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Android based application which helps for Parkinson's disease patients

BSc (Hons) Computer Science and Software Engineering

Undergraduate Thesis Report

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Abstract

PDP HealthCare is an android application which has been developed to guide the Parkinson’s patients to do their daily activities and some tips which they use in their daily life. The PDP Healthcare mobile application has some unique features when compared to other systems on the market, such as feedbacks, reminders, and tips that are used for patients. If the patient wants, he/she can read the text or if the patient unable to read the text, then he/she can hear the text-to-speech by playing it. The text colors, font size and page themes are designed to use it user-friendly. There are various mobile applications on the market that help with the treatment of Parkinson's disease, but some of those don't always meet the patients' needs and preferences. PDP HealthCare stands out from the competition by offering features like daily activity guidance, dietary recommendations, exercise recommendations, and stress-reduction techniques like meditation. additionally, some mental-training game is added to the application for the patient. Most people are looking for the simplest way to complete their tasks due to the current pandemic, so they choose to use their mobile phones and computers to complete their daily tasks as a result. Therefore, using a mobile application is the most effective and practical way to help Parkinson's patients. Patients who use this mobile app can benefit from a variety of benefits, including the fact that they won't need to use another app to lower their stress levels because this one can do it by playing relaxing music that will calm them and lower their level of anxiety. The PDP Android application successfully accomplished its goals and includes a wide range of features.

Acknowledgement

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Special thanks go for all the internet resources, including Google Scholar, which provide articles, theses, books, and abstracts from academic publishers, professional associations, online repositories, institutions, and other websites across a wide range of fields. I’m able to create the project's database thanks to Google Firebase, a platform for developing applications that is supported by Google. Mainly I would be thanked to Note one from windows, GitHub, VS Code to develop my project and some external resources to help to fulfil my work on this research project.

Contents

List of tables

List of figures

List of Abbreviations

Abbreviations	**Full Form**
PD	Parkinson Disease
UI	User Interface
WBS	Work Breakdown Structure
APPDA	American Parkinson Disease Association

Chapter 1 Introduction

This chapter contains the introduction of the final report of the project PDP HealthCare, which covers the Problem Statement and Scope of the Project under the Project Background section, the Project Aims and Objectives, and the report's structure.

1.1 Project background

Parkinson's disease is a brain condition that results in unintended or uncontrollable movements like trembling, stiffness, and issues with balance and coordination. This problem arises from the death of nerve cells in the basal ganglia, an area of the brain that regulates movement. If the neurons die, they produce less dopamine, which causes the movement problem. Dopamine is an important brain chemical that these nerve cells normally produce.

There are 2 symptoms which are called as motor symptoms and non-motor symptoms which motor symptoms contains vocal symptoms, body balance problem, tremor, and Rigidity while non-motor contains depression, sleep problems, pain, and mental issues. Researcher have shown that the PD affects men twice more than woman. In the past few years, the Parkinson death rate has been faster increasing. The number of people who died from the disease increased from 5.4 per 100,000 people in 1999 to 8.8 per 100,000 people in 2019. And the average annual increase was 2.4%. There are no specific treatments that must be carried out, but some specific treatments can help the disease progress make slower.

1.1.1 Problem Statement

In past few years, technology has advanced to new heights, with thousands of systems being created by developers to aid patients and people in various fields, and 50 to 70 systems are created each year to treat patients with Parkinson's disease. The largest industry in this world is human health care, which has grown quickly in recent years. Most people are looking for the simplest way to get things done in the current pandemic situation, so some people visit doctors for their needs

while others don't. Patients with Parkinson's disease (PD) can slow the progression of their condition by following medical professionals' recommendations and receiving the appropriate and timely treatments. Since PD patients are over age 60, a caregiver must provide timely care by giving medications, foods, and exercises one at a time. Due to the workload of some caregivers, patients may not receive their medications, meals, or exercise regimens on time. To fulfill this requirement, a system must be built to help both patients and caregivers by pointing them in the right direction and reminding them of important facts that patients need, so that the disease can be slowed down and the rate of death of PD patients can be reduced. Some of the PD patients take information from the web and some of the mobile applications are developed for the patients. However, the patients or caregiver must use multiple applications to suit their needs, as there is no single application or website than can cover all the needs which they want.

1.1.2 Scope of the project

As a result, the main goal of this project is to design and develop an android based application that will provide one major platform for all the Parkinson patients to do their work without missing anything. PDP Health care application includes a diet plan which the patient or a caregiver can follow the plan with the guidelines, exercises which are relevant to the patients which are on stage 1 to 5, and some meditations which the patient can relax the mind by hearing to some music and some mind games which has developed to train the patient brain. A feedback function also included in the PDP Health care application. This research project offers an excellent solution to the PD patients in all over the world.

1.2 Project Aim and Objectives

The goal of the "PDP HealthCare" project was to address the most common problems faced by Parkinson patients. Patients can complete their daily tasks with the aid of this application, and caregivers can easily assist Parkinson patients by using it. The project’s aims and objectives are listed below

1.2.1 Aim

- To create and implement an android-based application that helps the Parkinson patients by their needs and wants.

1.2.2 Objectives

- To determine the needs and issues faced by the PD patients.
- To find and assess the most up-to-date technology for developing an android-based application with advanced features
- Create user-friendly interfaces for the android application.
- To find a good database to the application
- To give good Exercises plans and Meal plans
- To help user to schedule the work on time.
- To help the user via a Feedback form

1.3 Project Framework

To understand and ensure that the project is viable, a formal requirement gathering must be finished prior to choosing a project framework. It was discovered that the suggested system is workable by studying literature from various journal papers, books, and reliable resources linked to the project. This was done by analyzing, contrasting, and confirming the information from the resources. It was determined that this project is practicable in considering the results. Using the Gantt chart and the WBS the tasks was divided into smaller tasks to fulfil the milestones and deliverables. At the last the developed system was provided to test to some users and some patients involved to some other chronic disease and a one PD disease patient.

1.4 Structure of the report

This thesis report for the last undergraduate project has eight main chapters. As a result, they are as follows: introduction, literature review, methodology, design, implementation, results, evaluation and discussion, and final chapter is conclusion and future works.

The introduction provides a basic overview of the project and is divided into four main sections: project background, aims and objectives, project framework, and structure of the report, which covers the whole structure of the thesis report from A to Z. The literature review, which compares the developed system to existing systems, is included in the second chapter of the thesis report. The thesis report's literature review includes scholarly articles, blogs, journal articles, books, and academic papers. Before beginning new research, you should conduct a literature review to demonstrate your knowledge with and understanding of the most recent studies in that topic. The reader should continue reading this chapter to gain a basic understanding of this thesis report. The research methodology, which covers the requirement gathering and analysis, will be covered in chapter three. The methodology that was used to develop this project will be carried in this chapter. The project's design will be described in Chapter 4. Here is a list of some of the project's wireframes and interfaces, along with pertinent descriptions. Looking at the interfaces and wireframes will give the reader an understanding. The system's implementation is covered in Chapter 5. The description was completed by using two subheadings, "resources and tools" and "security measures," which were used in the project's implementation. The result is presented in chapter 6. This chapter discusses the researcher's project. To prove the system is functional, the researcher will show interfaces and description, test cases and some code segments that show how the project was developed. Chapter 7 is about the evaluation and discussion. The study's conclusion and the work that must be done in the future to improve the research project will be covered in chapter 8 lastly. Other than that, any supporting documents used in the development of the system will be included in the thesis report's appendices. References are formatted according to the Harvard referencing style.

Chapter 2 literature review

2.1 Introduction

The main findings are outlined in the following literature review, which also provides an overview of the technologies used to create the "PDP Health Care" application, an Android-based application that assists Parkinson's patients in guide their daily activities. The researcher conducted a review of the literature on both motor and non-motor symptoms, human nutrition, meditations, human exercise, and chronic diseases. This chapter will demonstrate all technologies and frameworks pertinent to the project. Information is gathered using research papers and articles published between 2010 and 2021.

2.2 Chronic disease with Parkinson

A diet plan for each chronic disease should be offered if a PD patient also has diabetes, low blood pressure, or other chronic health conditions. As a result, this chapter will cover gathering information on other prevalent diseases as well as diet plans, exercise programs, and human nutrition for each disease, and it will also cover chronic diseases.

35 million people aged 30-69 died from heart disease, stroke, cancer, and other chronic diseases in 2005; only 20% of these deaths occurred in high-income countries, while the remaining 80% occurred in low- and middle-income nations. A higher percentage of deaths are reported in low-income and middle-income countries. According to Figure 1, the distribution of the 58 million deaths that occurred worldwide in 2005 can be seen. This pie chart shows that there are 13% cases of cancer, 2% cases of diabetes, 30% cases of cardiovascular disease, 30% cases of chronic respiratory disease, 9% cases of other chronic disease, 9% cases of injuries, and 30% cases of communicable, maternal, perinatal, and nutritional conditions. Figure 2 shows that what was worth 35 million in 2005 has increased to 64 million in 2015. (Strong, Mathers, Leeder and Beaglehole, 2005).

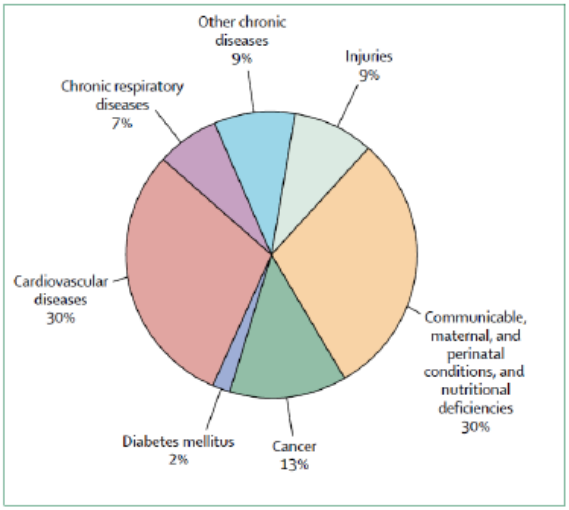


Figure 1 Projected global distribution of total deaths (58 million) by major

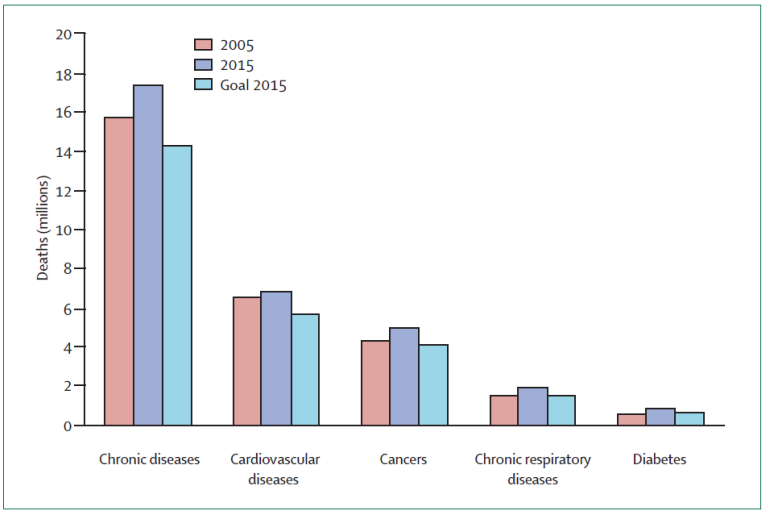


Figure 2 Chronic disease deaths (millions) projected from 2005

2.2.1 Blood Pressure

Blood pressure is the amount of pressure that the heart-pumping blood exerts against the artery walls. When a medical professional takes your blood pressure, they wrap a cuff that gradually tightens around your arm. As a result, it will be expressed as two numbers: the systolic blood pressure, which is measured when the heart contracts and pushes blood out, and the diastolic blood pressure, which is measured when the heart relaxes and fills with blood. The blood pressure levels are classified based on those two numbers. There are different blood pressure levels, including low blood pressure, normal blood pressure, elevated blood pressure, and high blood pressure. Low blood pressure is defined as having a systolic or diastolic blood pressure of less than 90 or 60. Low blood pressure can cause symptoms such as lightheadedness, weakness, dizziness, and even faith. A systolic pressure of less than 120 and a diastolic pressure of less than 80 is considered normal blood pressure for most adults. High blood pressure is defined as 130 or higher for the first number or 80 or higher for the second number. Elevated blood pressure is defined as a systolic pressure between 120 and 129 with a diastolic pressure of less than 80.

2.2.2 Diabetes

Diabetes is a long-term (chronic) illness that affects how your body converts food into energy. Most of the food you consume is converted by your body into sugar (glucose), which is then released into your bloodstream. Your pancreas releases insulin when your blood sugar levels rise. For blood sugar to enter your body's cells and be used as energy, insulin functions as a key. Too much blood sugar remains in your bloodstream when your body doesn't produce enough insulin or can't use it as it should, which causes the cells to stop responding to insulin. That leads to serious health issues like kidney disease, heart disease, and vision loss.

Type 1 diabetes, Type 2 diabetes, and gestational diabetes are the three main types of the disease. Type 1 diabetes affects roughly 5–10% of those who have the disease. Type 1 diabetes symptoms manifest more quickly than type 2 symptoms. To survive, a patient with type 1 diabetes should be required to take insulin daily. Approximately 90% to 95% of people with diabetes have type 2, which develops over a long period of time and is typically diagnosed in adults. Since you might not experience any symptoms with this type, it's crucial to check your blood sugar levels to reduce your risk. Type 2 diabetes can also be avoided by losing weight, eating well, and staying active. Gestational diabetes, the last type of diabetes, appears in pregnant women who have never had diabetes. This type of diabetes may increase the baby's risk of developing health issues.

Researchers analyzed information from nine earlier studies that tracked people with type 2 diabetes over time to see if they developed Parkinson's disease. They discovered that type 2 diabetes was linked to a 21 percent higher risk of Parkinson's and a faster rate of symptom progression. Along with cognitive and sleep issues, Parkinson's disease causes slow movement, tremors, impaired balance, and stiff muscles.

2.3 vitamins with Parkinson

There are various types of vitamins which are related to PD which are Vitamin B, Vitamin C, vitamin E and Vitamin D. B family vitamins are essential varieties that depend on dietary supply. Children, the elderly, vegetarians, pregnant mothers, and people with gastrointestinal conditions are frequently deficient in vitamin B. The link between vitamin B and Parkinson's disease (PD) is

receiving more and more attention recently. We discuss the connection between vitamin B and PD using vitamin B3 as a representative. Considering the following factors, vitamin C has potential for the treatment of Parkinson's disease (PD). Vitamin C is a nutrient that is abundant in vegetables, fresh fruits, and animal livers. The most crucial factor is that Vitamin C can increase levodopa absorption in elderly PD patients with poor levodopa bioavailability. A fat-soluble vitamin with strong antioxidant capabilities is vitamin E. However, a significant community-based study revealed that a high dietary vitamin E intake (10 mg/day) may reduce the occurrence of PD. The risk levels and the connections between vitamins and PD are shown in Figure 3 below (Zhao et al., 2019).

