

Development of Android-based Application for Mental Health Services in Butuan City, Philippines

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Abstract. This study aimed to develop and evaluate an Android-based mobile application relative to mental health services in Butuan City to address challenges faced by both clients seeking mental health services, and mental health service providers who are also trying to reach clients and patients in need of their services. This mobile application functions as an intermediary platform, allowing clients to conveniently search for mental health service providers, schedule appointments, and locate their physical office addresses. For mental health service providers, the application offers appointment management modules and service management, streamlining their workflow and potentially reducing administrative burdens such as scheduling and other workloads. To evaluate the effectiveness of the mobile application in addressing the identified challenges, a survey was conducted among 100 respondents within Butuan City, including potential clients and mental health service providers. The survey results yielded an *Excellent* rating which indicates a strong level of agreement among the respondents regarding the application's usability suggesting that users perceive that the mobile application is a user-friendly and intuitive platform. Qualitative feedback obtained during the usability study highlighted the application's value in addressing current challenges faced by both clients and mental health service providers. Future researchers may also consider to include other stakeholders, such as the local government units, in the promotion and further development of the mobile application for it to contribute and support regulatory decisions related to mental health or the integration of mental health apps into the healthcare systems of the country in general.

1 Introduction

Mental health problems have become an increasingly urgent concern worldwide, affecting individuals from all sociocultural backgrounds [1]. The Philippines, like many other countries, is facing the challenge of increasing prevalence of mental health problems and the difficulties in providing adequate mental health services [2]. The Department of Health in the Philippines has recognized mental health conditions as a disease, attributing this rise to

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factors such as globalization and rapid urbanization [3]. The rise in mental health concerns necessitates innovative solutions. Fortunately, remarkable progress in technological advancements is driving a significant shift in the development of accessible mental health services. One key innovation is the rise of teletherapy platforms, which offer remote delivery of mental health services through video conferencing and phone calls [4].

According to the World Health Organization, one in four people will experience mental or neurological disorders at some point in their lives [5]. This statistic reflects the fact that approximately 1 billion people worldwide suffer from some sort of mental health issue. In addition, approximately 15% of the adult population in the Philippines has reported the lifetime presence of any mental disorder, and nearly 11% has experienced a mental disorder within the past year, according to the Philippine National Survey on Mental Health and Well-being [4]. While the Department of Health Center for Health Development - Caraga reports only 5 mental health cases in Agusan del Norte for the year 2021, this data might not capture the true prevalence due to the well-documented issue of underreporting in mental health globally. Stigma surrounding mental health, limited access to services, and lack of awareness are key contributors to the underrepresentation of reported cases [6]. Studies have highlighted that barriers to utilizing mental health services include shame, sociocultural influences, resource scarcity, and difficulties in accessing services [6]. Additionally, the relationship between mental health literacy and stigma related to mental disorders has been explored in different community settings [7]. While there is a wealth of research on mental health barriers and stigma globally, studies specifically focusing on these issues in Butuan City, or the Philippines, were limited. Understanding the unique sociocultural context and challenges faced in these regions was crucial for developing effective interventions to address mental health underreporting. Future research in Butuan City or the Philippines could delve into the specific barriers to mental health service utilization, the impact of stigma on seeking help, and strategies to improve mental health literacy and awareness within these communities.

Traditionally, mental health services primarily relied on in-person therapy sessions conducted at healthcare facilities or private practices [8]. These sessions centered around face-to-face interactions between mental health professionals and clients seeking support. Recent years have witnessed a surge in innovative methods for engaging with mental health services [9]. These advancements were driven by technology and include teletherapy platforms, virtual support groups, and online communities [10]. Despite the established value of in-person therapy, traditional mental health services face significant limitations [11]; [12]. One significant limitation is geographical barriers. Individuals residing in remote areas often lacked access to qualified mental health professionals due to distance and limited availability of services in their local communities [13].

Furthermore, the lack of a centralized platform for mental health services in the Philippines, including regions like Butuan City, Agusan del Norte, created significant challenges in accessing timely and appropriate care. While research specifically focused on centralized platforms in the Philippines might be limited, studies examining teletherapy and online mental health interventions highlighted the potential benefits of such platforms in bridging accessibility gaps. Efforts to improve mental health services accessibility were crucial. Innovative strategies, such as the development of centralized platforms that integrate teletherapy and other online services, were crucial to bridge the gap in mental health service provision [14]. Policymakers and healthcare providers were advised to explore the potential of centralized platforms to connect individuals with mental health services, thereby enhancing mental health outcomes in communities [15]; [16].

