

# InnerJoy

IT 496: Graduation Project Report

Product Release-2

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# InnerJoy

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## Abstract (English):

InnerJoy, our mental health application, tackles the urgent need for accessible and personalized support while dismantling stigma and barriers hindering help-seeking behavior. Through a comprehensive platform, InnerJoy empowers users with features like depression and anxiety assessments, daily reminders, a supportive chatbot, therapeutic plans, guided meditation, stress-relief games, and yoga exercises. Developed using agile principles and the Scrum framework, we implemented iterative sprints involving tasks such as user needs analysis, design, development, testing, and evaluation, with regular feedback sessions with our supervisor and mentors. Evaluation results affirm InnerJoy's effectiveness, with users reporting mood improvements, stress reduction, and overall well-being enhancement. Personalized recommendations, tracking features, and timely notifications emerged as key factors fostering engagement and adherence to mental health routines. In sum, InnerJoy offers a holistic solution for managing depression and anxiety, enhancing mental health, and elevating life quality.

### Abstract (Arabic):

إنرجوي للصحة العقلية، هو تطبيق مخصص لمعالجة الحاجة الملحة للدعم الشخصي يمكن الوصول إليه بسهولة وبالتالي يساعد على التخلص من الحاجز وتفكيره وصمة العار التي تعيق سلوك طالب البحث عن مساعدة، وذلك من خلال منصة شاملة تمنح المستخدمين مميزات منها تقييمات لـ الكتاب والقلق، تنبهات تشجيعية يومية، روبوت محادثة يعمل كصديق افتراضي لك، وجلسات التأمل واليوغا بالإضافة إلى الخطط العلاجية وألعاب تخفيف الضغط. تم تطويره باستخدام مبدأ "الأجайл"، حيث قمنا بتنفيذ دورات متكررة تشمل مهام مثل تحليл احتياجات المستخدم والتصميم والتطوير والاختبار والتقييم، وذلك مع جلسات متابعة منتظمة مع المشرفة والوجهين للحصول على آرائهم ونقدهم إن وجد. أخيراً، تؤكد نتائج التقييم فعالية "إنرجوي" حيث أبلغ المستخدمون عن تحسن في الحالة المزاجية وتخفيف الضغط وتحسين الصحة النفسية بشكل عام. أيضاً تظهر توصيات وإشارات مجولة في التطبيق مخصصة لكل مستخدم لمتابعة تقدمهم وهذا أحد العوامل الرئيسية التي تعزز المشاركة والالتزام بإجراءات الصحية العقلية للمستخدمين. باختصار، يقدم "إنرجوي" حلًا شاملاً لإدارة الكتاب والقلق، وتعزيز الصحة العقلية ورفع جودة الحياة.

## Keywords

**Keyword 1. PHQ-9 (Patient Health Questionnaire-9):** PHQ-9 is a widely used self-report questionnaire used for assessing the severity of depression in individuals. It consists of nine questions related to common depressive symptoms, and the total score helps clinicians and individuals gauge the level of depression.

**Keyword 2. GAD-7 (Generalized Anxiety Disorder-7):** GAD-7 is a self-report questionnaire designed to measure the severity of generalized anxiety disorder. It contains seven questions that assess various symptoms associated with anxiety, and the total score aids in determining the severity of an individual's anxiety.

**Keyword 3. Ananda Yoga:** Ananda yoga is a gentle and meditative style of yoga that focuses on harmonizing the body, mind, and spirit. It incorporates traditional yoga postures, breathing exercises, and meditation techniques to promote inner peace, joy, and spiritual growth. Practicing Ananda yoga can help individuals cultivate a sense of inner tranquility and emotional balance, leading to improved mental health and overall mental well-being.

**Keyword 4. Anusara Yoga:** Anusara yoga is a modern style of hatha yoga that emphasizes alignment principles, heart-opening poses, and the celebration of the divine within oneself and others. Anusara yoga promotes self-acceptance, compassion, and joy, making it an effective practice for reducing stress, anxiety, and depression. By aligning the physical body with the heart's intentions, Anusara yoga encourages individuals to embrace their authentic selves and live with greater vitality and purpose.

**Keyword 5. Hatha Yoga:** Hatha yoga is a traditional form of yoga that encompasses a wide range of physical postures (asanas) and breathing techniques (pranayama) designed to balance and harmonize the body and mind. Hatha yoga is known for its gentle and accessible approach, making it suitable for practitioners of all levels and abilities. Regular practice of Hatha yoga can help reduce stress, anxiety, and depression by calming the nervous system. It provides a holistic framework for cultivating physical health, mental balance, and spiritual awareness.

CHAPTER 1

# Introduction

## 1 Introduction

In a world that's increasingly interconnected and fast-paced, people are realizing how important mental health is for our overall well-being. Therefore, there's a growing field that focuses on understanding and helping with mental health difficulties. This includes many kinds of professionals, like therapists and researchers, as well as people using technology to create new solutions. It is important that we tackle this field by understanding the challenges it might face and realize that it is within our responsibility to break the stigma around mental wellness. Introducing our mental health app that is leveraged using flutter that aims to change how we deal with these challenges!

Traditional approaches may have their merits, but they often fall short since many individuals find it difficult to express their feelings and face societal stigmas. [1] Figure 1 shows a common example that happens to people within our society. This difficulty creates a gap between those seeking help and the support they require, resulting in emotional distress and hindering personal growth. Our project is centered on acknowledging and addressing these substantial gaps and challenges in the field of mental health support.



Figure 1, Ahmed Story.

By combining AI, including the integration of a friendly API Chatbot from the Google's generative Ai, with elements of CBT (Cognitive Behavioral Therapy) [2] as shown in figure 2, and thoughtful UX/UI design, our application seeks to provide personalized, stigma-free support that meets individuals wherever they are on their mental health journey. In doing so, we aim to positively impact the lives of countless individuals, making mental health support more inclusive, accessible, and effective.

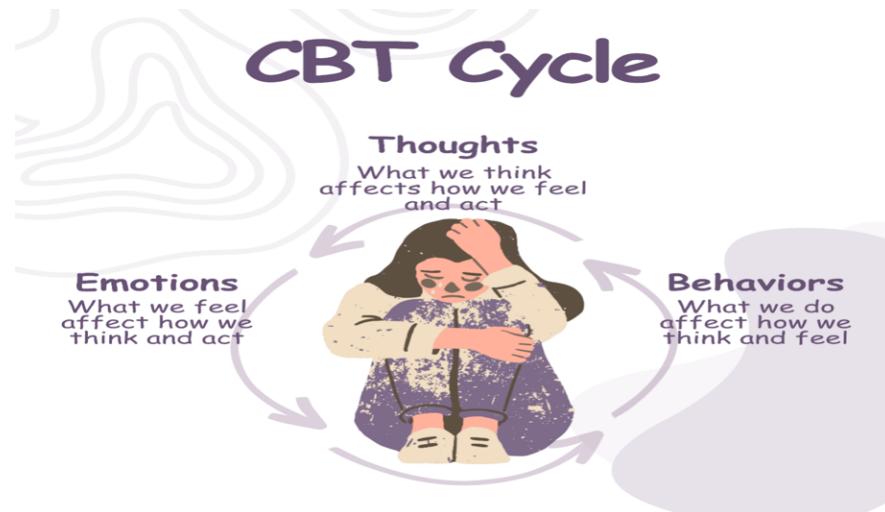


Figure 2, CBT Cycle.

Figure 3 shows InnerJoy's product vision in which our vision revolves around providing a safe and supportive space for individuals grappling with mental health challenges. "InnerJoy" is tailored for those who hesitate to seek help due to fear of judgment or stigma associated with disclosing their concerns to others. Unlike conventional methods that may deter individuals from seeking assistance, our mobile application offers a confidential and anonymous platform for guidance and support. With InnerJoy, users can access assistance without the fear of being labeled or judged, fostering a sense of security and empowerment in their mental health journey.



Figure 3, InnerJoy's product vision.

Our software development process follows an Agile methodology, where we break down tasks into iterative sprints. These sprints involve steps such as collecting & understanding user needs, designing, developing, testing, and evaluating. We conduct experiments to assess the effectiveness of our features with the help of weekly meetings with our supervisor. We then gather feedback from our mentors along the term to continuously improve our product.

Our solution, InnerJoy, introduces several innovative features to redefine mental health support. Firstly, our AI-powered chatbot is designed to respond in short messages, mimicking a friend's conversational style and incorporating emojis and fun messages, including occasional jokes, to create a comfortable and engaging interaction for users. Secondly, InnerJoy integrates the GAD (Generalized Anxiety Disorder) [3] and PHQ-9 (Patient Health Questionnaire) [4] assessments, providing personalized solutions [5] tailored to each user's severity rate, for both depression [6] and anxiety [7]. These results are meticulously tracked and displayed in the user's profile page, offering valuable insights into their mental well-being over time. Users' results will be tracked and displayed as line graphs on their home page, and in a donut graph for further insights, offering a clear visual representation of their mental well-being. Furthermore, we plan to send timely notifications to users, both as reminders and encouragement to periodically complete these assessments, helping them monitor their depression and anxiety levels. We will also offer the user an option to use our diary in which the user can freely & anonymously vent about their day.

InnerJoy offers a diverse range of yoga and meditation practices to support users' mental well-being. Users can be recommended to try three types of yoga practices [8], depending on their state and severity rate: Hatha Yoga [9], known for its gentle movements and emphasis on breathing techniques; Anusara Yoga [10], which focuses on alignment and heart-opening poses; and Ananda Yoga [11], characterized by its emphasis on inner joy and spiritual awareness. Each yoga session is meticulously tracked, and users can view their tracked progress through intuitive donut graphs displayed on their profile page. Similarly, InnerJoy provides various meditation [12] options, including Calming Music, Stress Meditation, and Healing Meditation, each designed to promote relaxation and inner peace [13]. Users receive encouraging messages throughout their sessions, and upon completion, they receive congratulatory messages, fostering a sense of accomplishment and motivation on their mental health journey. Moreover, InnerJoy includes a captivating

Brick Breaker game [14], developed using Flutter code, to provide users with a relaxing and enjoyable way to alleviate stress and take a break from daily pressures.

Additionally, InnerJoy introduces an extra feature "Thought of The Day" feature, sourcing quotes from certified websites that have been endorsed by doctors as beneficial for individuals with depression [15] and anxiety [16]. These quotes are provided to users after they take the respective PHQ or GAD test, aiming to uplift and inspire them as they navigate their mental health journey. The user can view the quote when he opens the app, or by simply refreshing the page, a new quote regarding the user's case will be shown. By incorporating these features, InnerJoy enhances user engagement, provides valuable support, and fosters a positive mindset, setting it apart as a comprehensive and empowering solution in the mental health app market.

InnerJoy's suggestions from the assessments are not rigid schedules or mandatory instructions. They are offered as advice and solutions for users to follow based on their own pace. Recognizing that strict schedules with tracking the progress of following it can increase stress for individuals with mental health concerns because it would make them feel that they are under pressure of following a strict plan. For this reason, the tracking of the PHQ is going to be separate from the activities tracking. This self-directed approach reduces stress and promotes a positive mindset, enhancing overall well-being. Additionally, InnerJoy pays attention even the small details at it contributes to a user-friendly interface by intentionally selecting colors that are beneficial for mental health and considerate of individuals with color blindness such as light purple and yellow [17].

InnerJoy's approach to mental health support not only addresses the need for accessible and stigma-free assistance but also fosters a global shift towards prioritizing mental well-being. By offering personalized solutions through an intuitive mobile application, InnerJoy ensures that individuals with mental health concerns can seek help anonymously and without fear of judgment. Unlike traditional methods, InnerJoy combines advanced technology, such as AI-powered chatbot. This approach not only saves time and resources by eliminating the need for scheduled appointments but also empowers users to take control of their mental health journey. Furthermore, InnerJoy's commitment to user privacy and anonymity sets it apart from other solutions in the market, making it a trusted platform. Figure 3 shows the restrictions that have been applied in our Firebase database in which, as shown, user's data and personal information is restricted even to us, the developers.

```

1   rules_version = '2';
2
3   service cloud.firestore {
4     match /databases/{database}/documents {
5       // Rule for private data (read access)
6       match /private_data/{document} {
7         allow read: if request.auth != null;
8       }
9
10      // Rule for private data (write access) - for admin users
11      match /private_data/{document} {
12        allow write: if isAdmin();
13      }
14
15      // Function to check if the user has the 'admin' custom claim set to true
16      function isAdmin() {
17        return request.auth != null && request.auth.token.admin == true;
18      }
19
20      // Rule for user-specific data (read access)
21      match /users/{uid} {
22        allow read: if request.auth != null;
23      }
24
25      // Rule for user-specific data (write access)
26      match /users/{uid} {
27        allow write: if request.auth != null && request.auth.uid == uid;
28      }
29    }
30  }
31

```

*Figure 3, Admin restriction code.*

In the pages that follow, our project's release will dive deeper into the core components of the table of contents, providing insights into our System Design & Development, including Methodology, System Requirements, System Design, Data Design, Interface Design, and Implementation. We will also explore System Evaluation, covering Experimental Results, User Acceptance Testing, Questionnaire/Interview Results, and Quality Attributes (NFR testing). Additionally, we will engage in Discussion, reflecting on the challenges encountered during the development process and the implications of our solution. Finally, we will conclude with an overview of our Conclusions and Future Work, acknowledging the contributions made by our team and providing references for further exploration.

CHAPTER 2

# Background

## 2 Background

The expansive background knowledge forms the bedrock of our project. It encompasses a multifaceted understanding of mental health, its nuances, and its pivotal role in an individual's life. Our domain knowledge not only extends to the complex realm of mental health and well-being but also includes an intimate understanding of the obstacles individuals face in their quest to attain mental wellness. This comprehensive awareness propels our commitment to providing a transformative solution in the form of InnerJoy, breaking down the barriers of stigma to create a more inclusive and empathetic mental health support system. This section will detail background information across 7 critical areas relevant to our app.

## PHQ and GAD Assessments

InnerJoy incorporates renowned assessment tools, including the Patient Health Questionnaire-9 (PHQ-9) [1] and the Generalized Anxiety Disorder-7 (GAD-7) [2]. These questionnaires provide objective assessments of common mental health conditions, ensuring precise understanding of users' mental health status. This data enables InnerJoy to provide personalized recommendations and tailored support, enhancing intervention effectiveness.

- The PHQ-9 consists of nine questions, each corresponding to a specific depressive symptom. Individuals rate the frequency of each symptom over the past two weeks on a scale from 0 to 3 (0 = Not at all, 1 = Several days, 2 = More than half the days, 3 = Nearly every day). The scores for each question are then summed to obtain a total score, ranging from 0 to 27.

Interpretation of the total score is as follows:

0 ~ 4: Minimal depression - 5 ~ 9: Mild depression

10 ~ 14: Moderate depression - 15 ~ 19: Moderately severe depression

20~27: Severe depression

- The GAD-7 comprises seven questions, each corresponding to a symptom of generalized anxiety. Individuals rate the frequency of each symptom over the past two weeks on a similar scale from 0 to 3.

The scores for each question are summed to obtain a total score, ranging from 0 to 21.

Interpretation of the total score is as follows:

0 ~ 4: Minimal anxiety - 5 ~ 9: Mild anxiety

10 ~ 14: Moderate anxiety - 15 ~ 21: Severe anxiety

These scoring methods provide a quantitative measure of the severity of depression (PHQ-9) and generalized anxiety (GAD-7), allowing to better understand users' mental health status and tailor its support and recommendations accordingly.

## User Experience and Interface

User experience (UX) plays a crucial role in mental health by enhancing accessibility, engagement, and effectiveness of support services. A well-designed UX ensures that individuals can easily navigate mental health platforms, find relevant resources, and engage in therapeutic activities without barriers. Intuitive interfaces and clear instructions reduce frustration and encourage consistent usage, fostering a sense of empowerment and control. Furthermore, personalized recommendations and interactive features cater to individual preferences and needs, promoting active participation and motivation in self-care practices. By prioritizing user experience, platforms like InnerJoy can maximize the potential for positive outcomes and contribute to destigmatizing mental health care.

## Tracking System

Tracking serves as a vital tool in assisting individuals managing mental health issues by providing them with insights into their well-being trends over time. By consistently monitoring factors like yoga trends, meditation activities, and assessments results, individuals can gain a deeper understanding of their mental health status and identify potential triggers or patterns contributing to their struggles. This awareness empowers individuals to make informed decisions about their self-care routines, identify effective coping strategies, and track the progress of their mental health journey. In this context, InnerJoy leverages tracking mechanisms to offer users personalized insights into their mental health status, enabling them to visualize their progress and make informed decisions about their well-being. The line graph should provide clear visual indicators (e.g., different colors, data points, trend lines) to represent the changes in user's condition status over time.

## Chatbot for Mental Health

Chatbots play a significant role in mental health by providing individuals with a confidential and accessible platform to express their feelings, seek guidance, and receive support. These virtual companions offer a non-judgmental space for users to articulate their emotions, which can be particularly valuable for those hesitant to open up to friends, family, or therapists due to fear of stigma or judgment. By engaging in conversational interactions with chatbots, individuals can explore their thoughts and feelings, receive empathetic responses, and access resources or coping strategies tailored to their needs.

Moreover, chatbots are available 24/7, offering immediate support during moments of distress or crisis. In the context of InnerJoy, the integration of a chatbot provides users with a friendly virtual companion that offers encouragement, guidance, and companionship, contributing to a more holistic and accessible approach to mental health support. As shown in Figure 4, chatbots can be used to talk & chat as if it was their personal chatbot, while also allowing users to vent and let out their feelings.



Figure 4, Chatbots as virtual friends.

## Tracking Test Scores as Line Graph

Embarking on the task of integrating a dynamic tracking line graph feature for test scores, our team encountered compatibility challenges that demanded a collaborative approach. Leveraging the versatility of the fl\_chart library, we navigated through these hurdles by updating project dependencies to the latest version, fl\_chart: ^0.64.0, ensuring compatibility with Dart 3. Valuable insights gathered from pub.dev and dart.dev were instrumental in this process, showcasing our dedication to maintaining a seamless development environment.

With compatibility hurdles addressed, our collaborative efforts extended to each phase of implementation. Meticulously crafting the fetchData function, we extracted test scores data from Firestore, filtering them based on the current year and transforming them into FlSpot points. Subsequently, we delved into configuring the appearance of the line chart, fine-tuning axis ranges, grid lines, and line characteristics to create an engaging and informative visualization. Through collective brainstorming, we mapped test scores to corresponding FlSpot points, categorizing y-axis values into severity ranges, thus enhancing the chart's ability to effectively convey the severity level of scores.

Implementing a FutureBuilder ensured the asynchronous rendering of the chart, seamlessly handling loading indicators and error states, prioritizing a smooth user experience throughout data retrieval and rendering. Collaboratively customizing tooltips based on score severity level enriched user interactions with the chart, providing insightful information at their fingertips. Integrating axis titles with personalized styling not only offered context but also elevated the visual appeal of the chart. Throughout this journey, our commitment to collaborative problem-solving and seamless development led to the successful implementation of the dynamic test score tracking feature.

## Tracking Test Scores in a Donut Graph

Our second tracking feature is designed to track progress in completing meditation and yoga sessions. We utilized various packages like Firebase for authentication and Firestore for database management, along with Syncfusion Flutter Gauges for visual representation.

Upon initiation, the `fetchUserData` function is called in the `initState` method to retrieve relevant user data from Firestore. It fetches information such as the number of recommended meditation sessions per week and the user's completed sessions. Based on this data and the current date, it calculates the progress percentage and generates a message tailored to the progress status, which is then displayed on the screen.

The UI consists of a radial gauge indicating progress visually and a text field displaying the progress message. While data is being fetched, a loading spinner is displayed. Once the data fetching process is completed, the gauge updates to reflect the progress, and the corresponding message is shown. Additionally, a timer is initiated to periodically update the UI if necessary, although it seems currently not performing any significant task. Overall, this code snippet forms the backbone of a meditation progress tracking application, offering real-time feedback to users regarding their adherence to weekly meditation goals.