Vitamins	Authors	Type of study	Patients/controls	Conclusions
Vitamin B_3	Abbott et al. [37]	A Honolulu-Asia Aging Study in Japanese-American	Total 8006 and observed 137 PD	Niacin has no obvious relationship with clinical PD
	Johnson et al. [38]	A case-control study in US	126/432	Niacin has no relationship with PD
	Fall et al. [34]	A case-control study in Sweden	113/263	High-niacin diet can reduce the risk of PD
	Hellenbrand et al. [35]	A case-control study in German	342/342	PD patients with lower intake of niacin than controls
Vitamin C	Yang et al. [61]	A prospective study in Sweden	Total 84,774 and observed 1329 PD cases	Intake of vitamin C has a negative correlation with PD risk in women at borderline significance ($P = 0.04$)
	Hughes et al. [59]	A prospective study in American	Total 129,422 and observed 1036 PD cases	Intake of vitamin C has no relationship with PD risk
	Ide et al. [58]	A case-case study in Japan	62 PD	The severe PD patients with significantly lower lymphocyte vitamin C levels ($P < 0.01$)
	Miyake et al. [60]	A case-control study in Japan	249/368	Intake of vitamin C has no relationship with PD risk
	Zhang et al. [10]	A prospective study in US	Total 124,221 and observed 371 PD cases	Intake of vitamin C has no relationship with PD risk
	Férnandez-Calle et al. [56]	A case-control study in Spain	63/63	Vitamin C has no relationship with PD
	King et al. [127]	A case-control study in United States	27/16	Vitamin C was higher in PD groups
Vitamin E	Yang et al. [61]	A prospective study in Sweden	Total 84,774 and observed 1329 PD cases	Dietary intake of vitamin E has negative correlation with the incidence of PD in women ($P = 0.02$)
	Hughes et al. [59]	A prospective study in American	Total 129,422 and observed 1036 PD cases	Vitamin E has no relationship with PD risk
	Miyake et al. [60]	A case-control study in Japan	249/368	Vitamin E significantly reduced the risk of PD
	Zhang et al. [10]	A prospective study in US	Total 124,221 and observed 371 PD cases	Intaking foods containing more vitamin E can reduce the risk of Parkinson's disease
	Molina et al. [82]	A case-control study in Spain	34/47	CSF and serum vitamin E levels have no difference between two groups
	de Rijk et al. [78]	A cross-sectional study in Netherlands	5342 individuals including 31 PD cases	Intaking 10 mg dietary vitamin E daily may reduce the risk of PD
	Logroscino et al. [77]	A case-control study in USA	110/287	Vitamins A, C, and E were not associated with PD
	Férnandez-Calle et al. [80]	A case-control study in Spain	42/42	Serum levels of alpha-tocopherol (vitamin E) have no difference between two groups
Vitamin D	Kim et al. [128]	A prospective, observational study in Korea	39 PD cases	The level of vitamin D might impact the olfactory dysfunction in PD
	Sleeman et al. [112]	A prospective observational study in England	145/94	Serum 25(OH)D concentrations are often lower in PD patients than controls and relate to the severity of motor symptoms

Figure 3 Other clinical study of vitamins and Parkinson's disease.

2.4 Therapy on Motor and Non-Motor Complications in Parkinson's Disease

Both motor and non-motor symptoms can be present in people with Parkinson's disease. Tremor, Bradykinesia, Rigidity, Postural Instability, and Vocal Symptoms are examples of motor symptoms that are related to patient movements. Non-motor symptoms include depression, sleep issues, loss of smell, sweating and melanoma, and gastrointestinal problems.

The developed project has been focused on both motor and non-motor symptoms. The exercises, daily activities, diet plans are included in the application on motor symptoms while meditations and brain games are included for the non-motor symptoms. The researchers demonstrated how diet and exercise plans affect PD (Zesiewicz and Evatt, 2009).

2.4.1 Exercises

People in the previous century did not have vehicles and machines, so they worked on their own, and there was no need for them to do exercise for their health. Researchers estimate that before 20,000 BC, the average number of footsteps per day was 13,200 - 21,120. By 2010, the average number of footsteps per day had decreased to 5340 due to changes in the nature and availability of machines and vehicles. As a result, humans are increasing the incidence of many chronic diseases. Figure 4 shows an estimate of a human's daily footsteps from the past to the present (Booth, Roberts and Laye, 2012).

Population year	Steps per day	References
Paleolithic (~20,000 BC)	~13,200-21,120 (men); ~10,560 (women)	(384)
Amish (2002)	18,425 (men); 14,196 (women)	(27)
Mean of 26 studies (1966-2007)	7473 (mainly women)	(63)
Colorado (2002)	6733 (men); 6384 (women)	(572)
US adults (2010)	5340 (men); 4912 (women)	(26)

Figure 4 Estimated Historical Reductions in Daily Steps by Humans (Booth, Roberts and Laye, 2012).

For older people, exercise is crucial because it lowers disability and extends life expectancy. Exercise enhances both physical and mental performance. Eating regularly and attempting some meditation will help us live longer and reduce our risk of developing high blood pressure, diabetes, and other chronic diseases. Figure 5 illustrates the main evidence-based pathway for how physical activities or exercises delay disease progression, disability, and death (Kujala, 2009).

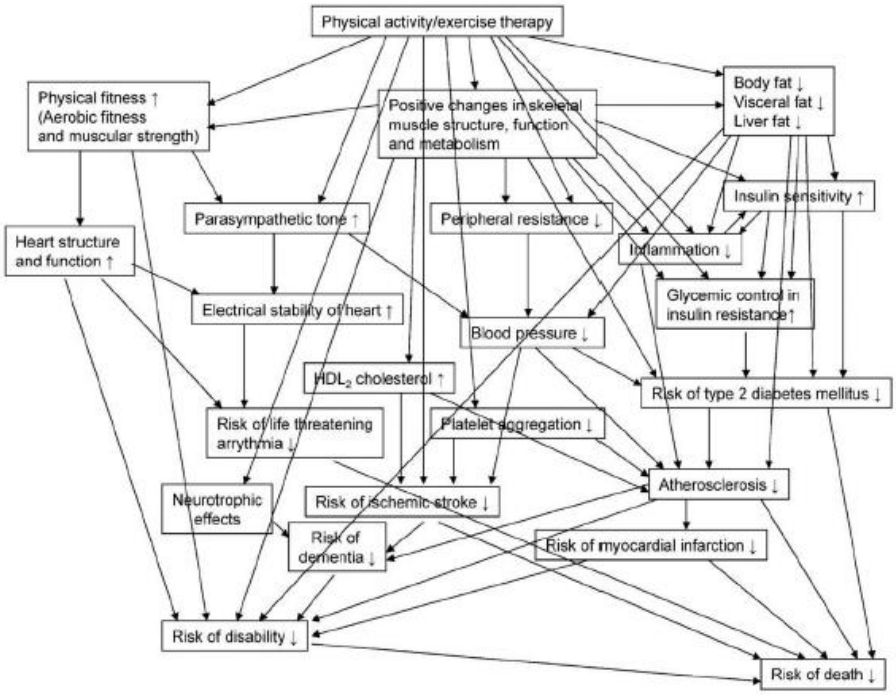


Figure 5 Physical activity/exercise therapy.

2.4.2 Healthy foods

A nutritious diet is essential for good health and nutrition. It also guards against many chronic, noncommunicable diseases like cancer, diabetes, and heart disease. A healthy diet must include a variety of foods and be low in salt, sugar, saturated fats, and trans fats made in factories. Figure 6 and 7 show how fruits and vegetables affect chronic diseases, how many vitamins and portions they contain, and how beneficial they are to health. They also provide information about the sources of these foods (Zesiewicz and Evatt, 2009).

Constituent	Sources	Established or proposed effects on human-wellness
Vitamin C (ascorbic acid)	broccoli, cabbage, cantaloupe, citrus fruits, guava, kiwifruit, leafy greens, pepper, pineapple, potato, strawberry, tomato, watermelon	prevents scurvy, aids wound healing, healthy immune- system, cardiovascular-disease
Vitamin A (carotenoids)	dark-green vegetables (such as collards, spinach, and turnip greens), orange vegetables (such as carrots, pumpkin, and sweet potato), orange-flesh fruits (such as apricot, cantaloupe, mango, nectarine, orange, papaya, peach, persimmon, and pineapple), tomato	night blindness prevention, chronic fatigue, psoriasis, heart disease, stroke, cataracts
Vitamin K	nuts, lentils, green onions, crucifers (cabbage, broccoli, brussel sprouts), leafy greens	synthesis of pro-coagulant factors, osteoporosis
Vitamin E (tocopherols)	nuts (such as almonds, cashew nuts, filberts, macadamias, pecans, pistachios, peanuts, and walnuts), corn, dry beans, lentils and chickpeas, dark-green leafy vegetables	heart-disease, LDL-oxidation, immune-system, diabetes, cancer
Fiber	most fresh fruits and vegetables, nuts, cooked dry beans and peas	diabetes, heart disease
Folate (folicin or folic acid)	dark-green leafy vegetables (such as spinach, mustard greens, butterhead lettuce, broccoli, brussels sprouts, and okra), legumes (cooked dry beans, lentils, chickpeas and green peas), asparagus	birth defects, cancer heart disease, nervous system
Calcium	cooked vegetables (such as beans, greens, okra and tomatoes) peas, papaya, raisins, orange, almonds, snap beans, pumpkin, cauliflower, rutabaga	osteoporosis, muscular/ skeletal, teeth, blood pressure
Magnesium	spinach, lentils, okra, potato, banana, nuts, corn, cashews	osteoporosis, nervous system, teeth, immune system
Potassium	baked potato or sweet potato, banana & plantain, cooked dry beans, cooked greens, dried fruits (such as apricots and prunes), winter (orange) squash, and cantaloupe	hypertension (blood pressure) stroke arteriosclerosis

Figure 6 Nutritive constituents of fruits and vegetables that have a positive impact on human health and their sources

Constituent	Compound	Sources	Established or proposed effects on human-wellness
Phenolic compounds			
Proanthocyanins	tannins	apple, grape, cranberry, pomegranate	cancer
Anthocyanidins	cyanidin, malvidin, delphinidin, pelargonidin, peonidin, petunidin	red, blue, and purple fruits (such as apple, blackberry, blueberry, cranberry, grape, nectarine, peach, plum & prune, pomegranate, raspberry, and strawberry)	heart disease, cancer initiation, diabetes, cataracts, blood pressure, allergies
Flavan-3-ols	epicatechin, epigallocatechin catechin, gallocatechin	apples, apricots, blackberries, plums, raspberries, strawberries	platelet aggregation, cancer,
Flavanones	hesperetin, naringenin, eriodictyol	citrus (oranges, grapefruit, lemons, limes, tangerine)	cancer
Flavones	Luteolin, apigenin	celeriac, celery, peppers, rutabaga, spinach, parsley, artichoke, guava, pepper	cancer, allergies, heart disease
Flavonols	quercetin, kaempferol, myricetin, rutin	onions, snap beans, broccoli, cranberry, kale, peppers, lettuce	heart disease, cancer initiation, capillary protectant
Phenolic acids	Caffeic acid, chlorogenic acid, coumaric acid, ellagic acid	blackberry, raspberry, strawberry, apple, peach, plum, cherry	cancer, cholesterol
Carotenoids			
Lycopene		tomato, watermelon, papaya, Brazilian guava, Autumn olive, red grapefruit	cancer, heart disease, male infertility
α-carotene		sweet potatoes, apricots, pumpkin, cantaloupe, green beans, lima beans, broccoli, brussel sprouts, cabbage, kale, kiwifruit, lettuce, peas, spinach, prunes, peaches, mango, papaya, squash and carrots	tumor growth
β-carotene		cantaloupes, carrots, apricots, broccoli, leafy greens (lettuce, swiss chard), mango, persimmon, red pepper, spinach, sweet potato	cancer
Xanthophylls	Lutein, zeaxanthin, β-cryptoxanthin	sweet corn, spinach, corn, okra, cantaloupe, summer squash, turnip greens	macular degeneration
Monoterpenes	limonene	citrus (grapefruit, tangerine)	cancer
Sulfur compounds	glucosinolates, isothiocyanates, indoles, allicin, diallyl isulphide	broccoli, Brussels sprouts, mustard greens, horseradish, garlic, onions, chives, leeks	cancer, cholesterol, blood pressure, diabetes

Figure 7 Non-nutritive plant constituents that may be beneficial to human health

2.4.3 Prebiotic & Probiotic

Gut microbiome is dominated by two main of bacteria which are called Bacteroidetes and Firmicutes and furthermore small number of proteobacteria, verrucomicrobia, actinobacteria and fusobacteria. Different people have different levels and kinds of bacteria. The colon contains the most microbiomes. Prevotella and Bacteroides are both members of the bacterial order Bacteroidetes, and people who consume higher fiber diets may also have higher levels of prevotella. According to studies, a strict animal- or plant-based diet for one day can change the microbiome's composition.

Mainly two parts of our diet that able to affect the microbiomes that are called as Probiotics and Probiotics. Probiotics are live microorganism that offer a health benefit for example helping to enhance or restore health to our gut microbiome. Many microorganisms that naturally lives in our bodies are like microorganisms in probiotic foods, drinks, and dietary supplements. These are some foods which can take as a probiotic food’s yogurt, coconut water, kefir, aged cheese, and probiotic milk.

Prebiotics are food component used by host microbes and therefore they offer health benefits. Many prebiotics are found in higher fiber foods that aren’t broken down by human digestive system, furthermore prebiotic are food for gut microbiome vegetables, fruits, grains, and beans are the best source of prebiotic fiber. Most people don’t eat enough fiber a day. The recommendation of fiber which want to human are 25-38 gras of fiber per day (Prebiotics & probiotics, 2022).

2.4.4 Levodopa and Rasagiline

Levodopa is drug which used to treat Parkinson patients’ disease, dopamine is a naturally occurring substance in the brain which helps to make control of the movement and activities such as talking walking and body balancing of the PD patients. When PD patients take levodopa as a medication, it enters the brain and helps to replace the lost dopamine, which improves people's ability to perform their tasks. Therefore, when dopamine is released into the brain, it helps to control

symptoms and enable daily activities like walking, getting dressed, maintaining balance, and bathing.

Rasagiline is used to treat Parkinson patients along with other drugs like levodopa and carbidopa. Rasagiline is a member of the class of medications known as MAO inhibitors, and it also functions by raising the levels of some naturally occurring brain chemicals like dopamine, norepinephrine, and serotonin (Carbidopa And Levodopa (Oral Route) Description and Brand Names - Mayo Clinic, 2022)

2.4.5 Stress release techniques

When we feel under pressure or threatened, we respond by becoming stressed. It typically occurs when we are in a precarious situation that we don't feel we have any control over. To overcome this situation, you can follow some of the techniques as mentioned bellow (Resolve to Beat Stress With These 10 Steps, 2022).

- Sleep More:
  The national sleep foundation states that healthy adults should get at least 7 hours of sleep each night. By getting a few hours of sleep, the patient can lower their stress levels and the impact that certain health issues, like diabetes and high blood pressure, have on their life.

- Pick Up a Hobby:
  Both children and adults can have hobbies. Having a hobby can give you the mental outlet you need and reduce your stress levels.
  The right hobby can also add a healthy dose of balance to your life. Here are some hobbies that are related to reducing stress: gardening, photography exploration, scrapbooking, aquarium maintenance, puzzles, drawing and painting, and coloring.

- Listen to some music:

  The patient can alter their energy and mood by listening to music. The patient needs to relax their mind by listening to slow music. Additionally, while engaging in their activities, the patient can hear some classical tones. You can listen to music at any time.

2.5 Dart

Fast app development on any platform is possible with Dart furthermore it a client-optimized programming language. it aims to provide the most productive programming language for cross-platform development. The dart forms the foundation of flutter, and the developer is the google. Flutter allows to develop IOS, Android and web by use of the Dart as the programming language (Dart overview, 2022).

