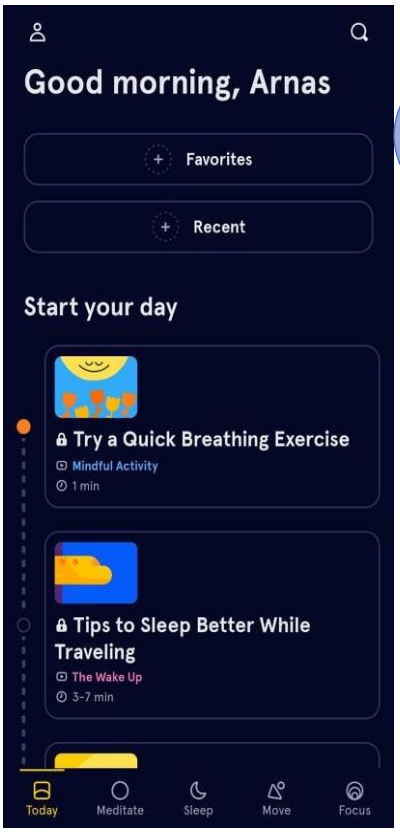


Figure 5: Application Home Screen

This is the home screen of the application. I especially like the good morning, Arnas text.

Here we see the meditation screen of the application. This gives me an idea for my application.

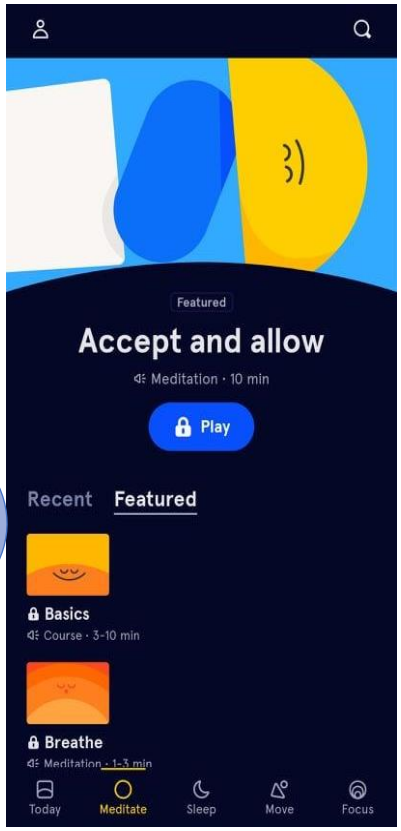


Figure 6: Meditation Screen

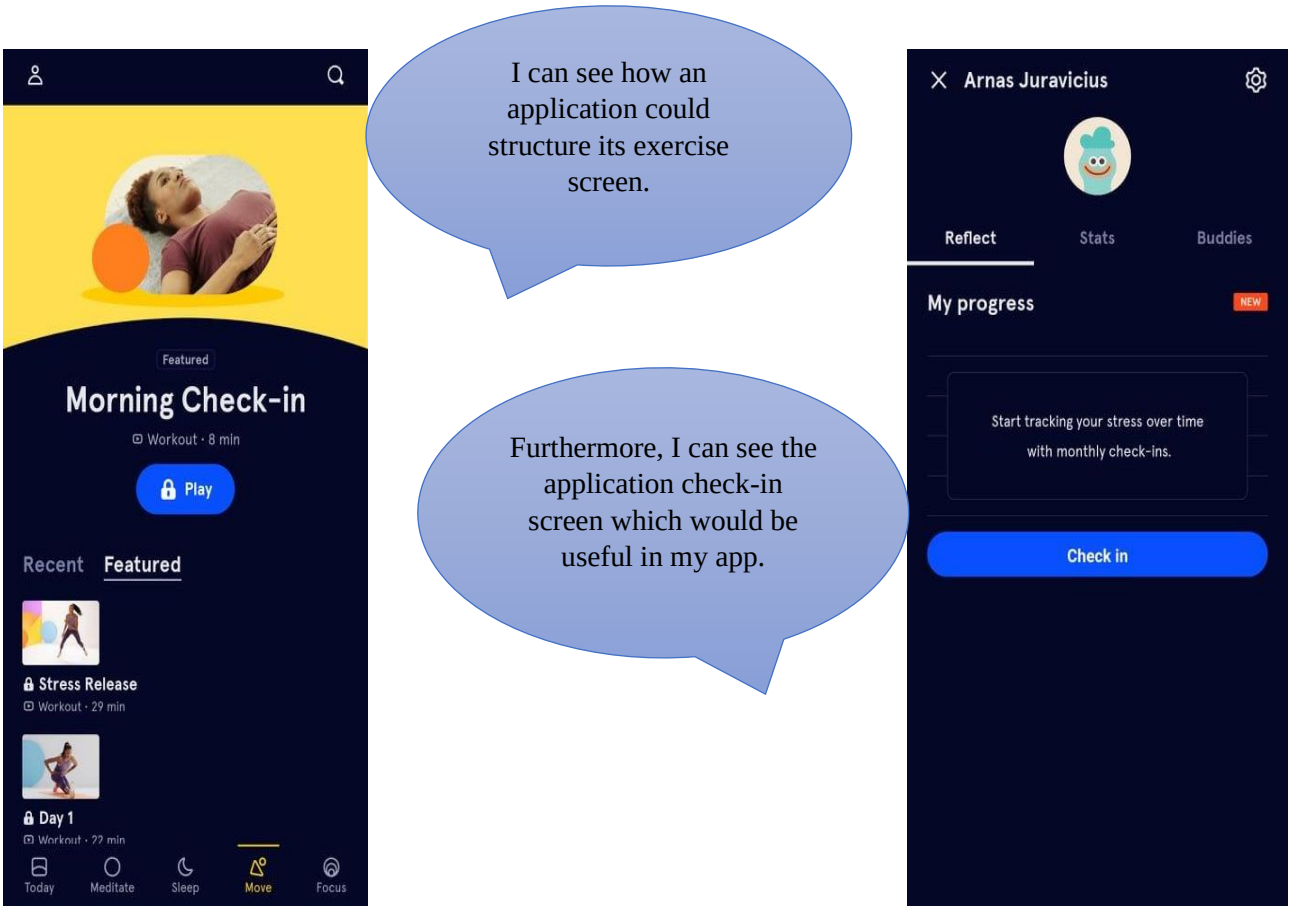


Figure 7: Exercise Screen

Figure 8: Check-In Screen

Features: When it comes to features, Headspace lacks in the number of features compared to Happify, yet the features of Headspace are rich in quality. Although, like Happify, Headspace requires the user to have a subscription to access many of the features. The meditation section of the application features activities from breathing exercises to help the user relax to courses and audio tapes which are narrated for mindfulness exercises which also help in relaxation. These exercises are excellent in design, for instance, a breathing exercise uses animations and cartoons which are easy to follow and maintain the user's attention. Another feature of the application is the sleep section. This allows the user to listen to audio tapes which may help a user relax before bed and aid in sleeping. The focus section of the application is also like the sleep section aiding the user in focusing. A great feature of the application is the move section which has videos and guides to follow for all sorts of exercising. Ranging from stress releases exercises, to yoga, to dancing exercises, that the user can follow along to.

Lastly, another feature of the application, which is one of the four key features when developing a high-efficacy application is self-monitoring. The user can track their stress by checking in monthly, this consists of performing an assessment of ten questions with the option of writing

notes reflecting on the past month. Submitting an assessment form returns a user with their stress score. Furthermore, the user can track their stress score over previous month using a bar chart to display the score.

Notes: When developing a product, Headspace has a number of qualities which would be good to include in the product. To begin with, the breathing exercises that are animated for the user to follow are a great addition. Breathing exercises are a great reducer of stress and the animated style will help to engage the user more efficiently. The navigation bar at the bottom of the screen was also a great quality of the application. Comparing the hamburger menu in Happify to the navigation bar at the bottom of the screen in Headspace, Headspace allows for easier, simpler, and cleaner navigation of the application adding to the user experience of the application. Furthermore, the self-monitoring feature was also excellent. This allowed the user to monitor their stress on a monthly basis. This is a key feature which should be included in a product as self-monitoring is a key characteristic of high-efficacy applications when it comes to reducing stress and anxiety. Lastly, the exercise section should also be included in a product. Exercises and yoga are one of the key reducers of stress and anxiety and an application around reducing stress and anxiety should include some form of exercise feature.

Summary:

- The first feature that must be included in a product from this application is the animated breathing exercises for the user to follow. This is found to be one of the many things to help lower anxiety and stress in a user.
- When developing the product, it should have easy and simple navigability as seen in this application using a bottom navigation bar. This helps promote a good user experience and ease of use.
- The self-monitoring feature should also be included in the product. Checking in a user's levels of stress and anxiety is a key characteristic of high-efficacy mental health applications.
- The ability to view exercise and yoga videos is also a must have feature in the application. Yoga and exercise are found to greatly reduce stress and anxiety.

4.3 Calm

Overview: Looking at the application for the first time Calm has a clean and crisp user interface. Once opening the application, the user can choose in which area they would like to improve in whether its reducing stress or sleeping better. The home screen consists of a beautiful nature scene with moving water and the noise of the waves and birds chirping. The user can navigate through the application using the navigation bar at the bottom of the screen. Without having a subscription, all of the features are locked for the user.

UI/UX: Calm has smooth transitions with an attractable user interface. The user interface colour scheme consists of blue colours having the background colour as light blue, this helps reduce stress. The scenic background image also promotes stress and anxiety reduction. The user interface is easy to navigate through with a navigation bar at the bottom of the screen. The navigation bar can be used to go to all key areas of the application. The user experience of the application is quite pleasant. The scenic animated background and easy to use application helps promote positivity when using the application.

Figure 9: Home Screen

I like the use of a bottom tab navigation for the application.

I like here how you can see the stats of the user.

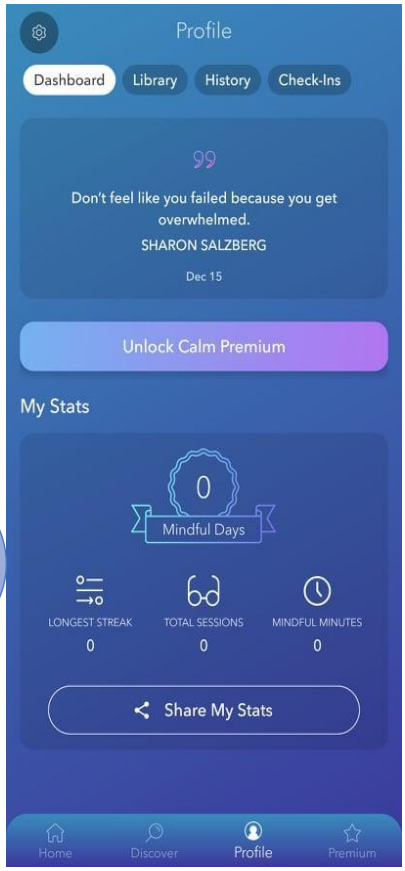


Figure 10: Profile Screen

Features: Calm is full of rich and involving features. The first feature where Calm really excels is the ability to change the background image to the user's preference. The user can change the image to a vast variety of settings from a sunny beach with large waves to a snowy forest. Changing the background image also changes the sound of the scene from the sound of waves to rain falling on leaves. This is an excellent feature that promotes relaxation in the user. As seen in other applications, Calm offers a wide range of audio tapes to listen too. There is a tape for almost everything when it comes to reducing stress. Audio tapes also may consist of strong, influential people such as Lebron James which may inspire people. Another feature in Calm is the statistics of meditation. The statistics show the consecutive days of meditation, the total number of meditation sessions and total amount of minutes meditating. This may help the user to stay engaged and committed in the application. The user is also able to share their stats which may help promote a fun competitiveness among their peers. Calm also offers great self-monitoring capabilities. There is a mood check-in which is done once a day where the user can input how they are feeling based on an emoji. The user can also do a gratitude check-in, where the user can partake in daily affirmations. This allows the user to note things that they are grateful for on that day. Furthermore, the is a daily calm reflection section. This allows the user to reflect on themselves daily. Lastly, there is a sleep check-in feature. The user can rate their sleep using emojis from 1-5, input the amount of time that they slept as well as what they have done before such as bed such as mediation. The sleep check-ins are then graphed daily using a bar chart which allows easy tracking of sleep patterns for the user. Steady, good sleep is a key reducer in stress and anxiety, so this feature is extremely useful.

Notes: Calm has numerous features and design ideas that one must be aware of when developing a product of the same nature. To begin with, the use of a scenic nature background in the application promotes engagement of the application. The self-monitoring capabilities in Calm are also excellent. From monitoring mood to monitoring sleep as well as daily affirmations, Calm provides excellent capabilities in this area which is a key characteristic of a high-efficacy application. This should be noted when developing a product of the same liking.

Summary:

- Scenic background images are a great reliever of stress and anxiety and should be included somewhere in the product.

4.4 MoodMission

Overview: MoodMission has changed from being a free application to costing €4.99, this prevented for an investigation and walk through of the application. Instead, a preview YouTube video of MoodMission was used instead (MoodMission, 2021). On viewing MoodMission for the first time I noticed there was very bright and vibrant colours which may help engage the user and promote positivity. Opening the application gives a quick guide through application and the benefits of using it. The user is asked to complete a number of surveys which is used for research and help to tailor the application to the user's needs.

UI/UX: The applications user interface and user experience are quite good. The background of the application has a scenic background image of nature with numerous bright and vibrant colours. With lots of vibrant and bright colours, the text may sometimes be hard to read as it may blend in with the colours. The user experience of this application is not as good as other applications reviewed above. To begin with, there is no navigation throughout the application whether it is a hamburger menu as seen in Happify or a navigation bar at the bottom of the screen as seen in Headspace. The user must use the back button to navigate back through the application rather than tapping on an icon, greatly worsening the user experience. Also, the use of many vibrant colours may also be hard to view for a long period of time.

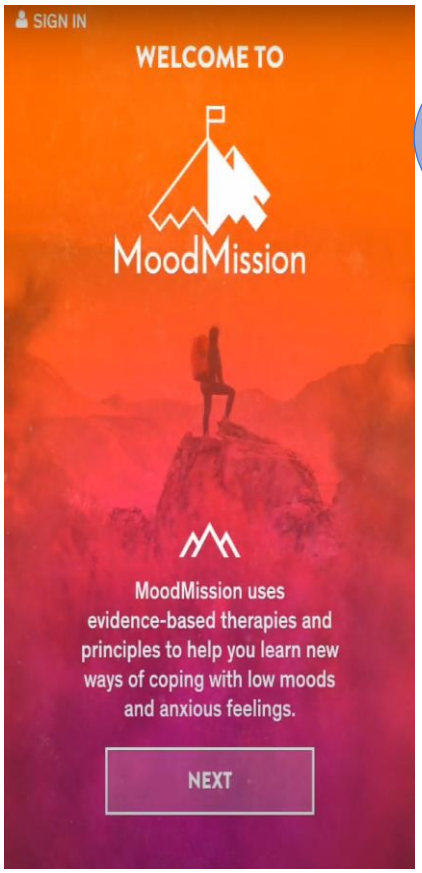


Figure 11: Welcome Screen

The use of a welcome screen is a good feature.

Here we can see the use of missions to carry out activities for the user.

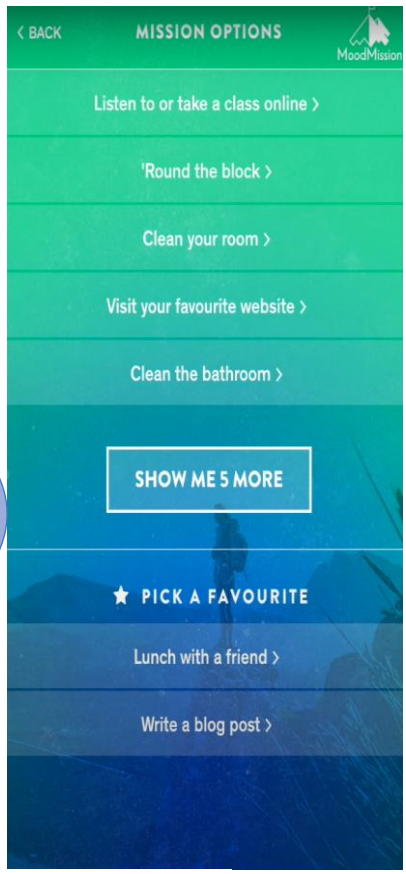


Figure 12: Mission Screen

Figure 13: Benefits Screen

The use of a benefits screen for the activities is a great feature.

A helpline screen is a must include feature.

Figure 14: Helpline Screen

Features: On the home screen the user is asked to describe how they are feeling with the options depressed, anxious or neither. Then the user is prompted to rate their feelings out 0-10 and answer a final question about how they are feeling. The application then generates 5 tasks for the user to do to help reduce stress, anxiety, or depression. After completion of the task, the user is required to rate the task and if they deemed it useful. Completing tasks earns the user rewards and achievements. The achievements page allows the user to view their achievements and view achievements they may want to unlock. This helps promote commitment and usage of the application. MoodMission allows the user to view their mission logs which show statistics such as the completed tasks they have partaken in. The final feature of the application is the "Find Help Now" feature. The user can find help such as helplines and emergency services numbers.