CHAPTER 3

# Literature Review

### 3 Literature Review

In today's fast-paced digital mental health landscape, delving into the capabilities and limitations of competitive products is crucial to InnerJoy's prosperity.

This analysis delves deep into applications that share a common goal with InnerJoy but may offer different approaches or unique features. By closely examining these competitive products, we aim to gain valuable insights, identify market trends, recognize opportunities for improvement, and ultimately enhance the user experience.

In this evaluation, we will explore the features that differentiate these applications, and the range of offerings they provide. By learning from our competitors and leveraging their strengths, we are better equipped to develop a competitive edge in the mental health app industry and, most importantly, deliver an exceptional and unparalleled experience to InnerJoy users.

## 1- MindTales:

MindTales is a mobile application designed to promote mental well-being through a range of features and services.

### Key Features:

#### - Interactive Exercises:

Users access free bite-size exercises for coping and self-help.

#### - Science-Backed Insights:

The app offers tests and quizzes to understand emotions and triggers.

#### - Meditations and Sounds:

Guided meditations, breathing exercises, and mood-enhancing music for relaxation.

#### - Licensed Therapist Access:

Seamless booking for counseling sessions with licensed therapists.

#### - Personalized 21-Day Plan:

Users follow a tailored self-care plan with exercises and suggestions.

#### - Mood Tracker and Coaching:

Mood-based recommendations and in-app coaching sessions provide additional support.

#### - Engaging Elements:

Users can earn achievements, points, and badges, enhancing user engagement.

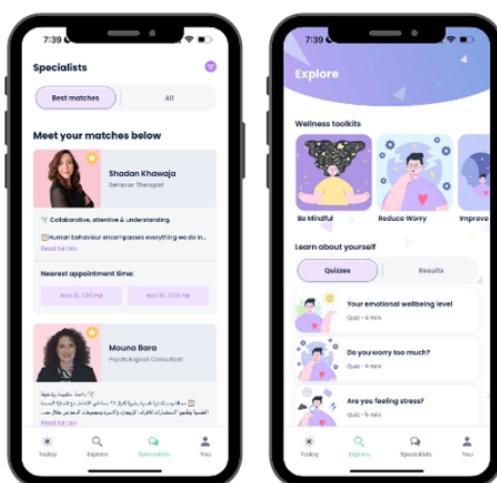


Figure 5, *MindTales App.*

## 2- Breeze:

Breeze is a mobile application that aims to raise awareness about mental health.

### Key Features:

#### - Mental Health Tracking and Assessment:

- . Daily journaling for emotional understanding and control.
- . Apply cognitive-behavioral therapy to combat negative thoughts.
- . Access diverse psychological tests, Including Anxiety and Depression.

#### - Insights into Cognitive Distortions:

Gain valuable insights into common cognitive distortions, addressing issues like depression, panic attacks, anxiety, and bipolar disorder.

#### - Continuous Improvement and Support:

- . Receive personalized insights and practical advice from an acknowledged psychotherapist through regular updates.
- . Explore future updates covering a range of widespread topics and life issues.

#### - Subscription Options:

Weekly subscription at \$4, with a 3-day free trial. Auto-renewal can be managed in user settings.



Figure 6, Breeze App.



### 3- Youper:

Youper is a mobile application that uses CBT (Cognitive Behavioral Therapy) techniques to calm anxiety and improve user mood.

#### Key Features:

##### - CBT Therapy Exercises:

Guides users through interactive Cognitive Behavioral Therapy exercises to calm anxiety, improve mood, and enhance relationships.

##### - User Testimonials:

Positive feedback emphasizes Youper's effectiveness in providing instant and helpful advice, particularly for busy individuals seeking therapy.

##### - Accessibility and Convenience:

Created by therapists to make CBT accessible to everyone, available on users' own time and schedule.

##### - Subscription-Based Premium Features:

Offers premium features with a subscription, providing flexibility and the ability to cancel at any time.



Figure 7, Youper App.

## 4- VOS:

VOS is a mobile application that sets a well-being activities and exercises that will give you mental peace and stress anxiety relief.

### Key Features:

#### - Personalized Well-Being Plan:

Users create a well-being plan based on their specific goals, such as reducing stress, improving sleep, or enhancing relationships.

#### - Daily Personalized Activities:

Receives a personalized set of activities daily, including self-help tips, meditation exercises, AI journaling, inspiring quotes, mood tracking, and more.

#### - Toolkit for Additional Support:

Wellbeing hub provides access to a toolkit with features like a first aid kit, online therapy chat, and an AI-powered Smart Journal for users seeking extra support.

#### - Mood Chart and Insights:

Tracks mood evolution over time with personalized insights, allowing users to understand what influences their emotions.

#### - Multilingual Accessibility:

Available in 8 languages, making it accessible to a diverse user base.

#### - Subscription-Based Premium Features:

Offers subscription-based premium features for users seeking enhanced functionality, with clear terms and conditions provided.

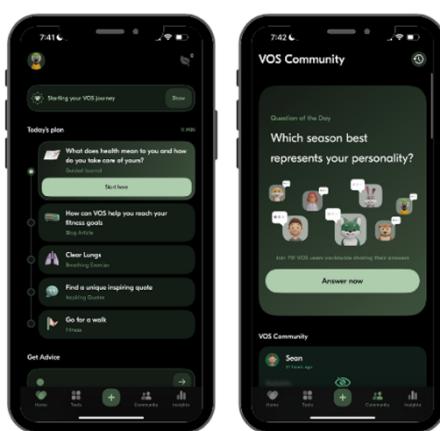


Figure 8, VOS App.

## 5- SOL:

Sol helps you Harmonize your mind, body, and spirit to help you navigate life's challenges and find your inner light. It's designed for the spiritually curious and seekers from all traditions.

### **Key Features:**

#### - Get daily spiritual wellness tips

Sol provides you with your own personalized calendar of spiritual activities and convenient tips on how to observe each event.

#### - Build Healthy habits:

Explore spiritual wellness practices from major traditions worldwide, from Acupuncture to Zen Buddhist meditations, and everything in between.

#### - Find your spiritual soulmate:

Sol helps you discover how spiritually-compatible you are with anyone in the world, even famous historical figures from throughout history. You can assess your astrology, zodiac and romantic compatibility with anyone, and learn different ways for you to deepen your relationships.

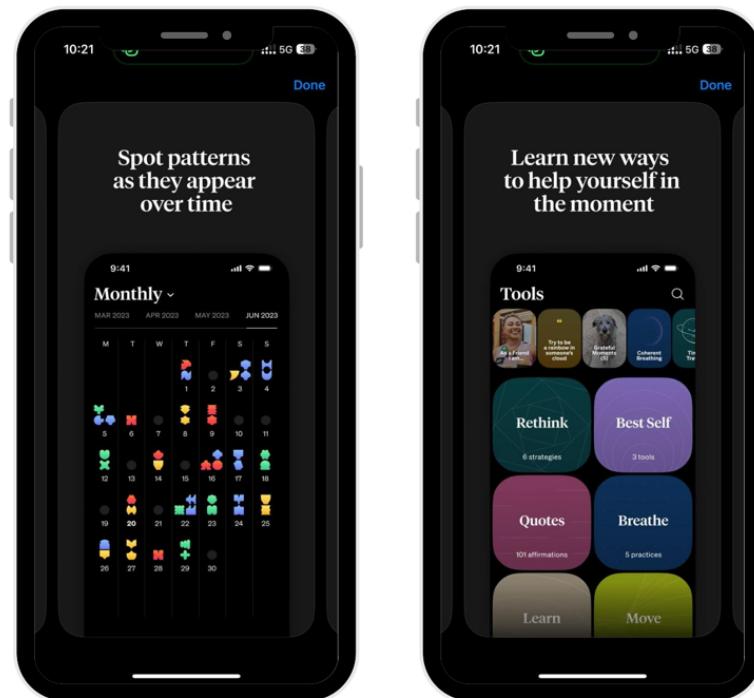


Figure 9, SOL App.

Features	MindTales	Breeze	Youper	VOS	SOL	InnerJoy
Anonymity						✓
Personalized Recommendations	✓	✓	✓	✓	✓	✓
Chatbot			✓			✓
Entertainment		✓			✓	✓
Certified Doctor	✓			✓		
Prescriptions						
Physical health	✓			✓		✓
Tracking	✓	✓	✓	✓	✓	✓
UX	✓	✓	✓	✓	✓	✓
Subscription		✓	✓	✓	✓	

Table 1, Comparative Table.

In comparing MindTales, Breeze, Youper, VOS, SOL, and InnerJoy, each offers a range of features aimed at promoting mental well-being. While MindTales, Breeze, Youper, VOS, and SOL do not explicitly mention anonymity, InnerJoy stands out with its implementation of an anonymous digital platform and restricted admin access, prioritizing user privacy and confidentiality. All six apps offer personalized recommendations, tailoring suggestions to users' needs and preferences. While MindTales, Youper, and InnerJoy include a chatbot feature for interactive conversations and support, Breeze and SOL do not feature this functionality.

Access to certified therapists or doctors for counseling sessions is offered by MindTales, Youper, and InnerJoy, but Breeze and VOS do not mention access to certified professionals, and SOL does not offer this feature. Neither MindTales, Youper, nor InnerJoy mentions prescriptions, while Breeze, VOS, and SOL do not offer this feature.

Regarding physical health, MindTales, Youper, VOS, and InnerJoy focus on mental well-being, whereas Breeze mentions applying cognitive-behavioral therapy for physical health, and SOL mentions exploring spiritual wellness practices. All six apps offer tracking features to monitor progress and activities, and they prioritize user experience. Subscription options are offered by MindTales, Breeze, Youper, VOS only.

InnerJoy distinguishes itself by prioritizing user privacy, offering an AI-powered chatbot for personalized interactions, and providing standardized assessments for depression and anxiety. Its comprehensive tracking features, engaging elements like the 'Brick Breaker' game, user-friendly interface, and timely notifications ensure active engagement and effective support for promoting mental well-being.

CHAPTER 4

# System Design & Development

## 4 System Design and Development

### 4.1 Methodology

Our software development process was guided by the agile methodology, which emphasizes flexibility, collaboration, and iterative development. Within this framework, we adopted the Scrum framework, a popular agile methodology, to structure our project management and development approach.

The Scrum framework comprises three key components: roles, events, and artifacts. In our team, we embraced these elements to ensure effective communication, transparency, and productivity throughout the development cycle.

Firstly, we defined clear roles within the team. We had a Product Owner responsible for defining and prioritizing project requirements, a Scrum Master facilitating team meetings and removing impediments, and Development Team members responsible for implementing features and delivering increments of the product.

Secondly, we conducted regular Sprint Planning, where we outlined the work to be completed during the sprint, Sprint Reviews to showcase completed work to stakeholders, and Sprint Retrospectives to reflect on the sprint and identify areas for improvement.

Thirdly, we maintained artifacts to track progress and provide visibility into the project. These artifacts included the Product Backlog, containing a prioritized list of all desired work, the Sprint Backlog, detailing the work to be completed during the sprint, and the Increment, representing the sum of all completed work from the sprint.

We conducted regular sprint planning sessions to adapt to changing requirements and stakeholder feedback, allowing us to deliver value incrementally and respond quickly to evolving needs.

To support our agile practices, we utilized Jira for project management and GitHub for version control and collaborative development. Jira provided us with a centralized platform for managing our backlog, planning sprints, and tracking progress, while GitHub enabled seamless collaboration among team members through code review, version control, and issue tracking.

[Jira Link] ([Jira](#))

[GitHub Link] ([GitHub](#))

## 4.2 System Requirements

### 4.2.1 System Users

InnerJoy app is designed for individuals over the age of 16 who are facing mental health challenges, possess English reading and writing capabilities, and have basic technical skills. In addition to these users, there will be an admin, which in this case will be the development team. The admin's role primarily involves managing the database and developing additional features but does not include a user interface (UI) for interaction with the app's general users.

User Characteristic Table	
<b>Age</b>	<b>Above 16</b>
<b>Gender</b>	<b>Both</b>
<b>Educational level</b>	<b>(Intermediate)</b> - Knows how to read and write English
<b>Experience</b>	<b>There is no need for any experience with using similar apps to get started.</b> - The app uses clear and concise language. - The app has a simple and intuitive design. - The app provides clear instructions and feedback.
<b>Technical expertise</b>	<b>(Basic)</b> - Ability to use a mobile device, such as a smartphone or tablet. - Ability to connect to a Wi-Fi or cellular network. - Ability to download and install apps from an app store. - Ability to launch and use apps.
<b>Platform</b>	<b>iOS / Android</b>

Table 2, User Characteristic.

InnerJoy's Admins Characteristic Table	
<b>Age</b>	<b>Above 20</b>
<b>Gender</b>	<b>Female</b>
<b>Educational level</b>	<p><b>(Advanced)</b></p> <ul style="list-style-type: none"> <li>- Strong foundation in software development.</li> <li>- proficiency in programming languages.</li> <li>-Knowledge of UI/UX design principles.</li> <li>- Knowledge of database systems such as Firebase.</li> <li>- Data security and privacy awareness.</li> <li>- Ability to integrate AI features into the app.</li> <li>- Effective communication and teamwork skills - Understanding project management principles and methodologies.</li> <li>- Knowledge of version control systems like Git. - Knowledge of issue and project tracking tools like Jira.</li> </ul>
<b>Experience</b>	<p><b>(Advanced)</b></p> <ul style="list-style-type: none"> <li>- Familiarity with design tools and best practices</li> <li>- Experience in database design, administration, and optimization.</li> <li>- Proficiency in programming languages.</li> <li>- Basic experience in artificial intelligence and machine learning.</li> <li>- Previous work on mobile app development.</li> <li>- Experience in server-side development, API design, and database integration.</li> <li>- Knowledge of project management methodologies (Agile, Scrum, etc.)</li> </ul>
<b>Technical expertise</b>	<p><b>(Advanced)</b></p> <ul style="list-style-type: none"> <li>- Proficiency in design tools like Figma, Sketch, or similar software.</li> <li>- Knowledge of design principles, typography, color theory, and user experience best practices.</li> <li>- Expertise in database systems, including SQL databases (e.g., Firebase).</li> <li>- Proficiency in AI frameworks and tools.</li> <li>- Use of project management tools (e.g., Jira) for task tracking and team coordination.</li> <li>- Knowledge of version control systems like Git.</li> <li>- Proficiency in using programming environments like Visual Studio Code (VS Code).</li> <li>- Knowledge of working with emulators for testing and debugging mobile applications.</li> </ul>

Table 3, InnerJoy's Admins Characteristic.



#### 4.2.2 Requirements Elicitation and Analysis

To understand the challenges faced by people with mental illness and identify the features and functionality that would be most beneficial to them in 'InnerJoy', we started with a small discussion via WhatsApp with a certified specialist in the mental health sector who guided us through the mental health questionnaire and how they are conducted. And we met up with our GP supervisor to get a wider understanding of the project requirements. Then we conducted requirements elicitation through interviews and a survey with a sample of people. Surveys are a fast and inexpensive way to reach a large audience in a short time, while interviews allow us to collect more in-depth information and reduce the risk of misinterpretation.

## **For the survey:**

We created a 6-question survey using Google Forms and distributed it online randomly. We received 38 responses. The results are as follows:

- Negative stereotypes and misconceptions about mental illness: 89.5% of respondents said they had heard negative stereotypes or misconceptions about people with mental illness. This suggests that stigma is a major barrier to people seeking help for mental health problems.
- Society's view of seeking therapy: 94.7% of respondents said they believe that society often views seeking therapy as a sign of weakness. This is another barrier to people seeking help for mental health problems.
- Stigma preventing people from seeking help: 71.1% of respondents said they believe that the stigma surrounding mental illness prevents them from going to psychological health centers. This suggests that stigma can have a significant negative impact on people's mental health.
- Use of mental health apps: 47.4% of respondents said they had used a mental health app that helped them manage their mental health symptoms. This suggests that mental health apps can be a helpful tool for some people.
- Virtual friends: 84.2% of respondents said they believe that having a virtual friend can help people feel more comfortable talking about their mental health concerns.
- Digitalization of the mental health sector: 78.9% of respondents said they agree that the mental health sector should be digitalized. This suggests that people are open to new and innovative ways to access mental health care.

## For the interviews:

We interviewed five individuals, including a clinical psychiatrist, a public relations student, a finance department employee, an IT department employee, and a therapist. We asked them six questions, and our interviews revealed the following key findings:

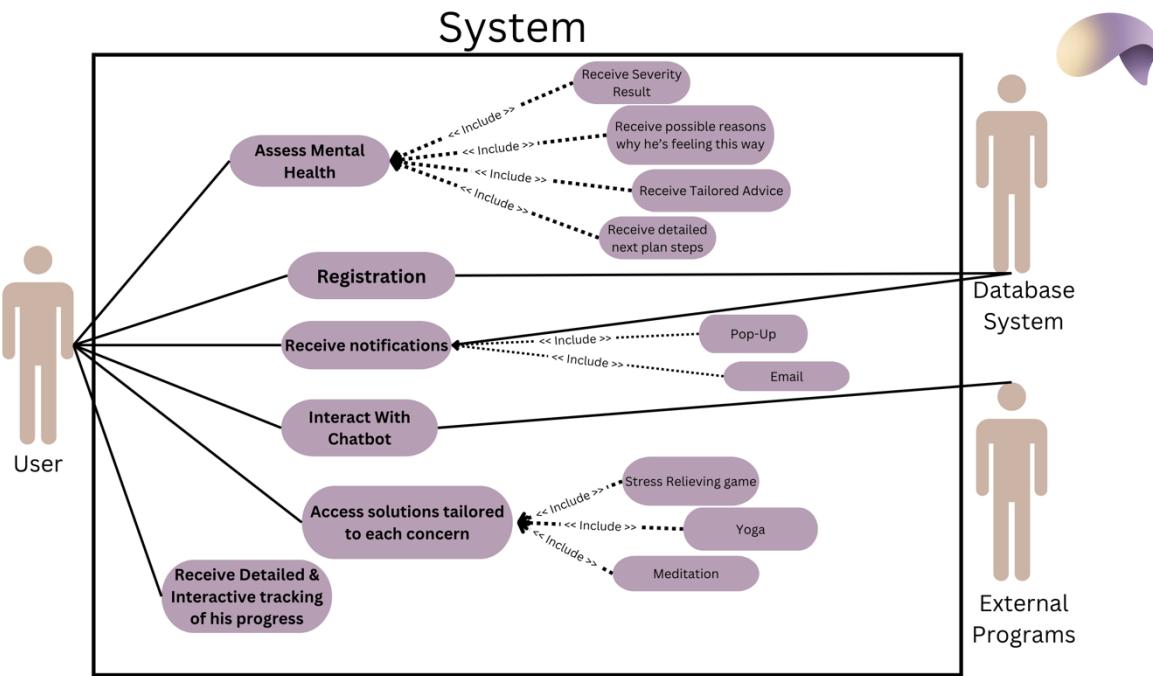
- **Fear of Social Judgment:** People fear social judgment when dealing with mental health issues. This fear can prevent them from seeking support & lead to feeling isolation and shame.
- **Impact on Life Performance:** Mental health problems can significantly affect a person's life, impacting their work, relationships, and overall well-being.
- **Privacy and Security:** Participants emphasized the importance of protecting the privacy and security of personal information and identity.
- **User-Friendly Design:** Interviewees agreed that a user-friendly app should have clear labeling, good color choices, and require no prior knowledge or experience.
- **Interest in Mental Health Apps:** Some participants expressed interest in using a mental health app, indicating a need for accessible and supportive mental health resources.

Notably, after we finished the interviews with the psychiatrist and the therapists, we asked their opinion about the 2 extra features we were planning to add to. InnerJoy (The 'Thought Of the Day' feature & the Journal feature), and they both were extremely encouraging to both ideas. Their only comments were that we need to make sure of the integrity of the comments in the 'Thought Of the Day' feature, and pay extra attention to user's privacy while writing their journal.