2.6 Existing Android systems

For those with Parkinson's disease, there are a few mobile applications available. The majority of the available applications help patients to complete the daily tasks like exercises and some voice training. Patients can ask questions and post the answers in some of the applications. A large percentage of Android applications

2.6.1 Parkinson’s Support

With the help of this Android app, users may ask other users personal questions and receive their answers. They can also submit stories that are personal to them or have to do with the illness. The patient can use this program to identify someone who looks like them in their area and meet them.

2.6.2 Parkinson’s Disease Diary

Reminders for taking medications, performing physical activity, and meals can also be added by the user. The method has demonstrated how crucial it is for a patient with Parkinson's disease to take their medications on schedule and keep track of their symptoms to make sure that their medications are working as efficiently as possible.

2.6.3 Loud and Clear

The goal of this Android app is to clearly hear the patient's voice. The device offers warm-ups and regular workouts to assist in recalibrating and maintaining the patient's voice's integrity. The voice-findings in this app are excellent for voice-training Parkinson's disease patients.

2.6.4 Yoga against Parkinson’s

This Android app is entirely dedicated to yoga workouts. The software provides up to 24 yoga positions that can assist users in managing some of the Parkinson's disease-related adverse effects. Patients who struggle with body balance can access a huge number of yoga positions.

2.6.5 Parkinson Exercise Tablet

Parkinson's disease patients and therapists can use this video app. The app offers movement guidance and directions for daily exercises and mobility, as well as more than 50 videos of at-home workouts are included. This android software covers workouts for walking, posture, bed mobility, balance, flexibility, and relaxation.

2.6.6 APDA Symptom tracker

The system is proposing a simpler approach to track patients' symptoms using this android application. With the use of the APDA Symptoms Tracker app, patients can keep track of their symptoms, such as tremors, rigidity, balance issues, and non-motor symptoms, and the system will generate a report that they can share with their care team. Users of this system can add practical notifications and reminders.

2.7 Features Comparison: Developed system vs similar systems

Table 1 developed System vs Similar Systems

Developed System Features	PDP App	Similar Apps
User Friendly Interfaces	✓	✓
Diet Plans related for some additional diseases	✓	✗
Reminder	✓	✓
Meditation	✓	✗
Feedbacks	✓	✗
Puzzle Game	✓	✓
Exercises	✓	✓
Authentication	✓	✓
Daily Activity instructions	✓	✗

2.8 Research Gap

A complex project with many elements is the design and development of an android-based application to suit the needs and wants of PD patients with exercise and diet plans. In this literature review chapter of the thesis report, the viability of the major project characteristics has been evaluated utilizing the present systems. Additionally, this analysis of the literature review prompted an examination of the various platforms and frameworks. The researchers chose a few of the most well-known apps from the Google Play store that make use of a technology comparable to the suggested system and described it above. The Android software mentioned above focuses mostly on voice training, reports, meals, and workouts. However, these kinds of sections will be handled by the developed system. which include guidelines for daily tasks, a feedback form, mind-training games, nutrition plans for PD patients who also have chronic illnesses, and exercise sets that can be used by both types of patients—those who are seated in a wheelchair and those who can stand.

The system that was created was primarily focused on Parkinson's patients and built to support their functions. If a person with Parkinson's disease and other chronic diseases uses the app, the system instructions will advise them on what they should and shouldn't eat. However, the similar systems cannot full fill the proposed requirement and functions. The reader can get a sense of the system that was designed to fulfill all the functions and needs mentioned above in order to close this research gap.

Chapter 3 Methodology

The Methodology section of this chapter of the thesis report talks about the Agile development methodology, which was used to develop the research project using an incremental approach. According to the agile development methodology all the documentation and design parts will be discuss in this chapter.

3.1 Methodology of development

Any product will fail if it is not well planned, as it is challenging to create and deliver a product on time, The Agile development methodology is used for the project. A conceptual framework for software engineering called agile methodology starts with planning and progresses through incremental and iterative interactions over the course of a project's life cycle. The agile software development methodology is a lean method of developing software that lowers costs and overhead while allowing for change without affecting the process. The primary advantages of agile software development are improved teamwork and communication, fast release, design flexibility, and more reasonable procedure (Samer Sawalha and Hiba Abdel Nabi, 2020).

One of the important features of agile development software is its capacity for change adaptation, as shown in Figure 8. Agile processes have an incremental delivery property that flattens and reduces this cost, enabling changes at a later stage without incurring significant costs or delays.

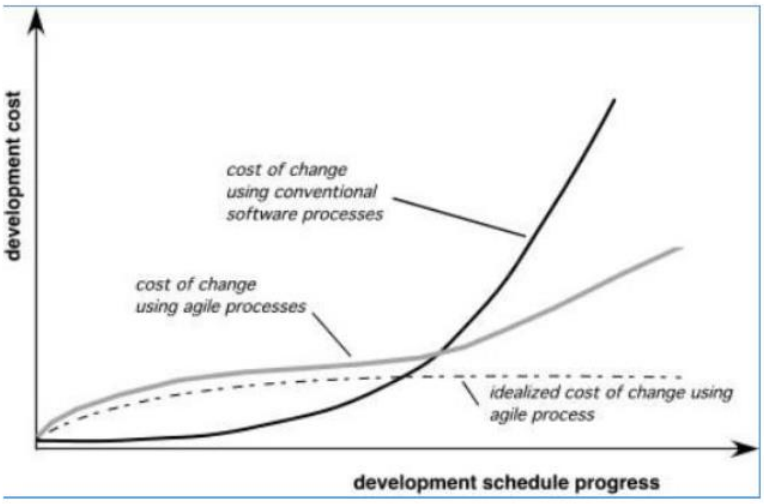


Figure 8 The development cost vs. change in the development process

3.2 Planning

Without proper preparation, a lot of projects end in failure. As a result, planning is a key component of the Agile methodology because it gives us a visual overview of the project. The planning is most important to a project because the developer can understand the deliverables and the project milestones. Using a Work Breakdown Structure (WBS) and a Gantt chart the project planning process has been done. Mainly this project use WBS and Gantt chart to appropriate planning and time management.

Many activities can be broken down into smaller ones using the work breakdown structure. If the activities are broken down into smaller chunks, it is easier to complete the job at a certain time. In “PDP Healthcare” WBS each box represents the key milestones and using it we can get an idea to complete the project. The primary objectives and timelines of this research project's Gantt chart demonstrate that the project must be finished by the project deadline. This research project's WBS and Gantt chart are included in Appendices A and B, respectively.

3.3 Requirement Gathering and Analysis

Studying the project's background, trying to gather the important and relevant requirements needed to develop the project, and clearly analyzing the requirements to determine whether the project is feasible, are the most important roles of a successful project. This chapter explains the procedures used to gather the project's requirements and the methods utilized to evaluate them.

Under requirement gathering, there are two methods for gathering data: primary data gathering and collecting secondary data. Research papers, journals, e-books, and articles are used to collect secondary data, whereas questionnaires are used to collect primary data. Collecting secondary data is the most effective way to advance the project because it is a PD health care application. Obtaining secondary data enables one to understand the differences in technologies, functions, and methods to complete project-related tasks. It is useful to discover how to finish the remaining gaps in existing systems. Referring to all the research papers, documents and articles which are published between 2010 to 2022 help to full fill the gaps in the existing systems with the project.

3.2.1 Functional Requirement

The researcher has carried out a secondary data analysis which carried a literature review and identify the existing systems and figured what are their features based on that the researcher planed how would the system make unique. In the literature review the needs of the PD patient are figured by the researcher, using the information that has been gathered and examined, the following functionalities are determined and constructed.

- Exercise plans

  With the help of this system feature, the patient may perform the daily exercises that are necessary to keep their balance and physical activity levels up.

- Meal plans

  This system feature helps the patient to maintain their body weight, good meal plans and some menus for breakfast, lunch, and dinner. When the user can maintain the diet plan correctly the PD patients can slower the symptoms which related to PD.

- Daily activity

  This feature can guide the PD patient from A-Z. the important is in this feature the researcher has include all the activities which the PD patient wants.

- Meditations

  If the user has some mental problems and stress problem, this feature is the best part for it. User can hear some sound clips while meditating and listen in to slow music.

Chapter 4 Design

During this step the system design and architecture are specified. Important goals or key goals are properly assessed and organized into a work breakdown structure as well as the project's tasks are successfully scheduled using a Gantt chart to ensure proper planning and management.

4.1 System Architecture design

An overview of a system can be found in its system architecture. It displays the connections between the various system functionalities. The system architecture diagram demonstrates how the following application's functional connections are distributed. Figure 9 illustrates the system architecture design, which is simple for the user to use and clearly introduces functional elements to the diagram.

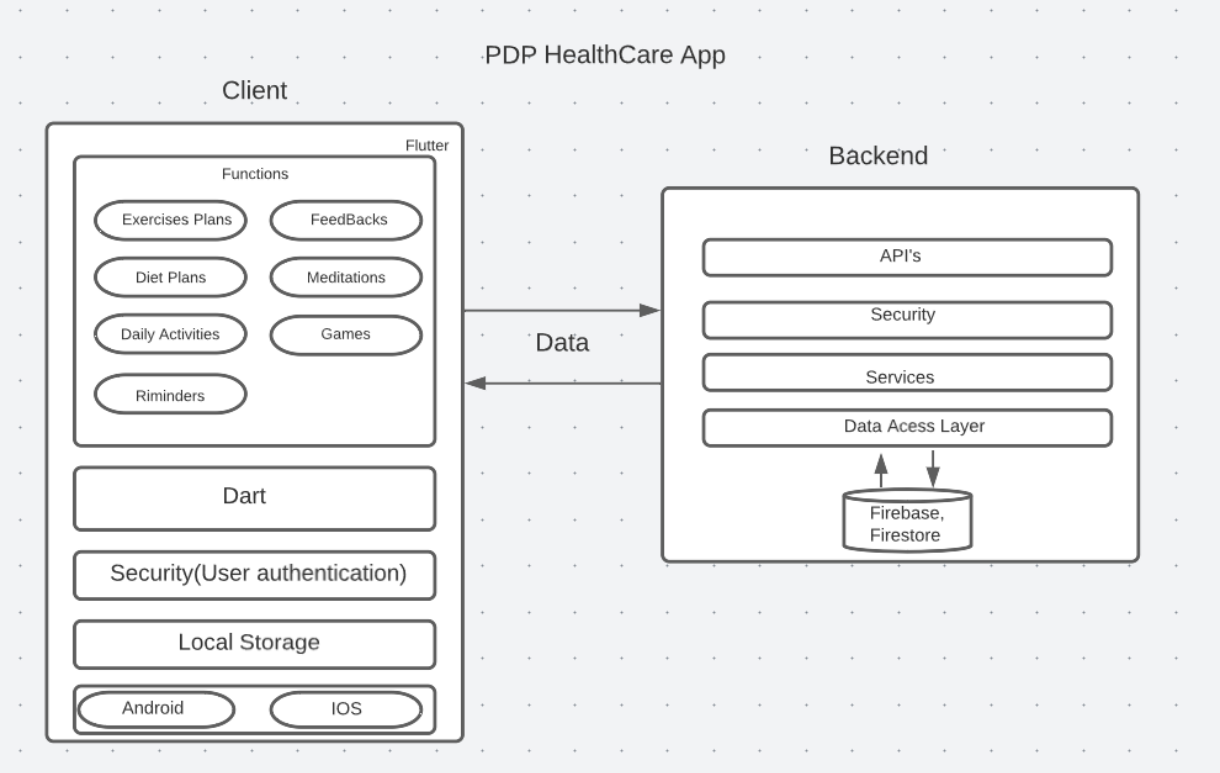


Figure 9 Architectural Diagram

The system architecture diagram shows that the application has seven key functions: workout plans, feedback sessions, nutrition plans, daily activities, brain training games, and reminders. A user must either register for an account or log in to one to access this mobile application. As a result, Firebase will be used to access the data and verify the user.

4.2 Design of the project

4.2.1 Use Case Diagram

Use case diagrams are used to understand how users interact with systems for various use cases. By focusing on this use case diagram, the system can be built and developed to handle the tasks of the system's users. Additionally, this will help with the graphical user interface design of the system in accordance with the functions. The use case diagram for the PDP health care center is illustrated in the figure 10.

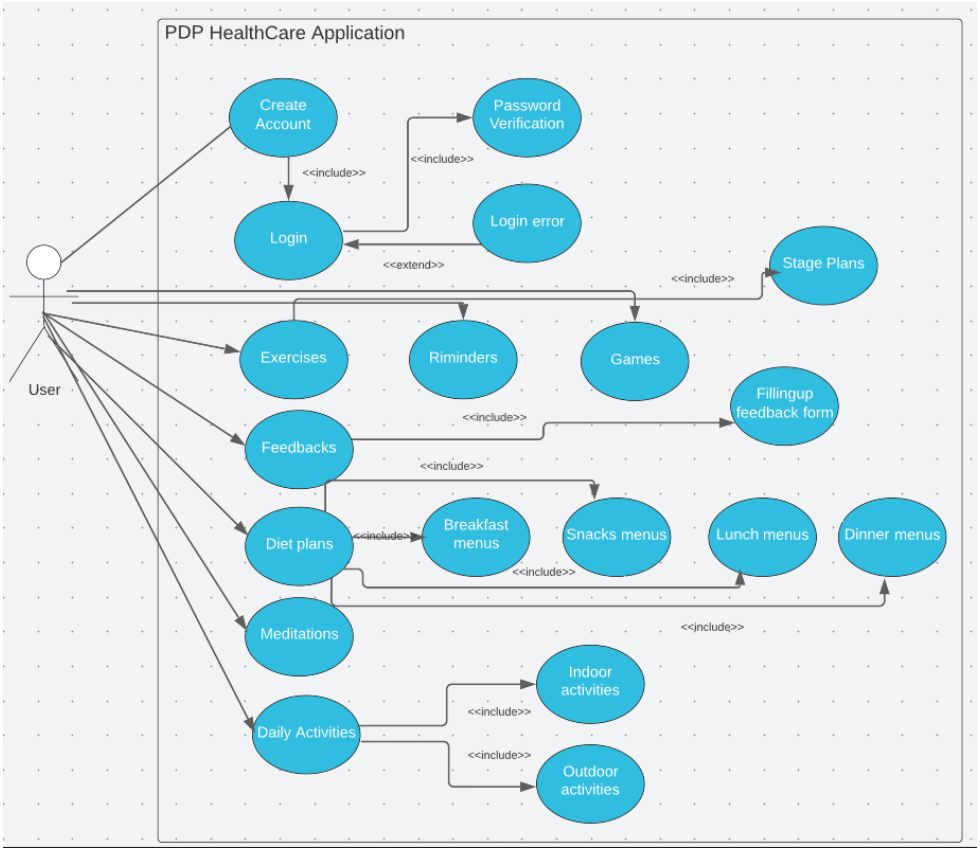


Figure 10 Use case diagram

4.3 Wireframes

These wireframe designs are done using MockFlow which is an online wireframes software for designers planning, building, and sharing work. The following wireframes shows that the overview of the designed application. Before starting the implementation phase, the developer should design the system to better understand the application and its functions and to get a feel of how to design it by looking at the wireframes. These are a few of the developed project's wireframes, which are listed below.

Figure 12 Onboarding Wireframe Design

Figure 11 Feedback Wireframe Design

Figure 14 Login Wireframe Design

Figure 13 Register Wireframe Design

4.4 Interfaces

These are a few interfaces that were created under the direction of the wireframes listed in the previous sections. The developed project's interfaces have an attractive appearance to the users. The onboarding screens shown in below Figures 15, 16, and 17 were developed in accordance with the wireframes listed in the above session. Some of the important information that users need to maintain their health is included in the onboarding screens. The onboarding screens will appear when the user use the system at the beginning after onwards the user will redirected to the register screen or to home screen.