Notes: MoodMission offers several ideas when developing a product of the same kind. The use of tasks which explain how to carry out the task and information on how the task will help the user reduce their stress or anxiety is a great feature and should be noted. The use of a helpline also is a great feature and can promote quick and easy access to help.

Summary:

- Displaying information on how a feature in the application will help the user reduce their anxiety and stress should be included in a product. This promotes usability of the application.
- The availability of helplines in an emergency situation is a must need feature in the product.

4.5 SuperBetter

Overview: SuperBetter's first glance revealed to me that it has a simple user interface. On opening the application for the first time, the user is given an overview of the application using a slide show explaining the different concepts of the application. After being navigated to the home screen after signing up, I can see that the application's user interface is continuing the theme of simplicity and plain colours. The application also does not have any rich features. The main aim of the application is for the user to carry out real life activities and get rewarded for completing them in the application. Although the application does not consist of rich features, the main concept of the application is great as lifestyle modifications such as exercises and socialising are found to be excellent in helping to reduce stress and anxiety.

UI/UX: The user interface of the application is very simple. It consists of plain grey and white colours, with minor usage of other colours. The navigability of the application is also not great with the application being hard to navigate using a hamburger menu that is not fully on the screen. The different aspects of the application are also confusing. The user experience of the application is also not as good as the other applications reviewed. I got a server error for a couple of minutes when using the application so it could not fetch any data making the app useless. There are also slow loading times when navigating to different pages of the app.

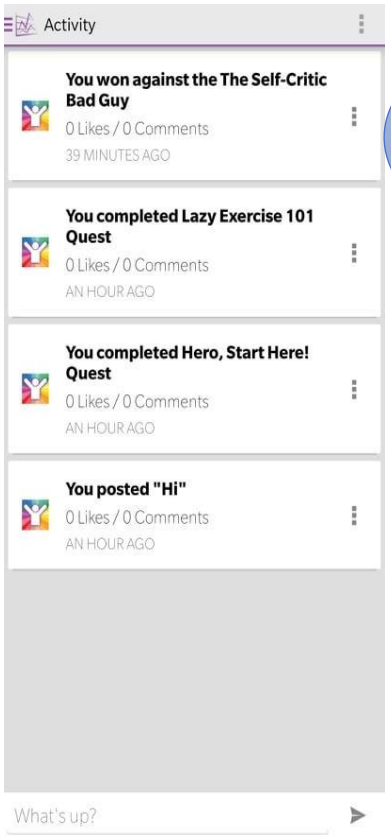


Figure 15: Activity Screen

An activity screen may be useful to add as a feature.

Here we can see the use of a side navigation bar rather than a bottom tab.

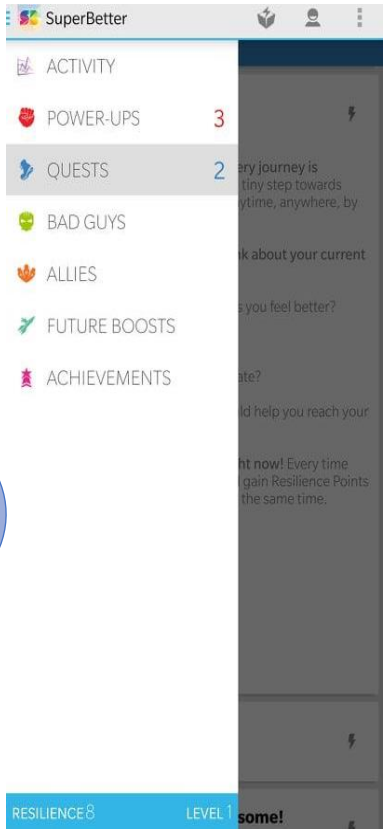
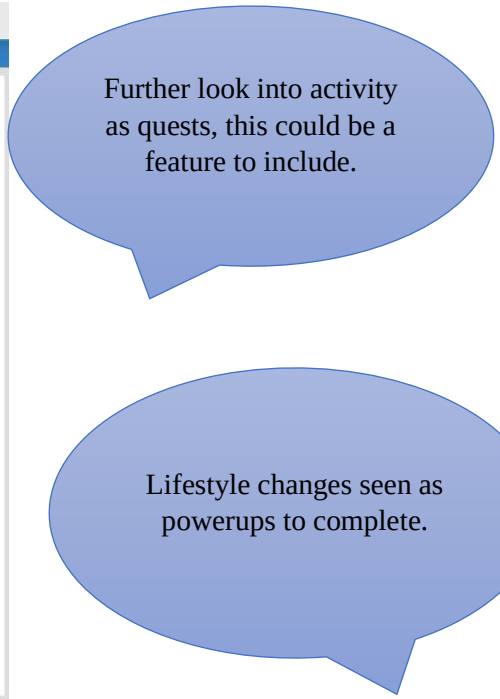


Figure 16: Navigation Screen



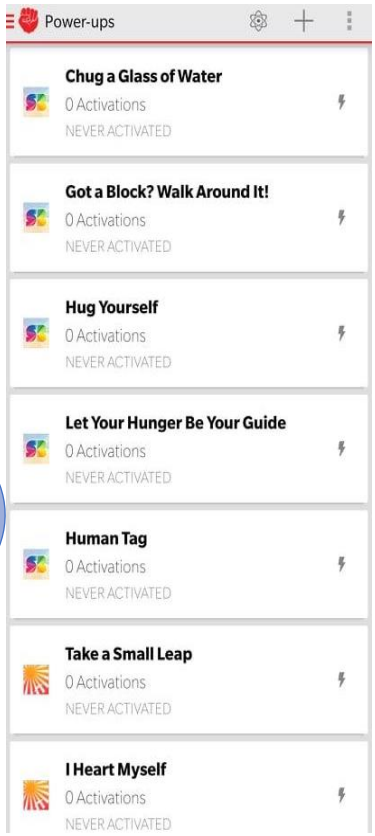


Figure 17: Quest Screen

Figure 18: Powerups Screen

Features: SuperBetter does not have complex and rich features compared to other applications reviewed. When launching the application, the user is brought to an activity page. Here the user's posts are shown which has likes and comments. Although the application has a social aspect, I could not find anywhere to add new friends or to discover other people. SuperBetter is focused on lifestyle modifications in terms of quests and power ups to help a user manage their stress and anxiety. SuperBetter is sold as a gamified application, yet there was little to no gamified features. All a quest involved was to carry out the real-life task and then tick a box that you were done, and the quest would be then completed. Powerups also were very similar to the quests. There was an allies section but there was no way to add friends in the application. SuperBetter also had an achievements section, but this section was blank with it saying "No Content" in the middle of the screen. This is a flaw as the user needs to know what achievements they can unlock first before using the application. The user could get powerpacks that added more quests and powerups to the application. It is evident that while SuperBetter's idea is great and unique, the execution of the application is not quite right.

Notes: There is not much to take note of when developing a product with regards to this application. Although, the concept of lifestyle modifications for the user to carry out in the

real-time is excellent and should be used. It is found the lifestyle modifications can help manage anxiety and stress and should be included in a product**.**

Summary:

- The display of some lifestyle changes or modifications and alerting the user on how these changes will reduce their stress and anxiety also must be included in the application.

4.6 Woebot

Overview: On opening the application and after creating an account, the user is introduced to Woebot. Woebot is an AI that helps the user deal with and manage their stress and anxiety. The home screen of the application is the conversations with Woebot which is the main principle of the app, like a social media messaging service. The conversation with Woebot seemed to flow nicely and seamless, it was as if you were talking to a real person. The idea for this application is great as it offers free CBT which is one of the key treatments for anxiety. The user can select a list of topics to talk to Woebot about such as coping with the Corona Virus pandemic or relationships to name a few. The user can also track their mood and also take part in daily affirmations.

UI/UX: The user interface of the application is quiet simple using dark and contrasting colours. The application did not use calming colours like blue which is found to reduce stress and anxiety. The plain colours made the application simple and easy to use. The user experience of the application is very clean and crisp. The application consists of smooth transitions to different features of the application. Furthermore, with the app being quiet lightweight in its features, it was easy to navigate around using the navigation bar at the top of the application.

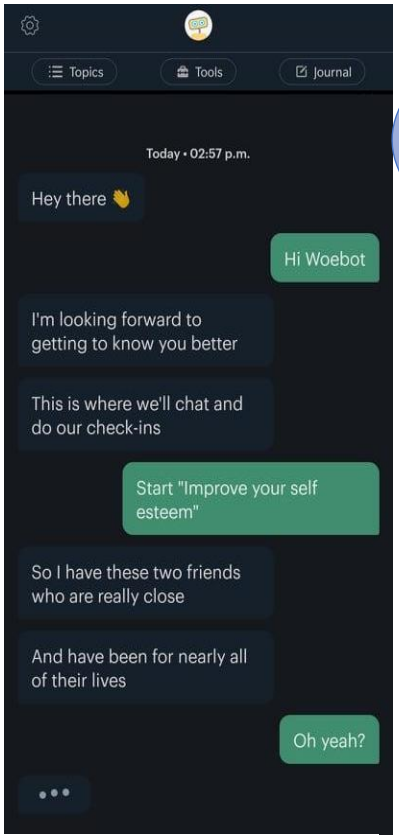


Figure 19: Bot Screen

The use of a machine learning bot to talk to the user.

The use of a check in feature.

Figure 20: Reflections Screen

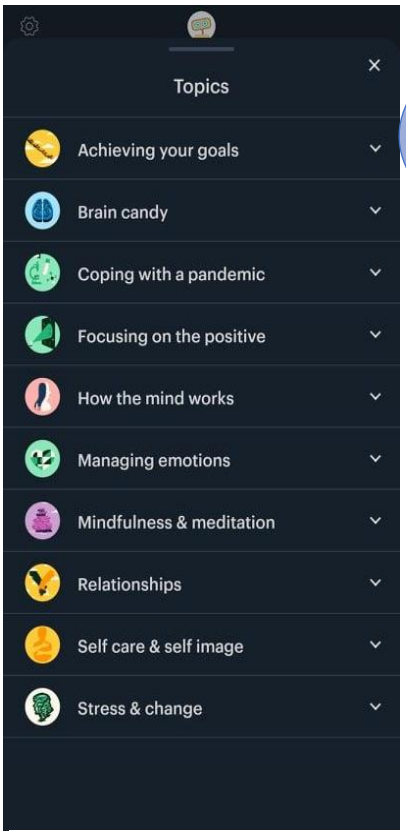


Figure 21: Topics Screen

An interesting way to navigate through the application.

The use of a graph to plot your moods is a great feature.

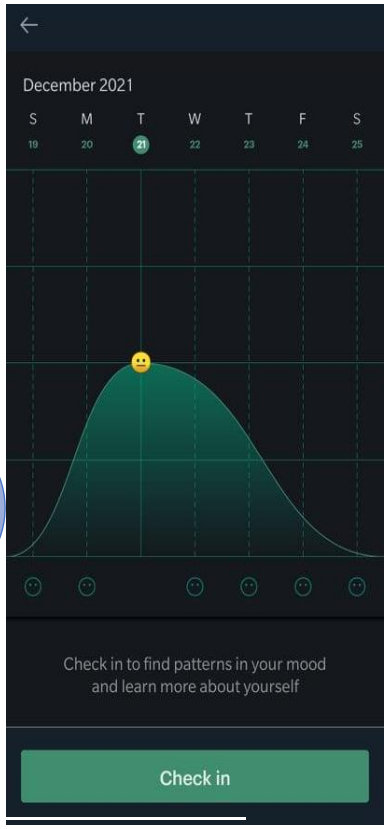


Figure 22: Check in Screen

Features: The main feature of the application is an AI called Woebot. Woebot can talk to the user about anything by selecting a topic from the topics section. Topics include things like achieving your goals, managing emotions, self-care, and self-image and such. Woebot may ask for user input on the given topic, and this will change the way Woebot will talk to the user given their input. A user can directly message Woebot about something that is on their mind and Woebot can talk back about this topic. Woebot is not meant for emergencies or crisis periods, Woebot can recommend actions to take by typing "SOS" in the chat with Woebot. In addition, Woebot has a mood tracker and a gratitude journal. The mood tracker shows a graph of recent days and the users' moods. A user can check their mood in by talking to Woebot and giving their mood and emoji. The user can also add a journal entry to their gratitude journal by telling Woebot what they are grateful for.

Notes: Woebot is an excellent application which I would love to incorporate into my product. I deem this not to be possible due to time constraints and the huge knowledge required in creating an AI. The two features that I liked other than Woebot was the gratitude journal used

for daily affirmations and also the mood tracker. The graph for the mood tracker as seen in other reviewed applications is a must to include in a product.

Summary:

- The ability to scroll through recent daily affirmations like a journal must be included in the product.
- When it comes to self-monitoring, a graph to display the results of previous days will show how a user is doing with regards to their stress and anxiety. This feature must be included in a product.

5.0 Product Design

Upon conducting both primary and secondary research, I have decided to develop a mental wellbeing application as there was an obvious lack of free resources available. This application will have a number of features which will help in reducing stress and anxiety. The purpose of the application is to help users lower their stress and anxiety levels. The application will be developed using React Native to broaden the accessibility of the application.

5.1 Features of the Product

The application features were gathered from both primary and secondary research. Primary research was done by downloading likeminded applications and making notes on each one such as features to include. Secondary research was done by reading about applications and their pros and cons. It was mostly their cons which were used for non-functional requirements in the application. A list of features which were found can be seen below.

- A feature to include in the product is the daily affirmations section where a user can write something that they are grateful, looking forward to, or plan to accomplish, etc. Notetaking is a great way to help reduce stress and anxiety and must be included in the product.
- Another feature that must be included in a product from this application is the animated breathing exercises for the user to follow. This is found to be one of the many things to help lower anxiety and stress in a user.
- When developing the product, it should have easy and simple navigability as seen in this application using a bottom navigation bar. This helps promote a good user experience and ease of use.
- The self-monitoring feature should also be included in the product. Checking in a user's levels of stress and anxiety is a key characteristic of high-efficacy mental health applications.
- The ability to view exercise and yoga videos is also a must have feature in the application. Yoga and exercise are found to greatly reduce stress and anxiety.
- Scenic background images are a great reliever of stress and anxiety and should be included somewhere in the product.

- Displaying information on how a feature in the application will help the user reduce their anxiety and stress, should be included in a product. This promotes usability of the application.
- The availability of helplines in an emergency situation is a must need feature in the product.
- The display of some lifestyle changes or modifications and alerting the user on how these changes will reduce their stress and anxiety also must be included in the application.
- The ability to scroll through recent daily affirmations like a journal must be included in the product.
- When it comes to self-monitoring, a graph to display the results of previous days will show how a user is doing with regards to their stress and anxiety. This feature must be included in a product.

5.2 Non-Functional Requirements

When designing the product, I should take on board some important non-functional requirements of the system.

- Capacity – When designing the product, I must take on board how the system will scale in the future with the increasing need for volume and what my system storage requirements are. The product should only save small files to storage such as daily affirmations which could be also extended to a database easily.

- Compatibility – The product should be supported for most phones whether it is Android or iOS. React Native will allow me to develop an application that is supported for both.

- Reliability and Availability – The application should be developed in a way that there is minimum to no errors that can decrease the reliability and availability of the application. Having error checking code and tests will increase the reliability and availability. Designing the product to not be internet based will allow the user to use the application no matter where they are, greatly increasing the availability of the application. The application should also be free to everyone, this will again increase the availability of the application.

- Usability – The usability should be great for the user; this involves a good user interface and a good user experience. An easy-to-use navigation is a key feature that must be incorporated into the application. This can be done using a bottom tab navigator. Furthermore, a nice colour scheme and a nice-looking application will add to the user experience.

- Scalability – The application should be easy to scale. Most of the code should be developed in a way to allow scalability and extensibility. Adding new features and scaling to a wider audience should be made easy.

5.3 Designing the Product

To design the product, the first thing I done was to google "mental health application designs". This allowed me to get inspiration when designing the application. Using this information and the information of the researched applications I was able to come up with a design using "Uizard". "Uizard" is a website where a user is able to design numerous aspects of an application including colours, the user interface and how a user will navigate through the application. Designing the application before starting the development phase allowed me to promptly progress through development as developing as you design is a difficult task. Having a set, clear plan, made the development of the application much easier.

5.4 Why Colour Schemes are Important

The main laws and criteria that govern colour and its usage in generating aesthetically pleasing visuals that are based on colour theory. Using attractive visuals and colour palettes strategically implies creating a specific feeling, attitude, or style (Cartwright, B, 2021). Colour is a crucial, if not the most essential feature of design since it may affect the meaning of text, how people navigate across a layout, and how they feel while doing so. You may be more purposeful in generating graphics that have an impression if you understand colour theory (Cartwright, B, 2021). Any design project's success hinges on the effective use of colour (Programming Design Systems, 2021). Choosing the correct colours is like a form of art that is both subjective and objective (Programming Design Systems, 2021). For example, using yellow text on a white backdrop is objectively a terrible choice since the absence of contrast makes the text difficult to see (Programming Design Systems, 2021). Similarly, since around 8% of males worldwide

suffer from red-green colour-blindness, red and green should not be used as primary colours in a data display (Programming Design Systems, 2021).