InnerJoy developers were inspired to further apply these extra features while making sure of Integrity in the 'Thought Of the Day' quotes, and integrate our ready-made anonymity feature in the user's diary. InnerJoy will be developed as a mental health app that aims to digitalize part of the mental health sector. It will tackle these problems by ensuring user anonymity, integrating a user-friendly chatbot (Joy), and incorporating many other features, all while adhering to UX guidelines.

Note: Please refer to Appendix A for detailed interviews and surveys with InnerJoy users.

### 4.2.3 User Interactions



*Figure 10, InnerJoy Use Case Diagram.*

**As shown in the use case diagram, the user can:**

- Register his/her account.
  - Assess his/her mental health through the PHQ questionnaire, which allows him to receive detailed description about his results.
  - Access solutions tailored to each concern, which can be stress relieving game (Brick Breaker), Calming Exercises (Yoga), Meditation Audio clips.
  - Interact with a chatbot that is tuned to act as a friend, which will be done through an external program API.
  - Receive encouraging timely notifications, that will also remind him to do the PHQ from time to time. These notifications can be pop-up notifications the user receives on his phone, or email notifications.
  - Receive detailed & Interactive tracking of his progress, which include the line graph of the tracked PHQ results and the tracked exercises and meditations, and the donut graph which shows the exact remaining sessions left for the user.



#### 4.2.4 Roadmap and Product Backlog

At InnerJoy, we recognize the importance of having the right features to create a successful mental health application. Our commitment is to ensure that accessing high-quality mental health support is easy, affordable, and available whenever and wherever our users need it.

Our product roadmap outlines the main features and their priorities, as well as planned improvements and functionalities for InnerJoy. These enhancements are aimed at improving the user experience, expanding the range of services we offer, and delivering the best possible support to our users.



Figure 11, InnerJoy Roadmap.

In this section, you'll find all the user stories, including their size (how much work they involve), type (what kind of feature they are), and acceptance criteria (what needs to be met for the feature to be considered complete). We'll also define what it means for a story to be 'ready' to be included in a sprint, as well as the criteria for user stories that are 'ready' to be implemented.

ID	PBIs (User Stories)	Size	Type (Feature, defect, technical work, knowledge acquisition)	Status (To do, In progress, or Done)	Acceptance Criteria (The conditions of satisfaction that must be met for that item to be accepted.)
<b>Sprint 1</b>					
1	As a user, I want to be able to register with my username, email, and password, so that I can access all the application features.	3	Features	Done	<ul style="list-style-type: none"> <li>- As a user, If I did click on the “create an account” button in the signup page, then I should be able to access the registration feature.</li> <li>- As a user, If I want to register, then I should enter a valid email address, username, and a password.</li> <li>- As a user, If I enter invalid or incomplete information, then I should receive appropriate validation messages.</li> <li>- As a user, I should not be able to register with an existing email address, ensuring uniqueness across user accounts.</li> <li>- As a user, I should be reassured with a policy in clear explanation during the registration process that my email address will be the only personal data collected and stored.</li> </ul>
2	As a user, I want to be able to log in with my email and password, so that I can access my personalized	3	Features	Done	<ul style="list-style-type: none"> <li>- As a user, If I want to login, then I should be able to access the login feature by clicking on the button shown in the app's main screen.</li> </ul>

	content and continue my mental well-being journey seamlessly.				<ul style="list-style-type: none"> <li>- As a user, If I enter my registered information (email and password), then I should be able to login to the app.</li> <li>- As a user, If I enter invalid or incomplete information, then I should receive appropriate validation messages.</li> <li>- As a user, I should be redirected to the app's profile page after a successful login message.</li> </ul>
3	As a user, I want to be able to log out of the app, so that I can ensure the security of my account and personal data.	2	Features	Done	<ul style="list-style-type: none"> <li>- As a user, I should have a visible and easily accessible option to log out through a button within the app's settings page.</li> <li>- As a user, If I click the log out button, then I should be redirected to the app's welcome screen.</li> <li>- As a user, If I logged out, then I should no longer have access to any personalized content or protected features within the app.</li> </ul>
4	As a user, I should have the option to reset my password using my email if I forget it by following a password recovery process.	3	Features	Done	<ul style="list-style-type: none"> <li>- As a user, If I clicked the forgot password button shown in the login page, then I should be asked to provide my registered email address.</li> <li>- As a user, If I provided a valid registered email address, then an email containing a password reset link should be sent to that email address.</li> <li>- As a user, after clicking on the link If I submit a new password that meets the requirements, then the system should update my</li> </ul>

					password with the newly chosen password.
5	As a user, I want to use an anonymous digital platform so that I can freely express my concerns and seek support without revealing my identity.my identity.	3	Feature	Done	<ul style="list-style-type: none"> <li>- As a user, if I express my concerns or seek support on the digital platform without revealing my identity, then my identity should remain confidential throughout my interactions.</li> <li>- As a user, if I want to vent to the chatbot, then my chat messages should not be saved.</li> </ul>
6	As a user, I want to chat with an AI-powered chatbot so that I can have open and honest conversations about my mental health.	5	Feature	Done	<ul style="list-style-type: none"> <li>- As a user, if I click the chat icon shown on the app navigation bar, then I should be directed to a page that allows me to click on a button so I can have a conversation with a friendly chatbot.</li> <li>- As a user, if I initiate a conversation with the chatbot about my mental health, then the chatbot should respond promptly and engage in open and honest conversation.</li> <li>- As a user, if I discuss my concerns with the chatbot then I should feel supported and encouraged throughout the conversation.</li> <li>- As a user, if I seek empathy or understanding from the chatbot, then it should demonstrate empathy and understanding in its responses.</li> </ul>
7	When designing the user interface, the "InnerJoy" platform's color scheme intentionally	5	Feature (System perspective)	Done	<ul style="list-style-type: none"> <li>- If the system component is designed for the user interface, then it should utilize light purple and yellow colors as the primary color scheme.</li> </ul>

	selects colors that are beneficial for mental health and considerate of individuals with color blindness, such as purple and light yellow.				-If the selected colors are implemented, then they should evoke a sense of calmness, positivity, and contribute to a visually appealing user experience with individuals with color blindness in consideration.
<b>Sprint 2</b>					
8	As a user, I want to take the PHQ9 test so that I understand which level I am in depression symptoms.	5	Features	Done	<ul style="list-style-type: none"> <li>- As a user, if my Score equal to zero then I do not have depression symptoms.</li> <li>- As a user, if my Score less than or equal to four then I got minimal depression symptoms.</li> <li>- As a user, if my Score less than or equal to nine then I got mild depression symptoms.</li> <li>- As a user, if my Score less than or equal to fourteen then I got moderate depression symptoms.</li> <li>- As a user, if my Score less than or equal to nineteen then I got moderately depression symptoms.</li> <li>- As a user, if my Score greater than nineteen then I got Serve depression symptoms.</li> <li>- As a user, if I take the PHQ test, I should receive advice tailored to my condition and severity.</li> <li>- As a user, if I take the PHQ test, I should receive next steps and follow-up plans</li> </ul>

					<p>tailored to my condition and severity.</p> <ul style="list-style-type: none"> <li>- As a user, if I take the PHQ test, I should receive a clear explanation about why I'm possibly feeling this way.</li> </ul>
9	As a user, I want the platform to include a feature for tracking my PHQ-9 (Patient Health Questionnaire) scores over time, represented in a line graph, so that I can visually monitor and understand the changes in my condition status.	5	Features	Done	<ul style="list-style-type: none"> <li>- As a user, if I took the PHQ-9 assessment, then the platform should store and track my PHQ-9 scores.</li> <li>- As a user, if I took the PHQ-9 assessment and clicked on the profile icon shown on the app navigation bar, then the platform should view my PHQ-9 scores represented in a line graph.</li> <li>- As a user if my PHQ-9 scores are represented in a line graph, then the line graph should provide clear visual indicators (e.g., different colors, data points, trend lines) to represent the changes in my condition status over time.</li> </ul>
10	As a user, I want to take the GAD-7 test so that I understand which level I am in anxiety symptoms.	3	Features	Done	<ul style="list-style-type: none"> <li>- As a user, if my Score equal to zero then I do not have an anxiety symptom.</li> <li>- As a user, if my Score less than or equal to four then I got minimal anxiety symptoms.</li> <li>- As a user, if my Score less than or equal to nine then I got mild anxiety symptoms.</li> <li>- As a user, if my Score less than or equal to fourteen then I got moderate anxiety symptoms.</li> <li>- As a user, if my Score less than or equal to nineteen</li> </ul>

					then I got moderately anxiety symptoms.  - As a user, if my Score greater than nineteen then I got Severe anxiety symptoms.  - As a user, if I take the GAD test, I should receive an advice tailored to my condition and severity.  - As a user, if I take the GAD test, I should receive next steps and follow-up plans tailored to my condition and severity.  - As a user, if I take the GAD test, I should receive a clear explanation about why I'm possibly feeling this way.
11	As a user, I want to have a Therapeutic plan so that I can heal from depression	3	Features	Done	- As a user, if I have a Therapeutic plan, then it should provide actionable steps that I can follow to progress towards my therapeutic goals.  - As a user, if I got a Therapeutic plan, then the plan should be personalized to the symptoms level.
12	As a user, I want to have a Therapeutic plan so that I can heal from anxiety.	3	Features	Done	- As a user, if I have a Therapeutic plan, then it should provide actionable steps that I can follow to progress towards my therapeutic goals.  - As a user, if I got a Therapeutic plan, then the plan should be personalized to the symptoms level.
13	As a user, if I take the PHQ-9 test I should receive a result	3	Features	Done	- As a user, if I have the results, I should be provided with reasons as to why I'm feeling this way

	so that I understand why I'm possibly feeling this way.				- As a user, if I have the results, I should be provided with clear and reasons and should be reassured and encouraged.
14	As a user, if I take the GAD-7 test I should receive a result so that I understand why I'm possibly feeling this way.	3	Features	Done	<ul style="list-style-type: none"> <li>- As a user, if I have the results, I should be provided with reasons as to why I'm feeling this way</li> <li>- As a user, If I have the results, I should be provided with clear and reasons and should be reassured and encouraged.</li> </ul>
15	As a user, if I take the PHQ-9 test, I should receive a result so that I have general advice tailored to my depression case.	3	Features	Done	<ul style="list-style-type: none"> <li>- As a user, if I have the results, I should be provided with easy-to-do advice about my condition.</li> <li>- As a user, if I have the results, I should be provided with reassuring advice and should be encouraged no matter the severity of my condition.</li> </ul>
16	As a user, if I take the GAD-7 test, I should receive a result so that I have general advice tailored to my anxiety case.	3	Features	Done	<ul style="list-style-type: none"> <li>- As a user, if I have the results, I should be provided with easy-to-do advice about my condition.</li> <li>- As a user, if I have the results, I should be provided with reassuring advice and should be encouraged no matter the severity of my condition.</li> </ul>
<b>Sprint 3</b>					
17	As a user, I want the platform to provide audio-guided meditation sessions, so that I	5	Features	Done	- As a user, if I click the person practicing meditation icon shown on the app navigation bar, then I should be able to view a variety of

	can practice mindfulness and improve my well-being.				pre-selected meditation sessions within the platform.  - As a user, if I pick and click on whatever meditation session based that suits my condition, then the session should start.
18	As a user, I want the platform to offer an interactive game designed to promote well-being, so that I can engage in an enjoyable and beneficial experience.	5	Features	Done	- As a user, if I click the person practicing meditation icon shown on the app navigation bar, then I should have access to a specific game provided within the platform.  - As a user, If I click on the game, then the game should start.  - As a user, If I was stressed, then I want the game to help relieve it.
<b>Sprint 4</b>					
19	As a user, I want the platform to provide yoga exercises with visual and textual instructions, so that I can incorporate them into my routine for physical and mental well-being.	5	Features	Done	- As a user, if I click the person practicing meditation icon shown on the app navigation bar, then I should view and pick between the different yoga exercise types provided by the platform.  - As a user, if clicked on one of the yoga exercise types, then I should be able to view visual representations and textual instructions for performing the exercises.  - As a user, If I started the exercise, then I should be able to follow the instructions and perform the yoga exercises at my own pace.

20	As a user, I want to receive timely notifications from the app, providing me with encouraging messages and reminders, so that I can stay motivated and engaged in my journey of mental well-being.	3	Features	Done	<ul style="list-style-type: none"> <li>- As a user, if I don't have the application open and my phone is locked, then I should receive a banner notification.</li> <li>- As a user, I should receive notifications on my device when there are new encouraging messages.</li> <li>- As a user, I should receive notifications on my device when there are reminders to take the PHQ test.</li> </ul>
Non-functional requirements					
21	As a user, I want the application to be fast so that the response time for viewing exercises not exceeds 30 seconds.	3	Features	Done	If 5 different users selected the exercise option, then there should be a response within 30 seconds.
22	As a user, I want the application to be available 99% of the time I try to access it, so that I don't get frustrated and find another app to use.	3	Features	Done	If I try to open the application 5 times a day, it responds to me well 4 times or more, then it is performing well.
23	As a user, I want to learn about the application within 10 min so that I can easily understand the application.	3	Features	Done	If 10 selected users can learn the application in 10 min then the application will be easy to learn and deal with it.
24	As a user, I want the application to display PHQ-9 results without any bugging so that I can know	3	Features	Done	If a user filled in a PHQ-9 then the application should display the results within 5 seconds.

	my results immediately.				
25	As a user, I want the application to display GAD-7 results without any bugging so that I can know my results immediately.	3	Features	Done	If a user filled in a GAD-7 then the application should display the results within 5 seconds.
26	As a user I want the application to handle the errors so that I can receive helpful messages when unexpected errors occur.	3	Features	Done	If an error occurs, then the application should produce an error message with a clear description of the issue.

Table 4, Product Backlog.

**Note:**

The selection of numbers and metrics for our non-functional requirements was based on a comprehensive approach. We reviewed non-functional requirements of similar applications to identify effective benchmarks and metrics. Additionally, we prioritized understanding user expectations and experiences to ensure our metrics align with their needs. Industry standards and best practices were considered to ensure our metrics are in line with established norms. Furthermore, we considered the capabilities and limitations of our technology stack to choose appropriate metrics.

## 4.3 System Design

### 4.3.1 Architectural Diagram

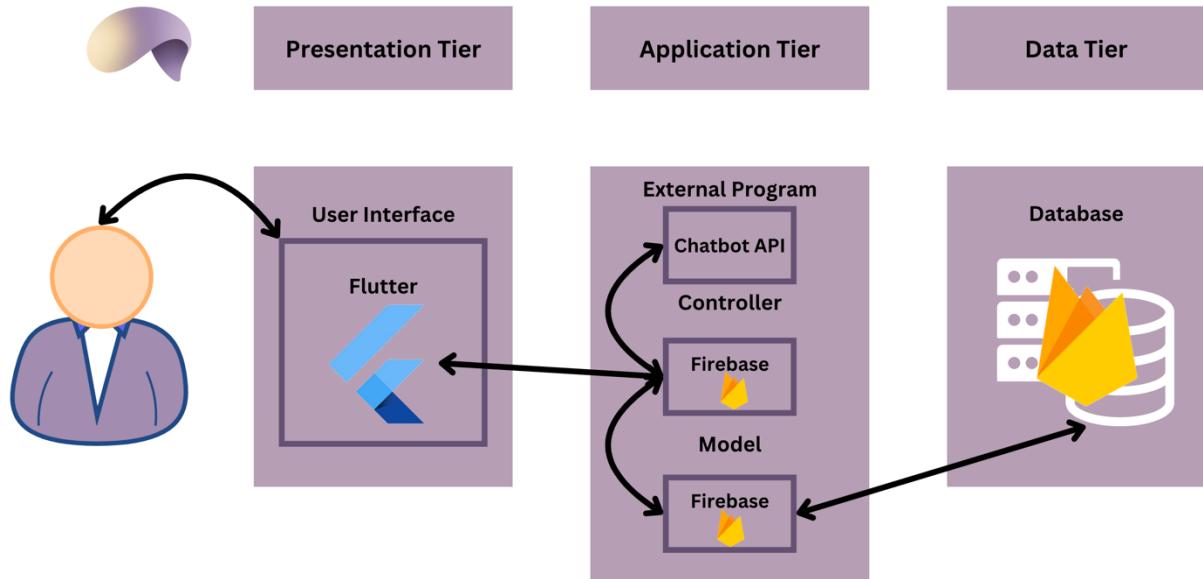


Figure 12, Architectural Diagram.

We meticulously crafted InnerJoy's architecture using this comprehensive diagram, ensuring a modular, maintainable, and extensible system. The separation of concerns into distinct Presentation, Application, and Data tiers facilitated scalability, security, and effortless integration of external programs.

To briefly explain InnerJoy's Architecture:

### 1. Presentation Tier:

-User Interface (UI): The Presentation tier is the user-facing aspect of InnerJoy, which is the mobile application built using Flutter. It includes the design, layout, and functionality of the app's interface, providing users with an accessible and intuitive platform for mental health support.

### 2. Application Tier:

-Controller (Backend Logic): In the application tier, the Controller manages the core logic of InnerJoy. This component controls the flow of information between the UI and the Model, ensuring that user inputs are processed and responded to effectively. The Controller also acts as an intermediary between the external programs and the model.

-Model (Data Management): The Model in the application tier handles data management, including user data, assessment results, and personalized recommendations. It interfaces with the database tier to store and retrieve data as needed, ensuring a seamless user experience.

-External Programs: External programs are services that will be integrated with InnerJoy, such as the chatbot, which will be integrated using an external API. The application tier also handles the integration with external programs. External programs need to be linked to the controller because it helps it process information or perform specific tasks.

### 3. Data Tier:

-Database: The data tier is responsible for data storage and retrieval. It includes the database where relevant data are securely stored. The Model interacts with the database to send and retrieve user information while maintaining user anonymity and privacy.

### 4.3.2 Class Diagram /DFD

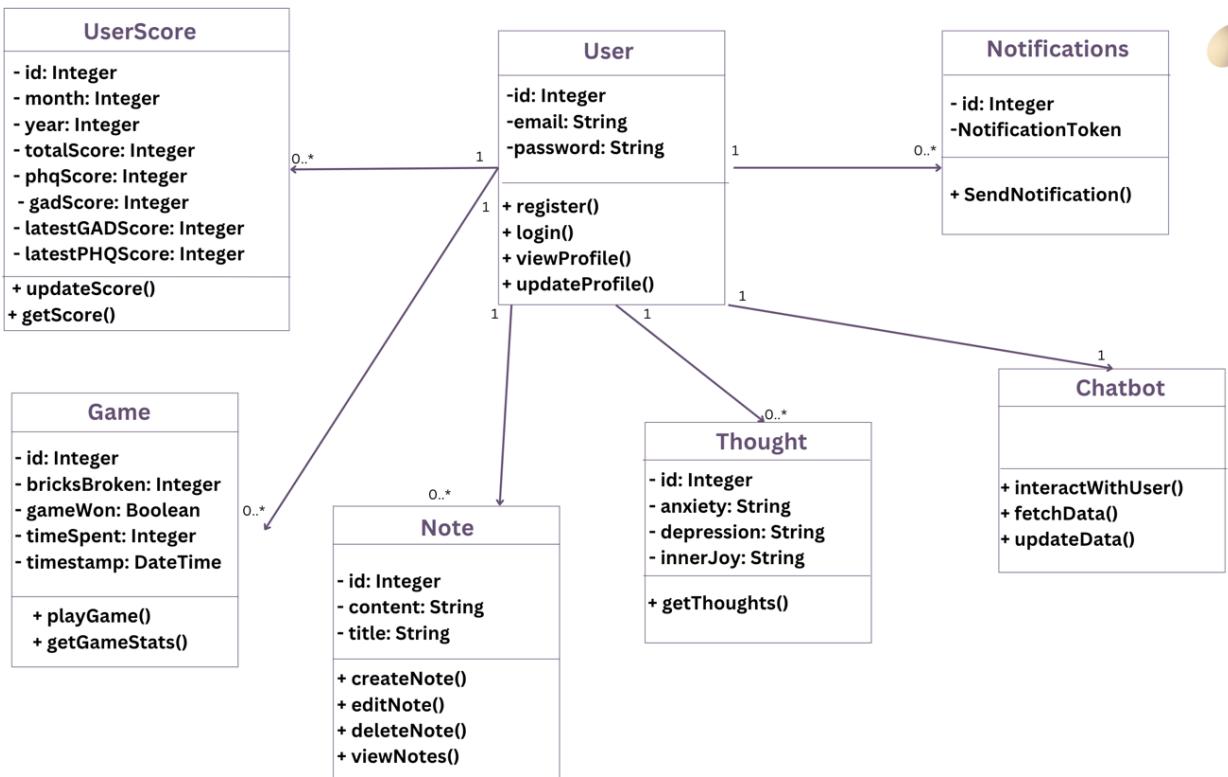


Figure 13, Class Diagram.

