Design and Development of Mobile Application for Online Psychotherapy

Alshaimaa Adel Tantawy
eatantawi@fci.zu.edu.eg

Information Systems Department – College of Computers and Informatics – Zagazig University, Zagazig, Egypt.

Abstract

Recently various health care applications and systems have been developed as technological remote solutions in the medical field, as an effective and secure mechanism for continuous communication between patients and doctors through the COVID-19 epidemic and the digital transformation era. The psychotherapy critically requires incessant interaction and collaboration between the psychotherapist and their patients. Therefore, this research designs and develops an easy to use mobile application for both the psychiatrist and the patients in order to implement the various psychotherapy methodologies anytime anywhere. The mobile application for online psychotherapy presented in this research promotes continuously the effective collaboration and interaction between Psychiatrist, and patients. It permits Psychiatrist remotely cure and assist patients, as it permits together Psychiatrists and their patients easily interconnect via chats, blogs or posts. Through registration to this psychotherapy mobile application, patients can store their health information, search for appropriate doctor, chat with doctors, get prescriptions and consult psychology professionals. Doctors can provide their detailed information, write blogs, provide prescriptions, make effective chat with their patients and follow up the patient medical history. For assessment and evaluation the psychotherapy mobile application; a questionnaire was conducted as a subjective evaluation technique for the usability assessment of the online psychotherapy mobile application, and it results in positive reaction from the participants.

Keywords: COVID-19, eHealth informatics; Online Psychotherapy; Mobile Application, Psychology Services, Digital Transformation.

1. Introduction

Due to the emerging Corona Virus COVID-19 outbreak and its strong effects on human practice of all daily activities and practices from a practical, psychological; health and social perspective, remote communication technology, web and mobile-based systems and applications are effectively used so as to transfer and communicate therapeutic/health care data, and related information in order to provide remote medical and health facilities [Socarrás et al., 2020]. Commonly tele-medicine and eHealth concepts denote as the adaption and usage of information and technology integrated into software applications with high-speed telecommunication infrastructure [Bokolo 2021]. Several telemedicine applications implemented for various types of diseases. As mentioned by Landi et al. (2022), The COVID-19 pandemic has accelerated the healthcare system's digital transformation, which had already begun in the pre-pandemic era.

According to the systematic review within Chakraborty et al. 2023, telehealth companies are progressing in order to satisfy the prerequisites of digital healthcare and are taking an important part in digital health record systems, telemonitoring, and teleconsultations. Therefore, the attention today has moved to using smartphones to allow AI-driven personalized care, involving the wearable device revolution and electronic therapeutics. Modern internet-based resolutions are currently widely accessible and potential freedom from desktop-based systems and operating systems whereas including quicker and extra-protected procedures. As healthcare standards have advanced over time, the emphasis on interoperable systems has helped set new benchmarks for medical support and computerized hospital management [Chaves et al., 2021].

There is no doubt that psychological disease has a special nature and high sensitivity degree among those people who suffer from psychological disorders, in terms of extreme fear and shame about discovering this disease or announcing to others especially in developing countries. According to the therapeutic contact and communication between psychotherapists and patients, psychotherapy is a procedure that dynamically reduces or alleviates indications. It also helps patients develop their personalities, integrate into society, and advance recovery [Yao et al. 2022]. However, the threat of lockdown and infection was a key obstacle for face-to-face psychotherapy in the COVID-19 epidemic. This has directed to novelties and enlarged usage of web and mobile-based psychological care supply facilities [Al-Alwai et al., 2021].

There has been a solid growth of web and mobile-based applications that support persons who have psychological diseases to self-control their psychological requirements, to sense self-directed, and take their care accountability [Ahmed et al. 2021]. In addition, there is evidence that therapeutic online treatment outcomes compare positively with old-style face-to-face sceneries. For instance, a current investigation conducted by Fernandez et al. (2021) built on 47 between-group and 56 within-group trainings discovered insignificant dissimilarities in the therapeutic outcome between in-patient and video-provided psychotherapy across various therapeutic orientations and numerous illness categories. In addition, a study done by Landi et al. (2022) suggested that to expand telemedicine use; improve usability, and boost patient adherence, telemedicine platforms should be better customized to patients' requests.

Therefore, the leading influence in this research is actually to design and develop a simple easy to use interactive mobile application for both the psychiatrist and the patients to effectively implement and support the various psychotherapy methodologies anytime and anywhere.

The leading influences of the psychotherapy mobile application formulated in the following:

- Diagnosis of psychiatric, neurological and psychological diseases at a distance,
- Prescribing the most appropriate medication and psychotherapy according to the requirements of the case remotely,
- On-line follow-up psychotherapy treatment activities with psychiatric patients,
- Providing and facilitating mechanisms of continuous communication with mental patients remotely, and
- Publishing various scientific articles and posts in order to raise awareness about psychological and neurological diseases to reduce and deal with them better.

This research paper is organized as the following; In Section 2, the related Literature Survey is demonstrated. Section 3 describes in detail the design and development methods and methodology. The evaluation and usability assessment of the psychotherapy mobile application is conducted in section 4. To end with, conclusions with future work are drawn to overcome the psychotherapy application limitation in Section 5.

2. Literature Survey

In spite of the extraordinary flow of scientific papers and publications generated by the current COVID-19 pandemic, just little studies have considered the COVID-19 influence on psychological health care [Amerio et. al., 2023]. The incorporation of systems and application within the information technology in medical and healthcare practices actually is not novel conception; though the increasing clarifications presented via the arena of information technology systems and applications are assertive a renovation of older implantations of various medical systems and applications [Chaves et al. 2021]. Hence, the following literature survey provides some of the telemedicine and eHealth solutions that recently developed in order to deal with the essential requirements of the digital transformation in the technology era in the psychotherapy and other various medical fields.