5.5 Choosing the Correct Colour

According to a study, both blue and pink hues are recognized to have calming properties, the extent to which they help reduce stress differs greatly (Lubos, L, 2008). People automatically equate red with the notion of rage across societies. Given that many people turn red in the face due to increased blood flow when they're furious, this association seems logical (Cherry, K, 2020). Blue has a more relaxing impact than pink since pink is a blend of red and white (Lubos, L, 2008). People cannot be hostile even if they want to be when they are in pink surroundings, according to an experiment, since the hue saps their vitality. Within minutes of exposure, pink has been discovered to have a relaxing and tranquilizing impact. It reduces aggressive, angry, and anxious behaviour (Lubos, L, 2008). Blue evokes calmness and confidence, depending on the tone. Lighter tones evoke feelings of peace, while darker tones evoke feelings of confidence (Cartwright, B, 2021). Blue has a relaxing impact and induces emotions of calmness and well-being. The exposure to blue reduced sympathetic nervous system activity, making the individual calmer and more relaxed (Lubos, L, 2008) Stressed and agitated people, were aided to relax by being exposed to colours like blue and pink. On living organisms, some colour combinations have either destructive or generative effects. These colours were shown to have a generative influence on the individuals according to this study (Lubos, L, 2008). It is clear that colours like blue and purple should be used in the development of a product as colours such as these aid in stress reduction levels in the user.

5.6 How to Choose a Colour Scheme

The first step when choosing a colour scheme for an application is to set a mood for the colour scheme. With colours in mind, decide the mood the colour scheme should be (Cartwright, B, 2021). Trending towards lighter greens and blues will help generate a sense of tranquillity or serenity in the application (Cartwright, B, 2021). Following this, considering the colour context would be next. Thinking about how colours are viewed when they are in contrast to each other helps create a more usable application (Cartwright, B, 2021). After this, referring back to the colour wheel, to discover what sticks out, trying a few different colour combinations utilizing a scheme such as monochromatic (Cartwright, B, 2021). Monochromatic colour schemes

employ a single hue in a variety of tones and tints to create a uniform appearance and feel. Despite the absence of colour contrast, it frequently seems to be clean and polished (Cartwright, B, 2021). Chosen colour schemes may appear appealing in principle, but do not fit with the applications design. Trial and error will help you select a colour palette that showcases your content while also improving the user experience (Cartwright, B, 2021). The last step when choosing the colour scheme would be to use the 60-30-10 rule. This idea of the rule is to use three colours. 60% of the colour is a main colour used in the design, 30% for a secondary colour of the design and 10% as an accent colour (Cartwright, B, 2021). Repetition of the above steps will help create a vibrant colour scheme for the application that provides a clean, polished and an appealing user interface.

The chosen colour scheme for the development of the product will be a blue colour scheme. Blue is the clear winner as blue helps to reduce stress and this application will be tailored to this.

5.7 Version Control and Integrated Development Environment

When developing the product, I will use GitHub for version control of the code base. This consists of committing and pushing my code to an online repo. GitHub tracks changes in my code across different versions and commits of the code. It also provides an online backup of my code if something were to happen to the code base on my personal computer. Another great feature of GitHub is, it allows me to rollback to previous commits, this allows me to experiment with different aspects of the product knowing my code is backed up online. Another plus of GitHub is that I am very familiar with it. I have used it all throughout college and my work placement and it is an excellent tool to know and have when developing a product.

Furthermore, the integrated development environment (IDE) I will be using for the development of the project is Visual Studio Code (VSC). VSC is the IDE I have been using since I have learnt to program. The familiarity of the IDE will allow me to greatly increase my code development speed thus presenting a finished product earlier.

5.8 Framework and Languages

The framework I have chosen to develop the product is React Native. React Native is JavaScript open-source framework that is used for the development of applications for cross-platform devices such as Android, iOS, and web. React Native is built on React which is a JavaScript front-end library. React user interface components are used to develop user interfaces in React Native. Furthermore, I will be using Expo. Expo is a platform for React applications. It's a collection of services and tools based on React Native that enable you to create, build, launch, and iterate rapidly on iOS, Android, and web apps. Expo also provides a platform for testing the React Native applications on your phone.

My choice for React Native was that it allows you develop cross-platform which is a major component of my product. Also, I have never used or have any experience with React Native, so it was very interesting for me to use and develop my own application. After developing this product, I feel that I have learnt a lot and would be very confident in developing other applications.

5.9 Development

When developing the product I used an Android Emulator, this is a virtual android device that is setup on a computer. I used the emulator for testing and running the application during the development phase as you are able to use an emulator the same as a normal phone. As well, I used my personal phone which is an Android to also test and run the application and I got hold of an old iPhone to test and run the application on iOS. The application ran smoothly on both operating systems throughout the development process.