Figure 15 Onboarding UI

Figure 16 Onboarding UI

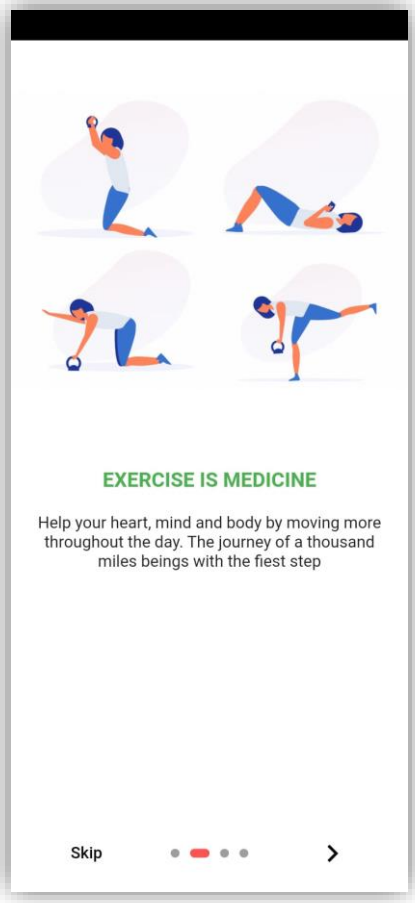


Figure 17 Onboarding UI

The login and register interfaces are shown in below Figures 18 and 19 respectively. Once the user has completed the onboarding screens, they are directed to the authentication screen where they can choose to login or register.

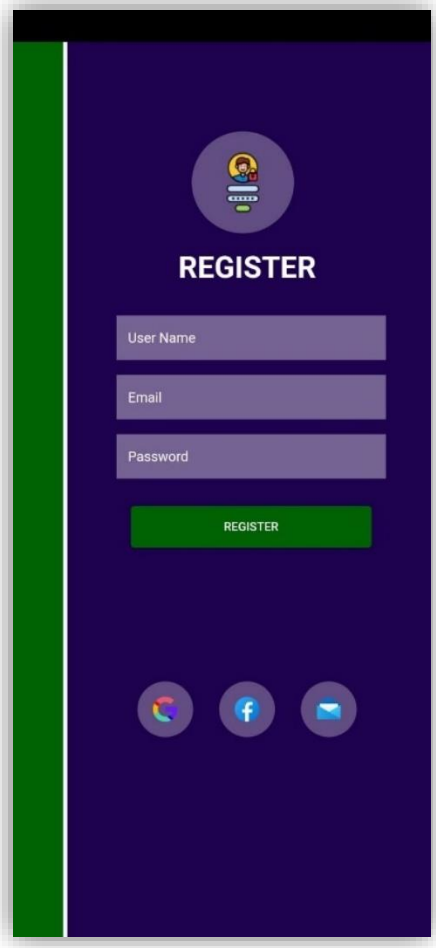


Figure 19 Register UI

Figure 18 Login UI

Chapter 5 Implementation

The final coding created during the planning and development process is developed during the implementation phase, which also includes testing the functionality. This phase also facilitates the development system's coding phase. The number of working products is increased and updated to the final system product after this phase is finished. Researcher has been chosen several technologies to build up the system and all technologies are new, and the technologies are selected because of the requirement of the system. Three sprints were used to build the project before the confirmed final system. Therefore, under the sprints system, responsibilities are listed. The Gantt chart lists the sprints and the responsibilities.

Sprint 1

- Design Database
- Design Frontend

Sprint 2

- Create Frontend
- Test Frontend
- Create Database

Sprint 3

- Creating Backend
- Testing Backend

5.1 Resources and tools

The Resources and tools which are used to develop the research project are listed below.

- Flutter

  Google's open-source UI software development kit, called Flutter, is used to create cross-platform applications for Windows, Android, and iOS. The programming languages Dart, C, and C++ are used to create the flutter application. The Dart programming language was used to create the PDP Healthcare application, which was built using flutter.

- Google Firebase

  Google has developed the Google Firebase platform, which can be used for both web and mobile applications. To store data and create user accounts, the developed project uses Firebase as a database.

5.2 Security measures taken during implementation

- Authentication of users

  Only authorized users with login and password credentials may access the web Android application. Users should register with the system before logging in.

- Validation of email address and password

  Plain text password storage in databases is never safe since users' passwords can be obtained by hackers with access to the database. As a result, it is always necessary to encrypt a password before saving it in a database. the firebase will get the details of the user and keep it secured.

Chapter 6 Result

This chapter provides a comprehensive explanation of the study project's goals and objectives. The PDP health care application's main page, shown in Figure 1, includes features for PD patients' exercises, feedback, reminders, meditations, diet plans, games, and daily activity functions. The researcher has also finished the project's study components. Additionally, this chapter covers the project results, the system's proof, code fragments, and test cases.

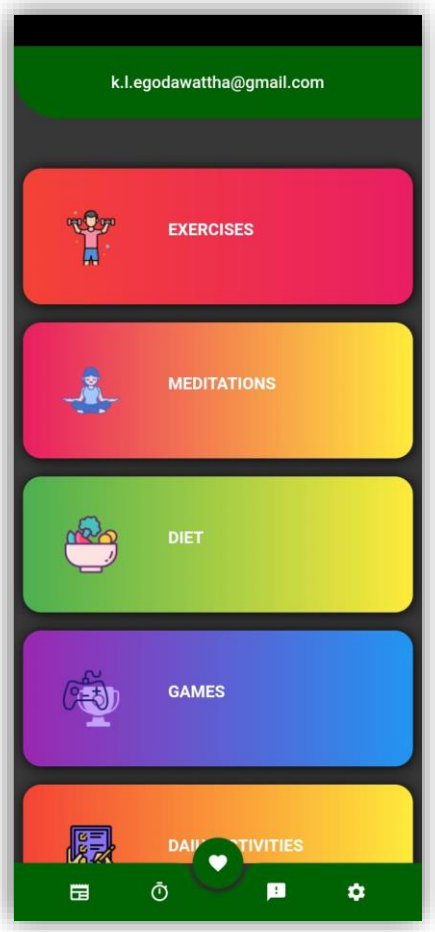


Figure 20 PDP Health Care Main UI

6.1 Evidence of the PDP Health Care project

To demonstrate the project's evidence, the functions of this built application will be divided into six sections and describe them using screenshots and some code segments.

6.1.1 Exercise Plans

- Interface

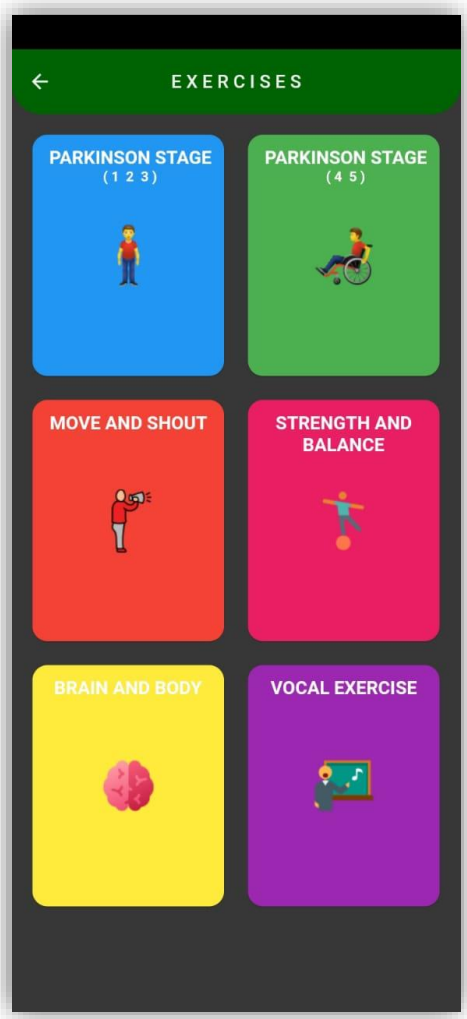


Figure 21 Exercises Main UI

The exercises UI in Figure 21 are divided into Parkinson Stages 1 to 3, Parkinson Stages 4 to 5, Movement and Shout, Strength and Balance, exercises for the voice, body, and brain. The exercise mainly consists of two parts, one where the PD patients can stand on their own two feet and the other where the PD patients is in a wheelchair. For these two levels, the system has designed 2 separate workouts.

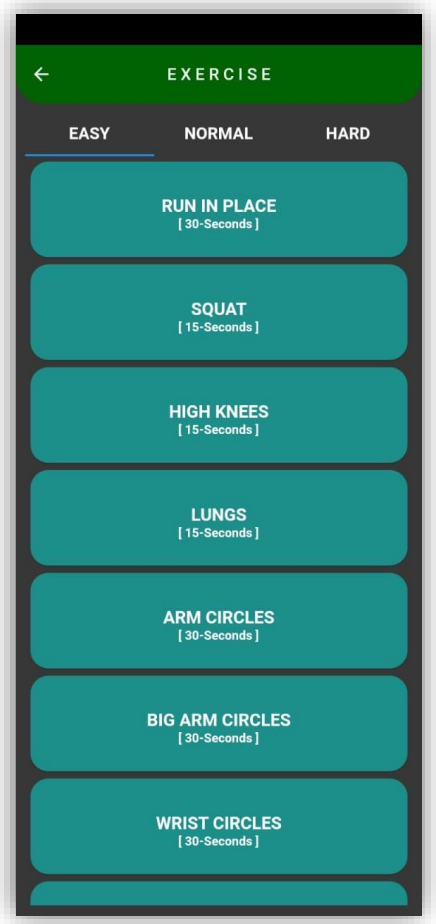


Figure 22 Exercise UI Tabs

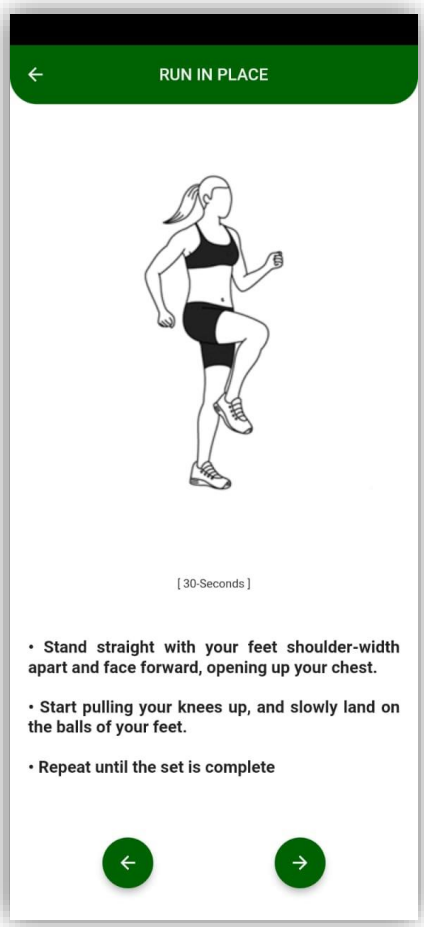


Figure 23 Exercise Instructions

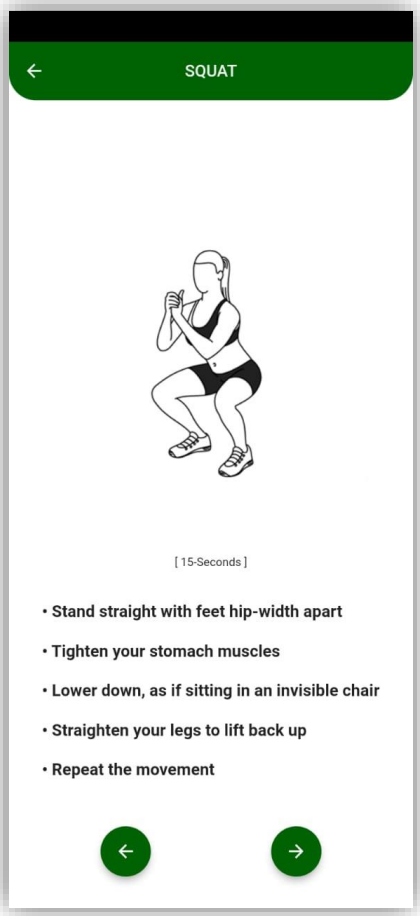


Figure 24 Exercise Instruction Screen 2

Figure 22 above illustrates the stages from 1 to 3 for which patients can walk or stand on their own two feet. There are three different types of exercise available for patients which are easy, normal, and hard. The form of exercise that best suits the patient's needs can be chosen. If the patient is healthy and active, they can choose the difficult option; otherwise, they can choose the simple. The patient can begin the exercise after choosing a category. The exercise's instructions and steps are shown in figures 23 and 24.

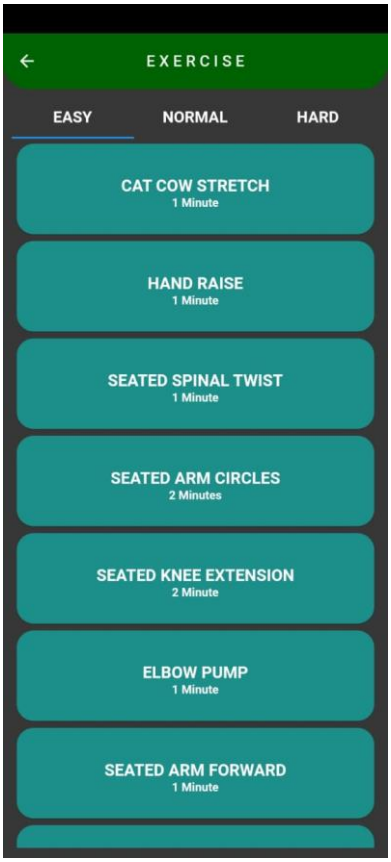


Figure 25 Exercise UI for stage 3 and 4

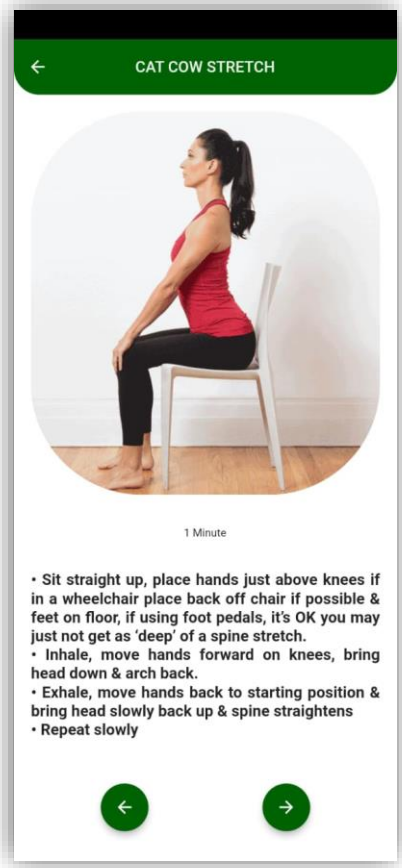


Figure 26 Exercise details UI for stage 3 and 4

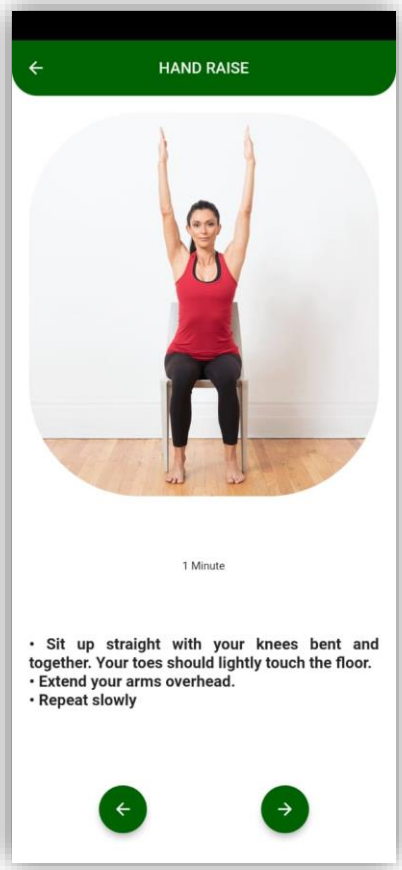


Figure 27 Figure 26 Exercise details 2 UI for stage 3 and 4

The exercises listed for stage 4 to stage 5 PD patients that are using wheelchairs are seen in figure 25 above. It is better for patients if they must follow a doctor's instructions before using these than to choose the types on their own. The PD patients who are unable to stand or walk are the major target of these forced exercises. The figures 26 and 27 show the processes and instructions for the users on how the exercises are carried out. It is recommended to conduct these exercises using a normal chair because some of the exercises cannot be completed using a wheelchair.