This study aimed to develop a platform that would act as an intermediary between individuals seeking mental health support and the institutions providing mental health services. The proposed platform had the potential to streamline the mental health services and delivery process for clients seeking mental health support. It could also benefit

organizations or agencies that provide mental health services by expanding their customer base and reaching a wider audience.

2 Method

Fig. 1 illustrates the overall concept of the system. In the proposed application, the mental health service providers will input specific details and service information, which will be saved in cloud storage and could be viewed in the clients via the mobile application. In the client's interface, they can browse the available services offered by the health service provider, view the service availability, description, price, discount, and office/clinic location.

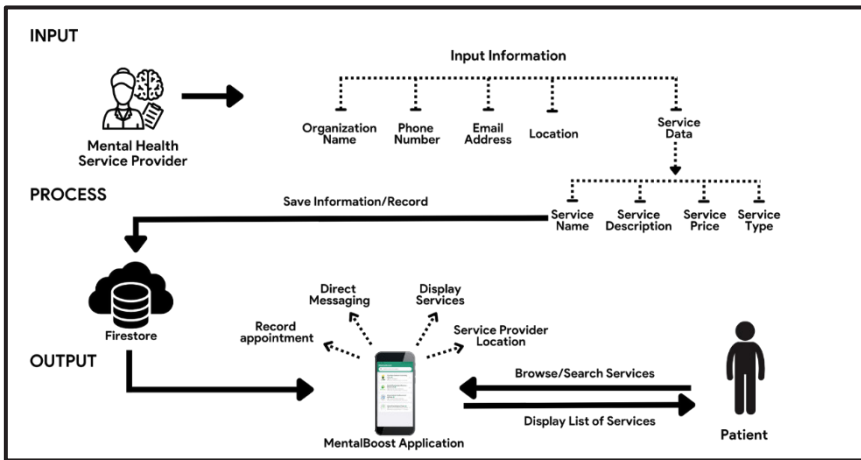


Fig. 1. Conceptual Framework.

While various development life cycle (SDLC) models existed, the proponents employed an Agile approach, shown in Fig. 2. Agile methodologies prioritize iterative development and continuous improvement, making them well-suited for projects with evolving requirements like those often encountered in mental health applications. Planning, analysis, design, implementation, and testing were crucial processes that the proponents completed.

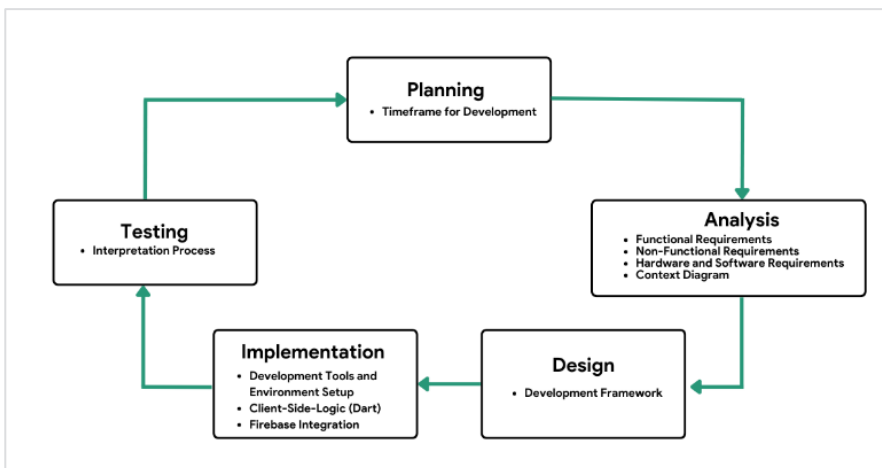


Fig. 2. The Agile Method: The Development Model.