5.10 User Interface Design

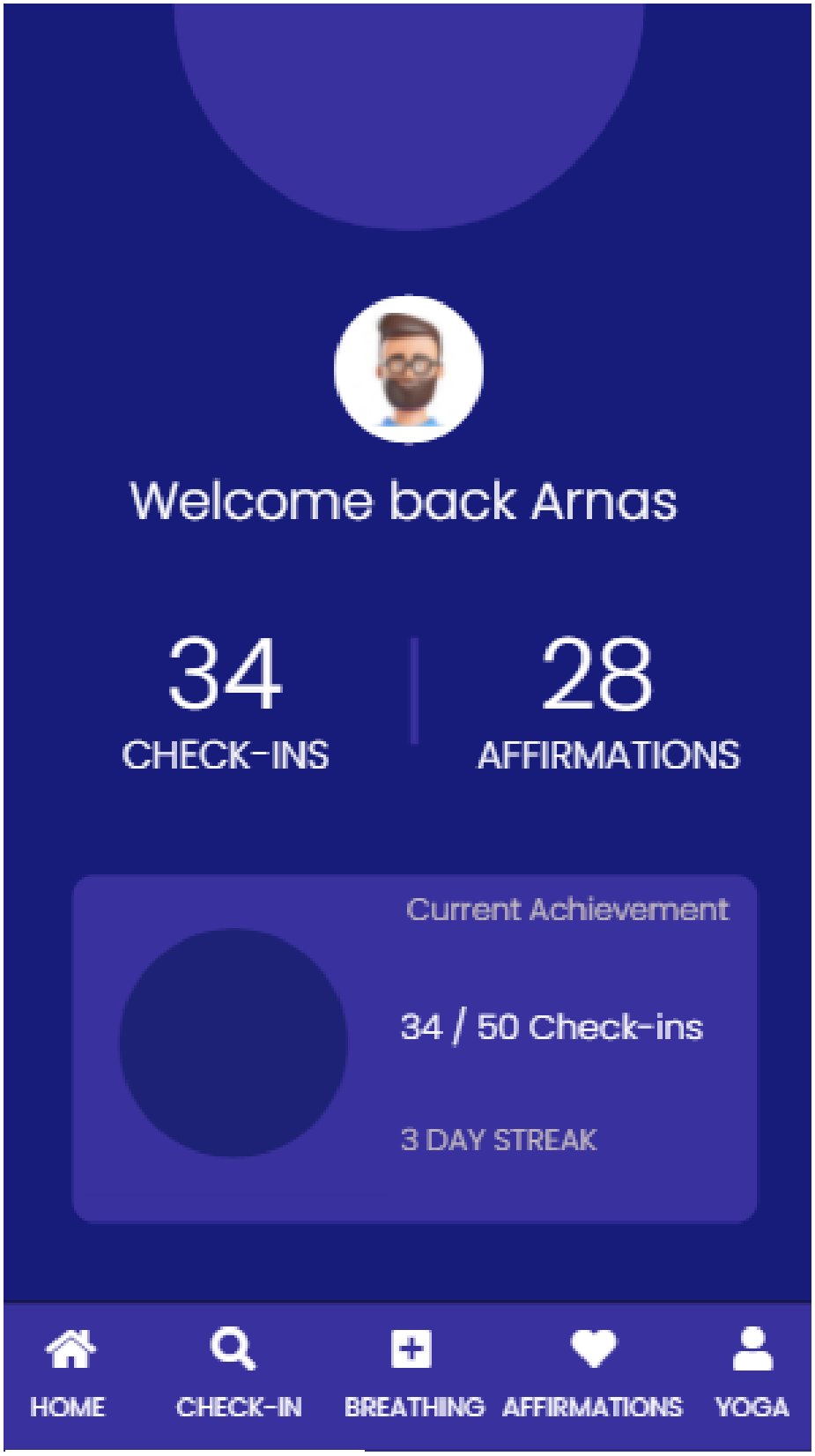


Figure 23: Home Screen

Figure 24: Welcome Screen

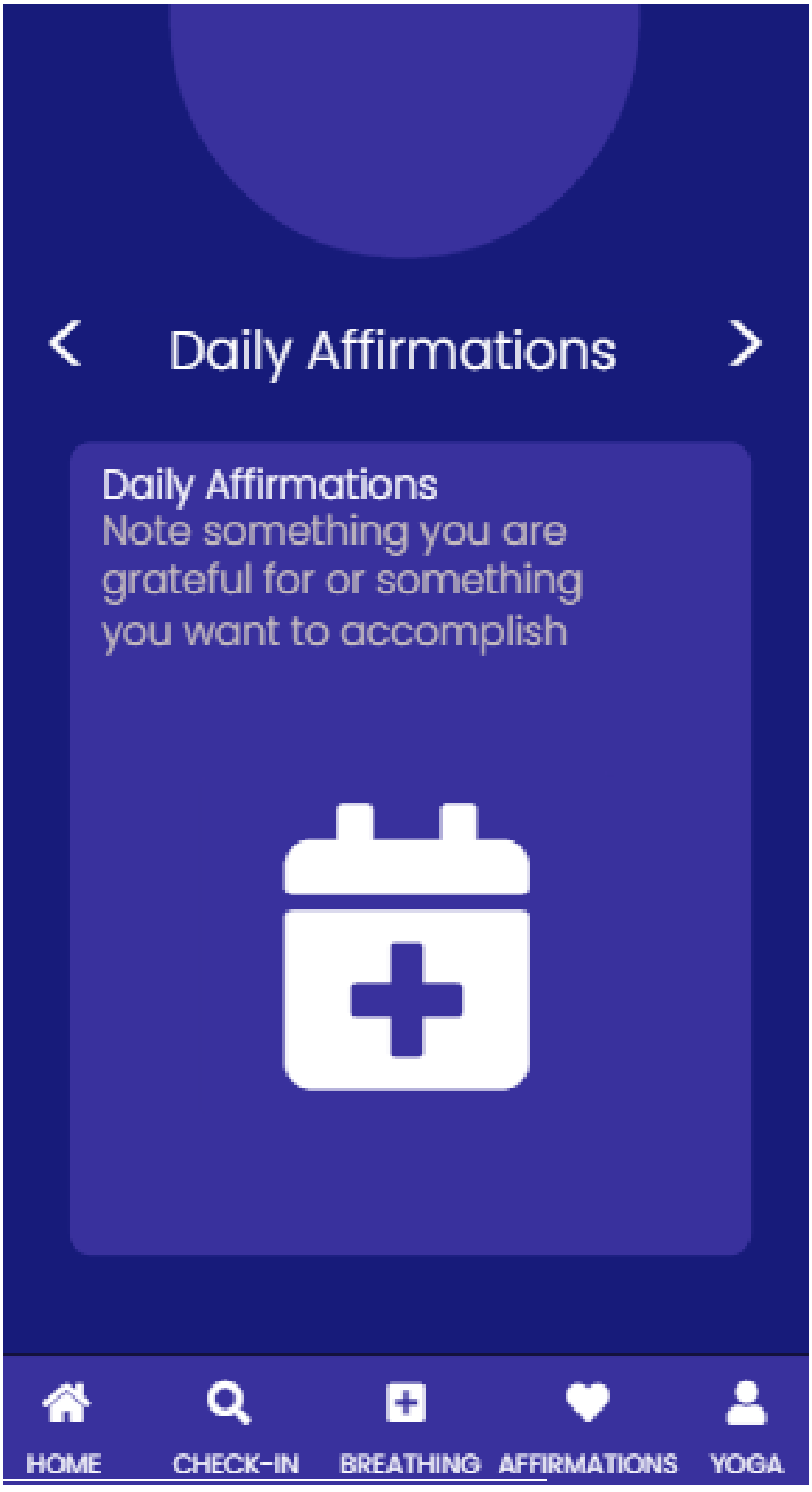


Figure 25: Affirmations Screen

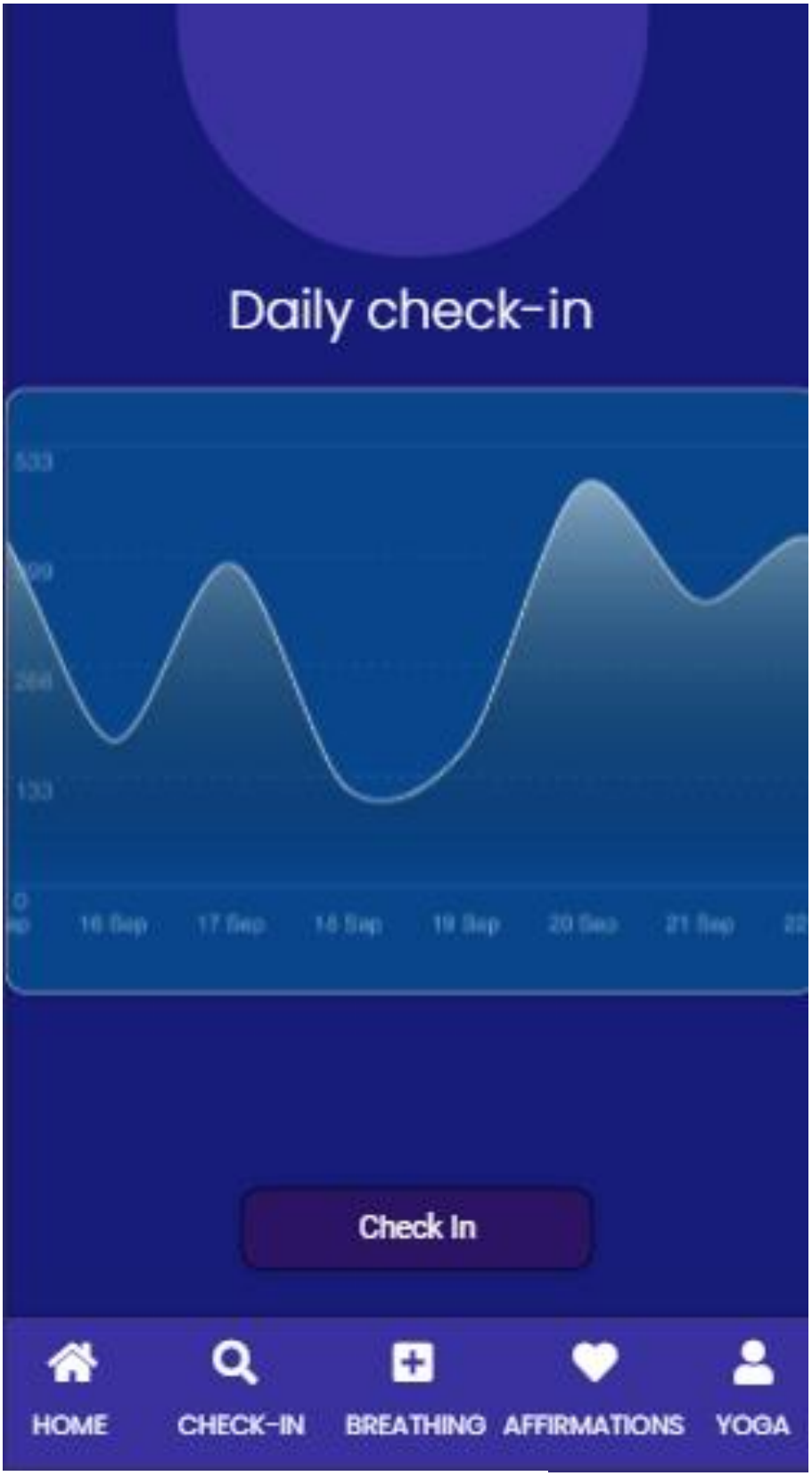


Figure 26: Check-In Graph Screen

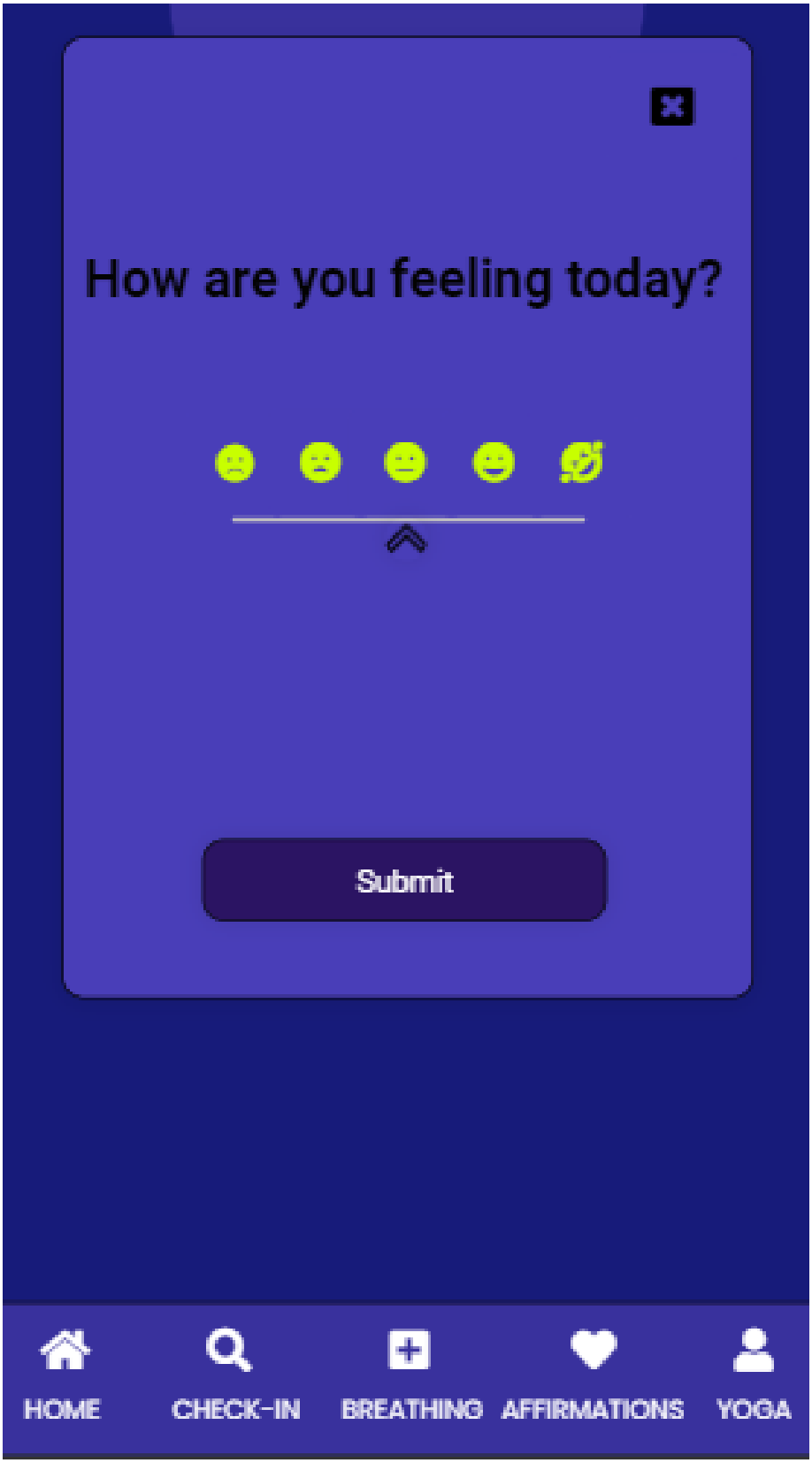


Figure 27: Check-In Screen

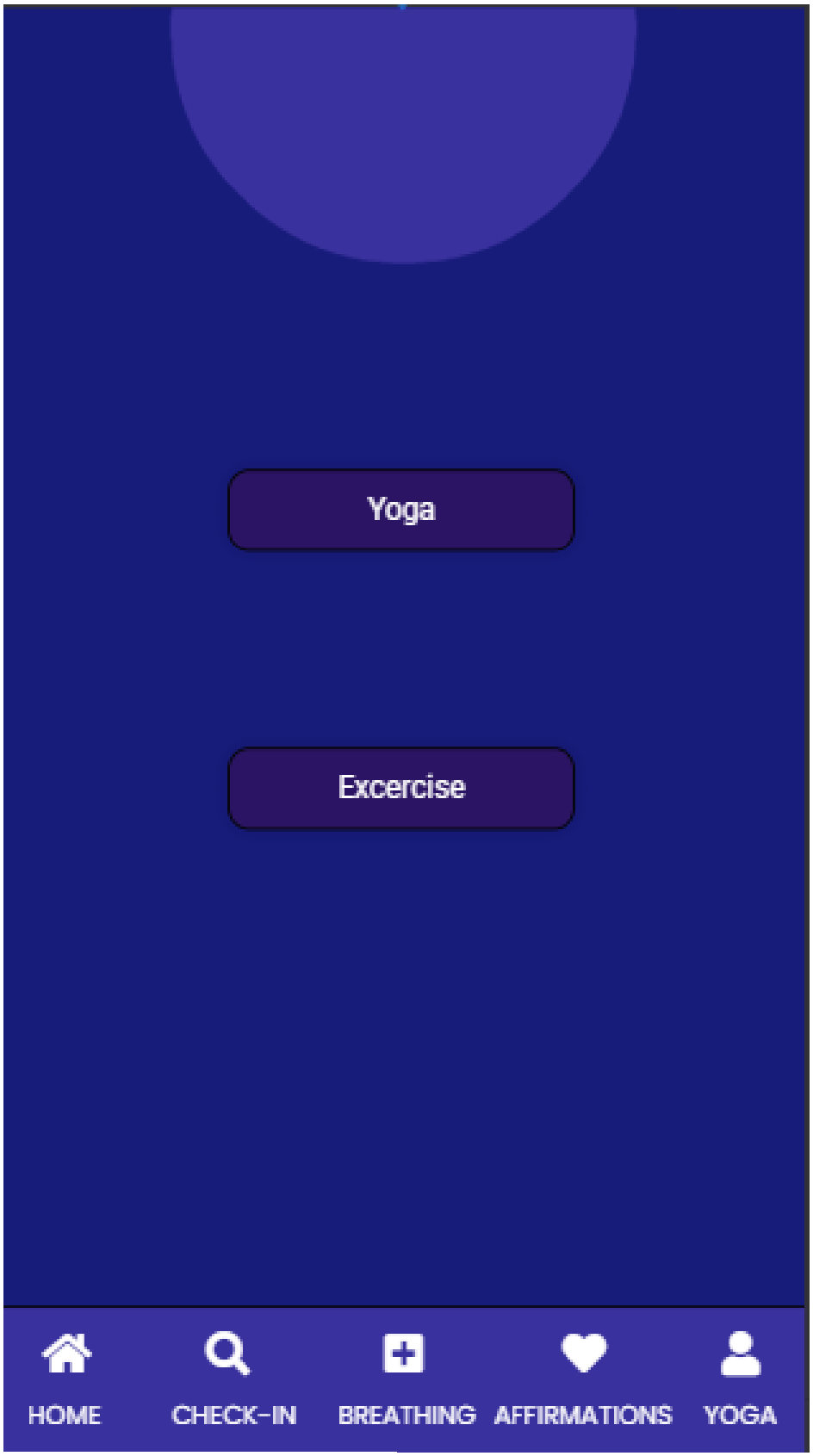


Figure 28: Yoga Screen

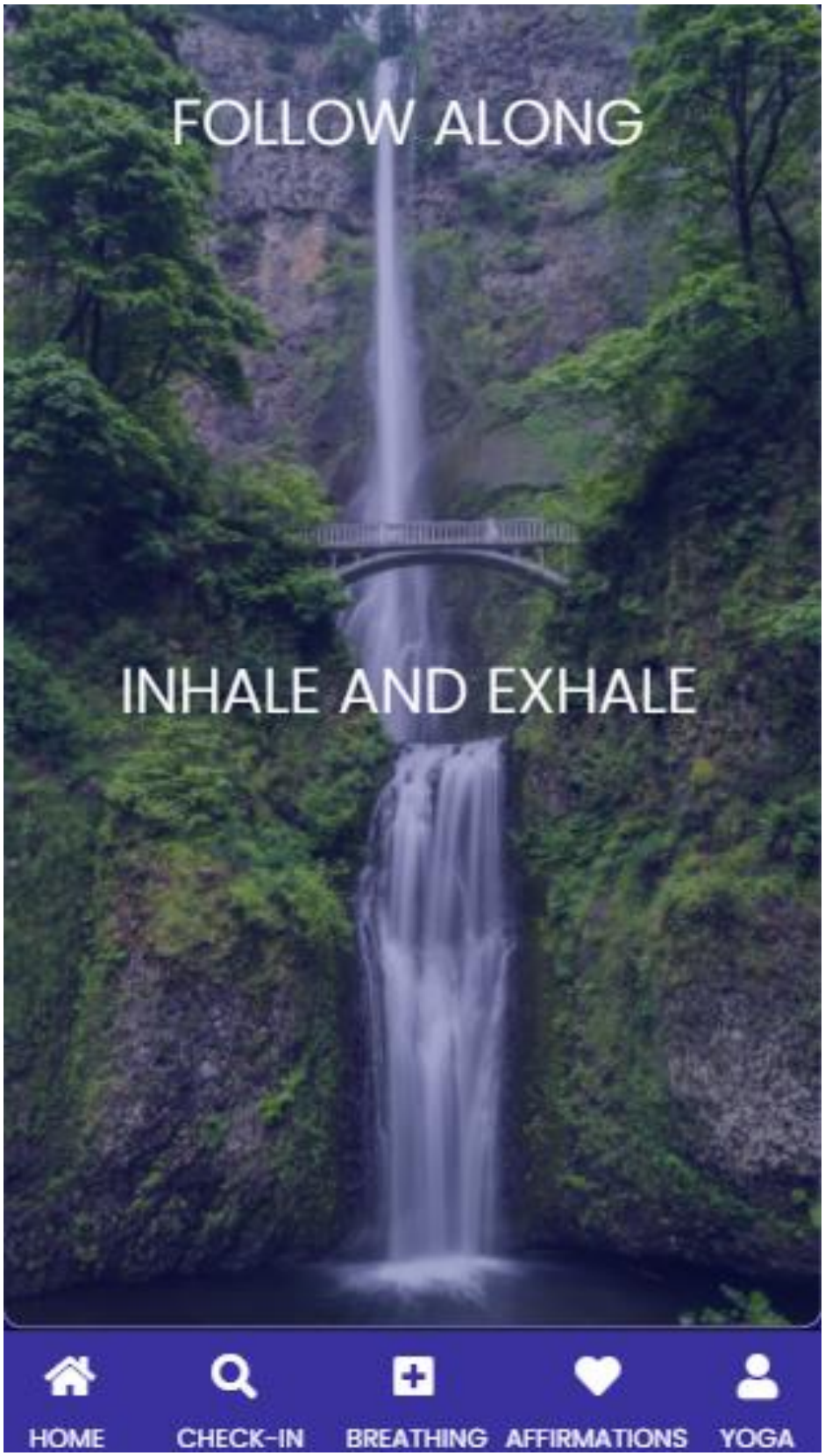


Figure 29: Breathing Screen

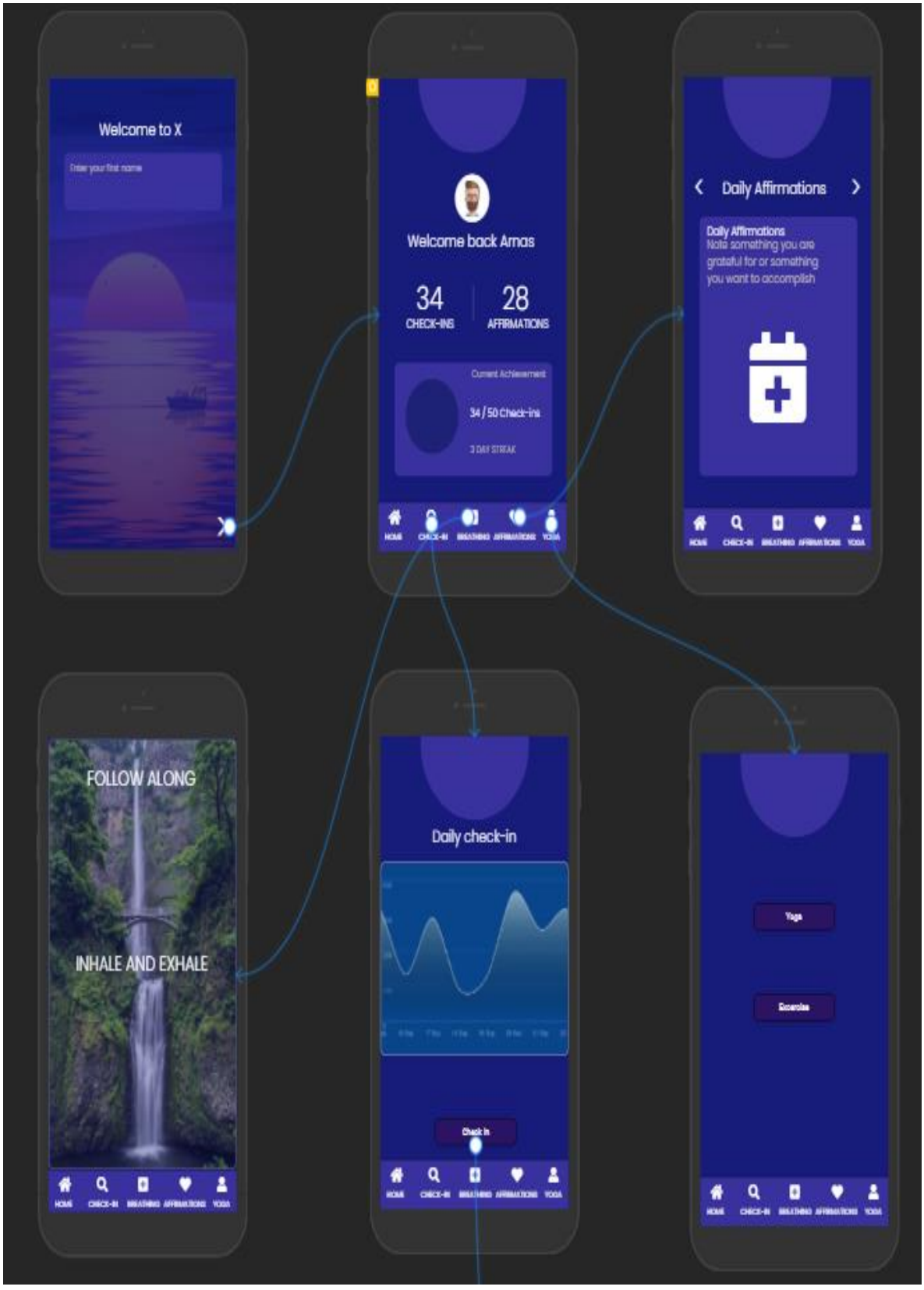


Figure 30: Navigation

6.0 Development Difficulties

6.1 React Native

When it came to developing the product, I experienced numerous difficulties which hindered my development speeds. The first major difficulty that I had in terms of development is the languages and frameworks I had chosen for the project. Since my project was to be developed for cross-platform devices, Android, and iOS, I had three options with regards to development. Option one was to develop two separate applications in their native code base. This means to develop one application on Android Studio and develop the same application on XCode (Apple's development environment). This is a major commitment time wise, and it is something that would not work with the given timeframe for the project. Option two was to develop one application using the React Native framework and the Expo platform for testing the application. As said before, React Native is a JavaScript open-source framework that is used for the development of applications for cross-platform devices such as Android, iOS, and web. This means that only one application would have to be developed and deployed on both instead of two native applications. Following this option would provide the ability to deliver a finished product in the given timeframe. The final option was to use another development environment like React Native called Flutter. Flutter would essentially provide the same result as option two, but Flutter uses the Dart programming language, which I have no experience in.

The decision was to go with option two. This was for a number of reasons. Firstly, during my time at my coop placement, I used JavaScript primarily, so, I believed that it would be easier to use React Native as React Native is JavaScript based. Another reason being that I had previously heard of React Native and watched some YouTube videos on developing applications over the summer break. Although React Native was an easy choice for me. I still had to give up a lot of time to teach myself React Native. Despite the fact that React Native is built of JavaScript, it has a completely different syntax and structure than ordinary JavaScript. React Native is a component-based framework. This means that reusable components are created and then rendered in the application. This is something that I would never have touched on in the duration of my college degree as we were taught object-oriented programming. Having to teach myself React Native was a huge difficulty and task in itself when it came to the development of the product.

6.2 Application Testing

Another difficulty encountered when developing the product was testing on both Android and iOS. Testing consisted of checking if buttons were working, if elements were in the correct location, and if the application looked the same on both devices. Even when it comes to just Android, the emulator I used on my computer was a much smaller size phone than my personal phone. Ensuring that the application looked the same on both, the emulator and my personal phone was a major difficulty and took a lot of time to get right. This was a major issue at the start of development as React Native was still new to me, and I did not fully understand how to get the application looking the same across all phones. As development progressed, I found it easier to make pages responsive throughout the application.

Here to the right, we can see the emulator which opens on my windows PC with the application running on it.