6.1.2 Meditations

- Interface

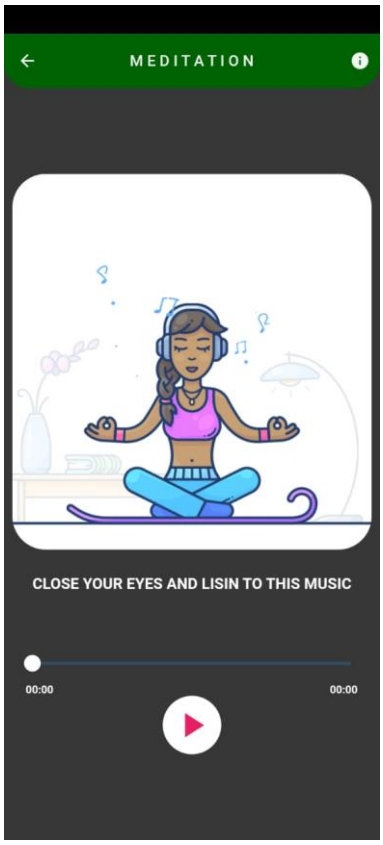


Figure 28 Meditation UI

Figure 29 Meditation Offline UI

The meditation feature that is useful for patients is shown in figure 28 above. The patient can meditate if they are alone at home, if their mood is bad, and if their stress level is high. If the patient is unable to meditate due to mental health issues, the researcher has added music to this function in order to capture the patient's attention. Figure 29 shows how some functionalities are unusable without internet access. To make use of this function Internet access is necessary, and the code that are in below will explain how this function works to internet users.

- Code

```
onPressed: () async {
                            if (isPlaying) {
                              await audioPlayer.pause();
                            } else {
                              const url =
'https://kanishkalakmina.github.io/parkinson/meditation.mp3';
                              await audioPlayer.play(url);
                            }
                          },
```

Listing 1: Connecting GitHub to play the music online

Due to the capacity of the application most of the large files are uploaded to the GitHub and linked it with the application through the internet. Therefore, the internet is a must to use this function properly.

6.1.3 Diet

- Interface

Figure 30 Diet main UI

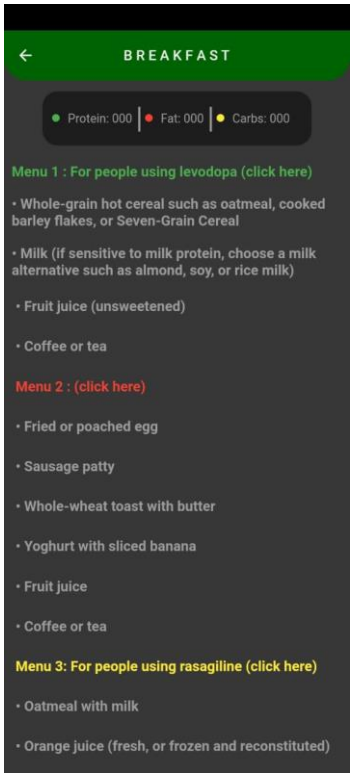


Figure 31 Breakfast UI

The figure 31 shown in the above is the home page of the diet function and it includes of all the parts which a PD wants. The diet feature is divided into four main categories. The main four cards are for breakfast, snacks, lunch, and supper, while the additional cards contain information that patients should consult before eating. Figure 32 shows the information that was provided to the patient regarding the breakfast card. Levodopa and Rasagiline, two key medications for PD patients, are the main topics of the researcher's focus in this section.

6.1.4 Games

- Interface

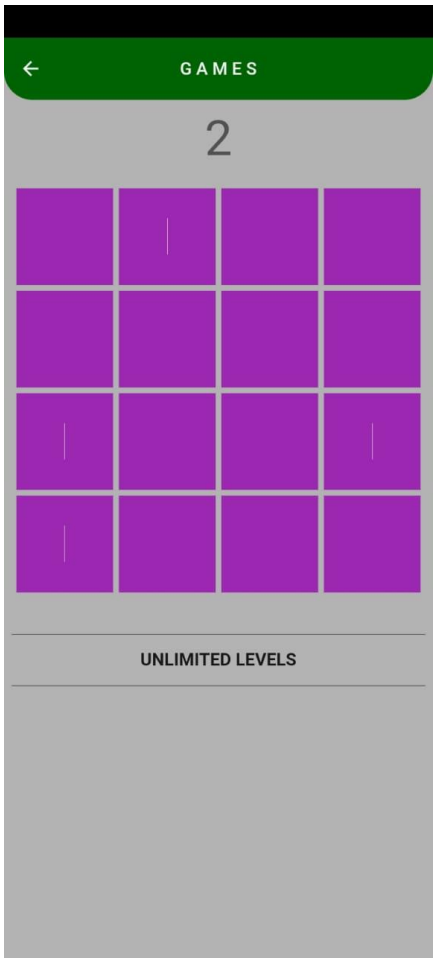


Figure 32 Game UI

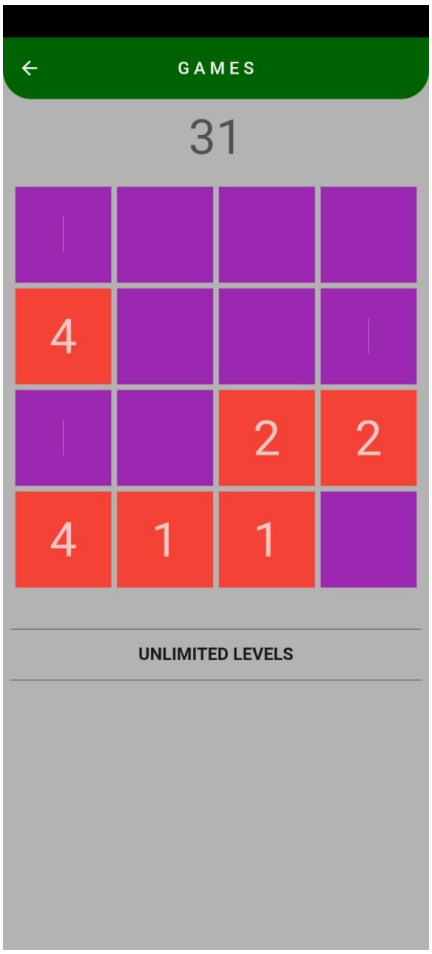


Figure 33 Game UI 2

Figure 33, which is above, illustrates an important feature created by researcher for those with higher levels of stress. There are no limits to the levels in this mental game. The user must select two cards at a time, as indicated in figure 34, in order to play this game. When the user touches it, the card will flip; if the two cards match, it will stay; otherwise, both cards will flip in the opposite direction. All of the cards must match for the user to win. The user can train their brain and improve their memory by utilizing this feature. The code segment for this feature, which specifies how the cards are flipped in this feature, is added in figure 35.

- Code

```
FlipCard(
                    key: cardStateKeys[index],
                    onFlip: () {
                      if (!flip) {
                        flip = true;
                        previousIndex = index;
                      } else {
                        flip = false;
                        if (previousIndex != index) {
                          if (data[previousIndex] != data[index]) {
                            cardStateKeys[previousIndex]
                                .current State
                                ?.toggle Card();
                            previousIndex = index;
                          } else {
                            cardFlips[previousIndex] = false;
                            cardFlips[index] = false;
                            if (cardFlips.every((t) => t == false)) {
                              print("Won");
                              showResult();
                            }
                          }
                        }
                      }
                    },
                    direction: FlipDirection.HORIZONTAL,
                    flipOnTouch: cardFlips[index],
                    front: Container(
                        margin: const EdgeInsets.all(3.0),
                        color: Colors.purple),
```

```
                back: Container(
                  margin: const EdgeInsets.all(3.0),
                  color: Colors.red,
                  child: Center(
                      child: Text(
                    "${data[index]}",
                    style: Theme.of(context).textTheme.displayMedium,
                  )),
                ),
              ),
```

Listing 2: Flip code for Game function

6.1.5 Daily Activities

- Interface

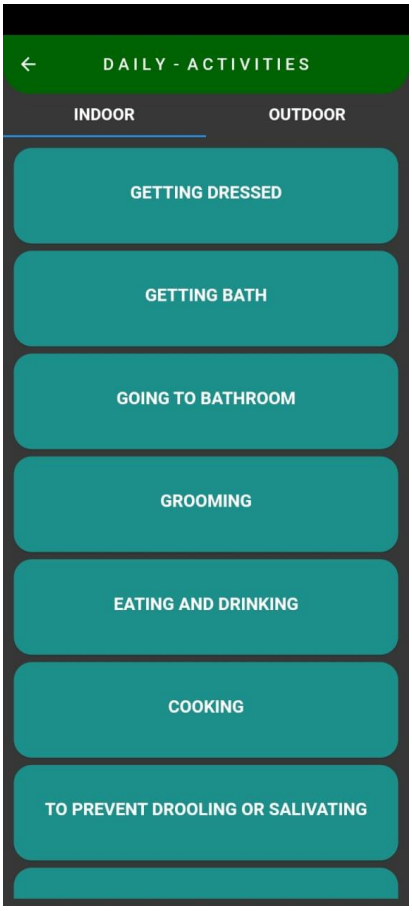


Figure 34 Daily Activities UI

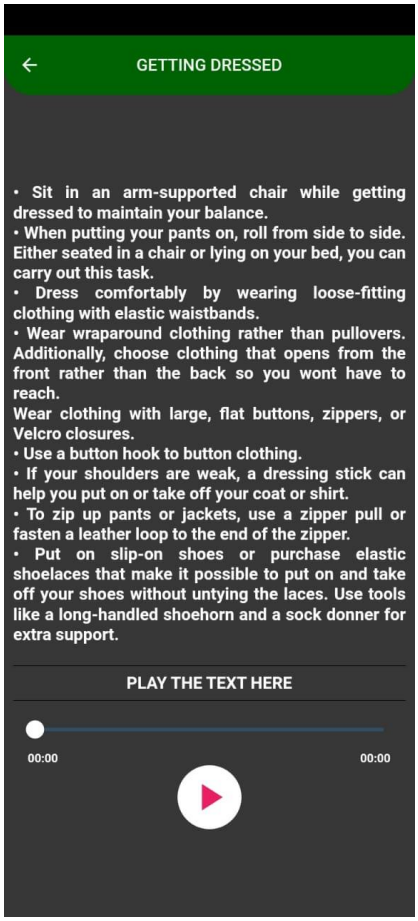


Figure 35 Daily Activities - getting dress UI

The Activity home page is given in Figure 36, and the instructions for the daily activities that patients engage in are shown in Figure 37. Every patient with Parkinson's disease needs a caregiver; as a result, if the patient needs instruction, the caregiver can read the text; otherwise, the patient can play the text. The task was finished by the researcher with the aid of text-to-speech tool called One Note.

6.1.6 Feedback form

- Interface

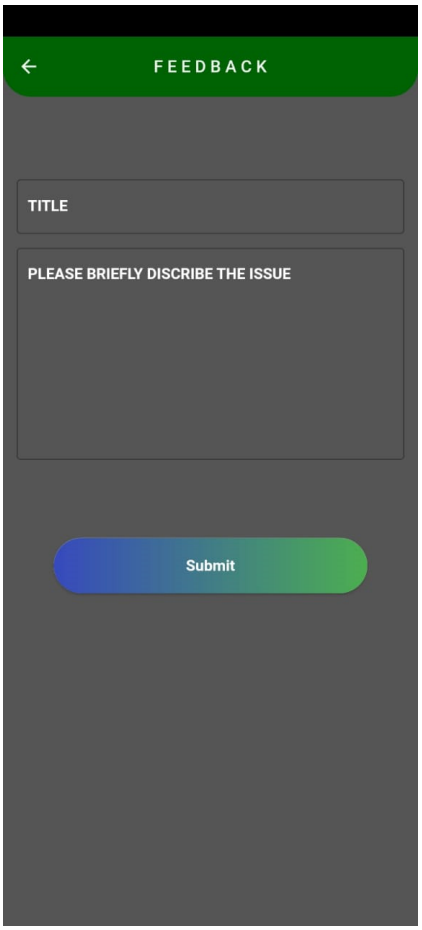


Figure 36 Feedback form UI

The diagram 38 depicts the feedback form that customers can use to provide feedback. They are able to submit any difficulties they have with PD, as well as any problems that may arise with the created application.

6.1.7 Reminder

- Interface

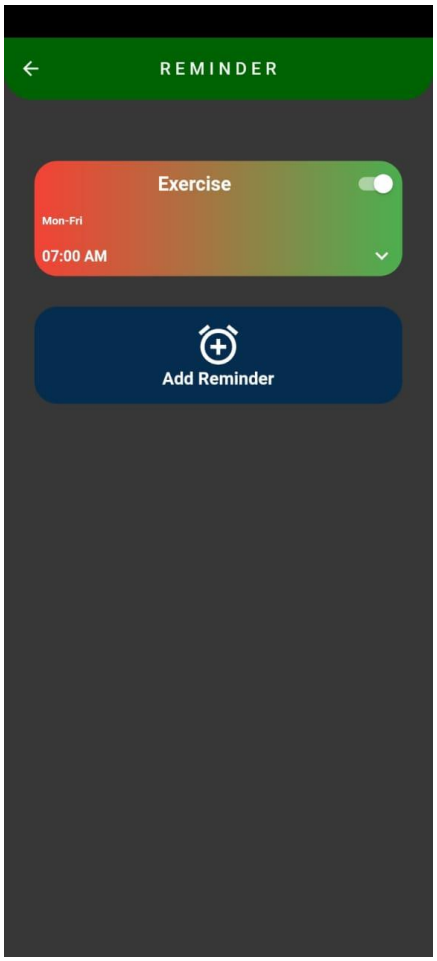


Figure 37 Reminder UI

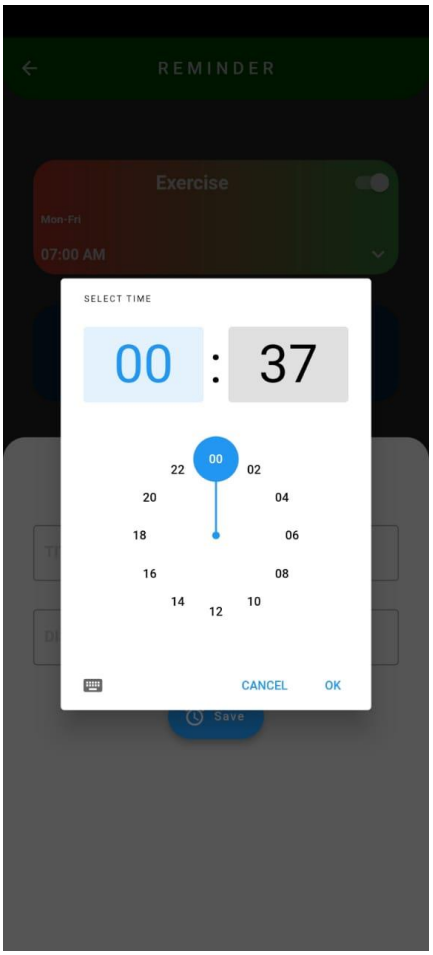


Figure 38 Reminder pop time UI

Figure 39 depicts the reminder function's user interface; this function's goal is to constantly keep the user in alert. The user is able to include reminders for workouts, mealtimes, and other important information. The user can set the time in figure 40. This interface is currently unavailable for unclear reasons, and only a notification will appear.