Despite decreasing the actions and opening hours, Public Psychological centers encouraged permanency of care for threatened groups, assisting them in coping with aloneness and desperateness in isolation and self-separation. In reality, COVID-19 restricted hospital care. The society and action of the community-based system of psychological care in Italy could requisite to be employed via; "territorial epidemiology" promotion which creates psychological requirements observable as the medical staffs engaged; a rise in psychological resources in line with the other European high-income countries; and the organized initiative construction. **Amerio et al. (2023)** assessed what have apprised from COVID-19. [Amerio et. al., 2023]

In addition**, Jakobsen and Babic (2022)** to investigate the use of heart sound data for patient self-monitoring created an internet and mobile-based model. It provides 3 simple functions that can be used by both patients and doctors to improve communication during treatment and create an understanding of heart signals, such as recording heart sounds, reviewing preceding heart signal records, and summarizing footings corresponding to the patient complaint and medications booked. Expert reviewers gave the application positive feedback. Furthermore, Savoldelli et al. 2022 presented a method to enhance patient experience of a telemedicine facility through the utilization of online visits and online monitoring with wearable sensors for heart failure patients. The encouraging outcomes with patients who had heart failure motivated researchers to create additional research trials utilizing the planned methodology with other chronic patient groups.

The results from **Eichenberg et al. (2022)** research provision the viability of interchanging from face-to-face treatment to a web-based setting and back through an explicit prerequisite for research in measuring potential properties of modifications in a therapeutic setting from face-to-face to online and vice versa; related to the therapeutic alliance effectiveness, such as described by therapists and their patients using the Helping Alliance Questionnaire. By comparing 3 points in time; after moving from face-to-face to web-based treatment, their alliance before the shift in setting, and their synchronized version of their involvement within web-based treatment—the study was able to, then another assessment after switching back to face-to-face setting afterward lockdown constraints were raised, the

study didn't find a variance as a result of a change in setting, despite discovering a general, enhancement in the therapeutic alliance over time. Changes in the therapeutic setting did not have a different impact on therapists and clients. Additionally, though no variances between therapists and clients towards their judgments associated with the therapy accomplishment, psychotherapists targeted to evaluate their approval within the therapeutic interaction lesser than their clients did.

Psychotherapy occasionally has unavoidable side effects. Despite the fact that therapists have a significant impact on the psychotherapy side effects, there has not been more quantifiable study on how they contribute to them. 530 therapists contributed within the cross-sectional study, which was conducted using the Psychotherapy Side Effects Questionnaire-Therapist Version (PSEQ-T) created by **Yao et al. in 2022** and released online via a formal WeChat account. Therapist groups with and without opinions on the side effects on clients were separated. The facilities were picked to differentiate the therapists by group. Six main algorithms form machine learning were educated on the research dataset in order to create models of classification. This research discovered that the therapist's mastery of the boundaries of psychotherapy technology and theory, particularly the consciousness and structure of their psychological circumstances, was the maximum precarious aspect within forecasting the therapist's insight of the psychotherapy side effects. [Yao et al. 2022]

As psychotherapy particularly is deeply based on a robust and effective relationship and coordination between the doctor and his patients, the therapeutic alliance, the doctor-patient correlation, is the medical practice keystone**.** According to **WYNN (2022)** lately e-health is considering a progressively significant fragment of the community medical facilities, it is essential to reflect how e-health can utilize and incorporate features of the customary doctor-patient connection to enhance the facilities and involve the ill individuals. [WYNN (2022)]

Justifying the COVID-19 associated disturbances in psychological care facilities is vital in a time of increased psychological complaints. In Witteveen et al. 2022 study sought to determine the COVID-19 impact had on psychological health facilities' availability and services, as well as how these facilities had changed. Up until August 12, 2022, 38 systematic reviews were found. Few admission to outpatient psychological care as well as fewer admissions and earlier inpatient treatment discharges were the core disorders in COVID-19. Reduced access to external psychiatric treatment, lower costs, and earlier discharge from inpatient care were the prominent disturbances during COVID-19. Via reaction, synchronous tele-psychological tools like videoconferencing and, to a minor degree, asynchronous virtual psychological toolkits like applications, were used to provide distant care on par with pre-COVID caution. During COVID-19, the implementation of synchronized tools was made simpler by time tractability and efficiency, but accessibility was a problem for some powerless groups. Poor technological literacy and opinions about a few therapeutic alliance, especially in the circumstance of severe psychological complaints, were two major barriers to ill people and practitioners using virtual psychological tools. Due to weak IT infrastructure, a lack of funding, concerns about security and confidentiality, and difficult employment during COVID-19, there is a dearth of organizational provision for the technological implementation of digital psychological interferences. Journals were of weak to middling excellence, enclosed principal researches within a variety of designs, and lacked information on how well they had been applied in power and medium nations. The overarching analysis by **Witteveen et al. 2022** revealed that in COVID-19, consultants and psychological institutions applied synchronous and, to a minor extent, asynchronous tele-psychological tools to permit patients to continue receiving psychological care. There were some

challenges, which demand more advancement. Moreover, more high-quality research within the relative efficacy and utilized apparatuses can enhance the psychological care scalability generally and in future outbreaks of infective illnesses. Therefore, this research conclusion is a great motivation to develop our Psychotherapy Mobile Application.

An online telemedicine system that fosters cooperation between medical professionals, hospitals, and patients was presented by Antor et al., 2021. The application enables doctors to treat patients who live in faraway locations. It enables video calls or text messages between medical professionals and patients. Text messages and video conversations allow patients to communicate with medical professionals, store health-related information, find doctors, and consult with them. Doctors can register to serve patients as well, but in order to maintain their legitimacy, they must write blogs, issue prescriptions, see the patients' medical records and assigned by hospitals to the appropriate departments. A lab setting used to test the system.

Richards et al. (2018) developed mobile software, which assists an interactive platform, permitting psychiatrists to interact with psychological patients between face-to-face psychotherapy meetings. The developed mobile application has the prospective to improve appointment, relationship, and patient authorization in face-to-face psychotherapy meetings. Christoforou et al. (2017) intended to assess the efficiency degree of a self-guided mobile-based; mobile application designed to target agoraphobia to help in decreasing symptoms of anxiety. The research concluded that people recognized as suffering agoraphobia might similarly advantage since a diagnosis-precise and a trans-diagnostic mobile-based involvement. Kuhn et al. (2017) conducted a stochastic organized experimental to evaluate the effectiveness of a free, publicly available smart-mobile application for self-controlling of Posttraumatic stress disorder (PTSD) indicators. PTSD trainer use occasioned in expressively more than enhancements in PTSD symptoms and additional consequences related to a wait queue circumstance.