Another problem I encountered was actually testing on an iPhone. To test an iPhone, a person would require having an iPhone emulator installed on their personal computer or to have an iPhone, but Apple do not allow an iPhone emulator to be installed on a windows computer. Since I had encountered this restriction, I would need to get hold of an iPhone. I had to borrow a companions iPhone to test my application. This would involve installing Expo, an application on the phone and also taking their phone for a while. This testing would be done every few weeks unlike the android phone

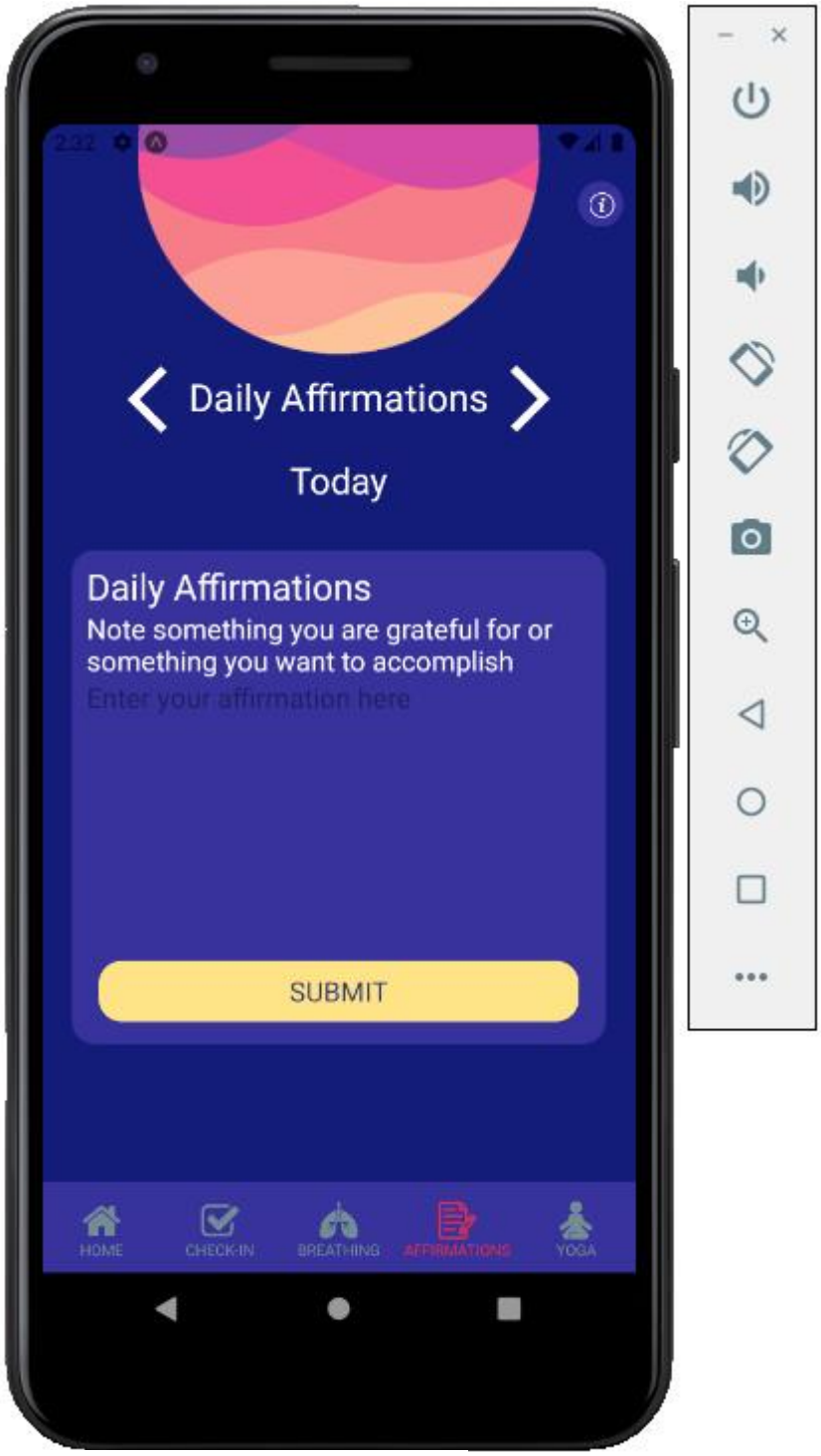


Figure 31: Android Emulator

which development had been done on. Very often, I would have to go back to elements and pages in the application and have to fix them up to make them look uniform across all devices. In fact, this process was very time consuming and a nuisance as each page and their elements would have to be compared. As said before, this process became easier to perfect as the development process went on and the more knowledge of React Native, I gathered.

6.3 AsyncStorage

When developing this application, I decided to create a totally offline application. This allowed the application to be accessed by anyone at any time regardless of internet connection, making the application very accessible. To do this, application information was saved to the device's local memory using React Natives AsyncStorage library. This library allows the developer to store data in an asynchronous and unencrypted way writing data to memory. The AsyncStorage provides fetching and setting methods for data. Fetching data is asynchronous meaning that one task may only start once another task has finished. This became a major problem when it came to development. React Native uses the standard syntax for creating a screen and does not allow for asynchronous calls as the render method which renders the screen that the user sees is called first before it carries out other asynchronous methods such as fetching data from storage. Below we can see what a standard syntax for a screen is in React Native. There is no constructor for this function, not allowing for methods to be called before the render method is called. I spent a number of days trying to figure out how to call methods before the return is called which renders the screen for the user. Each time the function would return the screen and only then call the methods so it would work synchronously. It was after many hours trying to make this work that I reverted to trying something else.

```
export default function YogaScreen({ navigation }) {
  const video = React.useRef(null);
  const [status, setStatus] = React.useState({});
  const [modalVisible, setModalVisible] = useState(false);
  const [modalVisible2, setModalVisible2] = useState(false);

  function setOrientation() {
    if (Dimensions.get("window").height > Dimensions.get("window").width) {
      //Device is in portrait mode, rotate to landscape mode.
      ScreenOrientation.lockAsync(ScreenOrientation.OrientationLock.LANDSCAPE);
    } else {
      //Device is in landscape mode, rotate to portrait mode.
      ScreenOrientation.lockAsync(ScreenOrientation.OrientationLock.PORTRAIT);
    }
  }

  return (
    <ImageBackground source={require("../assets/4.jpg")} style={styles.image}>
      <InfoScreenButton navigation={navigation} nextScreen="YogaInfo" />
      <SafeAreaView>
        <View
          style={{
```

Figure 32: Yoga Screen Code

A screen can also be made by defining a class which extends a React component rather than a defining a function which renders a screen. Defining a class allows for the use of a constructor.

The use of a constructor allows for the calling of methods before the render method is called which renders the screen. Below we can see that in the constructor there is a call for this.getData() which is a function defined by me which calls on AsyncStorage to fetch and set data.

```
class Home extends Component {
  constructor(props) {
    super(props);

    this.getData();
```

Figure 33: Home Screen Code

This getData method is an asynchronous method, this means that asynchronous methods will only be called in sequential order rather than simultaneously. Once the constructor calls this method, other methods in the class will only execute after this method has finished solving my problem regarding accessing data. Below we can see the getting of the application's user among other things such as the users profile picture. This now all works the way it was expected. After spending numerous hours on this problem, I was finally able to find a solution which helped me propel forward with the development.

```
getData = async () => {
  try {
    const user = await AsyncStorage.getItem("user");
    const allValues = await AsyncStorage.getAllKeys();
    const checkIns = allValues.filter((value) => value.includes("CHECKIN"));
    const img = await AsyncStorage.getItem("currentImage");
```

Figure 34: Home Screen Code

6.4 React Native Graphs

Another difficulty I ran into when developing the application was using the React Native Chart Kit library. This library provides a way to display data in charts such as line graphs, Bezier graphs, pie charts, etc, which is engaging to the user. This is something that I really wanted to use in the application to display the user's stats in an appealing way. The first instance I wanted to use this in was in the check in feature. When a user checks in their mood, I wanted the graph to update with the user's mood today and show the last previous seven days giving a clear indication of their mood in recent days. Below you can see an example of what the finished feature looks like. Here we can see that a Bezier line form, showing the user's moods in the past 3 days. This vividly displays the user's mood helping with their self-monitoring capabilities.

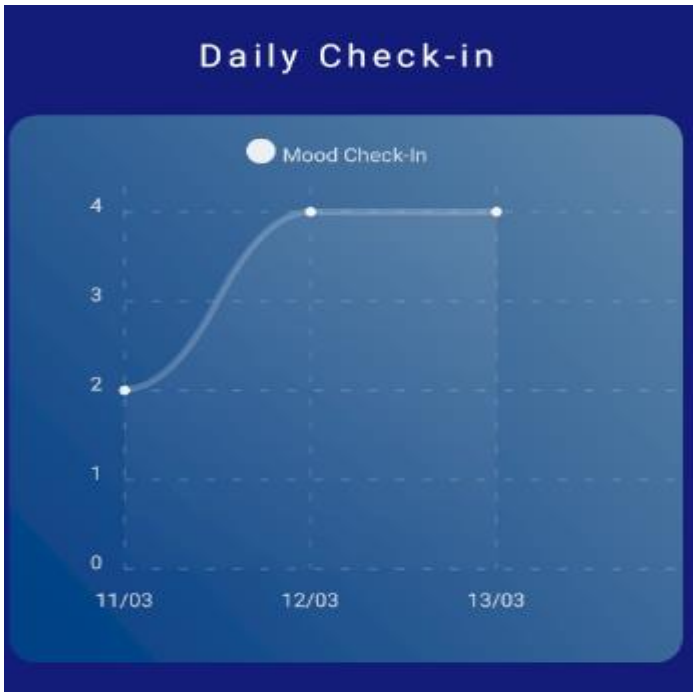


Figure 35: Check-In Graph Screen

The problem I faced was that the graph was being loaded in before async storage pulled the data from memory and processed it. Although this was very similar to the previous problem it was very difficult to figure out. One thing I noticed was that the keys for the graph would load into the graph fine such as the dates of the check ins, but the values representing the dates would not. This would then throw a huge error breaking the application. I would then have to rebuild the application from scratch which took approximately 30- 60 seconds each time. Such an occurrence would greatly hinder my development time and motivation as I was stuck on this error for a large amount of time. It was even harder to figure out since keys for the dates loaded into the graph fine, but the values associated with the dates did not. It was very hard to Google the error and find a fix as there was nothing relatable to view. To prevent the application from breaking I would set a static array of values depending on the number of days that have been checked in. So, if there were 3 check-in dates, I would create an array of numbers with 3 numbers ranging from 1 and 5 and let the graph use those incorrect values. This prevented the error from breaking the application and I thought that I would have to present the application using this static array.

After numerous hours tinkering with the code, I found the problem. I had the code separated out into three methods to make the code more readable and extensible. As seen before, I would call all the asynchronous methods in the constructor. Although my asynchronous methods were called in order, the third method which got the data for the check-ins and formatted it for the graph took a larger time to complete, thus rendering the screen for the user before it could complete this asynchronous call. The fix for this problem was to only have two methods in the constructor instead of three, this would make both functions much longer and make readability harder, but it fixed the problem I was suffering from. I was then able to fix the other graphs in the application also.

6.5 React Native Video

A further challenge I faced was when I tried to use the React Native Video library. This library allows a developer to play videos which are either local videos stored on the device or videos from URLs fetched from the internet. Using the react native video library should enable me to play a video with a few simple lines as seen below. Except this was not the case.

```
export default function YogaScreen({ navigation }) {
  return (
    <VideoPlayer
      video={{ uri: "Yoga.mp4" }}
      videoWidth={1600}
      videoHeight={900}
      thumbnail={{ uri: "https://i.picsum.photos/id/866/1600/900.jpg" }}
    />
  );
}
```

Figure 36: Yoga Screen Code

Rendering this in the application would return a huge error resulting in the application crashing. This would take around one minute to reload the application hugely hindering my application development time. This error that was returned would not fetch any recommendations on Google leaving me to figure the error out by myself. I spent around two days running and tweaking code to try make it compile correctly with no success, not figuring out why the code was crashing. It was only then that a peer of mine told me other external libraries which are not React Native libraries. That is when I learnt of the Expo libraries. Since react native was launched using Expo, this allowed me to avail of the Expo libraries. I was then able to install the Expo video library which was very similar to the React Native Video Library. Running practically the same code except using Expo Video library, the code ran completely fine not resulting in the application crashing. This was a huge relief but also a huge annoyance. It was a huge relief as I spent many hours trying to fix this and now, I could progress with development but also an annoyance as I still do not understand what caused the application to crash and that it was such an easy fix.

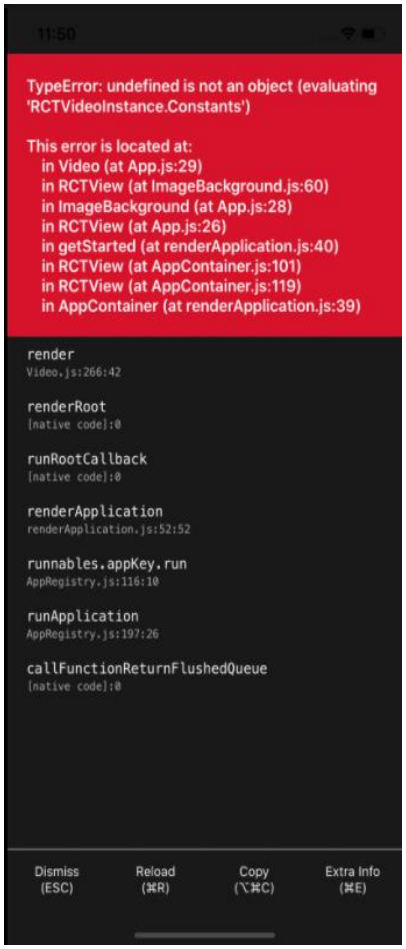


Figure 37: Yoga Screen Error

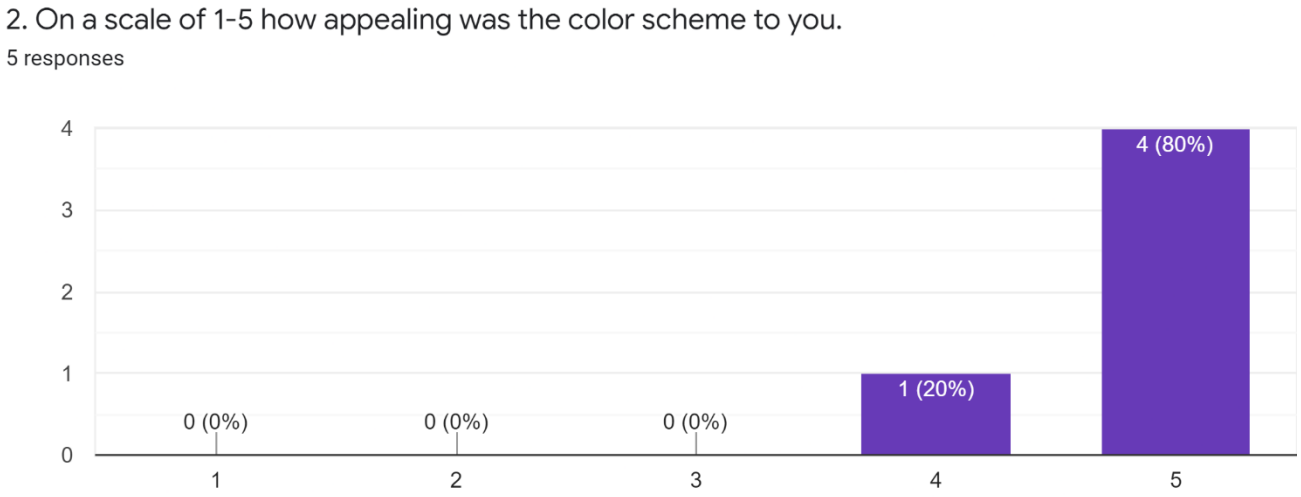
6.6 React Native Notifications

For this application, I wanted the ability to setup daily notification reminders to remind the user to exercise or to take part in some daily self-monitoring. In the application the user gets to set a time for the reminder notifications except I could not figure out how to get the React Native Notifications working. Once I called on the library without calling on any library code, the application would crash resulting in this error. I spent around one day reconfiguring the setup of the application, the dependencies, and the libraries installed. Numerous times, the application setup would break resulting in me having to delete the folder, re-clone the application from GitHub and rerunning the whole application. This could take anywhere from 5-10 minutes to re-setup. This was greatly time impeding and very discouraging. As it was breaking on importing, it did not matter if my code was correct or not as it would break as soon as the application was run. I was not able to figure this problem out and if there was more time permitted and some assistance regarding this matter, I would love to have figured this out. There is sudo code for a notification that could very easily be implemented if the importation error was fixed.