6.2 Test Cases for the project

Test cases are important part of the software development process. The researcher must have tested the system by running the application and ensure the system work properly without any errors. The test cases must be run to guarantee the function in the application working properly. PDP Health care is a Android application it includes registrations. Therefore, this system must be tested before the system release to the public. The following test cases are done with the main four functions which is user Register, user Login, user Feedback form and Reminder function.

6.2.1 User registration

The user registration function must be used to register the user for the PDP Health care application. To access the system user must provide a valid email address with strong password. After creating the account, the user can use the application.

Table 2 User registration test case 1

Test Case: User Registration					
Test Case No	Sequence	Test Description	Input Value	Expected Result	Status
1	1.1	Add an email that has previously been registered and a password.	Email: "k.l.egodawattha@gmail.com' Password: "123password"	Show a message saying that you already have an account.	Pass
Evidence					

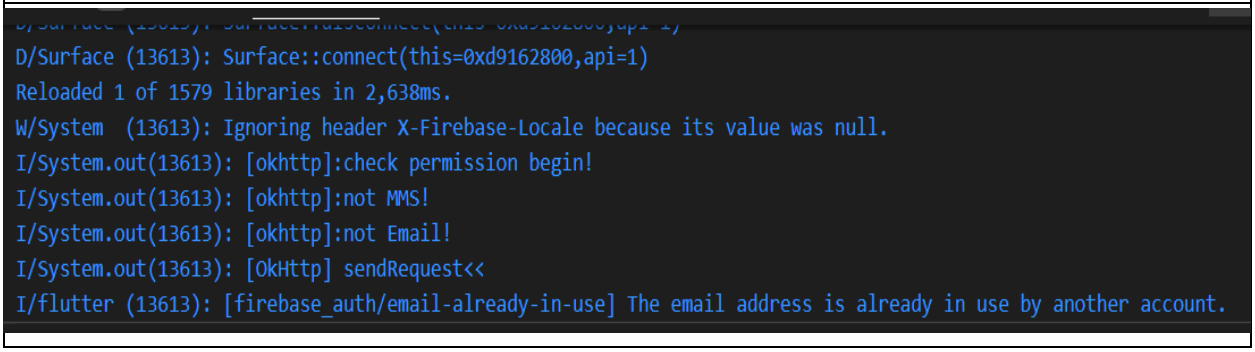
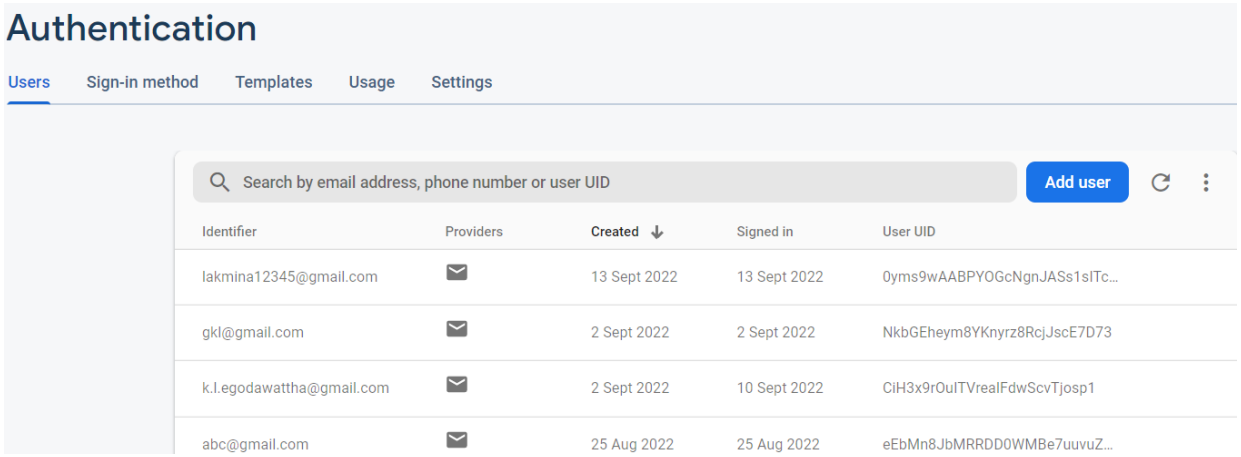


Table 3 user registration test case 2

Test Case: User Registration					
Test Case No	Sequence	Test Description	Input Value	Expected Result	Status
1	1.2	Create a new Account	Email: “lakmina12345@gmail.com” Password: “12345password”	Create an account and store the details on firebase	Pass
Evidence					
					

6.2.2 User Login

Once registered, the user has access to their account and can log in whenever they want. There is no need to log in each time the application opens if the user has already done so. The test cases are performed to validate the system's functionality and to test it.

Table 4 Login form test case 1

Test Case: Login Form					
Test Case No	Sequence	Test Description	Input Value	Expected Result	Status
2	2.1	Enter Registered email and a incorrect password	Email: “k.l.egodawattha@gmail.com’ Password: “123password”	Password does not correct	pass
Evidence					

```
I/AssistStructure(13613): Flattened final assist data: 612 bytes, containing 1 windows, 3 views
W/System  (13613): Ignoring header X-Firebase-Locale because its value was null.
I/System.out(13613): [okhttp]:check permission begin!
I/System.out(13613): [okhttp]:not MMS!
I/System.out(13613): [okhttp]:not Email!
I/System.out(13613): [socket]:check permission begin!
I/System.out(13613): [OkHttp] sendRequest<<
I/flutter (13613): [firebase_auth/wrong-password] The password is invalid or the user does not have a password.
```

Table 5 Login form test case 2

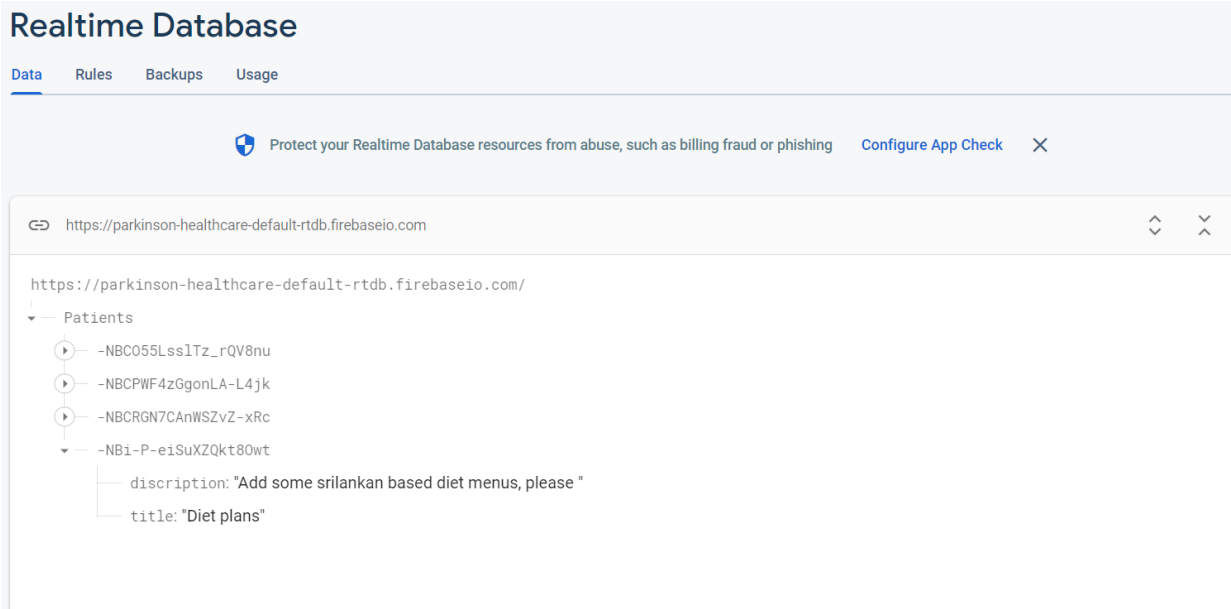
Test Case: Login Form					
Test Case No	Sequence	Test Description	Input Value	Expected Result	Status
2	2.2	Enter Incorrect Email and Incorrect password	Email: “kwattha@gmail.com’ Password: “123pdfrtassword”	There are no user records found	pass
Evidence					

```
D/Surface (13613): Surface::connect(this=0xd9162800,api=1)
I/AssistStructure(13613): Flattened final assist data: 632 bytes, containing 1 windows, 3 views
W/System  (13613): Ignoring header X-Firebase-Locale because its value was null.
I/System.out(13613): [okhttp]:check permission begin!
I/System.out(13613): [okhttp]:not MMS!
I/System.out(13613): [okhttp]:not Email!
I/System.out(13613): [OkHttp] sendRequest<<
I/flutter (13613): [firebase_auth/user-not-found] There is no user record corresponding to this identifier. The user may have been deleted.
```

6.2.3 Feedback Form

Table 6 Feedback form test case 1

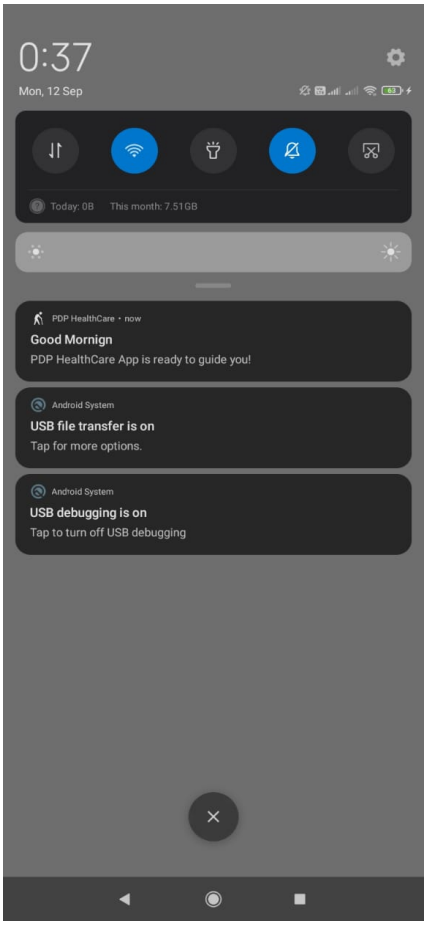
Test Case: Feedback Form					
Test Case No	Sequence	Test Description	Input Value	Expected Result	Status
3	3.1	Adding Some Feedback from the system	Title: “Diet plan” Description: “Add some Sri Lankan based diet menus, please”	Add feedback to firebase database	Pass
Evidence					



6.2.4 Reminder Function

Table 7 Reminder function test case 1

Test Case: Reminder					
Test Case No	Sequence	Test Description	Input Value	Expected Result	Status
4	4.1	Create reminders to alert user	Title: Breakfast Description: use menu 2 Time 7:00 AM	Add reminder cards to the screen	Fail
Evidence					



Even if the program has some issues that need to be resolved in further updates, all the testing has been completed, and as a result, the application is functioning with the interfaces. and requires some adjustments to be made in order to receive the application's best services. The application services are functioning smoothly and as expected overall.

Chapter 7 Evaluation and Discussion

In this chapter the evaluation process and the discussions are discussed. The discussion section covers the limits, challenges experienced by the researcher and what are the solutions made.

7.1 Evaluation of the project

This research project's primary goal is to use its available technologies, methods, and approaches to accomplish its goals. A system must be tested by an end-user to determine whether it is functional after the project's last session. When the product is released to the market and is accepted by the end-user, it will be of high quality and Useful. Because the produced project is a health app, user testing is crucial.

7.1.1 Evaluation of the users

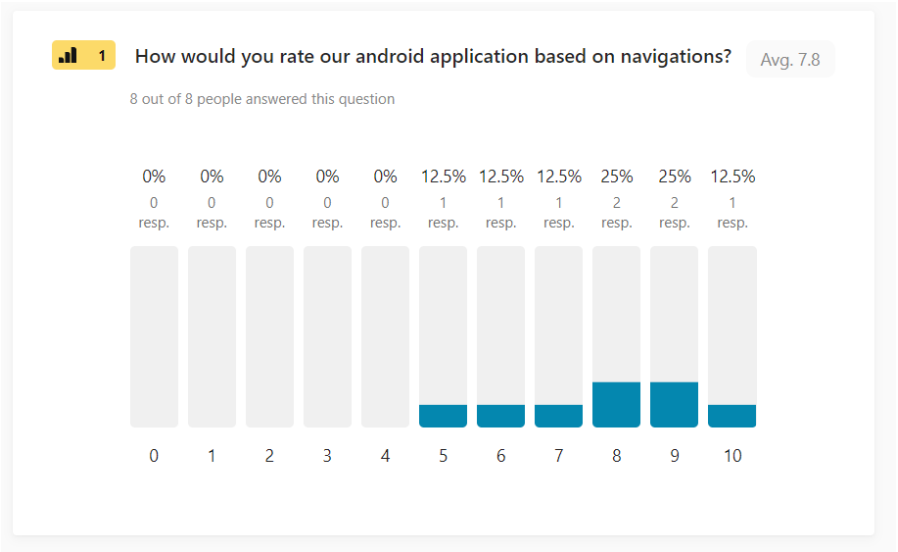


Figure 39 Rate app based on navigations

Based on the users' evaluations, figure 39 displays the ratings that were provided by the users. The majority of users give the developed application navigations to pages ratings of 10/8 and 10/9. This percentage explains how well the developed project does.