3. Design and Development Methodology

The online psychotherapy mobile application developed in this research provides interactive practices and necessary functions for both the doctor and the psychological patient to maintain their relationship and communication channel with the maximum degree of effectiveness and usefulness in order to provide the appropriate support to the patient and afford the suitable psychological services anytime anywhere.

3.1 The Psychotherapy Application Block Diagram

The key processes in psychotherapy mobile application the Doctors can create account by email, Facebook, google, make chats to his patients, insert Blogs and display them to patients, write prescription, edit their information in their profiles. In addition, the system Admin has basic functions; Login by email and password, Pending. Responsible for checking Doctor’s information, Upload articles on mental health and mental disorders, Change his own information in his profile as presented in the Block diagram of Psychotherapy mobile application in Figure 1. From the psychological Patient perspective, the Psychotherapy mobile application can help through the following:

i. Create account. Users can create an account by Email, Facebook, or Google.

ii. Search for a doctor. Patient can search for a doctor, doctors' name or see online doctors.

iii. Chat with doctor. Patient can make chat or video call with the relevant doctor.

iv. Read Blogs. Patients can browse blogs and read about psychological health and psychological disorders.

v. Add doctor to favorites. Patient can add the doctor to his favorites, for easy communication with him again.

vi. Edit profile. Patients can change or update all their information after registering.

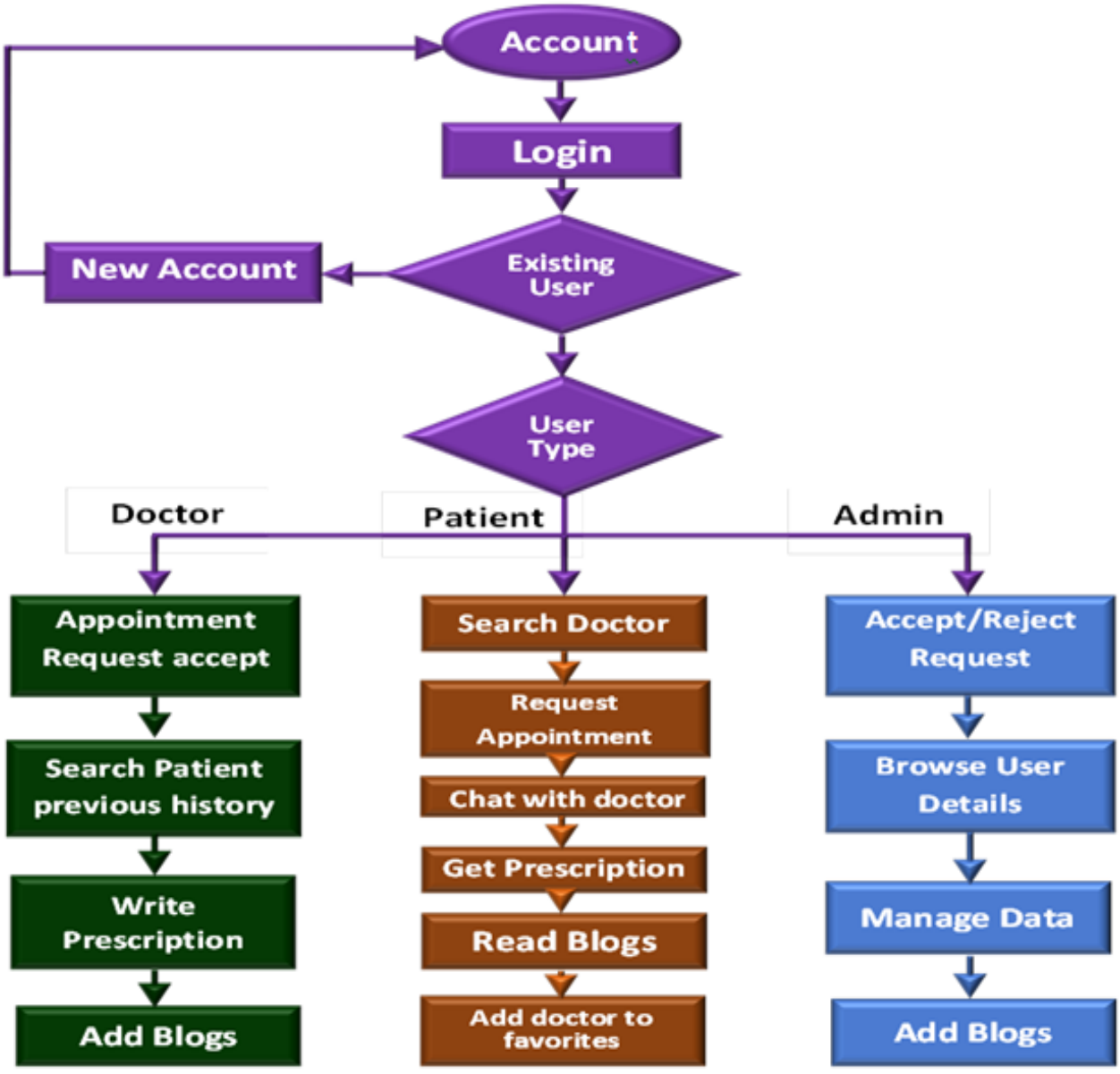

Figure 1: The Block Diagram of Psychotherapy Mobile Application.

From the Doctor perspective, the Psychotherapy Mobile Application can be used as the following:

i. **Create an account**; Doctors can create account by Email, Facebook, or Google.
ii. **Make chat**; doctor can make chats to his patients.
iii. **Add Blogs;** Doctors can insert Blogs and display them to patients
iv. **Edit profile;** Allows Doctors to edit their information in their profiles

From the Admin perspective, the Psychotherapy Mobile Application can be managed as the following:

i. **Login**; Admin can login by email and password.
ii. **Pending**; Admin responsible for checking Doctor's information (for validation).
iii. **Add Blogs**; Also, Admin can upload articles and posts on psychological health and psychological disorders.
iv. **Edit profile**; Admin also can change his own information in his profile.

3.2 The Psychotherapy Mobile Application Use Case Diagram

Regarding the psychiatric patient can create account, Search for and select an appropriate doctor, make chat or video call with the relevant doctor, request and get prescription, browse blogs and read about psychological health and mental disorders, add the doctor to his favorites; for easy and continuous communication with him anytime anywhere, and change all his information after registering as described in Figure 2 the Use case diagram which depicts the interaction of the user within the system through a set of activities performed within specific logic and a sequence of actions.