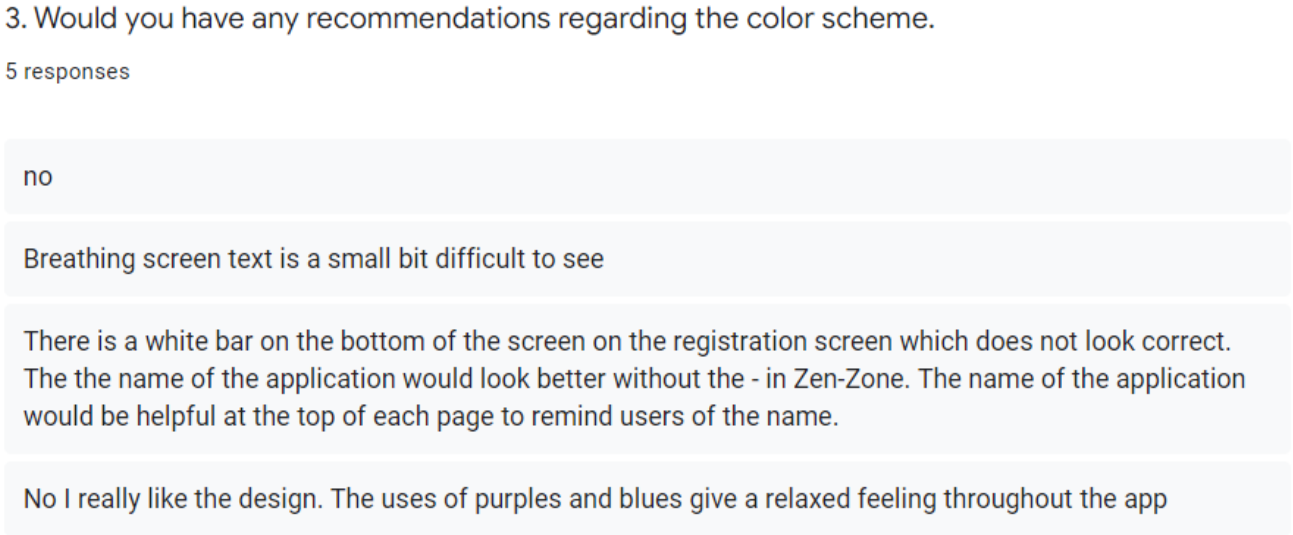
Figure 38: Notifications Error

7.0 Product Testing

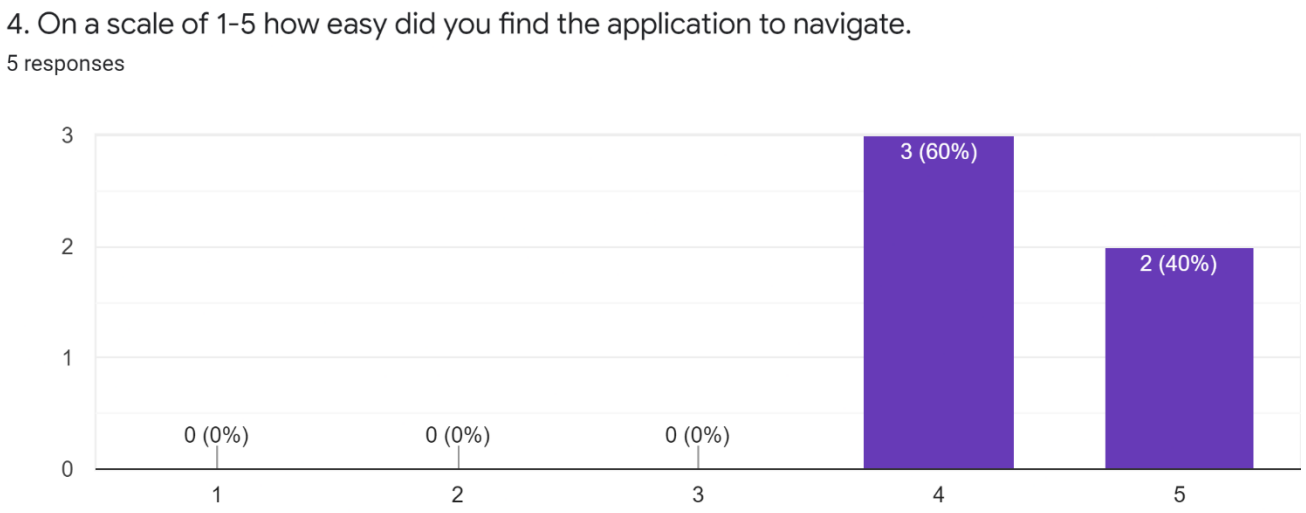
7.1 Testing Findings



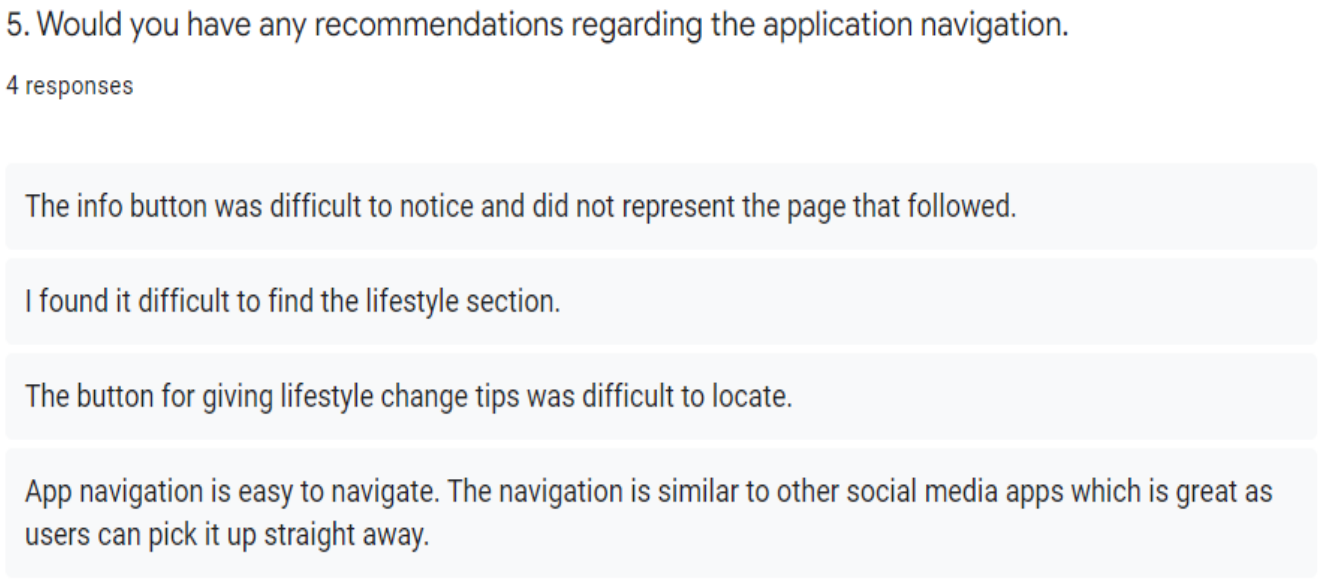
In question 2, the user was asked on how appealing the colour scheme was to them. Here we can see that it is evident that 80% of people found the colour scheme and user interface very appealing. While only 20% gave it the second highest rating. This illustrates that users found the colour scheme appealing to them.



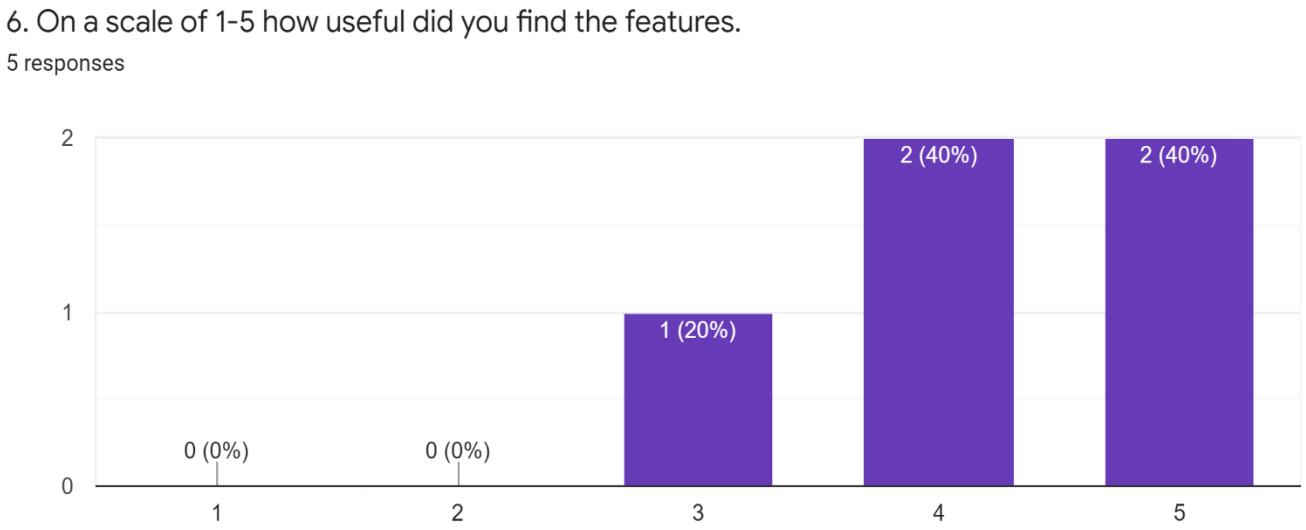
Question 3 asked to user to note down any recommendations that they might have regarding the colour scheme and user interface. These recommendations were taken onboard and will be applied to the product.



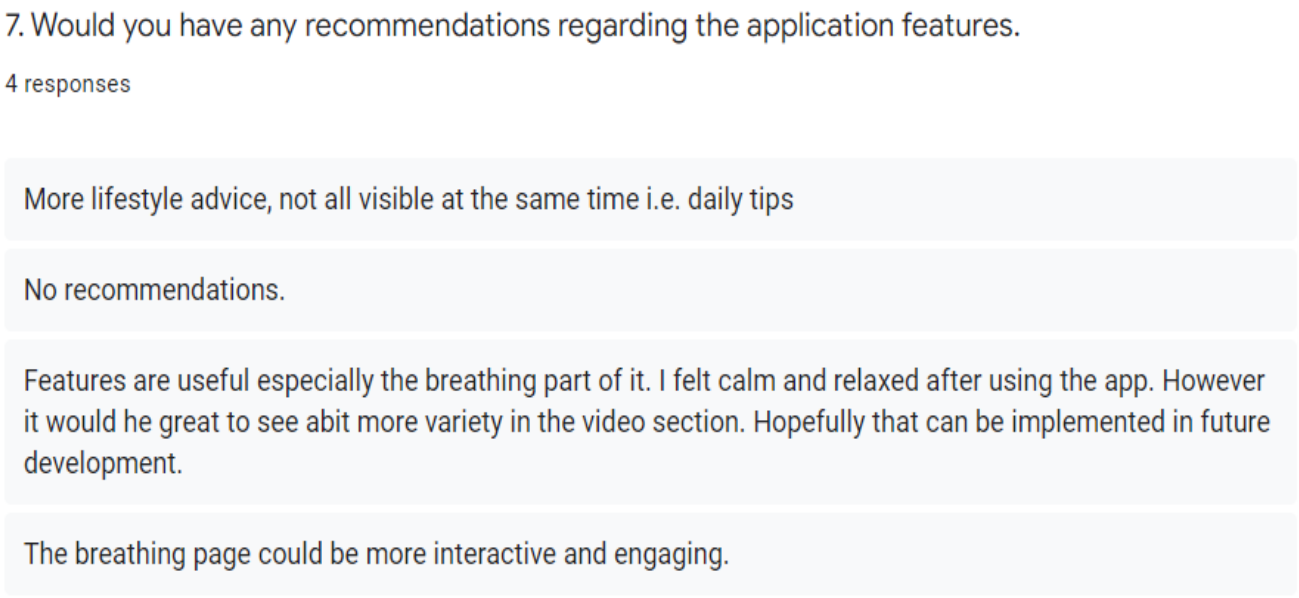
Question 4 asked the user how easily the application was to navigate. It is evident in question 5 why only 40% of the users gave the rating a 5/5 for navigability and 60% gave a 4/5 rating. The issues with navigability were addressed and resolved in the application.



Question 5 asked about recommendations for the application navigation. While we can see that a user found the navigation easy using the bottom navigation tab, all three other comments found the lifestyle changes tips section in the application to find. This will be noted and fixed in the product.

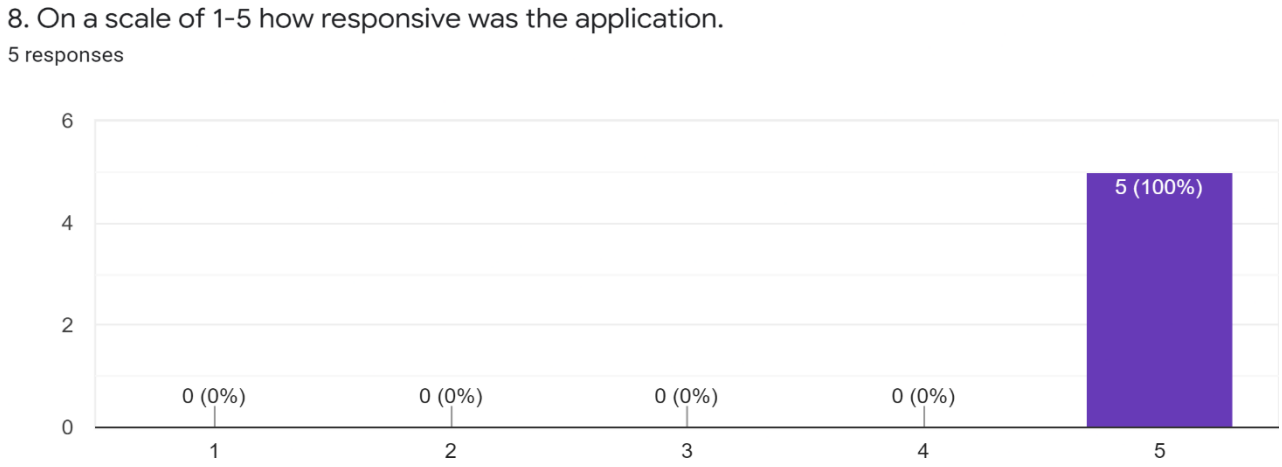


Question 6 was with regards to the product features. These features were found in the secondary and primary research that I conducted. Only 20% found the features to be somewhat useful, 40% found them to be useful, while 40% found them to be very useful. This is a great result and illustrates that the research was conducted well.

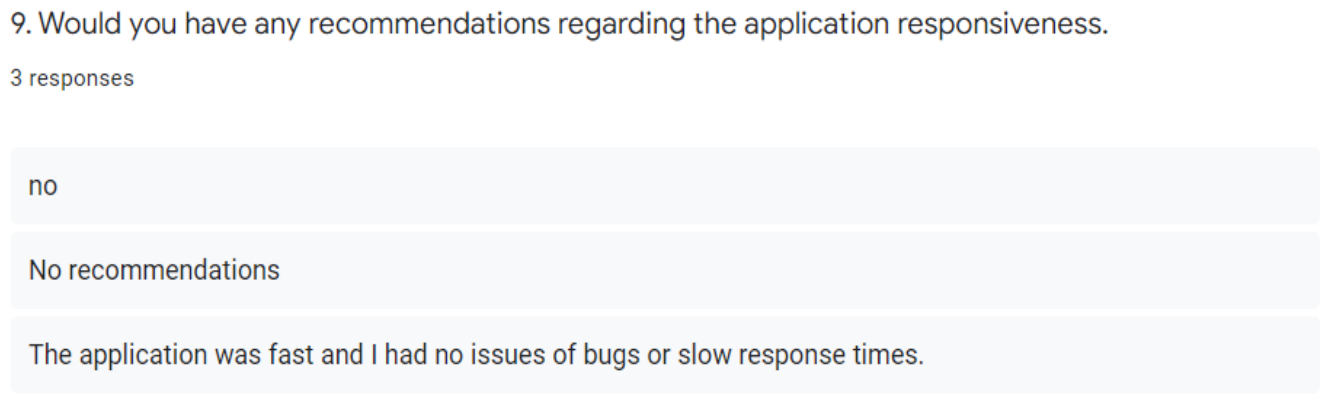


Question 7 asked the user to recommend any changes with regards to the application features. One comment recommended for more lifestyle advice. This is an easy recommendation to add if more users would request this addition. Another response noted for more variety in the video section. This is not feasible as it would drastically increase the size of the application and may

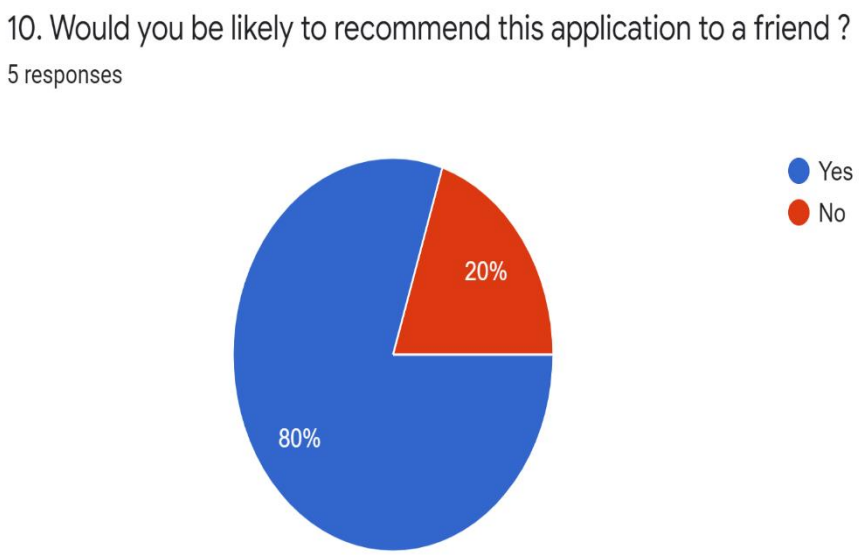
reduce application speed and responsiveness. The last recommendation was with regards to the breathing page. It was noted that it could be more interactive and engaging. Currently, the breathing page animates a five second inhale and then a five second exhale. If time constraints did not matter and I had more expertise in animation, I would love to make the breathing animation much more engaging and interactive, but this is not feasible at the current time.