The flowchart for creating the appointment module within the application is shown in Fig.3. The process starts with the user determining if they already have an account. If not, they must register to create an account. Once a user has an account, they can log in and proceed to search and browse for service providers based on their needs. After selecting a service provider, the user can choose a service and then select a date and time for the appointment. Once the appointment details are confirmed, the system automatically sends a notification to the provider. The user can then receive updates about the appointment status through the application.

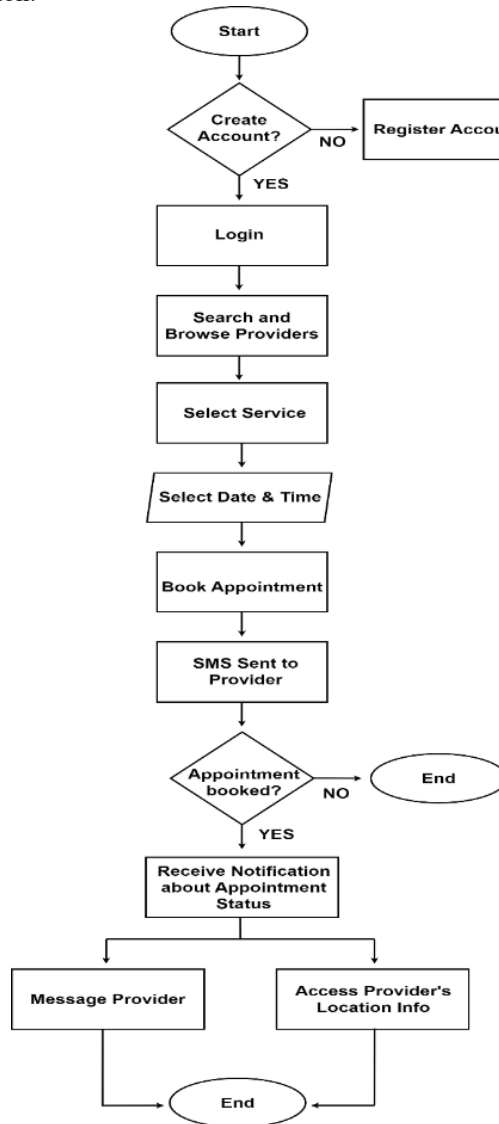


Fig. 3. Client Functionality Flowchart.

Fig. 4 illustrates how mental health service providers interact with the application. This includes account creation, setting profile information, payment details, and location information within the account. Additionally, it depicts service and appointment management functionalities.

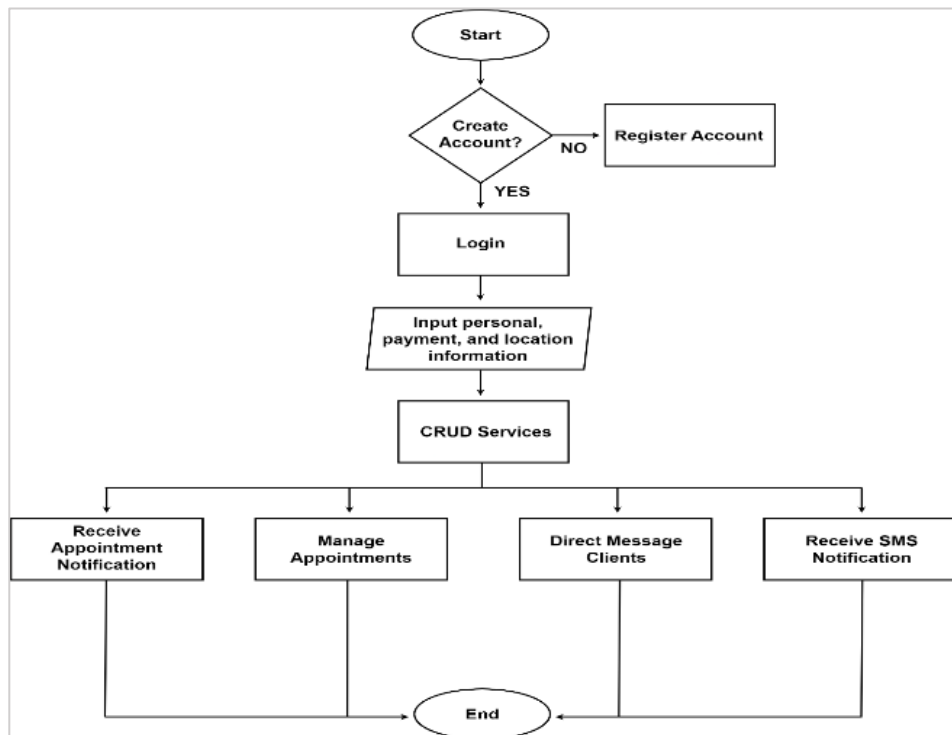


Fig. 4. Mental Health Service Provider Functionality Flowchart.