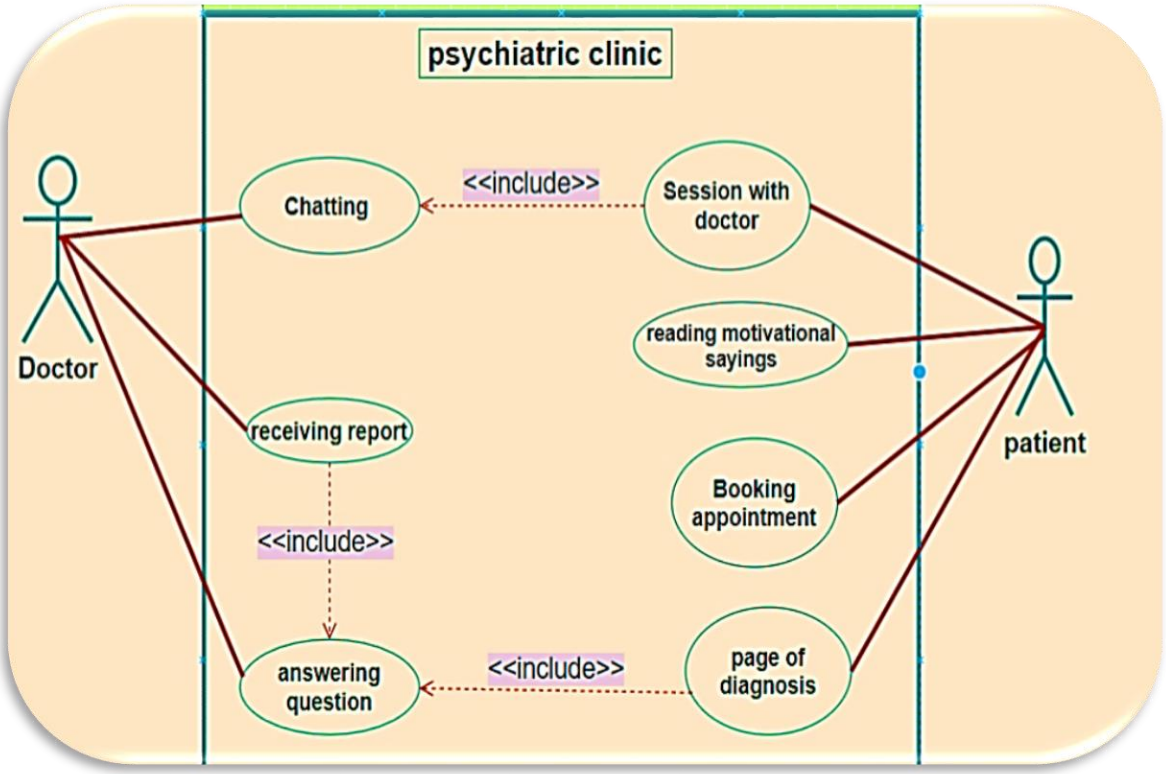

Figure 2: The Use Case Diagram of Psychotherapy Mobile Application System

3.3 The Psychotherapy Application Database

Google Firebase software is described as Google-backed key application development software that permits software creators to mature Web apps, Android and iOS. Normally Firebase offers various tools for tracing reporting, fixing application crashes, and various analytics, producing marketing and product investigations [Google Firebase 2022]. The non-SQL Firebase program is used in constructing the database of the psychotherapy system. It is a Backend-as-a-Service (Baas). It affords designers and developers various services and tools in order to aid them design systems, develop excellent applications, make profit, and mature their user base. It is constructed on Google's infrastructure. Firebase is considered a NoSQL database package that stores data in JSON-like documents [Educative Answers Team 2022]. **Figure 3** below portrays the structure of the existing system database. It shows how various entities, like a patient, doctor, chat… etc. are connected and related with each other through the different types of relationships according to the execution of the various processes in the psychotherapy mobile application.