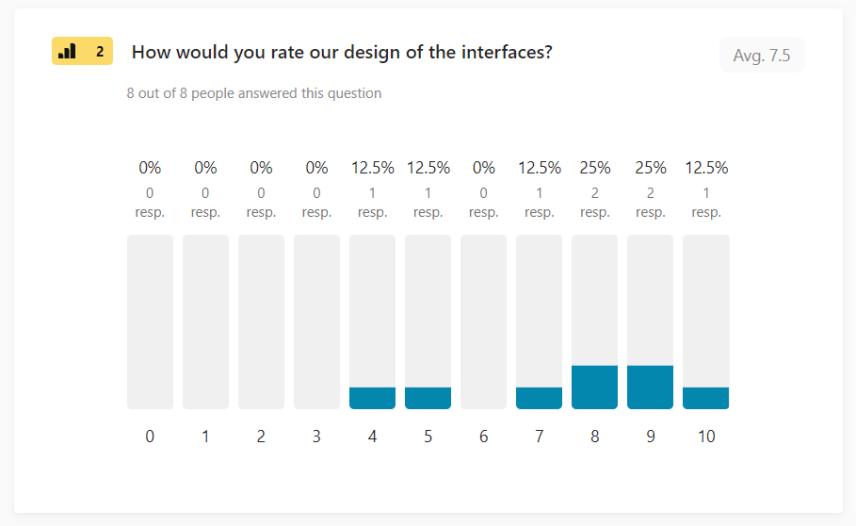


Figure 40 Rate app with design of the interface

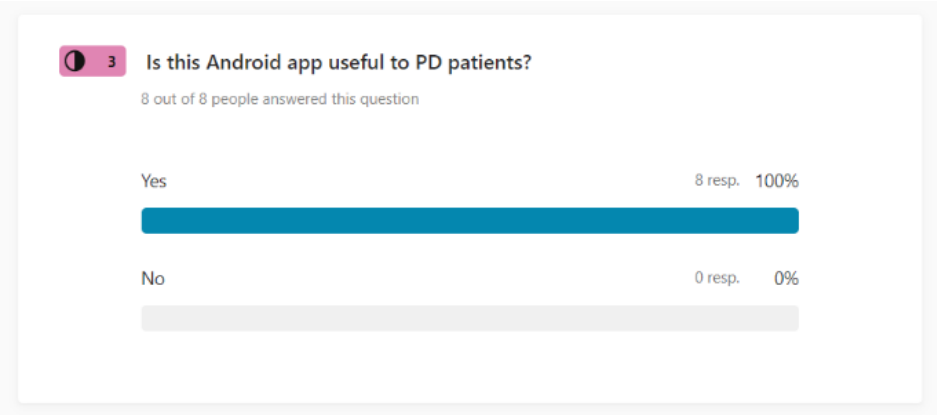


Figure 41 Rate app whether it is useful for not

The majority of users in figure 40 evaluated the system in accordance with their personal opinions. Therefore, on average, 75% of users gave the research project's interfaces the highest possible rating. As seen in figure 41, the application received 100% of the ratings, showing how helpful it is to PD patients.

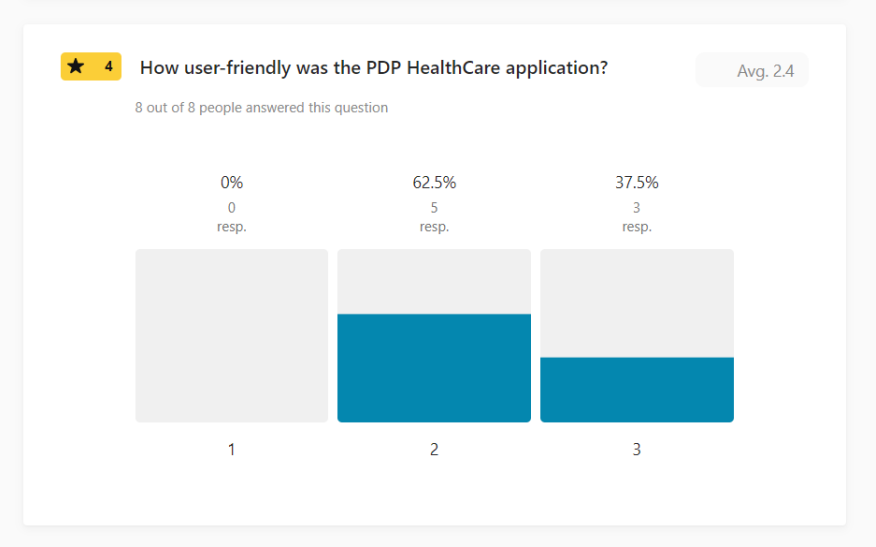


Figure 42 Rate app weather it is user-friendly

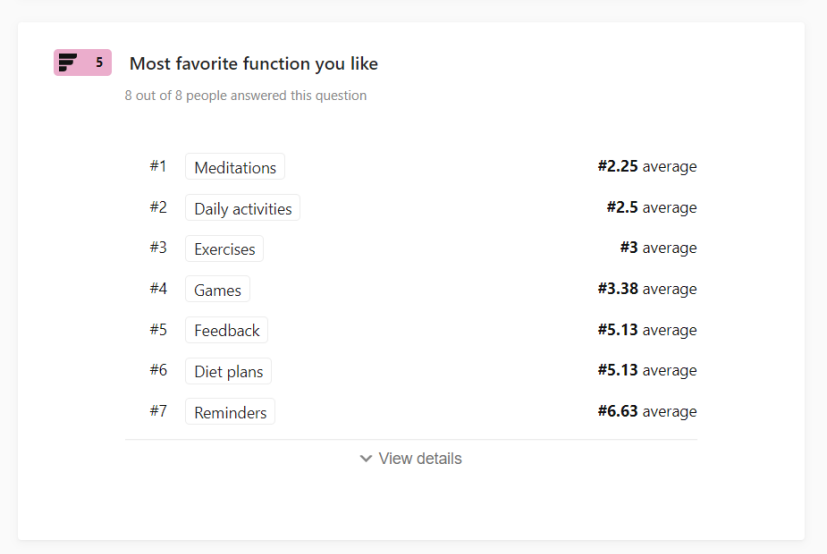


Figure 43 Most favorite function you like

The most important part of the PDP health care application is illustrated in Figure 43, which the researcher can understand. Users ranked the meditation feature highest in their ratings. Similar to top 2, daily activities take place and there onwards exercise function, games, feedbacks, diet plans, and finally reminders.

7.2 Discussion of the project

The system's limitations, the technical difficulties encountered, and the researcher's approach. The report's discussion section will go into detail about how they were resolved.

7.2.1 Technical problem faced and how it solved

At the beginning of the project the researcher tried to develop the PDP Healthcare android application using Android Studio, but this requires more space. Running Android Studio and its emulator can sometimes cause the computer to run slowly. The researcher used a mobile phone that was connected to the computer via USB to debug the application and switch Android Studio to Vs Code to solve this issue.

When the research application had completed 60% of the work, there was a flutter failure because some tools.jar were missing; as a result, the researcher tried to fix the problem by searching the internet and calling some friends to ask about the problem. Finally, the issue was resolved using stack overflow guidelines.

The developed application is a mobile application, and some features require an internet connection to operate. As a result, the research has integrated a feature that allows users to determine whether an application is connected to the internet or not. Only the latest SDK version will support the function. The researcher updated the version of the SDK to fix the issue.

7.2.2 Lessons Learned

Performing this research project had taught the researcher a lot about documentation and development and it helped to developed lot of skills. The researcher gained knowledge about a variety of open-source software that were used in the project's development, as well as documentation, technology research, understanding, planning, decision-making, and problem-solving.

7.2.3 Completion of Aims and Objectives

The project Aims and Objectives are explained in this chapter. The time the project start to end the researcher has put some effort to complete the goals and objectives which are mentioned in chapter one.

- Aims

  This research aim is to "create and implement an android-based application that helps the Parkinson patients by their needs and wants" under the evidence section of result chapter outcomes of the developed project has been discussed.

- Objectives

  Table 8 shows how the researcher completed the objectives on the research project.

Table 8 Objectives Status

No		Status
1	To determine the needs and issues faced by the PD patients.	Completed
2	To find the most up-to-date technology for developing an android-based application with advanced features	Completed
3	Create user-friendly interfaces for the android application.	Completed
4	To find a good database to the application	Completed
5	To give good Exercises plans and Meal plans	Completed
6	To help user to schedule the work on time.	Completed
7	To help the user via a Feedback form	Completed

Chapter 8 Conclusion and Future Work

In this chapter, the conclusion of the project PDP Healthcare and its future development are completely discussed.

8.1 Conclusion

There are countless web-based and Android applications available, and everyday thousands of new systems are created. There are so many web and Android applications available for PD patients as well, but some of them do not contain the information the patient is looking for, so the patient must spend a lot of time searching for them. There are no reliable resources for PD information in one place. Furthermore, the developed project has provided the best solution for all PD patients, and the patient can access all the information they need in one location by using the system that has been created. The research has completed all the objectives related to the research project The researcher has conducted a literature review to identify the needs and problems that PD patients face. In that chapter, all relevant information regarding the patients' needs, wants, and medications is listed. To create the research project, the researcher identified some technologies, filtered them, and then selected some of the technologies. The exercise plans and the meal plans are studied by conducting a literature review because the researcher must study the objectives and to implement them to the project. In the chapter 2 the meals plan, vitamin and some drugs exercises techniques are studied by referring the articles, books and some internet papers. The PDP Healthcare application was completed and tested on the two most popular mobile operating systems, iOS, and Android. Since different types of mobile phones are used by the users, it is useful for the user to use the application on both platforms. If a user submits feedback in the developed application's section for user feedback, the information is stored in Firebase. This requirement needs to be met manually by the researcher visiting the data and viewing it. An admin function must be added to this developed project to fulfill the limitations. To conclude, the developer of the project here hopes that the PDP Healthcare application achieves its goal of resolving this issue. Users can share their application-related issues through feedbacks to improve the application's capability to assist them.

8.2 Future Work

A web-based application can be done to this project as a future work. This feature will attract more people and from it can do may tasks at a time. The major goal while designing a web-based application is to increase the screen so that patients and elderly people can see it well. The system can function successfully because the addition of a chat bot is a new feature. According to the chat bot implementation, the system operates 24 x 7, allowing patients to utilize it whenever they want to ask questions, submit feedback, and perform various PD-related tasks. The ideal feature to communicate with people in the future is the addition of an admin panel, along with other necessary tasks. One of the primary issues raised by users is that in this pandemic case, the PD patient is unable to go to the doctor. As a result, a video configuration function can be included to this research project so that the doctor and patient can consult via video conference. In addition, after looking at user evaluations and comments from experienced users, the following features were proposed as improvements for the system's future development.

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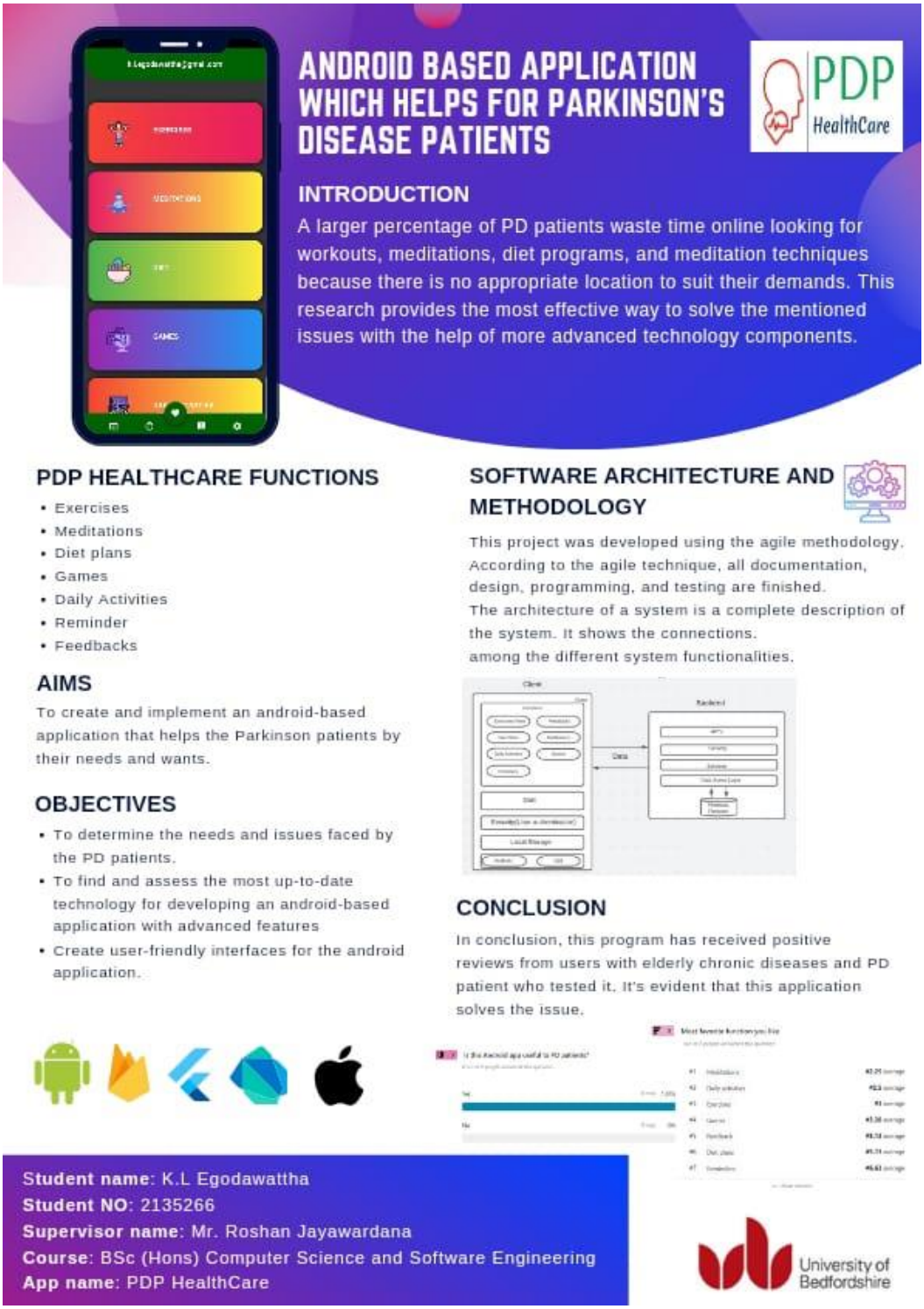
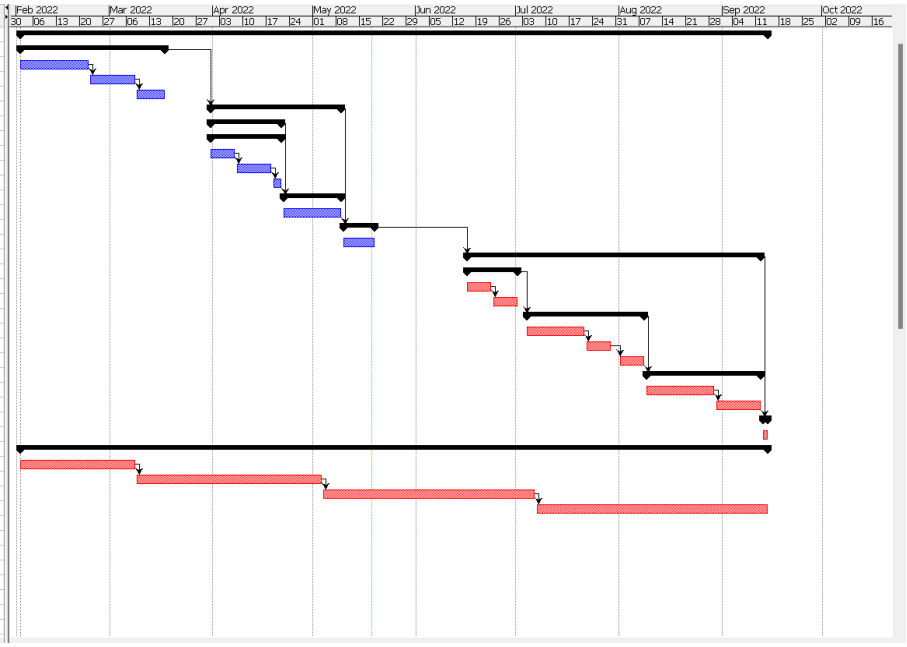
Appendix A – Research Poster