The context diagram shown in Fig. 5 indicates the mobile application’s functionalities for clients and providers. Clients can browse/search services, schedule appointments, and message providers. Providers can manage their location, information, services, and appointments.

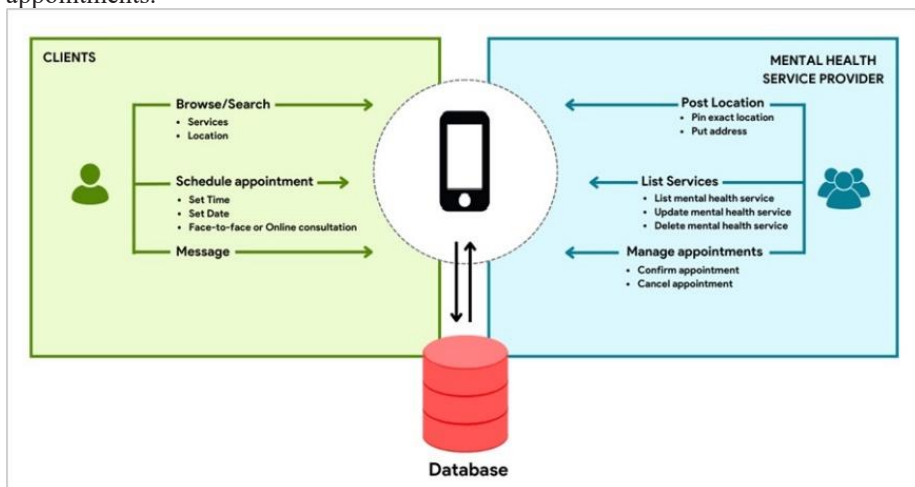


Fig. 5. Mobile Application’s Context Diagram.

Fig. 6 illustrates the relationship between the actor and the functions running on the system. The individual seeking mental health support is responsible for browsing, searching, and booking appointments. On the other hand, the mental health service provider is also

responsible for providing the exact location, posting the services they offer, and managing appointments. By serving as a centralized platform, it streamlines the process of connecting users with mental health service providers, making it easier for individuals to access the services they need. The platform will also incorporate a database system to store and retrieve information related to mental health service providers and user-client interactions. This database will act as a central repository where all the relevant data provided by mental health service providers, such as their exact location, post-service information, and appointment schedules, will be securely stored.