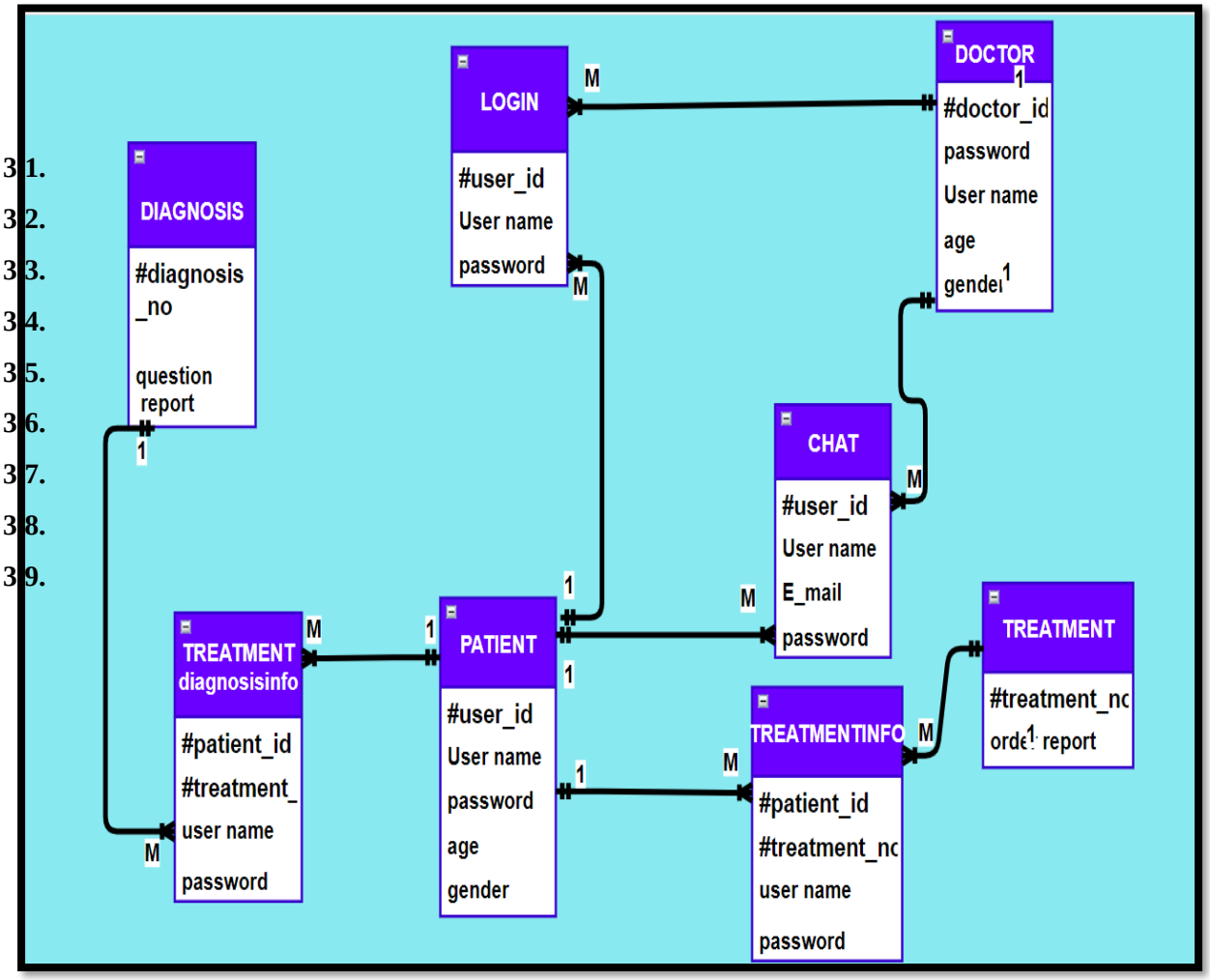

Figure 3: The Database Diagram of Mobile Application Psychotherapy

Unified Modeling Language™ (UML®) is the most popular modeling semantic suitable for developers business analysts, and software architects to help to designate, postulate, design, and document current/novel business processes and practices, construction and performance of artifacts of

software systems. It is a typical visual modeling language proposed to be used for modeling the mobile application's processes and objects, analysis, design, and implementation of the system in this research as will be illustrated in the following diagrams [UML 2022]. The following sections illustrate in details the various modeling tools and diagrams form UML, which used in order to help in designing and developing the Psychotherapy Mobile Application.

3.4 The Psychotherapy Application Sequence Diagram

Sequence diagram can be described as the furthermost communal tool of UML interaction diagrams that emphases on the communication exchange between a group of supports. It designates an interaction via concentrating on the messages arrangement that is switched, within their corresponding occurrence specifications on the supports [UML Sequence Diagrams 2022]. Often it is used in behaviors that highlight object interactions at the expense of appropriate decision logic. It uses a time sequence to describe how objects work together. With the help of sophisticated visual possibilities, it demonstrates how various objects interact with one another in a specific use case scenario. As an example from the Psychotherapy mobile application, Figure 4 below illustrates the Sequence Diagram for the process of **Registration as a patient** describing the sequential steps in order to perform this process through using the application.