Appendix A Research Poster

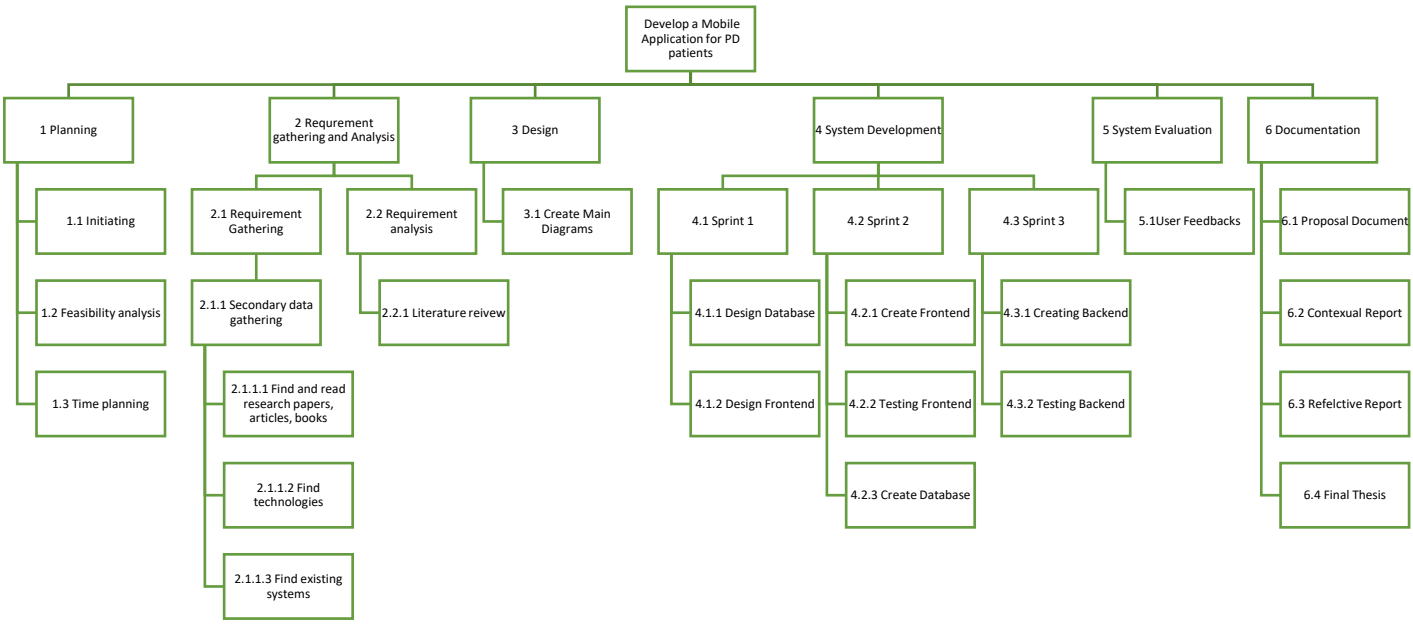
Appendix B – Gantt Chart

	Name	Duration	Start	Finish
1	**Develop Mobile Application**	161 days?	**2/2/22 8:00 AM**	**9/14/22 5:00 PM**
2	**Planning**	32 days?	**2/2/22 8:00 AM**	**3/17/22 5:00 PM**
3	Initiating	15 days?	2/2/22 8:00 AM	2/22/22 5:00 PM
4	Feasibility analysis	10 days?	2/23/22 8:00 AM	3/8/22 5:00 PM
5	Time planning	7 days?	3/9/22 8:00 AM	3/17/22 5:00 PM
6	**Requirement gathering and Analysis**	28 days?	**3/31/22 8:00 AM**	**5/9/22 5:00 PM**
7	**Requirement Gathering**	16 days?	**3/31/22 8:00 AM**	**4/21/22 5:00 PM**
8	**Secondary data gathering**	16 days?	**3/31/22 8:00 AM**	**4/21/22 5:00 PM**
9	Find and read research papers, articles, b	6 days?	3/31/22 8:00 AM	4/7/22 5:00 PM
10	Find technologies	7 days?	4/8/22 8:00 AM	4/18/22 5:00 PM
11	Find existing systems	3 days?	4/19/22 8:00 AM	4/21/22 5:00 PM
12	**Requirement analysis**	12 days?	**4/22/22 8:00 AM**	**5/9/22 5:00 PM**
13	Literature reivew	12 days?	4/22/22 8:00 AM	5/9/22 5:00 PM
14	**Design**	8 days?	**5/10/22 8:00 AM**	**5/19/22 5:00 PM**
15	Create Main Diagrams	8 days?	5/10/22 8:00 AM	5/19/22 5:00 PM
16	**System Development**	63 days?	**6/16/22 8:00 AM**	**9/12/22 5:00 PM**
17	**Sprint 1**	12 days?	**6/16/22 8:00 AM**	**7/1/22 5:00 PM**
18	Design Database	6 days?	6/16/22 8:00 AM	6/23/22 5:00 PM
19	Design Frontend	6 days?	6/24/22 8:00 AM	7/1/22 5:00 PM
20	**Sprint 2**	26 days?	**7/4/22 8:00 AM**	**8/8/22 5:00 PM**
21	Create Frontend	14 days?	7/4/22 8:00 AM	7/21/22 5:00 PM
22	Testing Frontend	6 days?	7/22/22 8:00 AM	7/29/22 5:00 PM
23	Create Database	6 days?	8/1/22 8:00 AM	8/8/22 5:00 PM
24	**Sprint 3**	25 days?	**8/9/22 8:00 AM**	**9/12/22 5:00 PM**
25	Creating Backend	15 days?	8/9/22 8:00 AM	8/29/22 5:00 PM
26	Testing Backend	10 days?	8/30/22 8:00 AM	9/12/22 5:00 PM
27	**System Evaluation**	2 days?	**9/13/22 8:00 AM**	**9/14/22 5:00 PM**
28	User Feedbacks	2 days?	9/13/22 8:00 AM	9/14/22 5:00 PM
29	**Documentation**	161 days?	**2/2/22 8:00 AM**	**9/14/22 5:00 PM**
30	Proposal Document	25 days?	2/2/22 8:00 AM	3/8/22 5:00 PM
31	Contexual Report	40 days?	3/9/22 8:00 AM	5/3/22 5:00 PM
32	Refelctive Report	46 days?	5/4/22 8:00 AM	7/6/22 5:00 PM
33	Final Thesis	50 days?	7/7/22 8:00 AM	9/14/22 5:00 PM



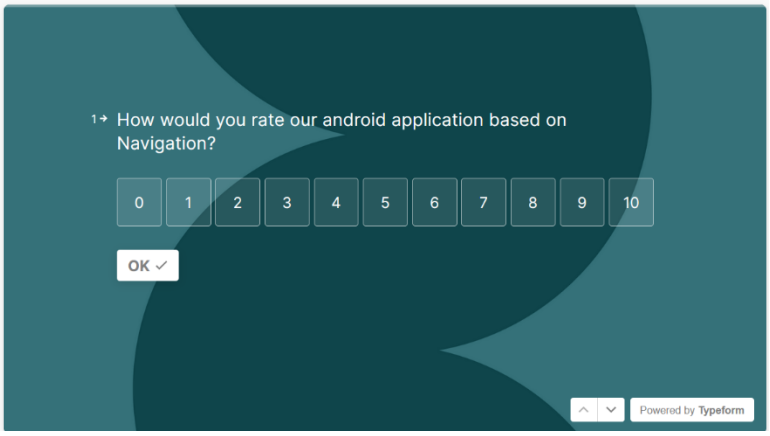
Appendix B Gantt Chart

Appendix C - WBS

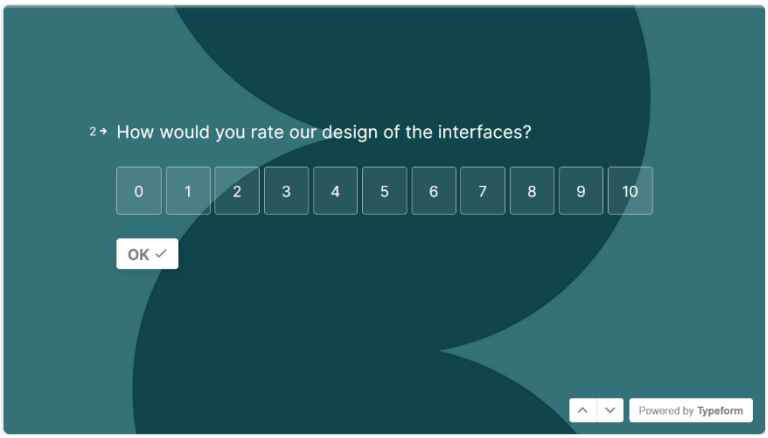


Appendix C Work Breakdown Structure

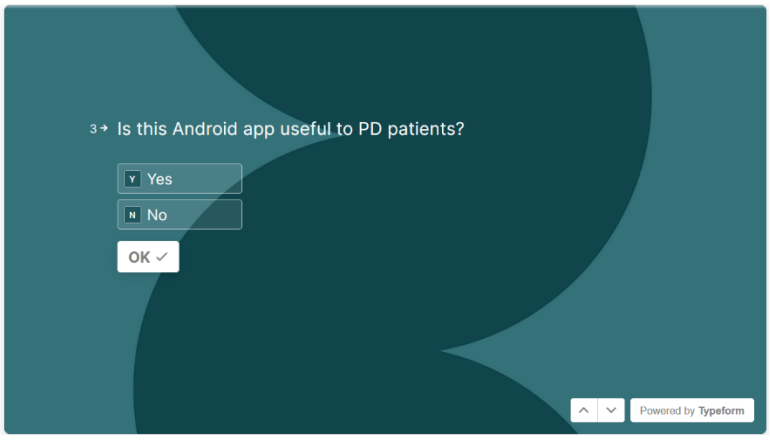
Appendix D - Questionnaire to Get User Feedback



Appendix D User Feedback Q 1



Appendix D User Feedback Q 2



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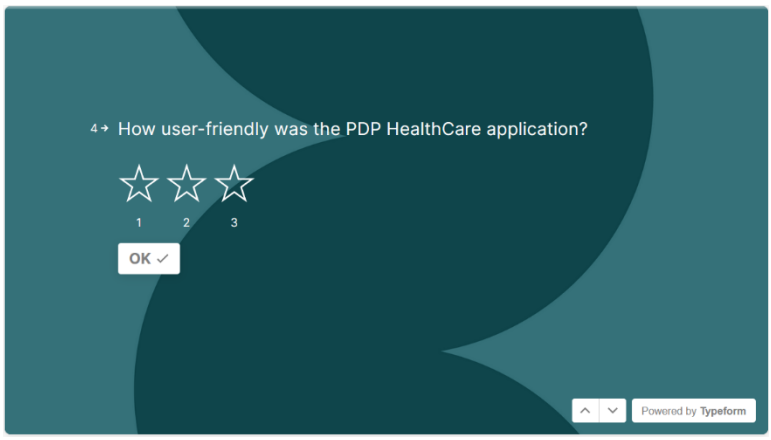
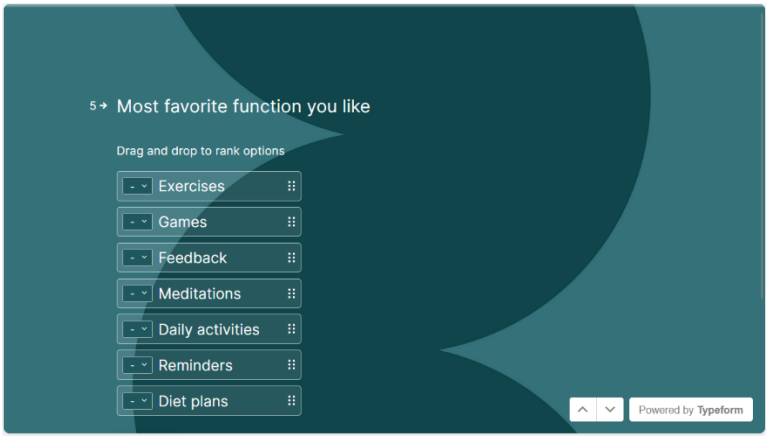


Appendix D User Feedback Q 4



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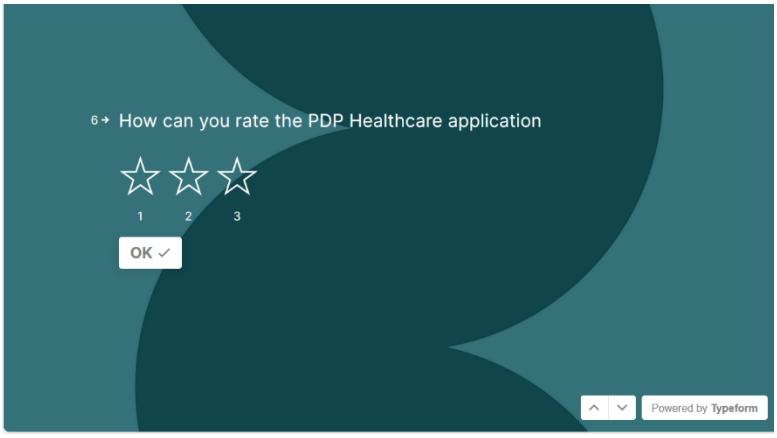
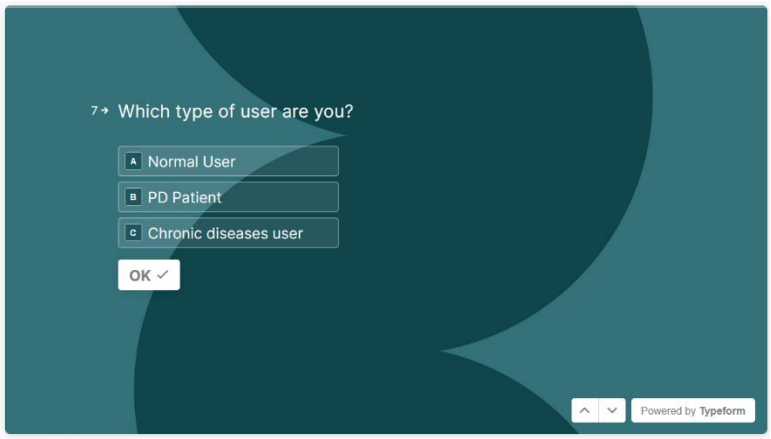
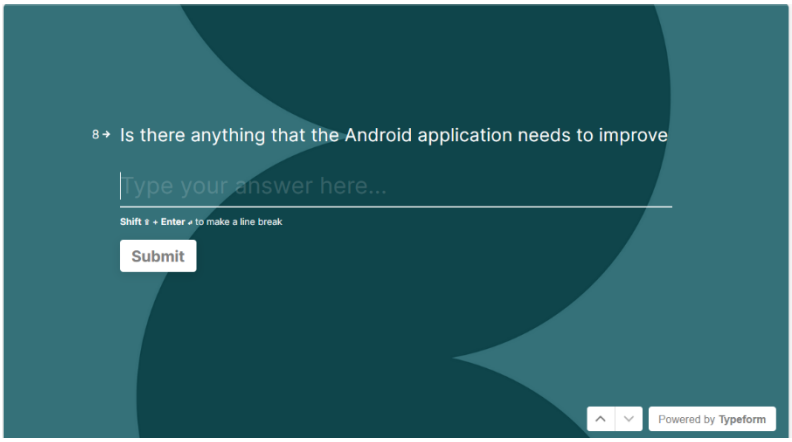


Appendix D User Feedback Q 6



Appendix D User Feedback Q 7



Appendix D User Feedback Q 8