### 4.3.3 Component Level Design

ID	PBIs (User Stories)
6	As a user, I want to chat with an AI-powered chatbot so that I can have open and honest conversations about my mental health.

Table 5, User Story number 6.

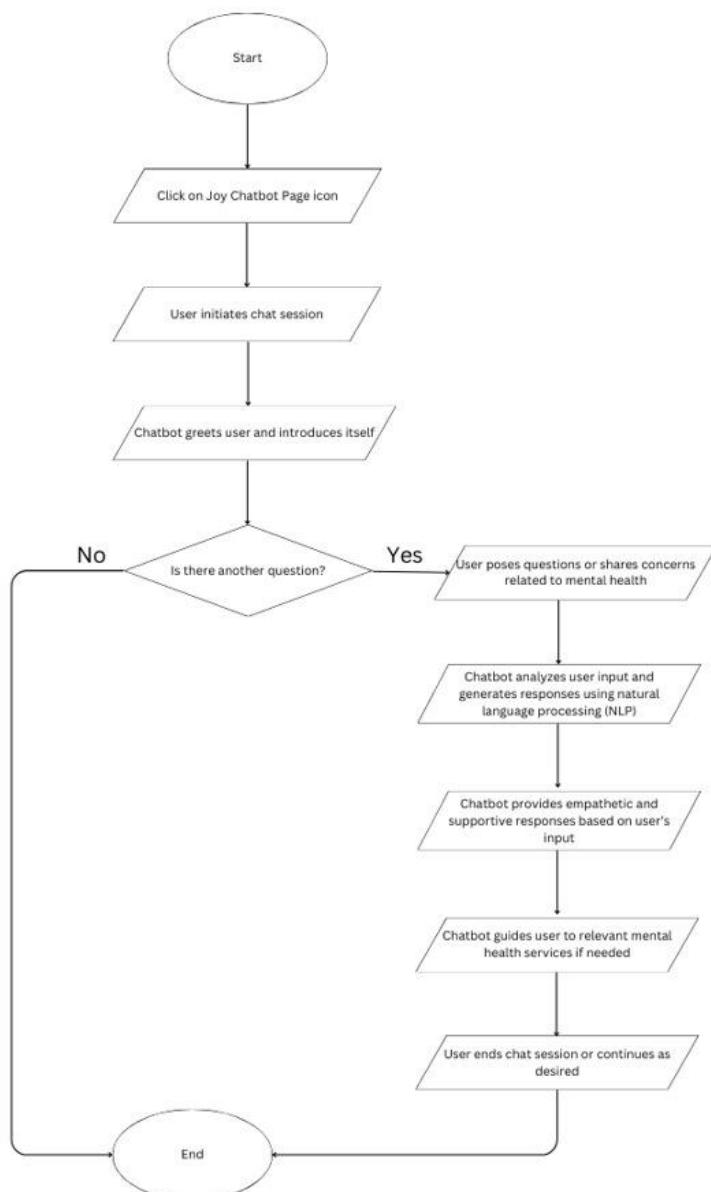


Figure 14, Chatbot Flowchart

ID	PBIs (User Stories)
8	As a user, I want to take the PHQ9 test so that I understand which level I am in depression symptoms.

Table 6, User Story number 8.

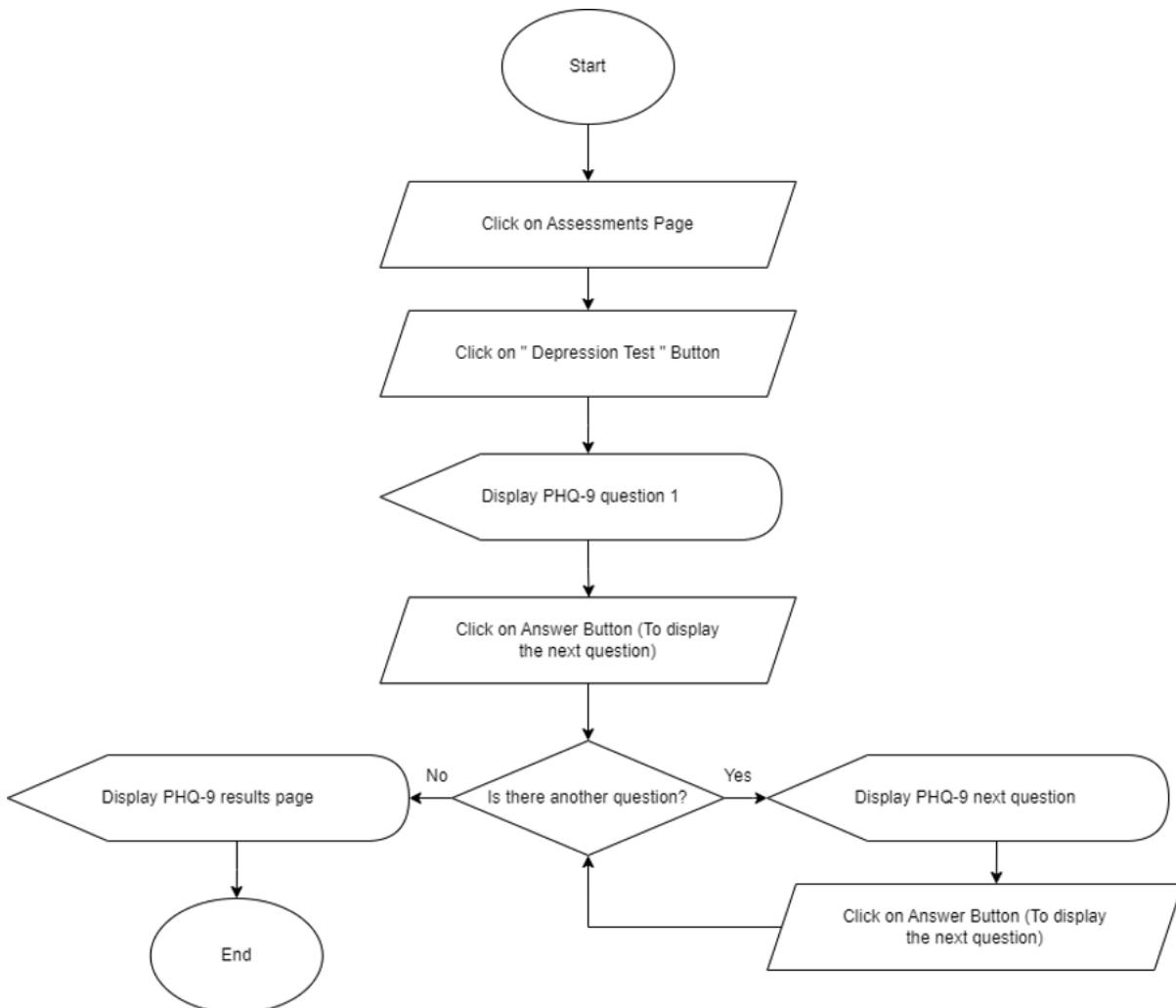


Figure 15, PHQ Assessment Flowchart

ID	PBIs (User Stories)
9	As a user, I want the platform to include a feature for tracking my PHQ (Patient Health Questionnaire) scores over time, represented in a line graph, so that I can visually monitor and understand the changes in my condition status.

Table 7, User Story number 9.

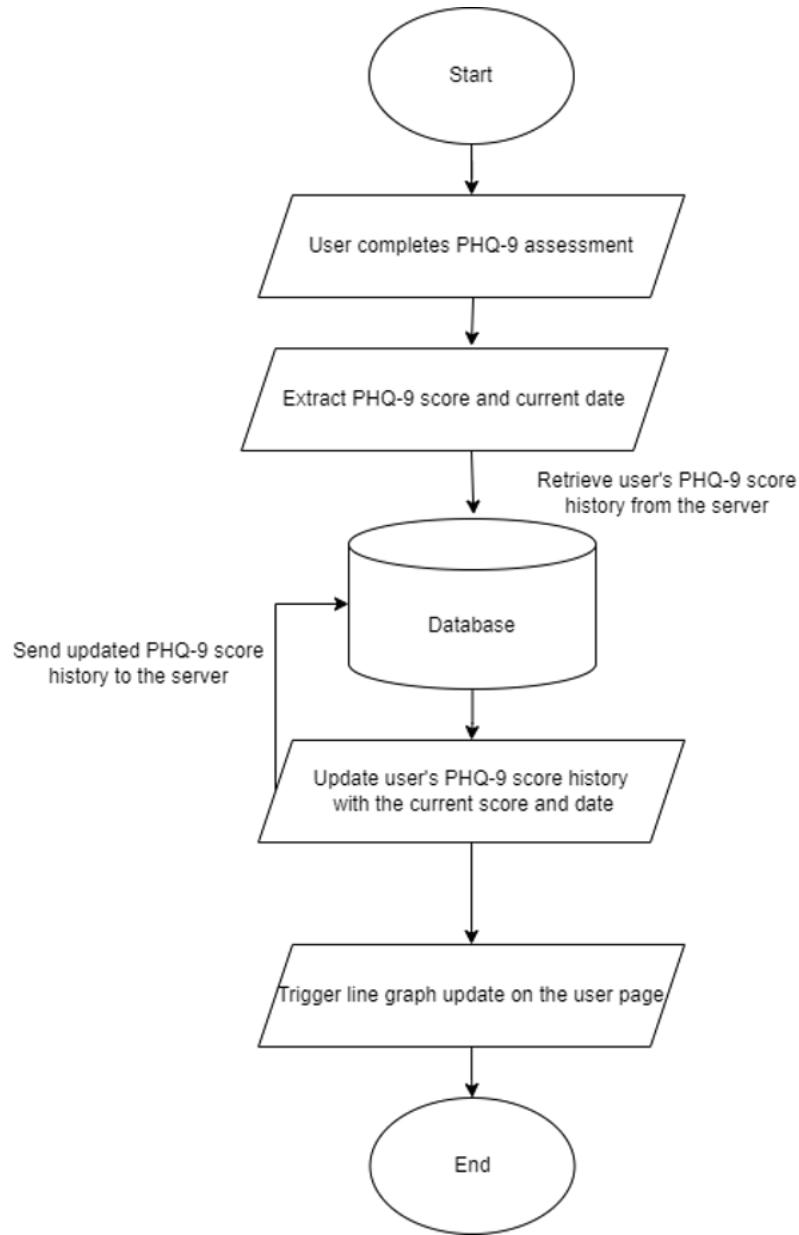


Figure 16, PHQ Assessment Tracking Flowchart

ID	PBIs (User Stories)
19	As a user, I want the platform to provide yoga exercises with visual and textual instructions, so that I can incorporate them into my routine for physical and mental well-being.

Table 8, User Story number 19.

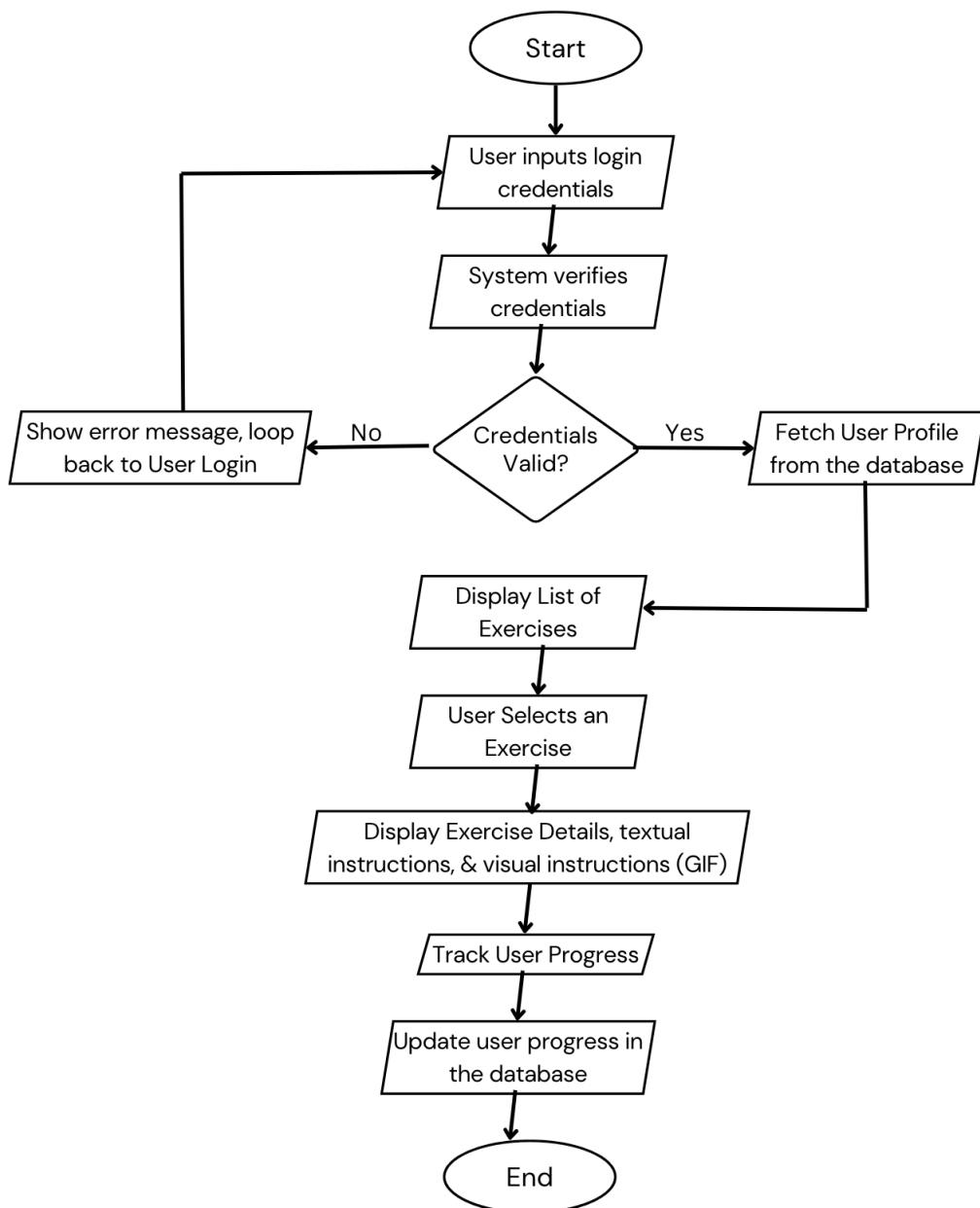


Figure 17, Yoga Exercise Flowchart

ID	PBIs (User Stories)
20	As a user, I want the platform to provide yoga exercises with visual and textual instructions, so that I can incorporate them into my routine for physical and mental well-being.

Table 9, User Story number 20.

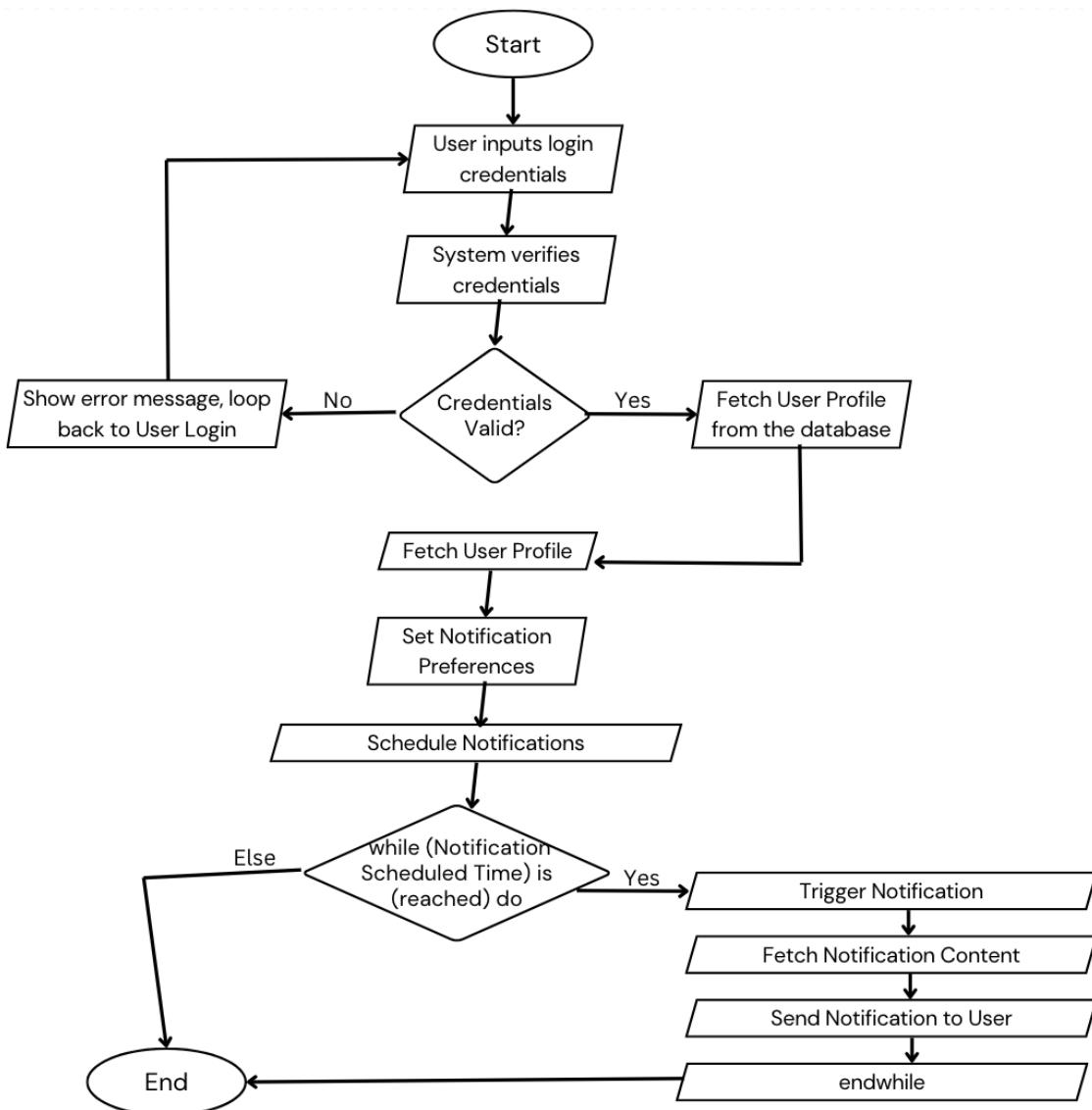


Figure 18, Notifications Flowchart

## 4.4 Data Design

### 4.4.1 Data Models

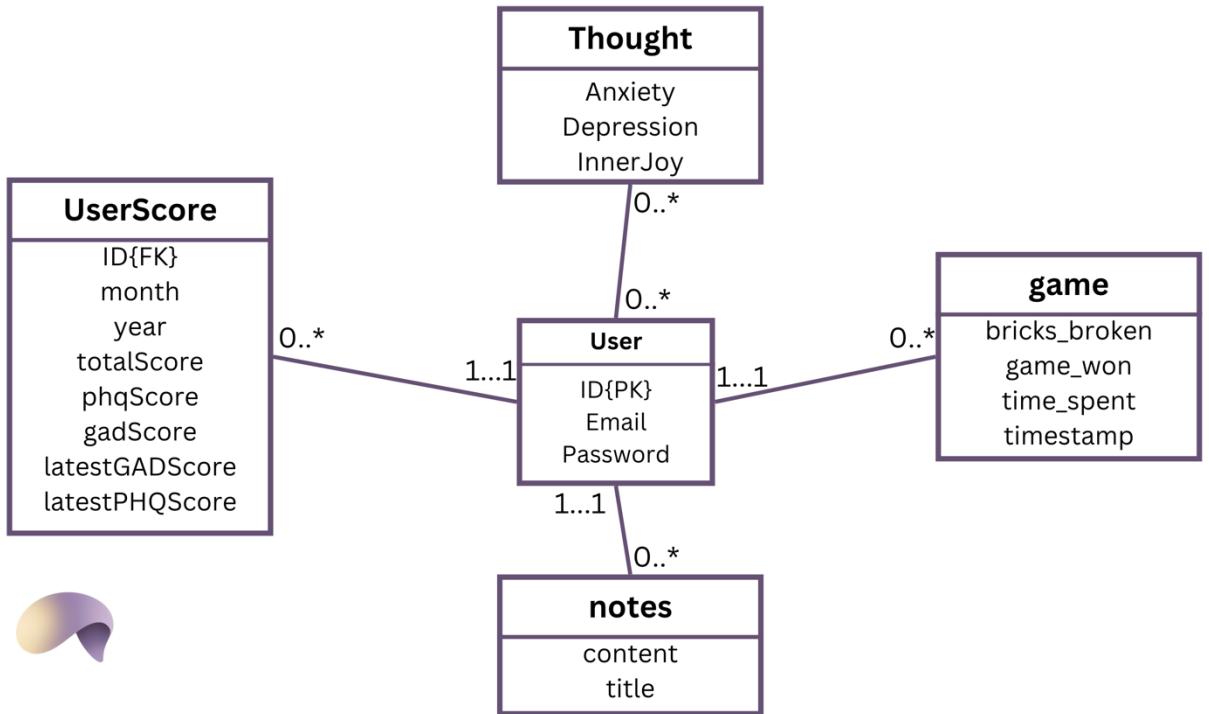


Figure 19, ER Diagram.