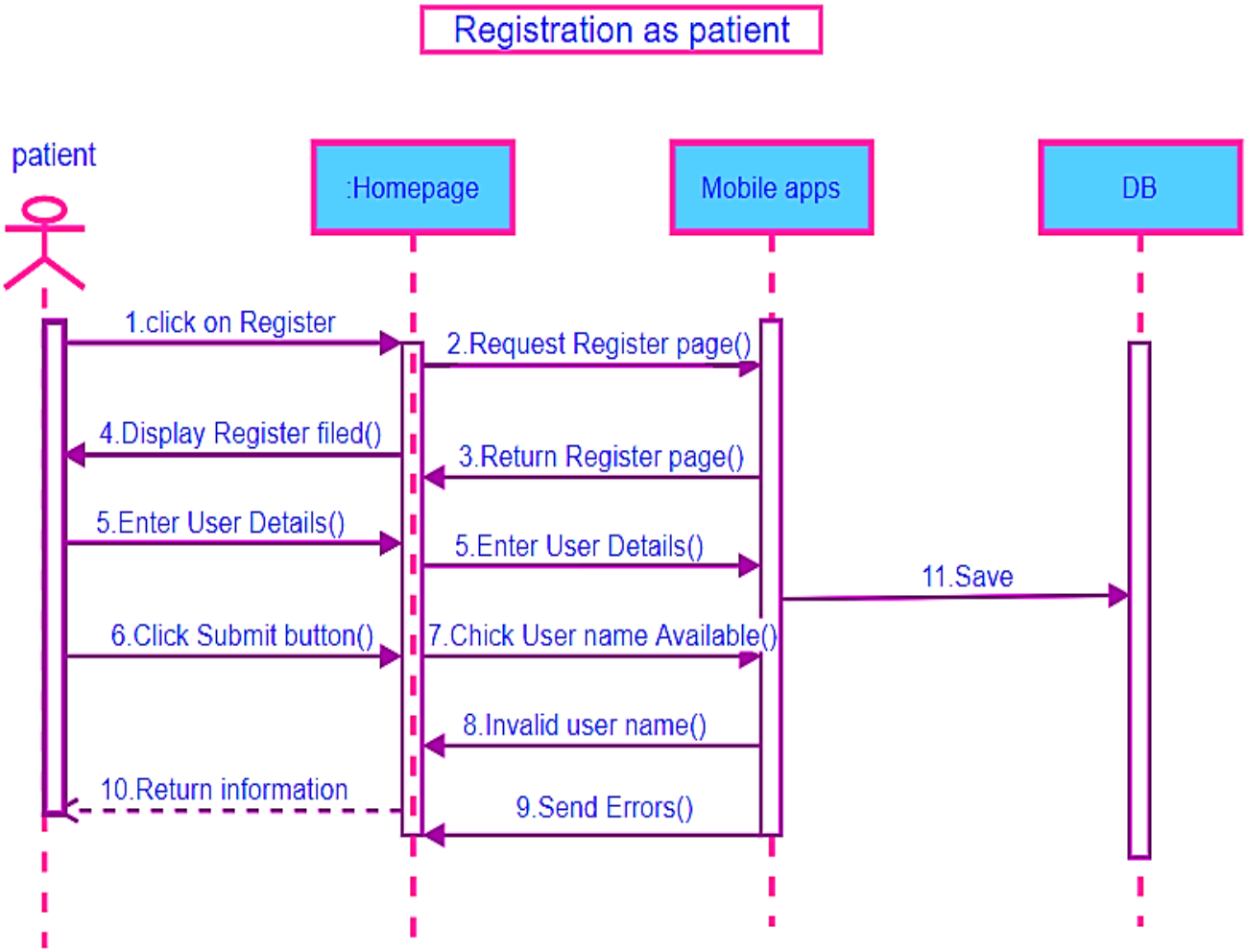

Figure 4: The Sequence Diagram for the process of **Registration as a patient**

3.5 The Psychotherapy Application Class Diagram

Another effective UML modeling tool used in developing this psychotherapy system is the Class diagram. It is an UML structure diagram that displays structure of the psychotherapy mobile application at the classes and interfaces level, displays their proprieties, dependences, constraints and degree of relationships/associations, generalizations… and so on [UML Class Diagram 2022]. Figure 5 depicts the Class diagram of psychotherapy mobile application showing the various objects in the application with the dependency and different relationships between them.

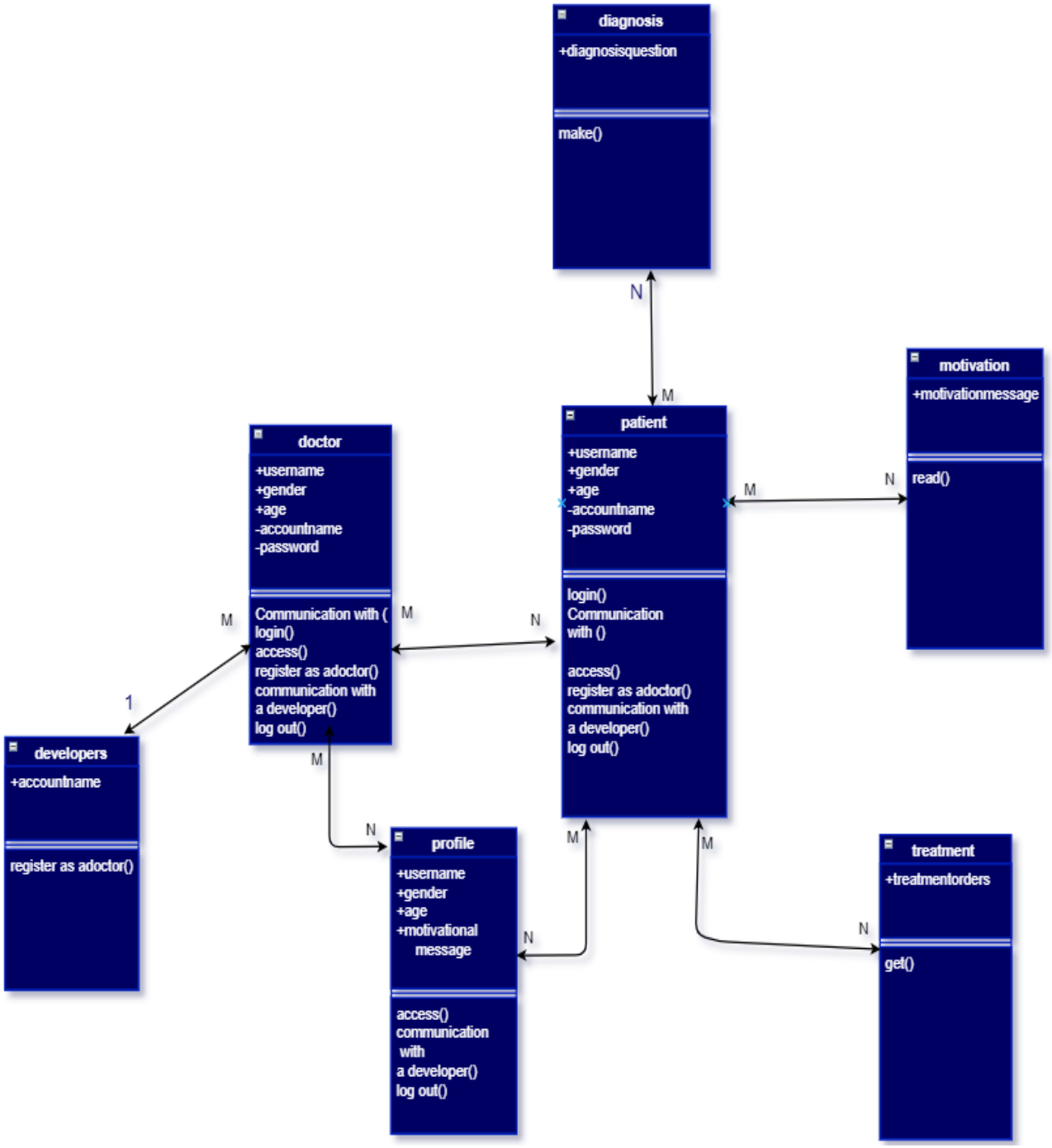

Figure 5: The Class Diagram of Psychotherapy Mobile Application

3.6 The Psychotherapy Application Activity Diagram

Activity diagram tool is considered as an effective UML behavior diagram, which shows in details the sequential control flow, or object flow through the psychotherapy mobile application with emphasis on the logical sequence and flow conditions. The psychotherapy application actions are synchronized by activity models can be started as various actions end executing, as objects and data become available, or because some events outside to the flow happen [Activity diagram 2022] as represented in Figure 6 which shows the dependency and the logical sequence of the actions to be executed in the psychotherapy mobile application through the interaction between the main objects in the application.