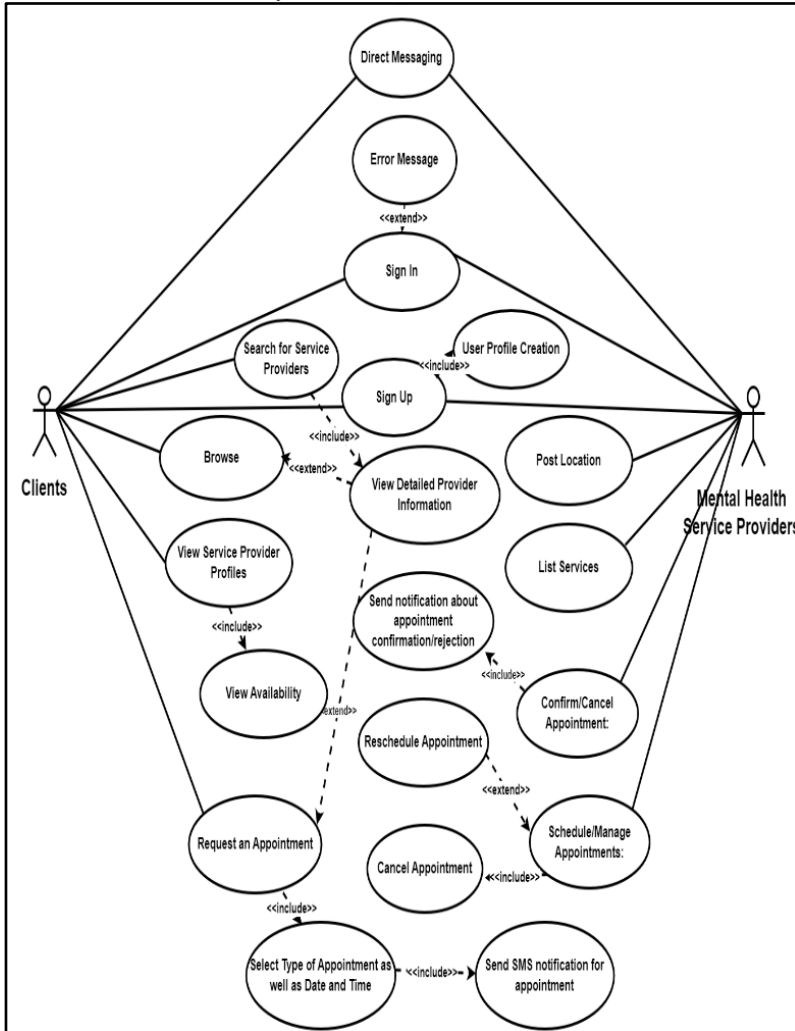


Fig. 6. Mobile Application's Context Diagram.

The proponents developed an android-based mobile application in recognition of the prevalence of Android devices among users today. Fig. 7 presents the technical architecture of the application. As shown, the application logic is written in Dart Programming Language and utilized within the Flutter framework to construct the user interface (UI) and functionalities. Flutter offers pre-built UI components for a streamlined development process [17]. The resulting App leverages Firebase services on the backend to handle functionalities like user authentication, and storage. Firebase essentially acts as the cloud infrastructure for

the application, providing scalability and capabilities beyond the limitations of a mobile device [18].

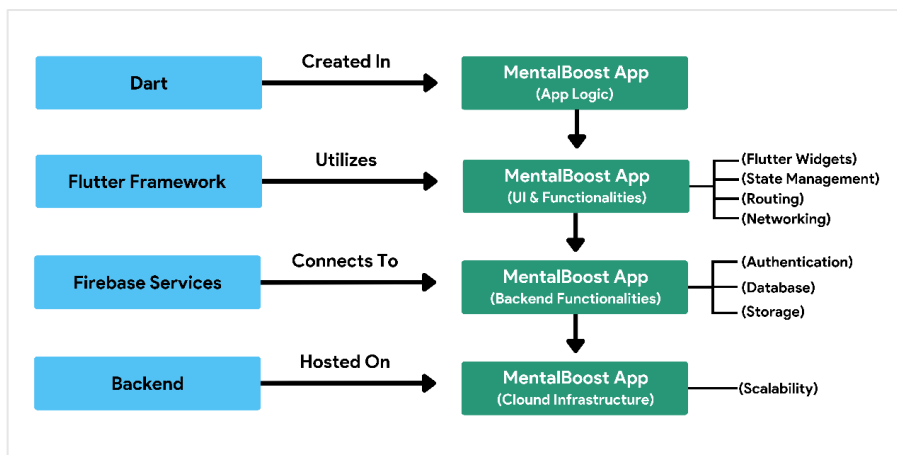


Fig. 7. Mobile Application’s Connectivity Flowchart.

For the development of the application, the proponents utilized the Android Studio Integrated Development Environment (IDE) as the primary development platform. This choice aligns with the target platform, as Android Studio offers comprehensive tools and features specifically designed for building Android applications. Additionally, the development process leveraged the functionalities of the Flutter plugin within Android Studio, further streamlining the development of the application's front-end with Flutter [17]. The specific versions used in the project were Flutter Framework 3.16.9 and Dart 3.2.6. Dart code implemented the app's functionalities within the mobile application. This included processing user interactions (e.g., search queries, appointment bookings) and interfacing with Firebase services. Dart code implemented the app's functionalities within the mobile application. This included processing user interactions (e.g., search queries, appointment bookings) and interfacing with Firebase services.