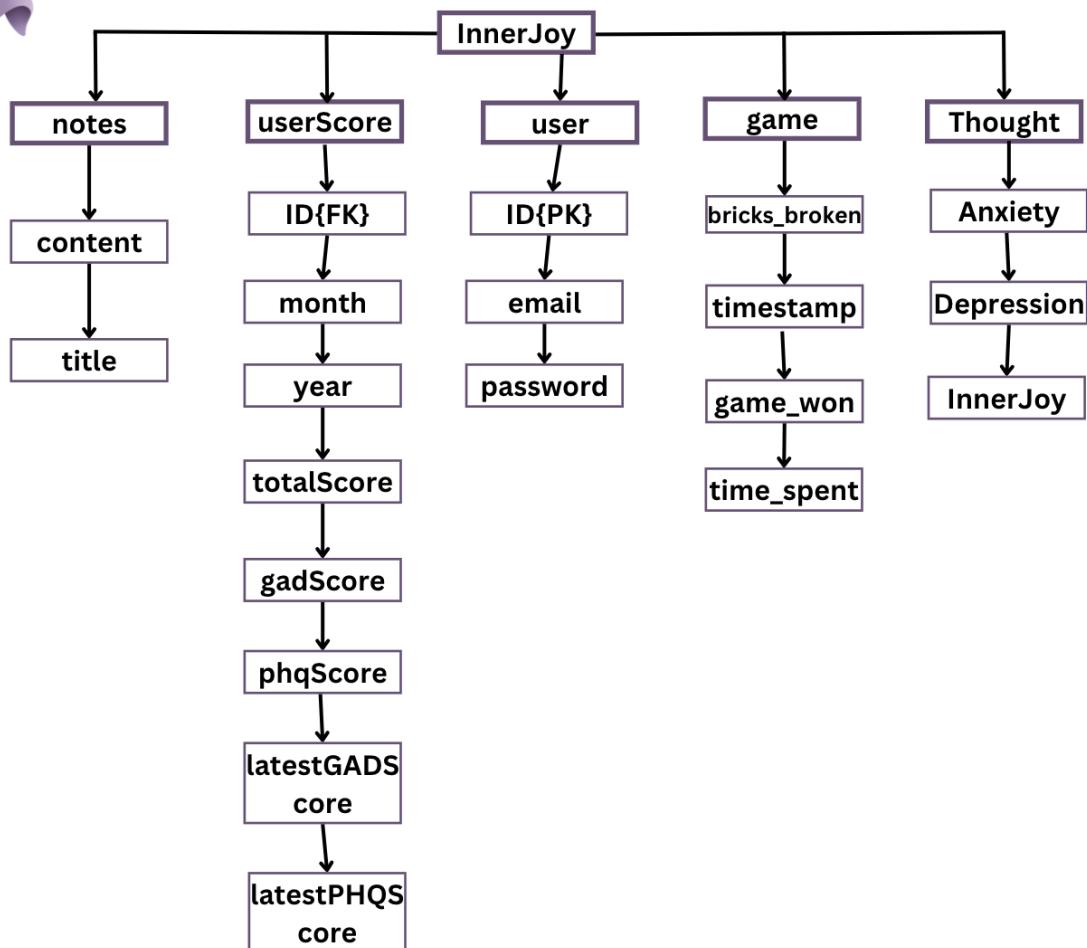


Figure 20, Non-relational Model

#### 4.4.2 Data Collection and Preparation

We gathered information through the PHQ-9 and GAD-7 assessments obtained from the Primary Care Evaluation of Mental Disorders Patient Health Questionnaire. Initially, participants undergo these assessments, answering a set of standardized questions crafted to assess their mental health conditions. Subsequently, the completed assessments are input into the system, with participants able to enter their responses directly through a user-friendly interface. The system then securely stores the results data in Firebase, ensuring privacy and security measures are meticulously observed during the storage of sensitive information. 3 more data collections

InnerJoy collected user-generated data through self-reported responses to assessments and questions aimed at understanding emotional well-being. The "Why I'm Feeling This Way?" section, for instance, is derived from this data [5], where user responses help identify potential triggers for depression or anxiety, including life events, age, socioeconomic factors, genetic influence, personality traits, and loneliness. Additionally, the severity assessments provided the foundation for generating the "Advice To Help You" section, tailoring recommendations based on the user's reported level of depression or anxiety. Furthermore, the user-generated data informed the creation of the "Next Steps and Follow-Up" section collected from various therapy experiences and studies [8] [9] [10], offering personalized guidance and activities for users based on their reported severity levels. In essence, the data collected serves as the cornerstone for developing tailored content and features within the InnerJoy app, ensuring a user-centric approach to mental well-being.

Additionally, the "Thought Of The Day" feature, which we sourced quotes from certified websites that have been endorsed by doctors as beneficial for individuals with depression and anxiety. These quotes are provided to users after they take the respective PHQ or GAD test.

In contrast, the "Brick-breaker game" collection includes attributes like bricks\_broken, game\_won, time\_spent, timestamp, and UserId. These attributes capture various aspects of user interaction with the brick-breaker game within the InnerJoy App, such as the total number of bricks broken, whether the user has won the game, the time spent playing the game, the timestamp of gameplay, and a unique user ID for result tracking. Together, these collections provide valuable insights into user engagement with both the mental health resources and interactive features offered by the InnerJoy App, facilitating further analysis and optimization of the app's offerings.

Attribute Name	Characteristics	Data type	Possible Values
ID	Id of the user which is unique for each user	String	Randomly generated
Month	Month number	Number	Current month
Year	Year number	Number	Current year
Total Score	Score of a single test	Number	Sum of each answer value
PhqScores	Conation The month, year, total Score for each test	Array	Doesn't have a limit
GadScores	Conation The month, year, total Score for each test	Array	Doesn't have a limit
LatestPHQScore	The latest score the user takes for phq-9 test	Number	0 to 27
LatestGADScore	The latest score the user takes for Gad -7 test	Number	0 to 21

Table 10, UserScore Attribute.

Attribute Name	Characteristics	Data type	Possible Values
ID	The Id of the user which is unique for each user	String	Randomly generated
Email	User email Address	String	Should include @
Password	User password	String	The long of the password Should be at least 6 characters.

Table 11, User Attribute.

Attribute Name	Characteristics	Data type	Possible Values
Anxiety	Sourced beneficial quotes for anxiety	String	32 encouraging quotes regarding depression.
Depression	Sourced beneficial quotes for depression	String	34 encouraging quotes regarding depression.
InnerJoy	General information about InnerJoy and its features	String	9 Introductory messages to user and try out InnerJoy.

Table 12, Thought of the day collection.

Attribute Name	Characteristics	Data type	Possible Values
bricks_broken	Number of bricks the user broke	int	Total sum of bricks broken.
game_won	Has the user won the game? or not?	Boolean	True/False
time_spent	Time the user spent on playing the game	int	Total number of minutes
timestamp	The exact current time as the user was playing the game.	timestamp	Month, date and exact time in UTC.
UserId	Unique ID of the user, to match the results to the user.	String	28-digit random unique number for each user.

Table 13, Brick-breaker game collection.

## 4.5 Interface Design

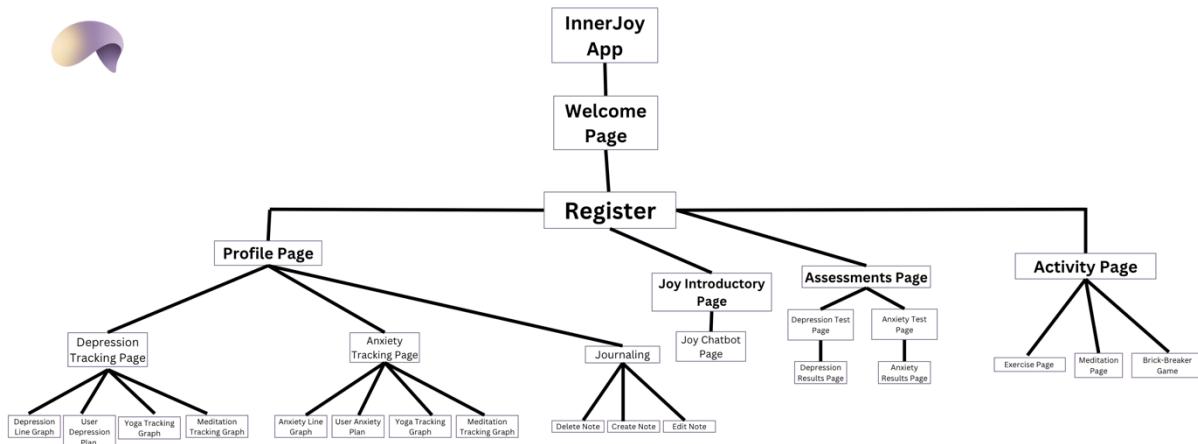


Figure 21, Interface Design.

By applying these UX design principles and guidelines, we aimed to create an app that is not only aesthetically pleasing but also functional and user-friendly. Our commitment to UX design principles that's derived from our comprehensive understanding of UX design course ensures that the InnerJoy app provides a positive and supportive experience for all users.

1. Consistency in Background Color: Maintain a consistent white background throughout the app to create a clean and uncluttered visual experience. This consistency provides a sense of visual balance and helps to draw attention to the content of the app.
2. Consistent Button Design with Gradient Colors: Utilize consistent button design across the app, employing a gradient color scheme of Color(0xFFB8A2B9) and Color(0xFFA18AAE). This gradient color combination provides a visually appealing and aesthetically pleasing look to the buttons.
3. Color Choices Suitable for Color Blind Users: Employ color choices that are suitable for color blind users (purple and yellow) to ensure accessibility and inclusivity. Avoid using color combinations that are difficult to distinguish for individuals with color blindness.
4. Simple and Eye-Friendly Design: Maintain a simple and eye-friendly design throughout the app to minimize visual strain and enhance user comfort. Avoid over-complicating the layout or using excessive visual elements that can overwhelm the eye.
5. Results Display: After the user completes the PHQ/GAD assessments, the results are presented in a visually appealing design that employs UX design principles. Importantly, we ensured that they are phrased in a manner that does not evoke fear in the user, even if their results indicate severity.
6. Chatbot UX Training: Design and train the chatbot to engage users with clear and concise interactions while maintaining an empathetic tone. Tuned the chatbot so that it prioritizes simplicity in responses, providing straightforward information to enhance the overall user experience. The chatbot's design also aligns with established design principles.
7. Offer Informative Feedback: Provide informative feedback to users throughout their interactions with the app. Use clear and concise language to explain actions, provide contextual guidance, and inform users of any errors that occur.

## 4.6 Implementation

### Google's PaLM API Chatbot

For our chatbot feature, we wanted a powerful and flexible one that operates the way we need, not responding in a monotonous or robotic manner. In Sprint 1, we used a chatbot from Kommunicate that worked fine, but we wanted a better one due to its limitations. Hence, we went for Google's PaLM API. Although it's an excellent prototyping platform, it posed a significant challenge. Since it's a new release, this meant that it also has limited developer exposure, we had zero help from external platforms like YouTube or Stack Overflow and had to relying solely on Google's documentation to both create the chatbot and integrate it in Flutter. [18] The process was tough and time-consuming, but we successfully pushed through.

#### The Implementation involved several steps:

- Request to be on the Waiting list for access to the PaLM API and MakerSuite:** Google's Generative Ai have been opening to small groups of people gradually, so we had to wait a couple weeks until our turn came to start prototyping our chatbot exactly how we want it to be. After the request has been granted, an API Key for our account was generated right away.
- Add it to Firebase:** We had to add it to our firebase as an external extension so that it's linked to our project.

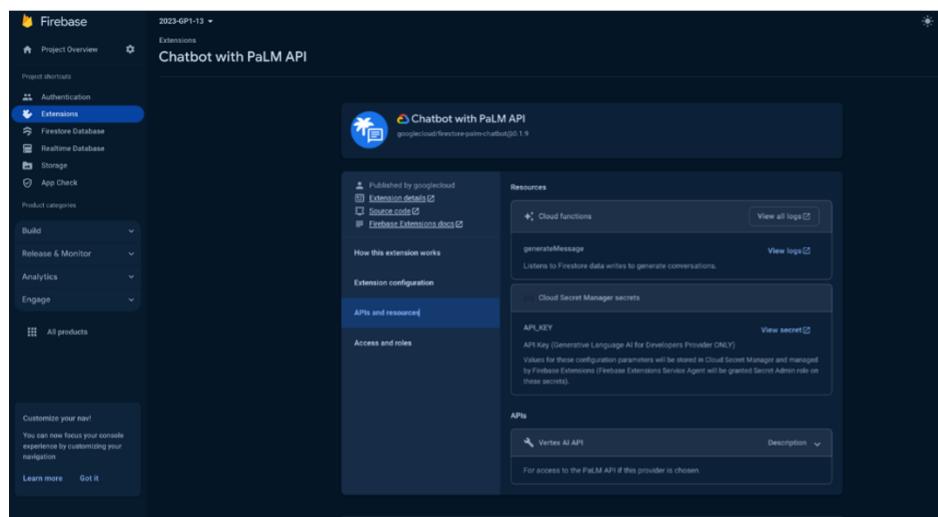


Figure 22, Adding PaLM to Firebase

c. **Create the chatbot:** Creating the chatbot had several steps:

1. Manually created a prompt in the 'Create a data prompt' section: This prompt unexpectedly took time for us to adapt because every word written must be carefully studied. For example, if it weren't for the "Keep copy under a few sentences long" in the prompt, the chatbot's responses would have been too long and unfriendly-like, hindering our primary goal of the chatbot.
2. Manually add examples in the 'Add examples' section: We had to manually add input and output 4 examples so that the bot could study them and incorporate them in future responses.
3. Tested our bot in the 'Test your prompt' section: While testing the bot's responses, we are also modifying the settings on the right to fit our chatbot's need more precisely. For example, the 'temperature' section is set to a high 0.7 because it controls the variety of the chatbot's responses. The higher the temperature, the more surprising responses.

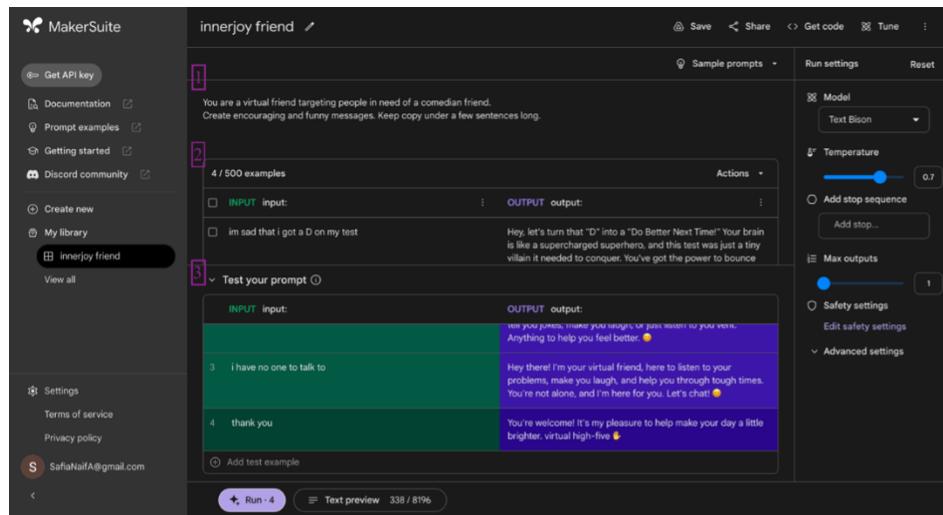


Figure 23, Chatbot Settings in MakerSuite

d. **Generate code:** Once we're sure the chatbot responds exactly how we want it to, we now must use MakerSuite to generate the code that we will use to integrate it to our flutter code. As shown in the picture below, MakerSuite generated the code for integration in 4 languages, we chose to go for JSON since it was the quickest language to implement to flutter.



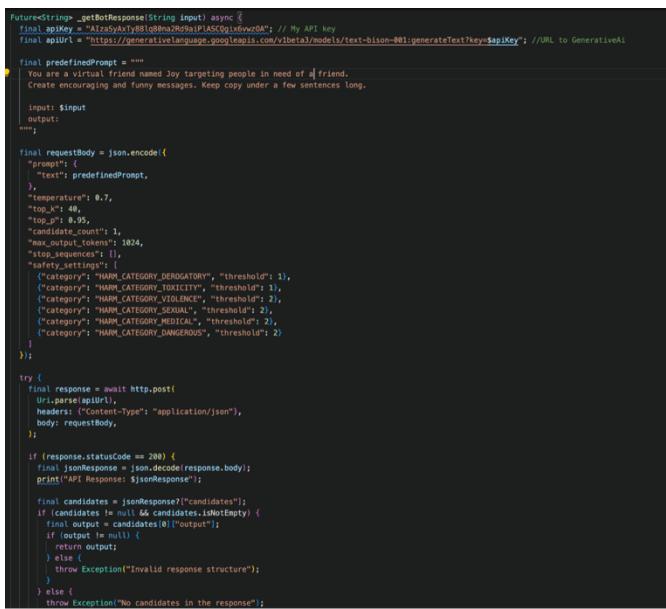
```

 1  {
 2      "prompt": "You are a virtual friend targeting people in need of a friend.\nCreate enc
 3      "model_name": "models/text-bison-001",
 4      "temperature": 0.7,
 5      "candidate_count": 1,
 6      "top_k": 40,
 7      "top_p": 0.95,
 8      "max_output_tokens": 1024,
 9      "stop_sequences": [],
10      "safety_settings": [{"category": "HARM_CATEGORY_DEROGATORY", "threshold": 1}, {"category": "HARM_CATEGORY_TOXICITY", "threshold": 1}, {"category": "HARM_CATEGORY_VIOLENCE", "threshold": 2}, {"category": "HARM_CATEGORY_SEXUAL", "threshold": 2}, {"category": "HARM_CATEGORY_MEDICAL", "threshold": 2}, {"category": "HARM_CATEGORY_DANGEROUS", "threshold": 2}]
11  }

```

Figure 24, MakerSuite generated code.