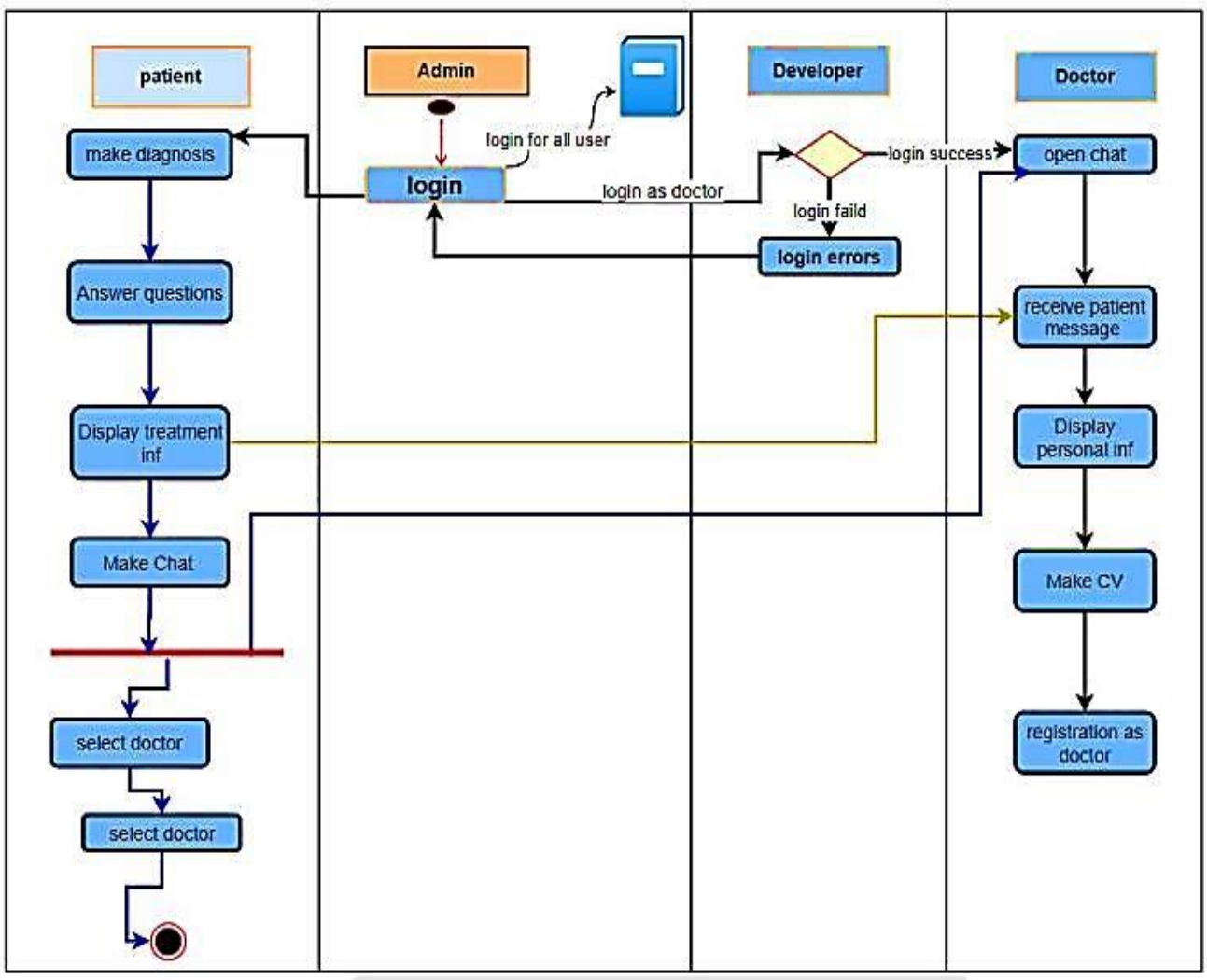

Figure 6: The Activity Diagram of Psychotherapy Mobile Application

3.7 The Psychotherapy Application Prototype

The psychotherapy mobile application in this research has been developed using various technical tools and software programs through the sequential phases of the software development life cycle (SDLC) which described in Table 1.

Table 1: The list of Tools and Software Programs used through the system development process.

SDLC Phase	Technical Tools	Software Programs
Analysis	• Context Diagram • Use Case • Function Decomposition • DFD • ERD • Business Model	• Diagram Editor • Untitled Diagram • Draw.io
Design	• Prototype • Activity Diagram • Class Diagram • Sequence Diagram • Deployment Diagram	• Adobe Xd • Creately • Online Diagram Software &Visual Solution
Implantation (Data Base) (Frontend)	• Data Base schema • Flutter Framework	• Db designer • Android Studio
Development (Backend)	• Dart • Fire base	• Android studio • Google Fire base

The psychotherapy mobile application in this research is a Flutter application to help patients who are psychologically ill to overcome some diseases and disorders they experience in their weak moments during the circumstances the difficulties faced by society and the absence of awareness as it helps natural people to make sure of their psychological health in order not to catch up with them before overtaking in the matter and the deterioration of the situation through the difficulty of obtaining an appropriate psychiatrist or the desire of some people not to go to psychologists because of the limited time and life concerns that are essentially a root cause in some psychological disorders. It is also an application for people with a desire to know more about the psychological disease, its aspects, causes, and methods of treatment for prevention.

Through the following, we display some examples from the set of screens through which the psychotherapy mobile application can be used and display some of the activities and tasks listed on this platform for remote psychological treatment that are carried out by the various systems' users. ***Figure 7*** represent the Onboarding Screen through which the user can login to the system if he has an account previously, or he can register as a new user whether a patient or a doctor through following the sequential steps in the patient Register Screen or Doctor Register Screen. Then he can go to the Homepage Screen as shown in ***Figure 8*** through this screen the user whether his type can begin his complete journey across the psychotherapy mobile application with its full functions and facilities.