To ensure the application met the needs and expectations of its target audience [19] in Butuan City, a thorough User Acceptance Testing (UAT) session was conducted. This UAT session involved 100 local participants, encompassing both potential clients seeking mental health services and mental health service providers who would be listed on the platform. This mix will ensure the application caters to both user groups. Participants were invited to interact with the prototype of the application and encouraged them to complete the tasks simulating real-world usage scenarios (e.g., searching for services, booking appointments). Throughout the testing session, the proponents observed the user interactions and gather feedback through answering a survey questionnaire. This feedback focused on the application's usability, intuitiveness, and overall user experience. For the testing, the result should reach the standard average SUS score which is 70 to yield a Good adjectival rating, based on Table 1 on the general guideline on SUS Score Interpretation adapted from [20].

Table 1. General Guideline on SUS Score Interpretation.

SUS Score	Grade	Adjectival Rating
> 80.3	A	Excellent
68 – 80.3	B	Good
68	C	Okay
51-68	D	Poor
< 51	F	Awful

3 Discussion and Analysis

The section delves into the discussion of the results of the development of the mobile application, particularly the findings from the System Usability Scale (SUS) assessment. This section also discusses the significance of these findings in relation to the overall goals of the application and their implications for future development.

3.1 Android-based Mobile Application

This section details the design decisions and functionalities implemented in the application. Drawing on insights from extensive online research, the development team identified key client and provider needs and their pain points related to mental health services. These findings were strategically utilized to inform the development process, resulting in the following key functionalities:

Login Screen: The landing screen features prominent buttons for user actions, including Sign In, Forgot Password, and Sign up.

Privacy & Security Notice: The Privacy and Security Notice screen, displayed upon user selection of the “Sign Up” button. This screen would inform new users on the following aspects related to application: Data collection practices, data usage, and security measures.

Role Selection: The application’s role selection screen, displayed upon user selection of the “Sign Up” button. This screen would allow new users to specify their intended role within the platform. It presents two options: clients and mental health service providers. Additionally, the screen offers a “Sign In” button for users who already possess existing accounts.

Client Sign Up Screen: The application’s sign-up screen facilitates user account creation for clients seeking mental health services. This screen prompts clients to enter the following information: first name, last name, phone number, email address, password, password confirmation, and a prominent “Create account” button that allows clients to submit their information and complete the registration process.

Mental Health Service Provider Sign Up Screen: The application’s sign-up screen facilitates user account creation for mental health service providers. This screen prompts mental health service provider to enter the following information: display name, first name, last name, phone number, email address, password, password confirmation, and a prominent “Create account” button that allows mental health service provider to submit their information and complete the registration process

3.2 Functional Requirements

The following are the functional requirements identified for the application:

Search and Browse: The application's clients home screen serves as the primary landing page for users seeking mental health services. This screen displays a list of available mental health service providers in a specific region. The list includes details such as provider display image, provider display name, and provider's location. The client's home screen also includes functionality for the clients to search for a service provider or location.

Profile Management: The application's mental health service provider profile screen is designed to showcase information about individual service providers. This screen likely presents details about a specific provider, including profile information, service listings, and functionalities through buttons for users to find provider locations and direct message the mental health service provider.

Mental Health Services Provider Appointment: The application's client appointments screen, allowing users to view and manage their scheduled appointments with mental health service providers. This screen likely presents a record of the user's appointments, including details such as appointment date and time, provider name, and appointment status such as pending, confirmed, done, and cancelled.

Direct Messaging: The application's direct messaging, facilitating communication between clients and their mental health service providers.

Client's Appointment Management: The client's appointment management allows the client to check and monitor the status of their appointment.

Provider's location: The application's Mental Health Service Provider's location screen, assisting clients in finding the physical office of a chosen provider. This screen likely integrates with a mapping service to display an interactive map and route guidance. Additionally, this screen provides supplemental information such as the provider's complete address and contact details.

Service Management: The application manages services screen designed for mental health service providers. This screen empowers providers to control the list of services they offer through the platform. It likely displays a list of the provider's current services, with functionalities such as service list, update details, delete service (per service), and add service buttons that allow providers to easily expand their service list by adding new services

3.3 Android-based Mobile Application

This section delves into the security, performance, and usability measures implemented in the application. These measures were designed to address the non-functional requirements with a specific focus on protecting user data, particularly client information and communication with mental health providers.