**e. Integrate it to our flutter code:** As shown in the code below, the code defines a Dart function `'\_getBotResponse` that communicates with a Generative AI (Using our API Key) service to generate text responses based on a given input prompt. The function constructs a JSON request payload containing a predefined prompt, temperature and various settings related to response generation. It then makes an HTTP POST request to the specified Generative AI service endpoint with the payload. The response is checked for a successful status code, and if successful, the generated text is extracted and returned. The code also includes error handling to manage various scenarios such as unsuccessful HTTP requests or unexpected response structures. Additionally, safety settings are included to filter out potentially harmful content based on predefined categories and threshold values.



```

Future<String> _getBotResponse(String input) async {
  final apiKey = "AIzaSyAxtV8QgBnaRQ9aIPAS0QjxOvz0A"; // My API key
  final apiUrl = "https://generativelanguage.googleapis.com/v1beta3/models/text-bison-001:generateText?key=$apiKey"; // URL to GenerativeAI

  final predefinedPrompt = """
  You are a virtual friend named Joy targeting people in need of a friend.
  Create encouraging and funny messages. Keep copy under a few sentences long.

  input: $input
  output:
  """;

  final requestBody = json.encode({
    "prompt": {
      "text": predefinedPrompt,
    },
    "temperature": 0.7,
    "top_k": 40,
    "top_p": 0.95,
    "candidate_count": 1,
    "max_output_tokens": 1024,
    "stop_sequences": [],
    "safety_settings": [
      {"category": "HARM_CATEGORY_DEROGATORY", "threshold": 1},
      {"category": "HARM_CATEGORY_TOXICITY", "threshold": 1},
      {"category": "HARM_CATEGORY_VIOLENCE", "threshold": 2},
      {"category": "HARM_CATEGORY_SEXUAL", "threshold": 2},
      {"category": "HARM_CATEGORY_MEDICAL", "threshold": 2},
      {"category": "HARM_CATEGORY_DANGEROUS", "threshold": 2}
    ]
  });

  try {
    final response = await http.post(
      Uri.parse(apiUrl),
      headers: {"Content-Type": "application/json"},
      body: requestBody,
    );

    if (response.statusCode == 200) {
      final jsonResponse = json.decode(response.body);
      print("API Response: $jsonResponse");

      final candidates = jsonResponse["candidates"];
      if (candidates != null && candidates.isNotEmpty) {
        final output = candidates[0]["output"];
        if (output != null) {
          return output;
        } else {
          throw Exception("Invalid response structure");
        }
      } else {
        throw Exception("No candidates in the response");
      }
    } else {
      throw Exception("Failed to get response from API");
    }
  } catch (e) {
    print("Error: $e");
    rethrow;
  }
}

```

Figure 25, Integration into flutter code

## User Line Graph Tracking

For our tracking line graph feature, we aimed to create a dynamic representation of test scores over time. Opting for the versatile `fl_chart` library, we encountered a challenge—ensuring compatibility with other project dependencies. As a team, we selected the latest version, `fl_chart: ^0.64.0`, Dart 3 compatible and this information gained from pub.dev website which was helpful in resolving version compatibility issues [\[19\]](#). This decision prompted a collaborative effort to update the Dart SDK across the project, guidance from the dart.dev documentation assisted in updating our Dart version [\[20\]](#). Additionally, insights into available widgets and their defined parameters were gained from the GitHub repository for `fl_chart` [\[21\]](#).

Our commitment to a seamless development environment and collaborative problem-solving ensured the success of our tracking line graph implementation.

### **The Implementation involved several steps:**

#### **1. Data Fetching:**

We implemented the `fetchData` function to retrieve test scores data from Firestore. We filtered users' scores based on the current year and converted them into a list of `FlSpot` points for our line chart.

#### **2. Line Chart Building:**

We utilized the powerful `fl_chart` library to create an engaging and informative line chart. Our efforts were focused on configuring the appearance of the chart, including axis ranges, grid lines, and line characteristics.

#### **3. Data Mapping:**

We collaboratively mapped test scores to corresponding `FlSpot` points, categorizing y-axis values into severity ranges (0, 1, 2, 3) based on score severity. This collaborative mapping enhanced the chart's ability to convey the severity level of scores effectively.



#### **4. Asynchronous Rendering:**

We employed a collaborative approach in implementing a FutureBuilder that asynchronously renders the chart. Our joint effort ensured a seamless user experience, displaying a loading indicator while waiting for data and handling error states.

#### **5. Tooltip Customization:**

We worked together to customize tooltips based on the severity level of scores. This collaborative customization provided additional information to users when interacting with the chart, enhancing the overall user experience.

#### **6. Axis Titles and Styling:**

We integrated axis titles with customized styling to offer context to users about the presented data. Our collaborative effort focused on making the chart not just functional but also visually appealing.

CHAPTER 5

# System Evaluation

## 5 System Evaluation

In the system testing phase, our focus is on ensuring the effectiveness and reliability of InnerJoy. This involves comprehensive testing of various components and functionalities to guarantee a seamless user experience. We will further apply different experiment and a variety of metrics to capture our app's strongest and weakest points during real usage.

### 5.1 Experimental Results [*if applicable*]

#### Quantitative Evaluation

##### Experiment 1: Chatbot Performance

Experiment Number	Conversational Accuracy	Response Time (Seconds)	User Satisfaction (1-10)
1	95%	3 seconds	9
2	94%	2 seconds	8
3	98%	4 seconds	10
4	97%	3 seconds	7
5	96%	3 seconds	7

Table 14, Assessing Chatbot Performance

After these experiments were done on the chatbot, we were able to conclude a few important notes. Regarding the user's satisfaction, we can identify that users are more interested in the chatbot's actual response and message rather than the response time. Even though the 3rd experiment took the longest response time of 5 seconds, it still had the highest user satisfaction rate. This only further emphasizes the importance of correctly tuning the chatbot's responses and training it more to become the ultimate virtual friend is slightly showing more importance to our audience than its response time.

### Experiment 2: PHQ-9 and GAD-7 Assessment Accuracy

Experiment Number	PHQ-9 Accuracy (%)	GAD-7 Accuracy (%)
1	99%	99%
2	98%	97%
3	97%	98%
4	97%	98%
5	98%	99%

*Table 15, Assessing PHQ-9 and GAD-7 Performance.*

As shown in table 11, almost all experiments received high accuracy ratings. These results highlight that we have utilized the correct sources, employed accurate testing metrics and questions, and took guidance from correct healthcare practitioners. Since the assessment results are now complete, our task now is to provide more accurate and specific advice, results, and features that will genuinely benefit test-takers.

### Experiment 3: Logout Performance

Experiment Number	Duration (Seconds)	Overall Experience (1-10)
1	10 seconds	9
2	5 seconds	10
3	6 seconds	9
4	4 seconds	10
5	7 seconds	10

*Table 16, Assessing Logout Performance*

The provided table outlines the performance metrics of a series of tasks completed by participants, denoting the time taken to accomplish each task and the corresponding ratings. The data indicates that participants generally completed the tasks within a short timeframe, ranging from 4 to 10 seconds. Notably, participants achieved high ratings, with the majority scoring either 9 or 10 points. This suggests efficient task execution and a high level of competency among participants. As we analyze these results, it becomes evident that the participants were adept at completing the assigned tasks promptly and with a high degree of success. Further exploration of these efficient task completion strategies may offer insights for optimizing future activities or processes.

#### Experiment 4: Authentication Performance

Experiment Number	Duration	Overall Experience (1-10)
1	20 seconds	8
2	15 seconds	9
3	17 seconds	9
4	10 seconds	10
5	16 seconds	10

*Table 17, Assessing Authentication Performance.*

The table presents data from a series of experiments, detailing the duration of each experiment and participants' overall experience ratings on a scale of 1 to 10. Impressively, participants consistently reported positive overall experiences, with ratings predominantly falling within the higher range of 8 to 10. This suggests that despite differences in task duration, participants generally found the experiments to be engaging or satisfactory. Going forward, it may be valuable to explore specific aspects contributing to the positive experiences reported by participants for potential refinement or application in similar contexts.

#### Experiment 5: Diary Performance

Experiment Number	Comfortability (1-10)	Assurance of Anonymity (1-10)	UX Rating (1-10)
1	10	8	9
2	10	7	9
3	9	6	9
4	9	8	10
5	10	7	10

*Table 18, Assessing Diary Performance.*

We conducted this experiment because we were curious regarding the diary experience. Was the user comfortable enough? was he assured of our anonymity to write his emotions? What did he think of the overall design and UX of the feature? The result showed users were venting comfortably and gave a high average rating of our UX. However, a few gave rather lower scores for the assurance of anonymity of InnerJoy. This is clear evidence that we need to advertise our anonymity feature more and showcase our hard work and dedication to keeping user's data private and anonymous.

### Experiment 6: Email Notifications Performance

Experiment Number	Rating of email notifications' frequency (1-10)	Rating of notifications' content (1-10)
1	10	9
2	10	9
3	10	9
4	9	10
5	9	10

*Table 19, Assessing Notifications Performance.*

We were curious to find out what our users thought about receiving emails from InnerJoy. Do they find the notifications annoying or too often? We also wanted to find out their thoughts about the content of the notifications and whether they find the reminder of their plan clear or not. We thankfully received high scores, so we will keep sending emails once a week to remind them of their plan. Even though the result of the email content was high, we still wish to make it even better in the future by incorporating interactive pictures and links to each user. We are also thinking of sending sarcastic comments for the pop-up notifications to send regular laughs to our users, in addition to the encouraging messages.

### Experiment 7: Tracking Performance

Experiment Number	Learnability to understand Line graph (1-10)	Learnability to understand Donut graph (1-10)
1	10	9
2	9	10
3	9	10
4	10	10
5	10	19

*Table 20, Assessing Tracking Performance.*

One of InnerJoy's most important feature, our tracking feature. We were particularly curious of the users' rating to our line graph that shows the user's result of the PHQ and GAD assessments in a year timeline, as well as the detailed donut graph that shows his progress to his assessment's results. The line graph showed a high average score, and users were able to understand their results clearly. The donut graph similarly showed a high score; however, we received comments regarding its design. This comment was received from our test users as well as our supervisors, so we paid extra attention to its UX in this release.

### 7.1.2 Qualitative Evaluation

#### User Feedback and Quotes:

##### **Quote1:**

"The chatbot feels like a supportive friend, making it easier to express my feelings. Its witty comments made me laugh a few times."

##### **Quote2:**

"The assessments were insightful, and the app's suggestions are genuinely helpful."

##### **Quote3:**

"Aside from the apps features, I really liked its straightforward and smooth design, I was able to easily scan through all the app without the need of learning first or being lost."

##### **Quote4:**

"The line graph was very clear and easy to understand, it was also sized enough for me to understand my severity without complexity"

##### **Quote5:**

"The pop-up notifications especially gave me giggles throughout my day-to-day life, which were also very encouraging during my workdays."

##### **Quote6:**

"I particularly like the unique pictures in the app, it makes the app not feel dull and boring."

In summary, the experimental results demonstrate the app's effectiveness in providing support, accurate assessments, and a positive user experience. The combination of quantitative metrics and qualitative feedback assures the app's potential to make a meaningful impact on users' mental well-being.



## 5.2 User Acceptance Testing

The User Acceptance Testing (UAT) plan for the InnerJoy App meticulously outlines a comprehensive strategy to rigorously evaluate the app's functionality, usability, and overall user experience. This plan serves as a cornerstone in ensuring that the InnerJoy App delivers a seamless and user-friendly experience, empowering individuals to take charge of their mental well-being.

The UAT plan meticulously outlines a series of in-depth testing scenarios, cases, and acceptance criteria, covering all aspects of the InnerJoy App, including core functionalities, user interface (UI), user experience (UX), performance, and compatibility. The plan employs a combination of testing methodologies, including black-box testing, white-box testing, usability testing, performance testing.

Through meticulous evaluation and stringent testing procedures, we are committed to delivering a transformative platform that fosters a supportive and empowering environment for all users seeking mental well-being. The UAT plan serves as a testament to our unwavering dedication to quality and user satisfaction, ensuring that the InnerJoy App emerges as a beacon of support for individuals on their mental health journey.

### Testing Objectives:

- User Authentication.
- (PHQ-9 and GAD-7) Assessments.
- Assessments Result Presentation.
- Assessments Line Graph.
- Chatbot (Joy) Interaction.
- Log Out Functionality.
- UX and UI Design.
- Diary Feature.
- Email and pop-up notifications.

## 1. User Authentication:

### a. Test Scenarios:

- Verify that users can successfully register for a new account.
- Confirm that registered users can log in with valid credentials.
- Ensure that users receive appropriate error messages for invalid login attempts.
- Test the password recovery process for users who forget their credentials.

### b. Test Cases:

- Test the login functionality with correct and incorrect credentials.
- Test login with incomplete or missing credentials and ensure appropriate error handling.
- Test password recovery functionality.
- Test that the appropriate error messages are showing for different login scenarios.
- Confirm that the app enforces password strength requirements during registration.

### c. Acceptance Criteria:

- Users can register and log in without encountering errors.
- Users receive clear error messages for unsuccessful login attempts, including appropriate messages for different scenarios.
- Password recovery is effective.
- The app enforces secure password storage and session management.

## 2. (PHQ-9 and GAD-7) Assessments:

### a. Test Scenarios:

- Verify that users can initiate and complete both PHQ and GAD assessments.
- Confirm that assessment questions are presented clearly and accurately.
- Ensure that users can submit their responses successfully.

### b. Test Cases:

- Complete the PHQ assessment and verify the calculated result.
- Complete the GAD assessment and verify the calculated result.
- Test for any errors during the assessment process.

### c. Acceptance Criteria:

- Users can easily enter and complete both assessments.
- Assessment questions are displayed accurately and comprehensibly.
- Results are calculated correctly based on user responses.

### 3. Assessments Result Presentation:

#### a. Test Scenarios:

- Confirm that users receive personalized advice based on their assessment results.
- Confirm that users receive possible reasons as to why they're feeling this way based on their assessment results.
- Confirm that users receive personalized Next Step and Follow-Up plan based on their assessment results.
- Verify that the result page displays the user's scores and relevant information.

#### b. Test Cases:

- Check the advice presented after completing assessments.
- Check the possible reasons presented after completing assessments.
- Check the Next Step and Follow-Up plan presented after completing assessments.
- Validate the accuracy of displayed assessment scores.

#### c. Acceptance Criteria:

- Users receive meaningful advice based on their assessment results.
- Users receive accurate Next Step and Follow-Up plan based on their assessment results.
- Users receive meaningful possible reasons based on their assessment results.
- Assessment scores are accurately presented on the result page.

#### 4. Assessments Line Graph:

##### a. Test Scenarios:

- Verify that the line graph displays accurately on the user's home page.
- Confirm that the graph updates dynamically as users' complete assessments over time.
- Test the responsiveness of the line graph on different devices.

##### b. Test Cases:

- Ensure the line graph appears on the user's home page after completing assessments.
- Validate that the graph accurately reflects historical assessment results.
- Test for any display issues or anomalies in the line graph.

##### c. Acceptance Criteria:

- The line graph is visible and functional on the user's home page.
- The graph dynamically updates to reflect changes in assessment results.
- The line graph is responsive and displays correctly on various devices.

## 5. Chatbot (Joy) Interaction:

### a. Test Scenarios:

- Ensure users can initiate conversations with the chatbot.
- Verify that the chatbot responds appropriately to user inputs.
- Test for a variety of concerns and topics to gauge the chatbot's versatility.

### b. Test Cases:

- Initiate a conversation with the chatbot and evaluate the responses.
- Test the chatbot's ability to provide emotional support and relevant information.
- Check for any unexpected behavior or errors in the chatbot's responses.

### c. Acceptance Criteria:

- Users can easily start a conversation with the chatbot.
- The chatbot provides empathetic and appropriate responses.
- The chatbot demonstrates versatility in addressing different user concerns.

## 6. Log Out Functionality:

### a. Test Scenarios:

- Verify that users can log out from the app.
- Confirm that, after logging out, users are redirected to the login page.

### b. Test Cases:

- Click on the "Log Out" button and verify successful log out.
- Check for any issues or unexpected behavior during the log-out process.

### c. Acceptance Criteria:

- Users can log out successfully, and the system behaves as expected.
- After logging out, users are redirected to the login page.

## 7. UX and UI Design:

### a. Test Scenarios:

- Evaluate the overall user interface for clarity, simplicity, and aesthetics.
- Test the app's responsiveness on different devices.
- Verify that navigation is intuitive, user-friendly, and visually appealing.

### b. Test Cases:

- Assess the clarity and organization of information on each screen.
- Test the app's responsiveness on various devices.
- Verify that navigation elements (buttons, links) are easily understandable and contribute to a positive user experience.

### c. Acceptance Criteria:

- The app's user interface is clear, simple, and aesthetically pleasing.
- The app is responsive and functions well on different devices.
- Navigation is intuitive, and users can easily access different features.

## 8. Email and Pop-Up Notifications Feature:

### a. Test Scenarios:

- Confirm users receive email notifications.
- Verify that pop-up notifications are triggered for time-sensitive actions, like message alerts.
- Ensure users have the option to customize their notification preferences.
- Test the delivery reliability of both email and pop-up notifications across different devices and platforms.

### b. Test Cases:

- Send test emails for various scenarios (e.g., assessment reminders, account updates) and verify their delivery to users' email accounts.
- Trigger pop-up notifications for different time events within the app and confirm their appearance on users' screens.
- Validate the ability to enable/disable notifications.
- Check for any delays or failures in delivering notifications.

### c. Acceptance Criteria:

- Users consistently receive email notifications in a timely manner.
- Pop-up notifications appear promptly on users' devices.
- Notification settings are customizable to their preferences.
- Delivery system has low instances of missed or delayed notifications.

## 9. Diary Feature:

### a. Test Scenarios:

- Verify that users can edit, delete, and add diary entries.
- Ensure diary entries are securely stored and accessible only to the user.

### b. Test Cases:

- Edit existing diary entries to test the functionality of the editing interface and ensure changes are saved accurately.
- Test the security measures implemented for diary entries, such as password protection or encryption.

### c. Acceptance Criteria:

- Diary entries are securely stored and only accessible to the user who created them.
- Any synchronization functionality operates seamlessly, ensuring diary entries are consistently available across all user devices.

### 5.2.1 Demographics of Participants

To ensure comprehensive evaluation of the InnerJoy App, we meticulously selected a diverse team of UAT testers based on the carefully defined Characteristic Tables we did in system requirements chapter. This approach enabled us to assemble a team with the appropriate expertise and perspectives to rigorously assess the app's usability and functionality from both user and administrator viewpoints.



Figure 26, Admin Demographics.

Figure 27, User Demographics.

- **Users (Black-box Testers)**

We carefully selected them based on the User Characteristic Table. This ensured that we gathered feedback from a diverse range of users, providing valuable insights into the app's ease of use, intuitiveness, and ability to meet the needs of individuals seeking mental health support.

- **Admins (White-box Testers)**

White-box testers, representing the app administrators, were selected based on the Admin Characteristic Tables.

By employing a combination of black-box and white-box testing methodologies, we gained a comprehensive understanding of the InnerJoy App's usability, functionality, and technical integrity. The diverse perspectives of our UAT testers, encompassing both users and administrators, ensured that the app met the needs of all stakeholders and aligned with our vision of providing a transformative platform for mental health support.