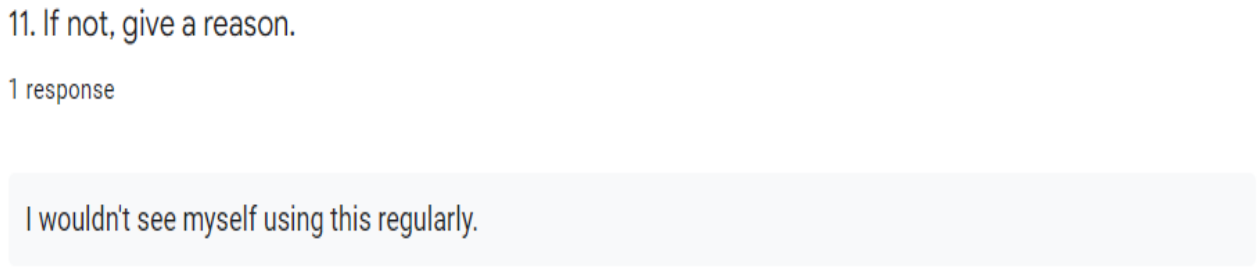
It is clearly evident that the application which was developed is highly responsive with 100% of users giving it the highest rating. This was a major non-functional requirement that I wanted to achieve within the application.



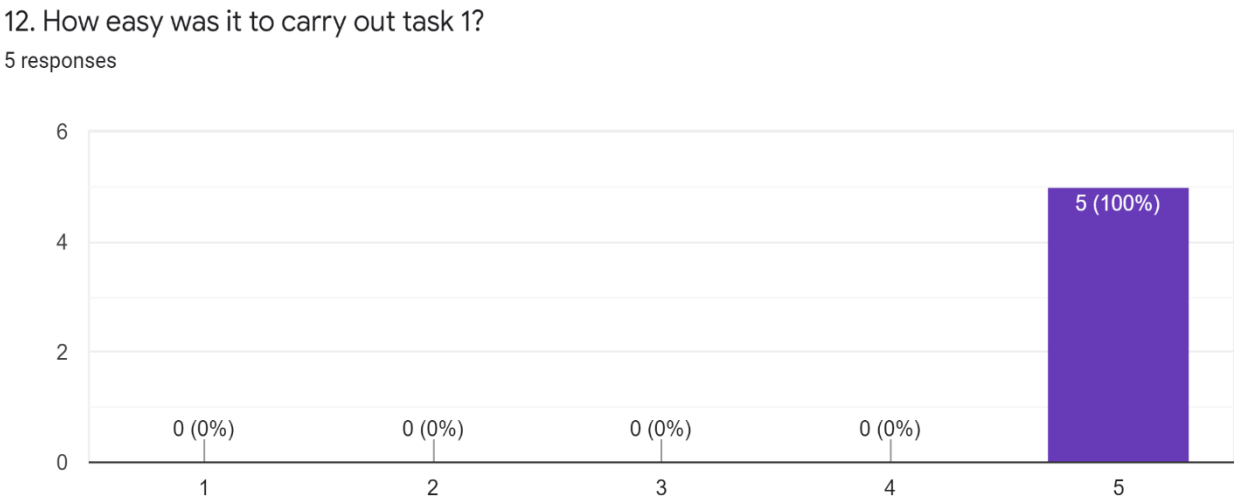
This question further backs up the point that there were no issues with the application with regards to responsiveness and usability, which shows a great achievement.



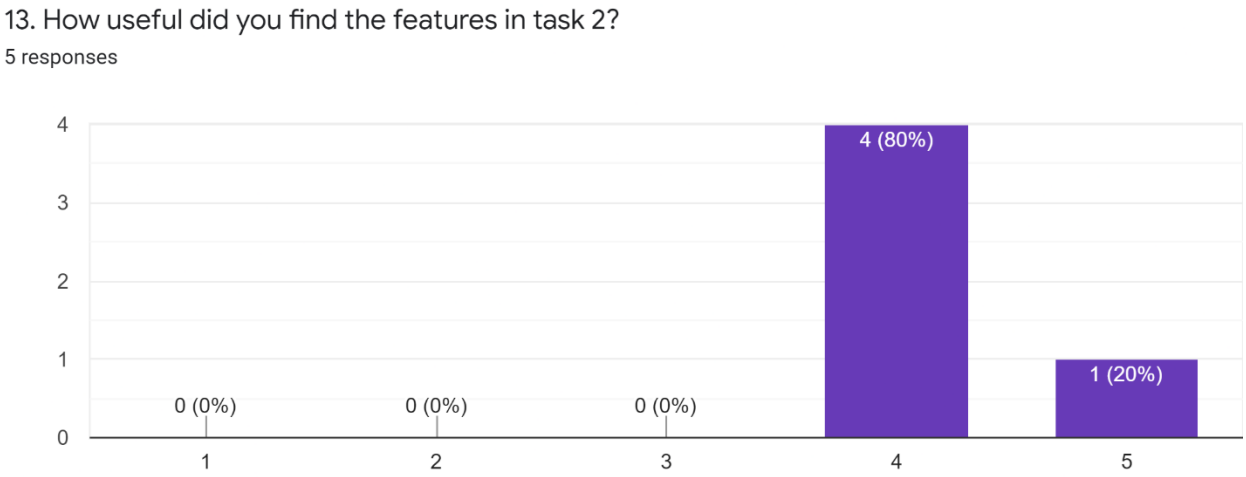
The next question showed that 80% were likely to recommend this application to a friend while only 20% would not. This conveys that the application was useful in terms of supporting a mental health condition being anxiety and stress.



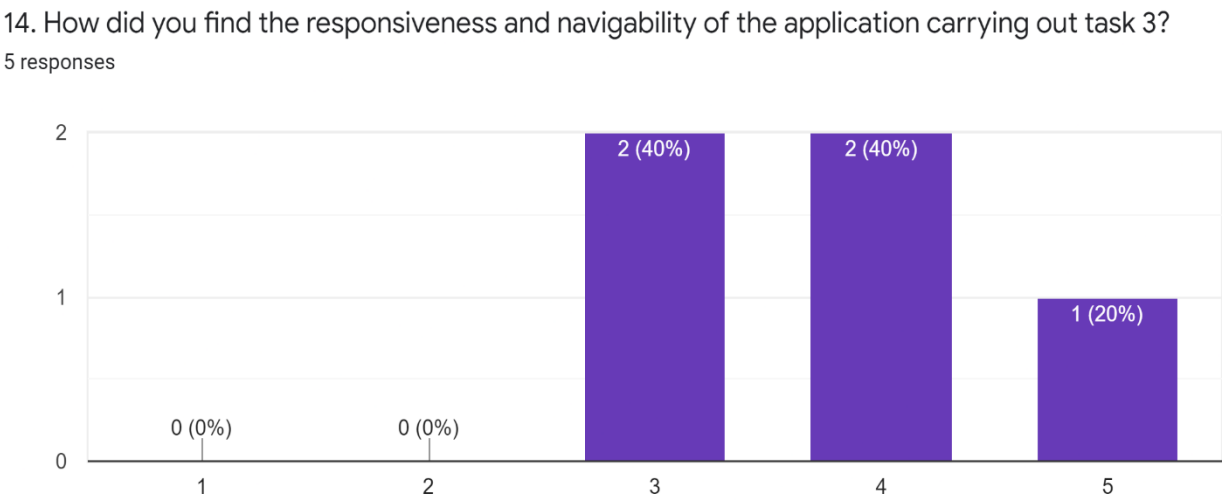
This is the response of the 20% of people which would not recommend the application. Mental health applications are not found to be 100% successive on every single person so we must allow for discrepancies.



Task 1 was to create a profile and change their profile picture. This shows that the responsiveness of the application was good, and it was easy to find these features and to carry out the task with 100% of users saying it was very easy to carry it out.



Task 2 was to perform some self-monitoring and do a daily check-in and a daily affirmation. 80% of users said that the features in this task were a 4/5 while 20% gave it a 5/5. It was found that performing self-monitoring over the course of multiple days would show greater results than just a one of day. Still, all responses being over 4/5 is a good result for the application.



Lastly, the third task was to navigate to the lifestyle modifications and read through them and then navigate to the yoga video and watch the video. This task got the lowest scores in all of the testing due to the fact that users could not find the lifestyle modifications section in the application. This greatly hindered the result of the task.

7.2 User Testing Refactoring

With all the recommendations gathered from the testing I was able to refactor the application to users' tastes. Some of the features which were refactored were:

- The button for the lifestyle changes tips was difficult to locate.
- The breathing screen text is difficult to see.
- There is a white bar on the bottom of the screen on the registration screen which does not look correct.
- The name of the application would look better without the - in Zen-Zone.
- The name of the application would be helpful at the top of each page to remind users of the name.

One feature which was unfeasible to refactor was the breathing animation to be more user engaging and interactive. As noted above, had I more time and more expertise in animation, this feature would have been greatly improved. Some of the changes will be shown with a before and after of refactoring.

The following refactoring changes took place here:

- There is a white bar on the bottom of the screen on the registration screen which does not look correct.
- The name of the application would look better without the - in Zen-Zone.

On the left we can see the name Zen-Zone and a white bar at the bottom of the screen, on the right you can see the changes that have taken place following refactoring of the code.

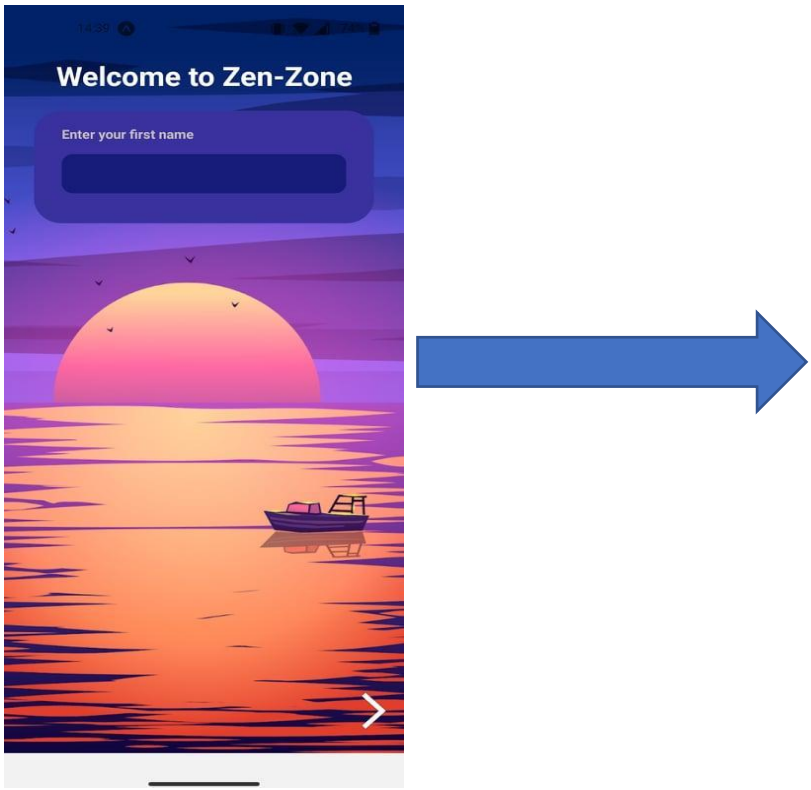


Figure 39: App pre-refactoring

Figure 40: App post-refactoring

For the next part of refactoring, the following changes are seen:

- The button for the lifestyle changes tips was difficult to locate.
- The name of the application would be helpful at the top of each page to remind users of the name.

We can see that at the top of the screen, there is now a text which displays ZenZone as recommended by one of the testers. This follows on other pages in the application also. Furthermore, there was a navigation issue with users finding the lifestyle modifications tips section in the application. On the left we can see that the small circle with the ⓘ button which navigates to this section, being hard to identify and see. On the right, I made the circle much larger and changed the logo which represents tips conveying the lifestyle modification tips.

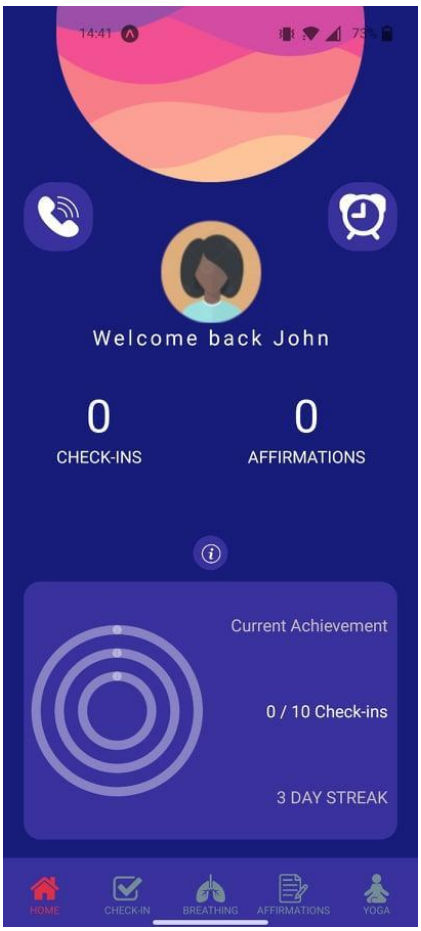


Figure 41: App pre-refactoring

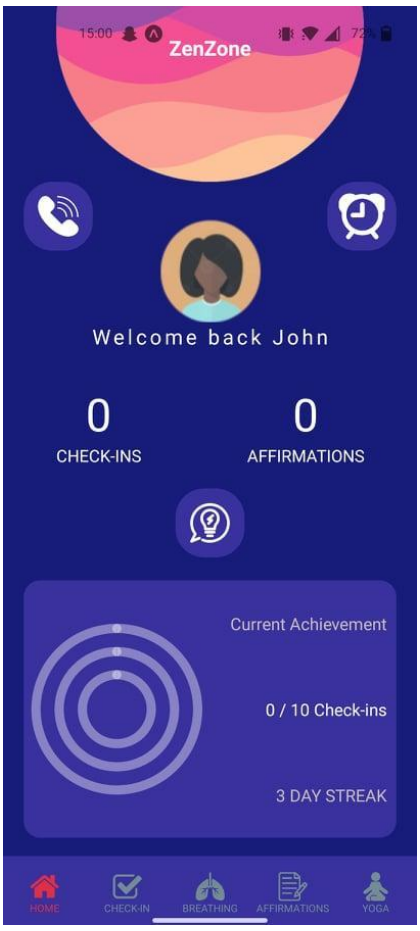


Figure 42: App post-refactoring

The last refactoring change to take place was:

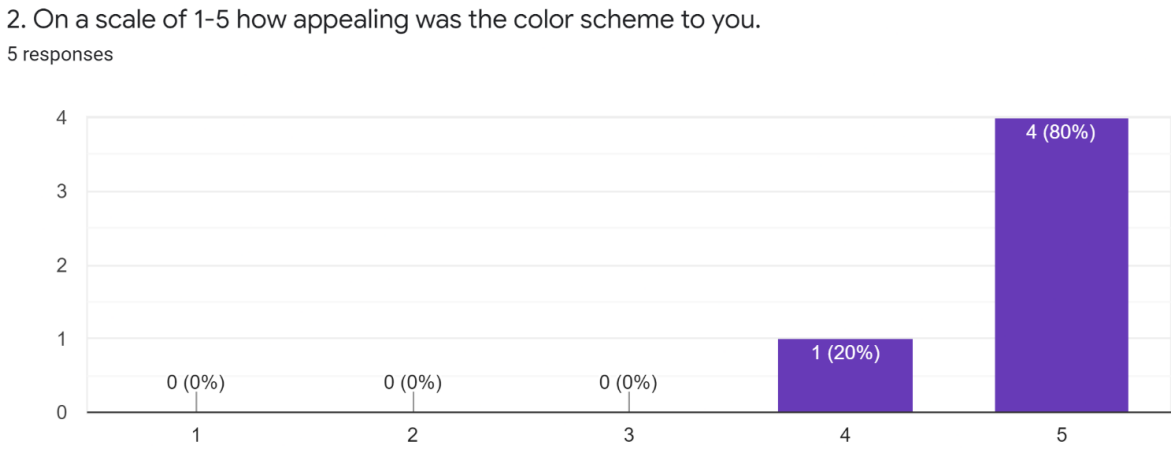
- The breathing screen text is difficult to see.