3.3.1 Security

The application leverages Firebase, a Backend-as-a-Service (BaaS) platform, to establish a secure foundation. Here's how Firebase contributes to the overall security of the application:

Secure User Authentication: Firebase Authentication ensures that only authorized users can access the platform.

Client Data Protection: Client data, including personal information is stored securely using Firebase Firestore [18], a cloud-based NoSQL database. Firebase offers built-in security features to control access and potentially utilizes encryption for added protection of sensitive data at rest and in transit.

Restricted Provider Access: The application enforces access control mechanisms. Only mental health service providers explicitly selected by a client can view their information. This restricts unauthorized access to client data and protects privacy.

3.3.2 Performance

The application aimed to deliver responsive and smooth performance across various Android devices and network conditions. This was achieved by:

Utilizing Dart and Flutter: The application was built using Dart, a programming language known for its performance and ability to compile into native code. Additionally, the Flutter framework facilitated efficient UI rendering [17]. These choices potentially resulted in smooth application performance compared to interpreted languages.

Optimizations for Network Conditions: Techniques like lazy loading (loading data only when needed) and caching frequently accessed data were employed to minimize network traffic and improve performance on slower connections. Image compression and resizing for different screen sizes further optimized data usage and performance, especially on devices with limited bandwidth.

3.3.3 Usability

The application prioritized a user-friendly design that catered to users with diverse technical backgrounds:

Simple and Clean Interface: The UI utilizes a clean and uncluttered design, minimizing visual complexity. This promotes ease of use and reduces the cognitive load for users with limited technical experience.

Clear Navigation: A clear and intuitive navigation system allows users to find desired functionalities effortlessly. This could involve implementing a consistent navigation bar or menu system with easily identifiable icons and labels.

Addressing Different User Needs: The client-facing interface focused on functionalities like searching for providers, scheduling appointments, and communicating with chosen providers. The provider interface catered to managing appointment schedules, client profiles, and secure communication with clients.

3.4 System Implementation

The successful testing of the application hinged on a well-defined set of functionalities [21]. This served as the foundation for a comprehensive testing process. Each functionality was thoroughly evaluated to ensure it met the design specifications and addressed the identified user needs. These capabilities covered a variety of important tasks, including:

User Authentication: This process verified a user's identity before granting them access to the system, typically involving a username or email address and a password. Additionally, a robust user authentication system included a "forgot password" functionality to assist users in recovering lost credentials and regaining access to their accounts.

Browsing/Searching Service Provider: This functionality focused on the client's discovery of mental health service providers through a comprehensive search and filtering system. It empowered clients to locate providers who best aligned with their specific needs and preferences [22].

Schedule Appointment: This functionality enabled clients to conveniently book appointments directly within the application.

Locating Mental Health Service Provider: This functionality provided clients with an effective tool to locate the exact location of the Mental Health Service Provider.

Service Management: This functionality provided full capabilities for managing the service information, allowing the mental health service provider to add, update, and delete service data as needed.

Appointment Management: This functionality provided full capabilities for managing the appointments, allowing the mental health service provider to organize the appointments based on the status of the appointments.

Direct Messaging: This functionality facilitated secure and confidential communication between clients and mental health service providers through a dedicated in-app messaging feature.

Set Location: This functionality empowered mental health service providers to manage their location information within the platform with clients.

3.5 Results

During the User Acceptance Testing (UAT) session, a development phase wherein if testing results meet the acceptance criteria, the software system can be released for operational use [23], the participants interacted with a prototype or early build of the application. They were encouraged to complete tasks simulating real-world usage scenarios, such as searching for services and booking appointments. Proponents closely observed user interaction and gathered feedback through surveys or questionnaires. To ensure the application met the needs and expectations of its target audience in Butuan City, a thorough User Acceptance Testing (UAT) session was conducted with at least 100 potential users in Butuan City. Including two mental health service providers the CSU Guidance and Counseling Office and Gestalt Psychological Center Butuan City. Participants evaluated the system's ease of use and learnability through the System Usability Scale (SUS) questionnaire. This established tool employs a 10-statement, 5-point Likert scale ranging from "strongly disagree" to "strongly agree," allowing participants to gauge their level of agreement with various usability aspects of the application.