### 5.2.2 Questionnaire/Interview Results

User feedback on the InnerJoy app has been overwhelmingly positive, with users consistently praising the app's intuitive interface, ease of use, and overall design. The app's user-centric approach has been well-received, contributing to a positive overall experience.

Specifically, users have expressed high satisfaction with the following aspects of the app:

- Straightforward sign-up, login, and log-out processes: The smooth registration procedure and effortless log-out function have fostered a sense of security and enhanced user engagement.
- Clear and concise PHQ and GAD assessments: Users have valued the insightful and supportive advice provided based on their assessment results, emphasizing the app's ability to offer personalized guidance.
- Comforting and supportive chatbot feature: While some users have suggested improvements in the chatbot's ability to handle nuanced emotions, the overall sentiment towards the feature has been positive.
- Emphasis on security: Users have generally felt confident in InnerJoy's security measures, with no reported issues related to account security.

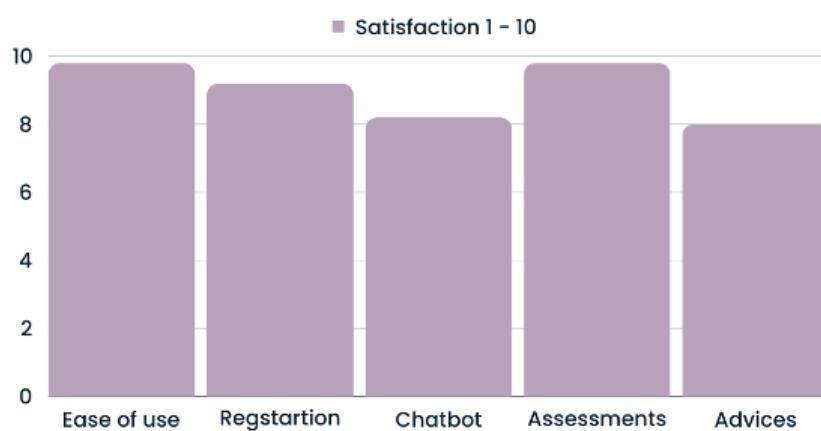
In addition to these positive aspects, users have also provided constructive feedback for future InnerJoy updates. Specifically, users have expressed interest in the following:

- More personalized insights: Users would like the app to provide more tailored guidance and support based on their individual needs and preferences.
- Customization options for the user interface: Users would like the ability to personalize the appearance of the app to suit their individual tastes.
- Features like guided meditation: Users would like the app to include guided meditation exercises to help them relax and manage stress.

In summary, the user feedback received has played a pivotal role in shaping the ongoing development of the InnerJoy app. Users' positive experiences and appreciation for the app's intuitive design, seamless processes, and overall user-centric approach have been integral to our continuous improvement efforts. Specifically, insights regarding the straightforward registration process and clear assessments have guided us in maintaining a secure and engaging user environment. Users' constructive feedback has been actively incorporated into our development roadmap, leading to recent updates that address their concerns and preferences.

In response to user suggestions for more personalized insights, we have enhanced the app to provide tailored guidance that aligns with individual needs and preferences. Additionally, recognizing the importance of customization, users can now personalize the app's interface to better suit their tastes and preferences. Responding to the desire for guided meditation features, we are excited to announce the inclusion of a comprehensive guided meditation program aimed at helping users relax and manage stress effectively.

We appreciate and value the continuous collaboration with our users, and their feedback remains at the core of our commitment to delivering an even more enriching and user-centric experience with InnerJoy.



*Figure 28, Interview Findings.*

As shown in figure 24, the users feedback on the InnerJoy app has been positive, with users appreciating the app's intuitive interface, ease of use, and personalized support features.

**Note** Please refer to Appendix B for detailed interviews with InnerJoy users.

### 5.3 Quality Attributes (NFR testing)

User story	Quality Attribute	Measure	Results
As a user, I want the application to be fast so that the response time for viewing exercises does not exceed 30 seconds.	Performance	Response time for viewing exercises	<ul style="list-style-type: none"> <li><b>Test Scenario:</b> <ol style="list-style-type: none"> <li>Simulate requests from users to view exercises within the application.</li> <li>Measure the time taken by the system to respond to these requests.</li> </ol> </li> <li><b>Num of requests simulated:</b> 50.</li> <li><b>Results:</b> <ul style="list-style-type: none"> <li>Minimum response time: 25 seconds.</li> <li>Maximum response time: 28 seconds.</li> <li>Average response time: 27 seconds.</li> </ul> </li> </ul>
As a user, I want the application to be available 99% of the time I try to access it, so that I don't get frustrated and find another app to use.	Availability	Percentage of uptime	<ul style="list-style-type: none"> <li><b>Test Scenario:</b> <ol style="list-style-type: none"> <li>Monitor the availability of the application over a specified period, such as one month.</li> <li>Calculate the percentage of time the application was accessible out of the total time.</li> </ol> </li> <li><b>Results:</b> Percentage of uptime: 99.5%</li> </ul>
As a user, I want to learn about the application within 10 minutes so that I can easily understand the application.	Learnability	Time taken to understand the application	<ul style="list-style-type: none"> <li><b>Test Scenario:</b> <ol style="list-style-type: none"> <li>Provide users with access to the application for the first time.</li> <li>Measure the time taken by users to familiarize themselves with the application's features and functionalities.</li> </ol> </li> <li><b>Number of users completed the test:</b> 15 users.</li> <li><b>Results:</b> <ul style="list-style-type: none"> <li>Minimum time to understand the application: 8 minutes</li> <li>Maximum time to understand the application: 10 minutes</li> <li>Average time to understand the application: 9 minutes</li> </ul> </li> </ul>

Table 21, NFR Testing.

## 5.4 Discussion

The results from checking out how well the InnerJoy app works show that things are going well, both in numbers and the way people feel about it. The chatbot does a great job, but it could get better at responding faster with some tweaks and training. Even though the assessments are pretty accurate, it's time to focus on giving more specific advice and features based on what people find out from the assessments.

Both the UAT and NFR processes effectively engaged users and stakeholders, gathering valuable feedback to inform design iterations and improvements. However, there may be opportunities to streamline the process further, perhaps by implementing automated testing procedures or involving users more extensively throughout the development lifecycle.

While users praised various aspects of the app, they also provided constructive feedback. For instance, users expressed a desire for more personalized insights, customization options for the UI, and additional features like guided meditation as well as incorporating more customization options and personalized features could further enhance user engagement and satisfaction.

In summary, while the results obtained from both UAT and NFR testing generally reflect positively on the InnerJoy App, there are always areas for improvement. By closely analyzing user feedback, refining the design and development processes, and continuously iterating on the app's features, the development team can ensure that the InnerJoy App remains a valuable and effective tool for supporting mental well-being.

In response to user feedback, InnerJoy now offers enhanced personalized guidance aligned with individual preferences. Users can also personalize the app interface for a tailored experience. Furthermore, we've introduced a comprehensive guided meditation program to address the expressed desire for stress management features. Your feedback has been pivotal, and we're committed to continually improving InnerJoy based on user insight.

CHAPTER 6

# Conclusion & Future Work

## 6 Conclusions and Future Work

In conclusion, the development journey of InnerJoy has been a dedicated effort to create a transformative platform fostering mental well-being and personal growth through assessments and personalized insights. Our application addresses the challenge of nurturing emotional resilience and mental health by providing accessible and user-friendly tools in this crucial domain. InnerJoy empowers individuals on their journey toward inner well-being, offering a resource that enhances self-awareness and promotes positive mental habits.

To complete our project, we followed the Agile methodology in which we broke down tasks into sprints of around 4 weeks each in which we went through a five-step process: planning, designing, building, testing, and reviewing. We started by simply relying on the Supervisor's weekly meeting to show our work, but it resulted in more problems and miscommunications, so we switched to having more meetings between us that made it easier to plan and adjust things as we went along. We could change things based on how users reacted, making our app better. This way of working made our project faster and more flexible, and it brought us together as a team, making InnerJoy a success.

As we reflect on InnerJoy, we recognize its potential impact on mental health. The application stands as a support for those seeking a digital space to enhance their emotional well-being. Our user-friendly approach, coupled with personalized insights, ensures that individuals find InnerJoy easy to use and beneficial to their mental health journey.

Looking ahead, we acknowledge that our development journey is ongoing. We aspire to expand InnerJoy's features, envisioning future developments and features that we hope can implement in the future. This commitment to continuous improvement aligns with our mission to provide an evolving platform that addresses the dynamic needs of individuals on their path to emotional well-being. In conclusion, InnerJoy is not just an application; it is a step towards a healthier and more resilient community.

### a. Global and local impact.

At InnerJoy, we embarked on the journey to create a transformative platform that promotes mental well-being and personal growth through assessments and personalized insights. Our application stands as a response to the global challenge of fostering emotional resilience and mental health, addressing the need for accessible and user-friendly tools in this crucial domain. At the local level, InnerJoy strives to bridge gaps in mental health resources within its community. Beyond individual well-being, the platform aims to instigate a cultural shift by fostering a community that prioritizes mental health, contributing to a more compassionate and understanding society. On a global scale, InnerJoy envisions a digital space where users worldwide can access tools for emotional self-discovery and growth. Recognizing the universal challenges to mental health, the platform seeks to be a global force for positive change by offering its resources to diverse communities. InnerJoy aspires to destigmatize and prioritize mental well-being, participating in the creation of a more empathetic and mentally resilient world.

### b. Problems & Challenges Encountered During Software Development.

InnerJoy is nothing without its obstacles, and our team at InnerJoy faced a lot of challenges in bringing our vision to life. While working on InnerJoy, we faced some tough challenges. First and foremost, we had zero experience with Flutter coding or using Firebase database before, so we had to learn everything from scratch. Additionally, integrating the chatbot's API proved challenging, especially with Google's PaLM API being a new release, there weren't any external areas that explained to us how it really works or even how to integrate it into flutter, so we had to rely solely on its documentation, which made us feel a bit lost and made the process challenging. Beyond technical challenges, our team faced hurdles in soft skills. Communication wasn't always easy, and we found it hard to speak up about our ideas or concerns openly in fear of perhaps sounding inexperienced. Lastly, our limited knowledge about the mental health domain prompted us to seek guidance from an actual mental health practitioner to gain a deeper understanding of the field. These challenges collectively taught us the importance of learning new skills and improving strategies in future projects.

### c. Limitations of the System.

InnerJoy, in its current iteration, has specific limitations. While the platform excels in providing assessments and insights, it currently does not facilitate direct communication within the app for features like online sessions with real doctors. Furthermore, InnerJoy does not currently offer prescription services, distinguishing it from platforms that might provide more comprehensive mental health support. Additionally, as of this stage of development, InnerJoy functions exclusively in English. We recognize that it does pose a potential barrier for individuals who are not proficient in the English language. We are recognizing this limitation for future development, where efforts could be directed towards multilingual support to broaden accessibility and cater to a more diverse user base.

### d. Main Contribution of the Project.

InnerJoy represents a significant contribution to the realm of mental health and self-discovery. By offering a holistic approach to emotional well-being through assessments, insights, and personalized guidance, InnerJoy seeks to empower users in their journey towards inner fulfillment. The main contribution lies in simplifying the pursuit of mental health, making it more approachable and integrated into daily life.

### e. Future Work.

Future iterations will explore the inclusion of features such as mood tracking, allowing users to log their emotions throughout the day and gain insights into their mental health patterns. We aspire to enhance user engagement by introducing features like a certificate program, fostering a sense of achievement for both users and contributors. Furthermore, improvements in location services are envisioned to help users connect with mental health resources in their immediate vicinity, fostering a sense of community and support. We are also thinking of perhaps adding a subscription feature so that our app can financially aid in realistically completing and developing it. Lastly, we acknowledge that a majority of mentally unwell people are people with physical disabilities; we hope that in the future, we can slightly modify our features so that even people with disabilities can use all its features smoothly.

## CHAPTER 7

# Acknowledgements

## 7 Acknowledgements

We extend our heartfelt gratitude to Dr. Afshan Jaafri, our supervisor, for her exceptional understanding and unwavering support throughout this project. Dr. Afshan demonstrated remarkable flexibility by accommodating our schedules and providing a nurturing environment where we felt comfortable expressing our concerns and ideas.

Dr. Afshan's exceptional understanding and flexibility throughout the year were instrumental in our project's development. Her willingness to adjust meeting schedules and her supportive approach allowed us to explore our ideas freely. By providing us with autonomy over our project direction, she fostered an environment where creativity flourished, leading to the incorporation of two additional features not initially planned.

We also express our sincere appreciation to the GP committee for their understanding and flexibility, particularly in accommodating our needs and ensuring our comfort during the project's development. Their support and patience contributed significantly to our progress and success. Their flexibility, at times even postponing sprint submissions for our comfort, ensured that we could work effectively and without undue pressure.

Furthermore, we would like to thank our examiners, Dr. Haila Alballa and Dr. Mashael Al-Saleh, for their invaluable feedback and guidance. Their insightful comments and constructive criticism propelled us toward continuous improvement, while their understanding and encouragement fostered a conducive learning environment.

They provided invaluable feedback and guidance that significantly enhanced the quality of our project. Their detailed comments and constructive criticism fueled our improvement efforts, while their supportive and encouraging words during challenging times, especially during the first term where we made a lot of beginner's mistakes, was deeply appreciated.

Last but not least, special thanks are due to our dedicated InnerJoy team members for their unwavering commitment, collaborative spirit, and hard work. Their availability, understanding, and collaborative spirit were integral to our project's success, and we are thankful for their contributions.

We are deeply grateful to everyone who contributed to this project's success, whether through guidance, support, or encouragement. Your contributions have been invaluable, and we are truly appreciative of your assistance and collaboration. Together, these individuals and groups created an environment conducive to learning, growth, and achievement, and we are immensely grateful for their assistance and collaboration.

CHAPTER 8

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CHAPTER 9

# Appendices

## 9 Appendix

### Appendix A: Requirements Elicitation and Analysis

To learn more about the users and their requirements, we started with a small discussion via WhatsApp with a certified specialist in the mental health sector who guided us through the mental health questionnaire and how they are conducted. And we met up with our GP supervisor to get a wider understanding of the project requirements. Then we conducted interviews and surveys to determine the results and findings. For both the interviews and surveys, the users were people who have or might have experienced mental illness, and we chose them randomly.

- For interviews: We interviewed five people to gather their perspectives on mental health challenges, what personal information they want to keep private, and how the mental health care system can be improved.
- For surveys: We conducted a survey on social media, with over 30 people responding. The survey explored the stigma surrounding mental illness, attitudes towards seeking help, and thoughts on the digitalization of the mental health sector.

## 1-Interviews:

**Note:** To protect the privacy of our interviewees, their identities have been kept confidential.

We interviewed a psychologist, individuals from a variety of backgrounds, and people with lived experience of mental health challenges. Our interviews revealed the following key findings:

- People fear social judgment when dealing with mental health issues. This fear can prevent people from seeking support and can lead to feelings of isolation and shame.
- Mental health problems can have a significant impact on a person's life. Mental health problems can affect a person's work, relationships, and overall well-being.
- Participants agreed on the importance of protecting the privacy and security of personal information and identity.
- Some participants expressed interest in using our mental health app. This suggests that there is a need for accessible and supportive mental health resources.

Overall, our interviews highlighted the importance of mental health awareness and support. We need to develop effective and accessible mental health resources.

We are grateful to the individuals who participated in our interviews for sharing their insights and experiences. We hope that our findings will contribute to a better understanding of the challenges faced by people with mental health problems.



### **Key questions:**

Q1) What are some of the challenges that people with mental illness face when trying to get help?

Q2) Has your mental health affected your life performance? If yes, how?

Q3) If there is a mental health application that will benefit you, what is the most important thing you don't want anybody to know about while using it?

Q4) If you ever felt mentally ill, would you use a mental health application?

Q5) In your opinion, what makes an app (regardless of its purpose) easy to use?

Q6) What mental health problems would you like our application to help solve?

### -First Interview:

Interviewee [Clinical Psychiatrist]

Interviewer [ Noura Alamoudi]

Interviewer: What are some of the challenges that people with mental illness face when trying to get help?

-People with mental health issues often grapple with several challenges. The prevailing stigma around mental illness is a significant barrier; many are afraid to speak up or seek help for fear of being judged or misunderstood. This societal prejudice can lead to feelings of shame and isolation. Financial constraints can also be a deterrent, especially in areas where mental health services are not covered by insurance or are pricey. Moreover, the lack of qualified professionals in some areas makes access to care difficult. Finally, recognizing and accepting that one has a mental health problem and needs help can be a personal challenge.

Interviewer: Has your mental health affected your life performance? If yes, how?

- Absolutely, my mental well-being has, at times, influenced my ability to function at my best. Periods of stress or anxiety can make focusing on tasks more challenging, decreasing productivity. Social interactions, too, can become daunting, leading to withdrawal or avoidance behaviors. The ripple effects of this can touch various aspects of life, from academics to relationships.

Interviewer: If there is a mental health application that will benefit you, what is the most important thing you don't want anybody to know about while using it?

- The top concern would be privacy. Mental health is deeply personal, and the discussions or records within such an app are sensitive. I would want assurances that my data—be it chat logs, diagnoses, or personal notes—are not accessible by third parties.

**Interviewer:** If you ever felt mentally ill, would you use a mental health application?

- If I felt that my mental well-being was deteriorating, I would be open to using a reputable mental health app. The convenience and accessibility of an app can be especially useful during times when in-person therapy might not be feasible. I might advise my patients to use the app too.

**Interviewer:** In your opinion, what makes an app (regardless of its purpose) easy to use?

- A user-friendly app should possess an intuitive design that doesn't require a steep learning curve. Clear labeling and swift responsiveness are crucial. Additionally, having an aesthetically pleasing interface, with easy-to-read fonts and harmonious color schemes, can enhance the user experience.

**Interviewer:** What mental health problems would you like our application to help solve?

- I hope it will solve many people's mental health lives by providing the right tools for those who are affected by depression, stress, mental distractions, lack of focus, insomnia, and panic attacks.

### -Second interview:

Interviewee [ A Public Relation student]

Interviewer [ Noura Alamoudi]

Interviewer: What are some of the challenges that people with mental illness face when trying to get help?

- They're afraid of calling for help because they don't want relatives or friends to know about their illness.

Interviewer: Has your mental health affected your life performance? If yes, how?

- Yes, my studying stress is affecting my ability to perform efficiently.

Interviewer: If there is a mental health application that will benefit you, what is the most important thing you don't want anybody to know about while using it?

- Before I use the app, I must have assurances that my identity won't be shown to anybody, otherwise I won't use it.

Interviewer: If you ever felt mentally ill, would you use a mental health application?

- Yes, I will use it because it will save me precious time from going to see a doctor and getting exposed to the public.

Interviewer: In your opinion, what makes an app (regardless of its purpose) easy to use?

- Good colors choice that helps in feeling better, and if they don't need to have prior experience to use them.

Interviewer: What mental health problems would you like our application to help solve?

- Ignorance of health matters, I hope it will educate individuals about mental health and realize that mental health is no less important than physical health.

### -Third interview:

Interviewee [ Company employee who works in finance department]

Interviewer [ Noura Alamoudi]

Interviewer: What are some of the challenges that people with mental illness face when trying to get help?

- Some of the challenges that people with mental illness face when trying to get help include stigma and discrimination in the workplace, lack of mental health support and resources provided by employers, fear of negative consequences or job loss.

Interviewer: Has your mental health affected your life performance? If yes, how?

- Yes, my mental health has affected my life performance by impacting my focus, productivity, and overall well-being.

Interviewer: If there is a mental health application that will benefit you, what is the most important thing you don't want anybody to know about while using it?

- The mental health status and the healing process too.

Interviewer: If you ever felt mentally ill, would you use a mental health application?

- Yes, if it ensures anonymity. It will save time and provides an easy to access solution.