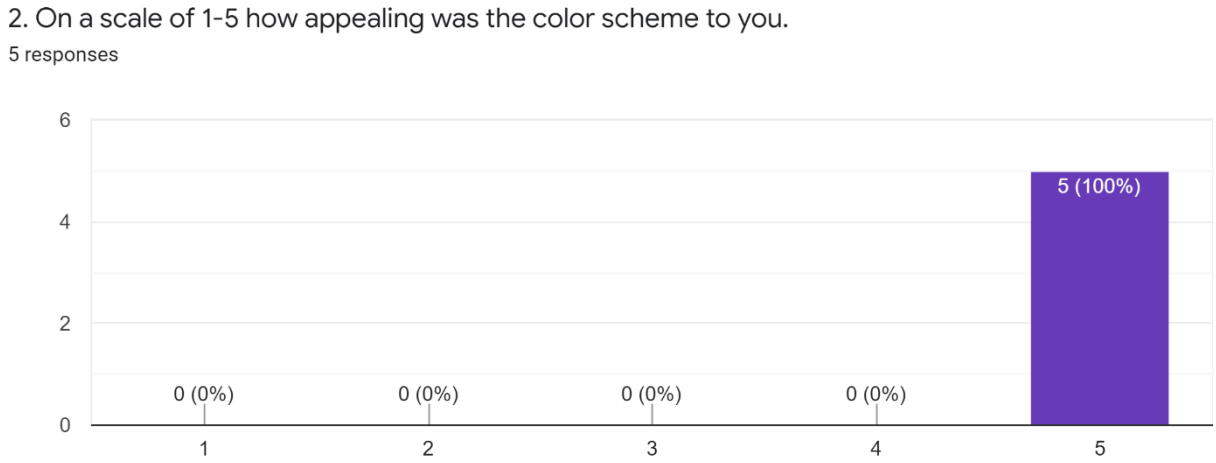
Below on the left we can see that the text was a bit faint, small, and difficult to see. On the right, I made the text clearer by reducing the opacity of the circle animation, I made the text bold, and I made the text larger, solving the difficulty in seeing the text.

Figure 43: App pre-refactoring

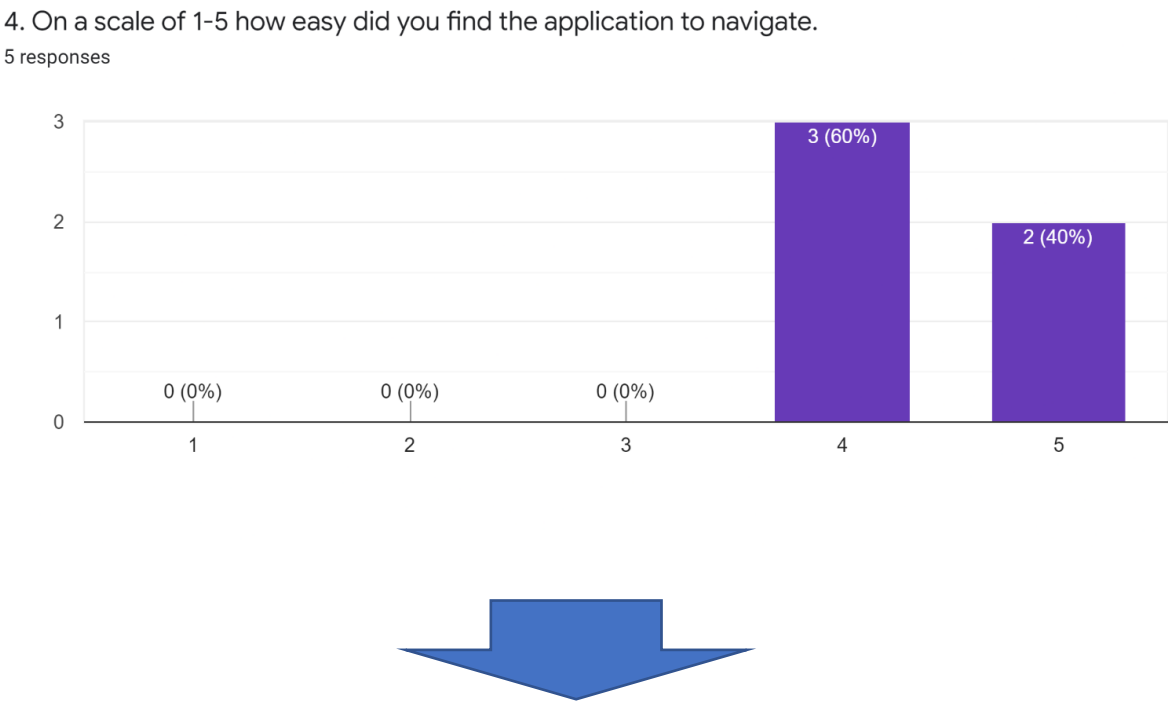
Figure 44: App post-refactoring

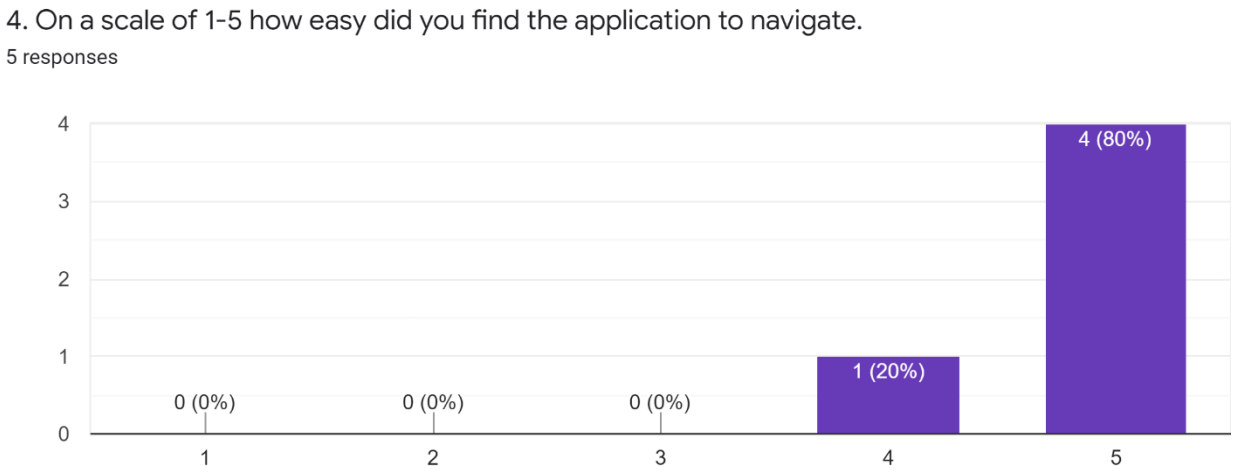
To show that the refactoring changes made a difference to the user and bettered the application, I got the same users to retest the application with these changes. Below we can see a vast improvement on the navigability, usability, and the colour scheme of the application.



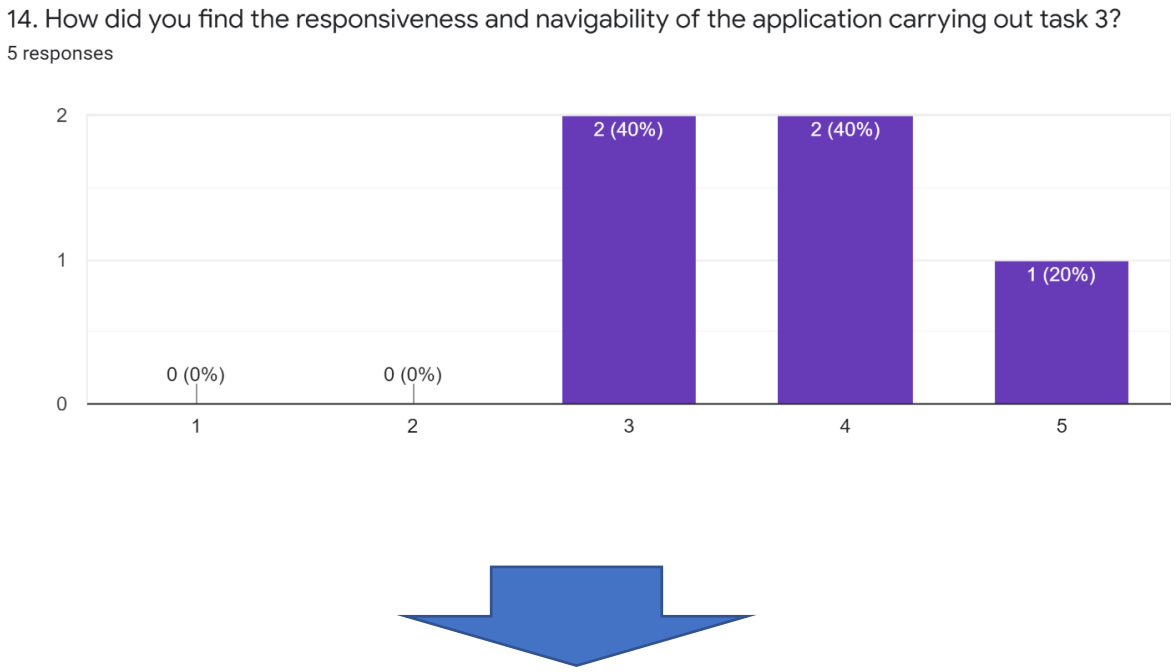


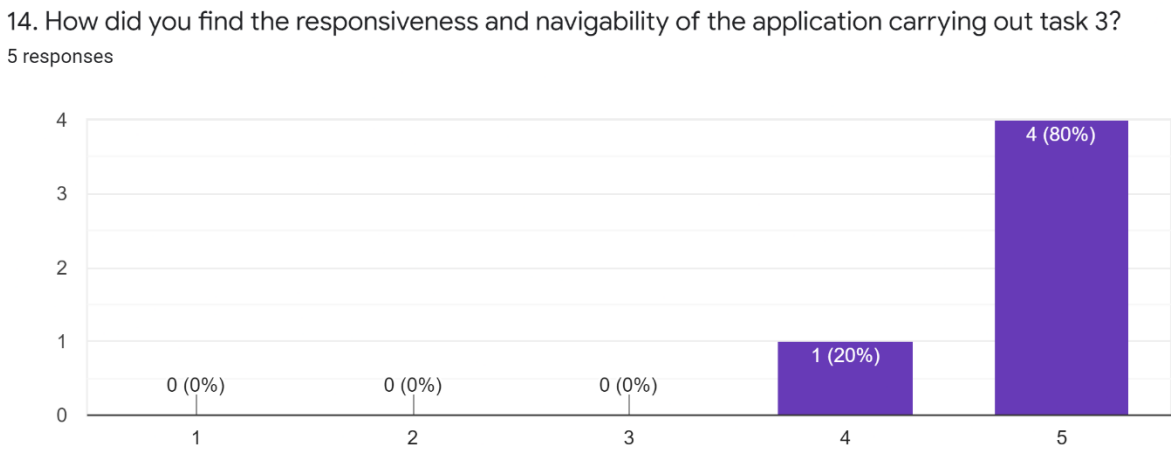
For question 2, we can see that the refactoring changed the user's opinion of the user interface and color scheme giving it 5/5 from 100% of the testers compared to above only 80% gave the user interface and colour schemes 5/5 while 20% gave it 4/5.





Regarding question 4, we can see a vast improvement with the navigation of the application. First time around 60% of testers gave it a 4/5 rating and only 40% of testers gave it 5/5. After the refactoring had the occurred and the recommended changes were added, navigation ratings of the application improved to 80% of testers giving it a 5/5 while only 20% giving it a 4/5.





It is question 14 which shows the major improvements in the navigation of the application. When carrying out task 3 first time around, the testers gave the task mediocre scorings regarding the responsiveness and navigability. We can now see vast differences, first time around 40% gave the navigation 3/5, 40% gave it a 4/5 while only 20% gave it 5/5. After refactoring only 20% gave it 4/5 while 80% gave it a 5/5. This is a huge achievement regarding the application testing and refactoring and shows the applicability and benefits of testing.

8.0 Conclusion and Reflection

8.1 Conclusion

This paper covered a number of components regarding mental health, delving deeper into Generalised Anxiety Disorder and Stress. In addition, the paper covered what can cause anxiety and stress, how to cope with it, and what mechanisms are helpful to carry out in order to reduce stress and anxiety.

A mental health application was chosen, as research shows a significant increase in mental health as a result of Covid-19. An example includes a study conducted by Adolescent Mental Health, which highlighted that 66% of teenagers had been concerned about their mental health being affected by Covid-19. Furthermore, there is a lack of free or low-costing resources available to people who suffer from anxiety and stress. Individuals diagnosed with any anxiety disorder had an estimated average total medical cost of $6,475. Due to this statistic, developing a free mental health application was an obvious solution.

This paper aimed to answer three research objectives. These are listed below.

1. Understand what anxiety and stress is.
2. Identify solutions on how to cope with anxiety and stress daily.
3. Create user requirements for the application.

In order to answer these objectives, research was conducted by both secondary and primary methods. To begin the literature review section of this paper Generalized Anxiety Disorder (GAD) was defined and said to be a chronic and prevalent disorder in which the patient experiences unfocused stress and anxiety that is unrelated to recent stressful events, but it can be exacerbated by particular situations. Additionally, the symptoms and treatments of the disorder were identified. Being easily exhausted, having trouble focusing, impatience, difficulty sleeping, and muscle tension were all found to be symptoms of GAD. In terms of treatments for GAD, regular exercise, consuming a healthy, nutritious diet, lowering exposure to stress stimuli, partaking in yoga, meditation, or mindfulness exercises, journaling can aid in the identification of anxiety triggers and coping mechanisms, minimising, or avoiding nicotine or caffeine, avoiding alcohol and narcotics, and getting consistent hours of 7-9 of sleep per night by abiding to a schedule were all identified.

Similarly, stress was defined and both symptoms and treatments were highlighted. Stress was defined as the sensation of being overwhelmed or unable to deal with emotional or mental pressure. Some of the symptoms that were identified include feeling afraid, anxious, angry, sad, frustrated, or irritable. Furthermore, one may experience faster breathing, faster heartbeat, anxious thoughts, moodiness, general unhappiness, or a feeling of being overwhelmed when stressed. The coping mechanisms identified to reduce stress include being observant, talking to a health professional, regular exercise, relaxing, setting realistic goals, speaking to someone, avoiding alcohol, caffeine, and smoking, breathing exercises, and walking or running.

Mobile applications have been found to offer a lot of potential when it comes to providing high-efficacy mental health therapies. Due to this finding, a mental wellbeing application was created to offer free support to people suffering from GAD and stress. The characteristics of high-efficacy apps were identified to provide a guideline for the application being created for this project. These include simple user interface and experience, high patient engagement, self-monitoring capabilities, and potential for cross-diagnosis.

The main risk identified in the ethical issues section of this paper regarded the privacy of the user's personal information. To combat this issue, security measures were taken to ensure data was not held on a database. The application as a whole was implemented using only the phone's memory. This ensured that only the user can access the private information.

Similar applications were analysed to weigh up the pros and cons of each, allowing for a deeper knowledge on what has worked best for other developers. In this case, the cons of each application were most helpful as it saved time during the development process and were eliminated from being used in the product created for this project. An example of this would include the application Happify which has a subscription model. Paying for a subscription is required in order for users to access all of the application's features. A major non-functional requirement for the application was for it to be accessible to everyone, therefore, it needed to be free.

For the purpose of this application development process, React Native was utilized as it offers greater accessibility, allowing for deployment on iOS and Android devices.

As part of the primary research element of this paper a number of similar applications were reviewed to help the decision process as to what features to include and what features to not include. An example of a chosen feature includes that of self-monitoring capabilities. This

feature was observed in the application Headspace. Checking in a user's levels of stress and anxiety is a key characteristic of high-efficacy mental health applications.

8.2 Reflection

The main learning outcome from this project is the substantial amounts of information gathered surrounding the topic of mental health. From learning about the symptoms of both GAD and stress to learning about the treatments required to live with both difficulties, an immense quantity of knowledge has been obtained.

In terms of the application itself, a new framework had to be self-taught. The framework in question was React Native. As a result of this project requiring the use of React Native, a high level of proficiency and capabilities have been obtained. This new skill set will make future projects which may be more intricate a lot more achievable. This framework will be carried out into the working world and make me more employable.

Reflecting back, if I were to undertake this project again, I would allow myself more time to create a more intuitive user interface and user experience of the application. An example of this would include improving the breathing page to be more interactive for the user. This would involve making the animations more intricate. Due to time constraints this was not feasible as I would have had to spend a large period of time learning animations in CSS.

Furthermore, given I had a longer period of time to work on this application, I would like to have added a machine learning element. This would involve a chatbot feature. This feature would be able to interact and talk with the user as conversing one's thoughts and feelings has been found to decrease stress and anxiety. This would allow the user to chat freely in a private space which would not be uploaded to a database.

Overall, I am satisfied with my product and these suggestions would just simply add to the already existent working product.

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10.0 Appendices

Image 1.1: Stress vs Anxiety

Image 1.1 Stress vs Anxiety, Source Medical News Today (2021)