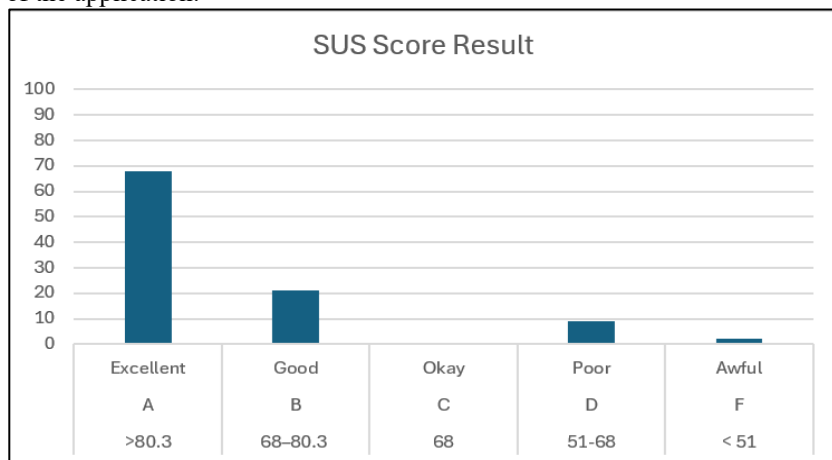


Fig. 8. Application Technology Stack: A connectivity Flowchart.

Fig. 8 presents the system's majority "A" and "B" grades based on the guidelines for interpreting SUS scores. The SUS survey includes 10 statements, divided into odd-numbered and even-numbered questions for computational purposes. "X" represents the sum of all odd-numbered questions (SUS1, SUS3, SUS5, SUS7, and SUS9), while "Y" represents the sum of even-numbered questions (SUS2, SUS4, SUS6, SUS8, and SUS10). Upon acquiring the

sums of X and Y, the calculation proceeds to derive "X0" and "Y0." Specifically, X0 is obtained by subtracting 5 from the sum of all points in odd-numbered questions, while Y0 is derived by subtracting 25 from the sum of points in all even-numbered questions. Following this, SUS scores are computed by adding "X0" and "Y0" multiplied by 2.5. The weighted mean average is computed by summing all SUS scores, resulting in a total of 8,462.50, and dividing by the number of respondents, which is 100. The overall weighted mean SUS score of 84.625 suggests that both potential clients and mental health service providers are more likely to use the system for accessing mental health services and enhancing efficiency in their work. This high score highlights the system's usability and successful implementation.

4 Conclusion

An evaluation of the mobile application's usability was conducted using the System Usability Scale (SUS) survey. The survey results yielded an overall weighted mean of 84.625, translating to an adjective rating of "Excellent." This high score indicates a strong level of agreement among the 100 respondents (including potential clients and mental health service providers in Butuan City) regarding the application's usability. These findings suggest that users perceive the mobile application as a user-friendly and intuitive platform. This is further supported by the qualitative feedback obtained during the usability study. Respondents highlighted the application's value in addressing current challenges faced by both clients and mental health service providers. The streamlined processes for appointment scheduling, provider search, service search, and physical office location were identified as key features that can potentially reduce time, effort, and workload for all both clients and mental health service providers.

The proponents concluded that the positive results from this study highlight the potential of integrating technologies into mental health services. However, they also acknowledge the need for further research to explore the long-term impact and broader applications of such integrations within the mental health field.

Additionally, the proponents emphasized the critical importance of considering data privacy and security throughout the development and implementation of mental health applications. Safeguarding client information must be a top priority to ensure user trust and ethical practices in this sensitive domain.

In conclusion, the mobile application demonstrates the promise of technology in improving access to mental health services. As the field evolves, it is crucial to prioritize further research and development efforts while upholding the highest standards of data privacy and security for all users. It is also important to consider the inclusion of all significant groups in the community as they may contribute to the overall design and impact in the implementation of the application [4]. Moreover, the government may also consider crafting and implementing healthcare regulations and ethical guidelines relative to the implementation of the mobile application and integration of the same to the national healthcare system. This is to ensure that medical services are accessible to everyone in the community [24]. Data privacy and security is another consideration, ensuring protection of both patients and healthcare providers [25].

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