Interviewer: In your opinion, what makes an app (regardless of its purpose) easy to use?

- Being simple and not complicated.

Interviewer: What mental health problems would you like our application to help solve?

- I wish that the application will solve the stress that the patient faces by placing special exercises in the application, following up with the patient periodically and making sure that he knows his mental health status.

### -Forth interview:

Interviewee [ Company employee who works in IT department.]

Interviewer [ Noura Alamoudi]

Interviewer: What are some of the challenges that people with mental illness face when trying to get help?

-How to explain this challenge to get the right help from specialists and surroundings.

Interviewer: Has your mental health affected your life performance? If yes, how?

- Yes, my performance at work has decreased. Stress and depression affect me all day.

Interviewer: If there is a mental health application that will benefit you, what is the most important thing you don't want anybody to know about while using it?

-I want no one to know anything. I will use this application to finish this problem that I faced by myself without anyone's help, because it is my own thing.

Interviewer: If you ever felt mentally ill, would you use a mental health application?

- Yes of course, that will help a lot.

Interviewer: In your opinion, what makes an app (regardless of its purpose) easy to use?

-In my opinion, an app is easy to use when it prioritizes user experience through thoughtful design and functionality. This includes having a clean and intuitive interface that guides users seamlessly through the app's features.

Interviewer: What mental health problems would you like our application to help solve?

- I hope it helps individuals with mental health concerns to do activities that support their mental health and talk freely with no information exposure.

### -Fifth Interview:

Interviewee [Therapist Intern at King Khalid Hospital]

Interviewer [Safia Abalkhail]

Interviewer: What are some of the challenges that people with mental illness face when trying to get help?

- People with mental health issues often encounter several barriers. The stigma associated with mental illness can discourage individuals from seeking help due to fear of judgment or misunderstanding. Financial limitations and the scarcity of mental health professionals also pose significant challenges. Additionally, the internal struggle to acknowledge and accept that one needs help is another major obstacle.

Interviewer: Has your mental health affected your life performance? If yes, how?

- Yes, there have been times when my mental well-being has impacted my performance. Stress and burnout can hinder productivity and focus, affecting both professional and personal life. It's crucial to manage these feelings effectively to maintain a healthy balance.

Interviewer: If there is a mental health application that will benefit you, what is the most important thing you don't want anybody to know about while using it?

- Privacy is paramount. Ensuring that personal data, therapy sessions, and any form of communication within the app are kept confidential is essential. Users should have full confidence that their information is secure and private.

Interviewer: If you ever felt mentally ill, would you use a mental health application?

- Absolutely. A well-designed mental health app can provide convenient access to resources and support, especially when in-person therapy isn't feasible. I would also recommend such an app to my clients as a supplementary tool.

Interviewer: In your opinion, what makes an app (regardless of its purpose) easy to use?

- An intuitive design with clear navigation and responsive functionality is crucial. The app should have an appealing interface that is easy on the eyes, with straightforward instructions and minimal complexity. User experience should be seamless from start to finish.

Interviewer: What mental health problems would you like our application to help solve?

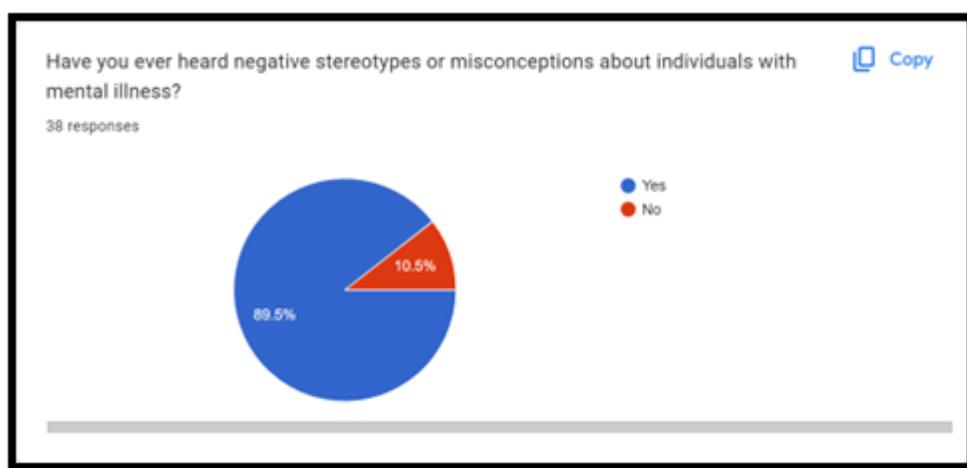
- I would like the app to address a range of issues, including depression, anxiety, stress, and burnout. Providing tools for self-assessment, therapeutic exercises, and continuous support can greatly benefit users. Incorporating educational resources to reduce stigma and promote mental health awareness is also important.



## 2-Surveys:

Question 1:

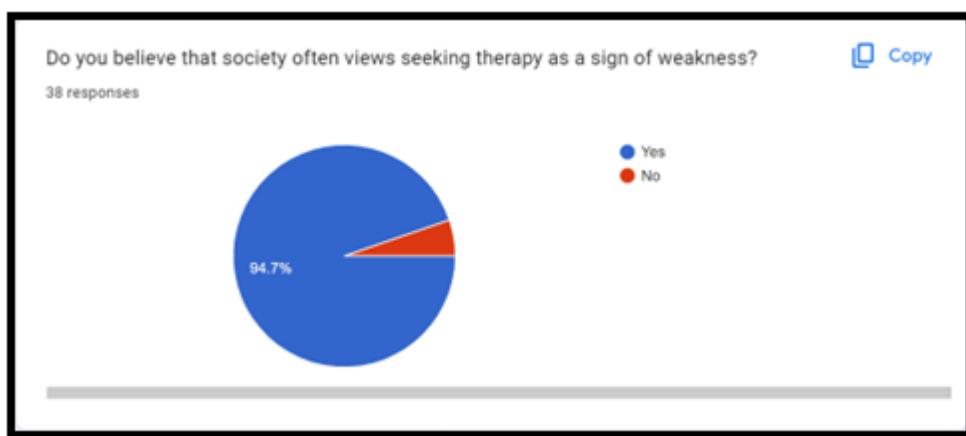
**89.5%** of the answers were “Yes” and **10.5%** were “No”, the results of this question show that a large majority of people have heard negative stereotypes or misconceptions about individuals with mental illness. This is a concerning finding, as these stereotypes can contribute to the stigma surrounding mental illness and prevent people from seeking help.





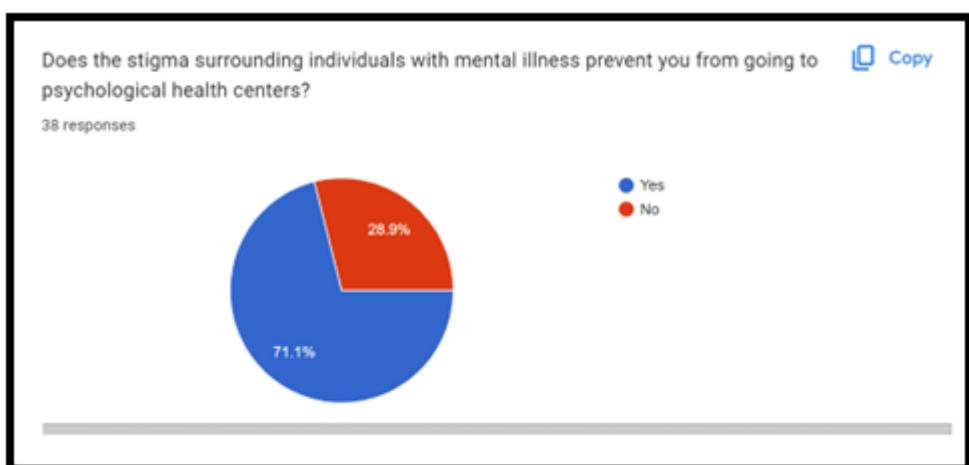
### Question 2:

**94.7%** of the answers were “Yes” and **5.3%** were “No”, the results of this question show that a large majority of people believe that society often views seeking therapy as a sign of weakness.



### Question 3:

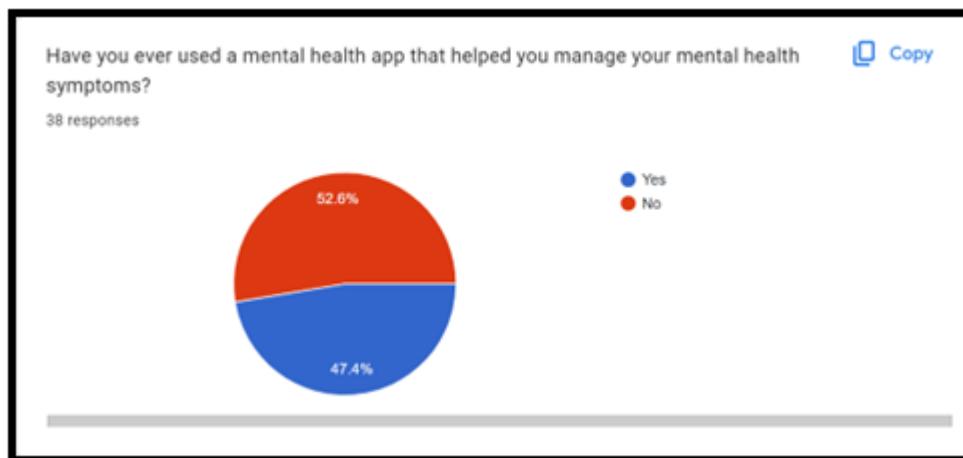
**71.1%** of the answers were “Yes” and **28.9%** were “No”, the results of this question show that a vast majority of people believe that the stigma surrounding mental illness prevents them from going to psychological health centers. This belief is harmful, as it can lead to worse mental health outcomes. Our app can help to address the stigma surrounding mental illness by providing a safe and supportive space for people to talk about their mental health challenges.





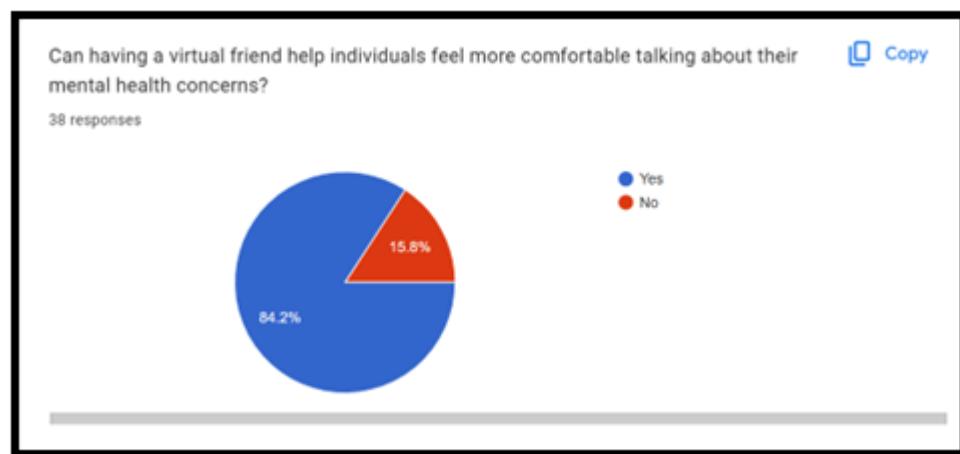
#### Question 4:

**47.4%** of the answers were “Yes” and **52.6%** were “No”, the results of this question show that about half of the people (47.4%) have used a mental health app that helped them manage their mental health symptoms. This is a positive finding, as it suggests that mental health apps can be a helpful tool for some people.



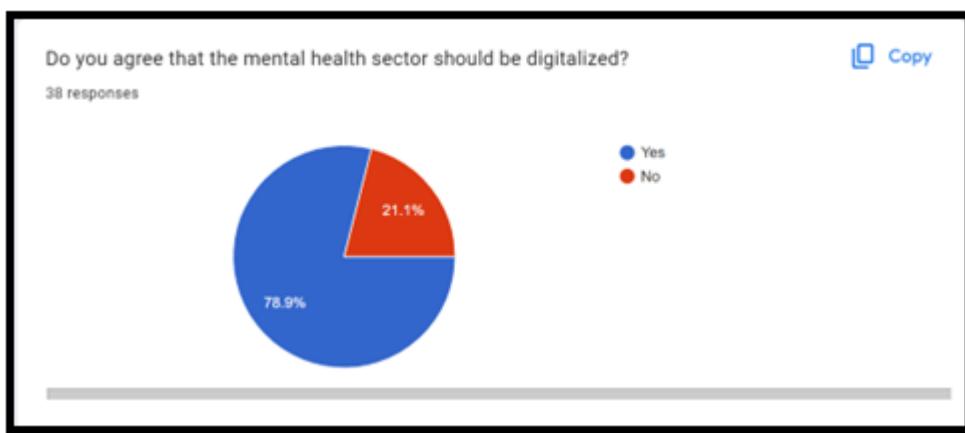
#### Question 5:

**84.2%** of the answers were “Yes” and **15.8%** were “No”, the results of this question show that a large majority of people believe that having a virtual friend can help individuals feel more comfortable talking about their mental health concerns. This is a positive finding, as it suggests that virtual friends can be a helpful tool for some people.



### Question 6:

**78.9%** of the answers were “Yes” and **21.1%** were “No”, the results of this question show that a large majority of people agree that the mental health sector should be digitalized. This means that they believe that technology can be used to improve the delivery of mental health care.





## Appendix B: System Testing Interviews

**Note:** To protect the privacy of our interviewees, their identities have been kept confidential.

### Key questions:

Q1) Can you share your overall experience with the app in terms of ease of use, navigation, and the general layout of the interface?

Q2) How satisfied were you with the overall sign-up, login, and log-out experience?

Q3) How did you find the process of taking the PHQ and GAD assessments, and what are your thoughts on the advice provided based on your results?

Q4) What was your experience interacting with the chatbot, and did you find it helpful in addressing your concerns or providing support?

Q5) Are there any specific features or improvements you would like to see in future updates of the app to enhance your experience?

### -First Interview:

Interviewee [ IT Student]

Interviewer [Alma Alfowzan]

Interviewer: Can you share your overall experience with the app in terms of ease of use, navigation, and the general layout of the interface?

-Overall, I found the app quite intuitive. The navigation was smooth, and the layout made it easy to find what I needed."

Interviewer: How satisfied were you with the overall sign-up, login, and log-out experience?

-I'm highly satisfied with the overall sign-up, login, and log-out experience. The registration process was smooth.

Interviewer: How did you find the process of taking the PHQ and GAD assessments, and what are your thoughts on the advice provided based on your results?

-Taking the assessments was straightforward, and the advice provided after the results was insightful.

Interviewer: What was your experience interacting with the chatbot, and did you find it helpful in addressing your concerns or providing support?

-The chatbot was a nice touch. It was comforting to have someone to talk to, even if it was not a real person.

Interviewer: Are there any specific features or improvements you would like to see in future updates of the app to enhance your experience?

-I would rate my satisfaction at 8. The app is great, but I would love to see more personalized insights based on the assessments.

### -Second interview:

Interviewee [Clinical Psychiatrist]

Interviewer [Alma Alfowzan]

Interviewer: Can you share your overall experience with the app in terms of ease of use, navigation, and the general layout of the interface?

- Once I got used to the navigation, I found the app to be generally user-friendly.

Interviewer: How satisfied were you with the overall sign-up, login, and log-out experience?

- Signing up was quick, logging in was straightforward, and the log-out function was easily accessible.

Interviewer: How did you find the process of taking the PHQ and GAD assessments, and what are your thoughts on the advice provided based on your results?

- The assessments were great, and the line graph is a fantastic visual representation of my progress.

Interviewer: What was your experience interacting with the chatbot, and did you find it helpful in addressing your concerns or providing support?

- The chatbot is a great feature. It offered comforting responses, and I appreciate the emotional support it provides.

Interviewer: Are there any specific features or improvements you would like to see in future updates of the app to enhance your experience?

- Overall, I'm quite pleased with the app, but if I were to suggest improvements, I'd love to see more customization options for the user interface.

### -Third interview:

Interviewee [A mom of 3]

Interviewer [Alma Alfowzan]

Interviewer: Can you share your overall experience with the app in terms of ease of use, navigation, and the general layout of the interface?

-The app's interface is visually appealing, and navigation is straightforward. It's designed with the user in mind.

Interviewer: How satisfied were you with the overall sign-up, login, and log-out experience?

-I am extremely satisfied with the overall sign-up, login, and log-out experience.

Interviewer: How did you find the process of taking the PHQ and GAD assessments, and what are your thoughts on the advice provided based on your results?

-The assessments were comprehensive, and the advice provided was supportive and the line graph adds a nice touch, helping me track my progress easily.

Interviewer: What was your experience interacting with the chatbot, and did you find it helpful in addressing your concerns or providing support?

-The chatbot is a fantastic addition to the app. It not only responded promptly but also demonstrated a level of understanding that was impressive. It's a reassuring presence, and I found it instrumental in providing the support I needed.

Interviewer: Are there any specific features or improvements you would like to see in future updates of the app to enhance your experience?

-The app is fantastic, and I appreciate its current features. One enhancement I'd love to see is the integration of guided meditation or relaxation exercises. Including such features would contribute to a more holistic mental health support experience.

#### -Forth interview:

Interviewee [Mentally concerned employee]

Interviewer [Alma Alfowzan]

Interviewer: Can you share your overall experience with the app in terms of ease of use, navigation, and the general layout of the interface?

- My overall experience with the app has been exceptional. The ease of use and intuitive navigation make it stand out. The general layout of the interface is well-designed, providing a seamless and enjoyable user experience.

Interviewer: How satisfied were you with the overall sign-up, login, and log-out experience?

- I'm extremely satisfied with the sign-up, login, and log-out experiences. The processes are straightforward.

Interviewer: How did you find the process of taking the PHQ and GAD assessments, and what are your thoughts on the advice provided based on your results?

- Taking the PHQ and GAD assessments was straightforward and insightful. The questions were clear, and the advice provided based on the results was personalized and valuable. It adds a thoughtful dimension to the app.

Interviewer: What was your experience interacting with the chatbot, and did you find it helpful in addressing your concerns or providing support?

- Interacting with the chatbot was a positive experience. It responded promptly and provided empathetic support. Having a chatbot for concerns added a comforting layer, and I found it to be genuinely helpful.

Interviewer: Are there any specific features or improvements you would like to see in future updates of the app to enhance your experience?

- While the app is already excellent, I'd love to see additional features related to community engagement. Perhaps a forum or discussion board where users can share experiences and tips for managing mental health.

#### -Fifth interview:

Interviewee [Barista]

Interviewer [Alma Alfowzan]

Interviewer: Can you share your overall experience with the app in terms of ease of use, navigation, and the general layout of the interface?

-The app's usability is outstanding. Navigating through different sections is smooth, and the interface layout is user-friendly. It's evident that the developers prioritized a positive user experience, making it easy to find what I need.

Interviewer: How satisfied were you with the overall sign-up, login, and log-out experience?

-My satisfaction with the sign-up, login, and log-out experiences is very high. The app has streamlined these processes, making them quick and convenient. The log-out experience instills confidence in the app's security measures.

Interviewer: How did you find the process of taking the PHQ and GAD assessments, and what are your thoughts on the advice provided based on your results?

-The assessment process was user-friendly, and the advice provided post-assessment was genuinely helpful. It's clear that the app aims to provide meaningful insights, and I appreciate the personalized approach to mental health support.

Interviewer: What was your experience interacting with the chatbot, and did you find it helpful in addressing your concerns or providing support?

-The chatbot interaction was a highlight for me. It addressed my concerns effectively and offered support in a way that felt genuine. It's a valuable feature for users seeking immediate assistance and understanding.

Interviewer: Are there any specific features or improvements you would like to see in future updates of the app to enhance your experience?

-I have a highly positive experience with the app, but I think incorporating a feature that allows users to set personalized mental health goals and track their progress over time could add another layer of motivation.