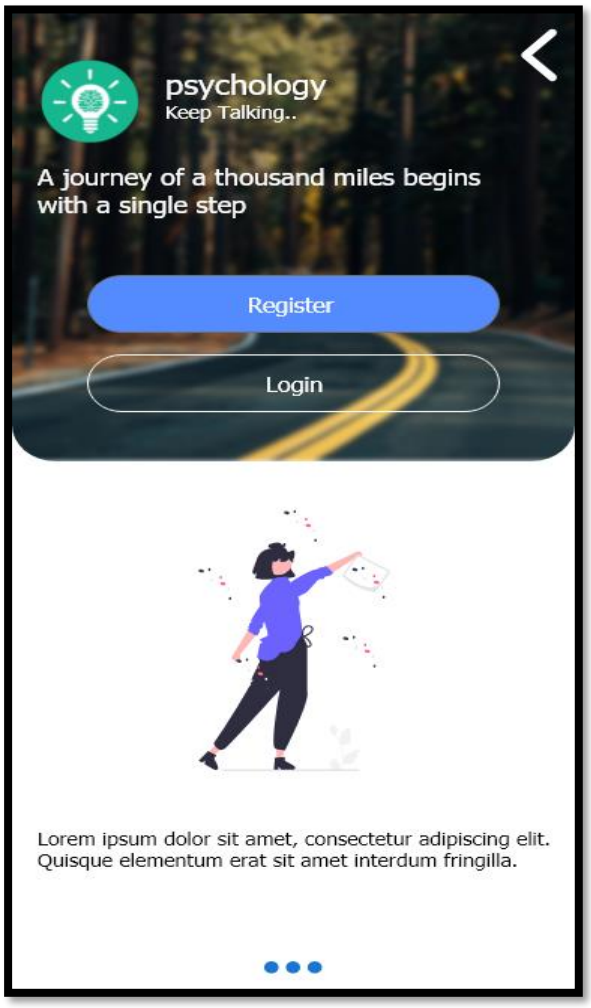

Figure 7: Onboarding Screen

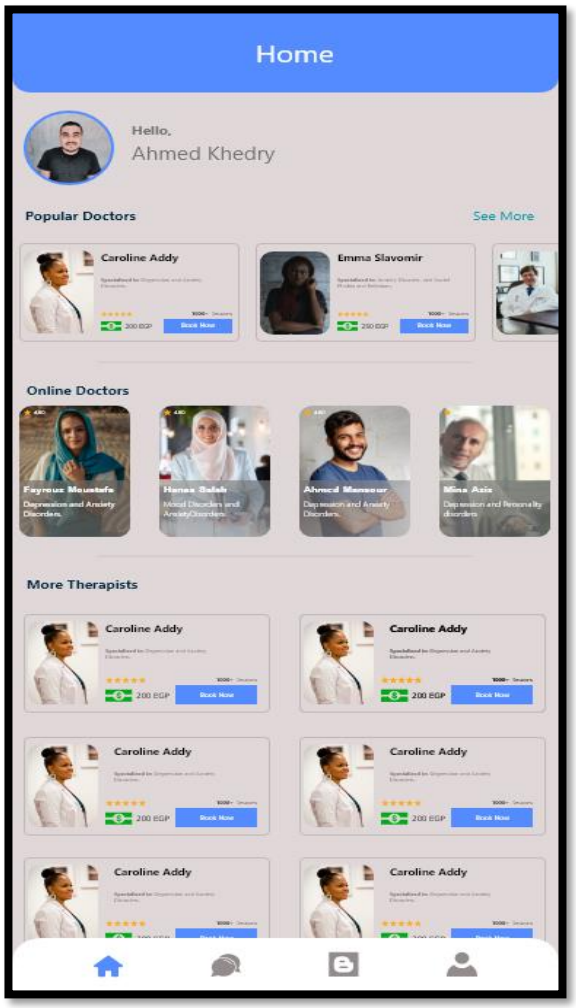

Figure 8: Homepage Screen

Actually, the main objectives and functions of the online psychotherapy mobile application can be expressed in the following:

- The psychotherapy mobile application is an easy way for the patient to find the appropriate doctor/ psychiatrist for him through the availability of the contacts, places, and addresses of the most famous psychiatrists, such that through searching about the available psychiatrists' details and knowing their main capabilities and features from the existing information about them, as described in the Doctor Profile for user screen within the online psychotherapy mobile application, as shown in ***Figure 9***.
- After selecting the appropriate psychiatrist, the patient can book the suitable time to meet and contact with him through the psychotherapy mobile application sessions as representing in the Booking Details Screen ***Figure 10***.
- The psychotherapy mobile application affords an effective platform for the psychiatrist and the patient to facilitate communication and continuous follow-up between them through Chat facility as shown in ***Figure 11***.
- It provides sufficient information and details about the Psychiatrist/Psychotherapist to make it easy to choose the appropriate doctor for the various disease conditions and symptoms.

- Also, the psychotherapy mobile application offers awareness, guidance, advice and adequate information about multiple psychological disorders and problems, how to deal with them, ways to prevent them, reduce their spread and exacerbate pathological conditions through the publication of psychological blogs from specialists on the mobile application through Blogs facility as shown in ***Figure 12***. The blog page is designed in such a way that doctors can easily write, publish, and manage useful blogs.

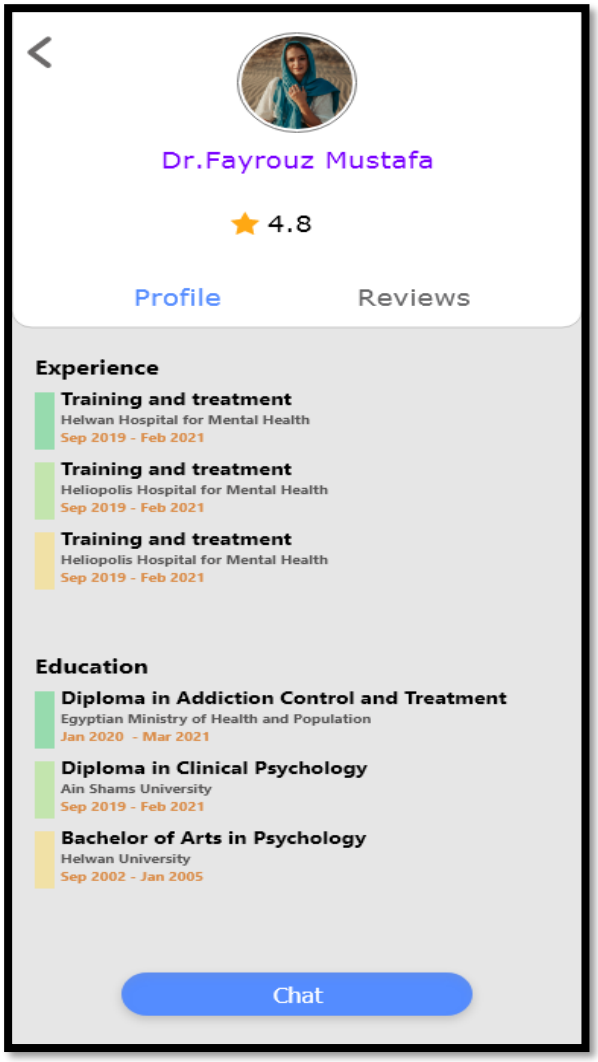

Figure 9: Doctor Profile for the user.

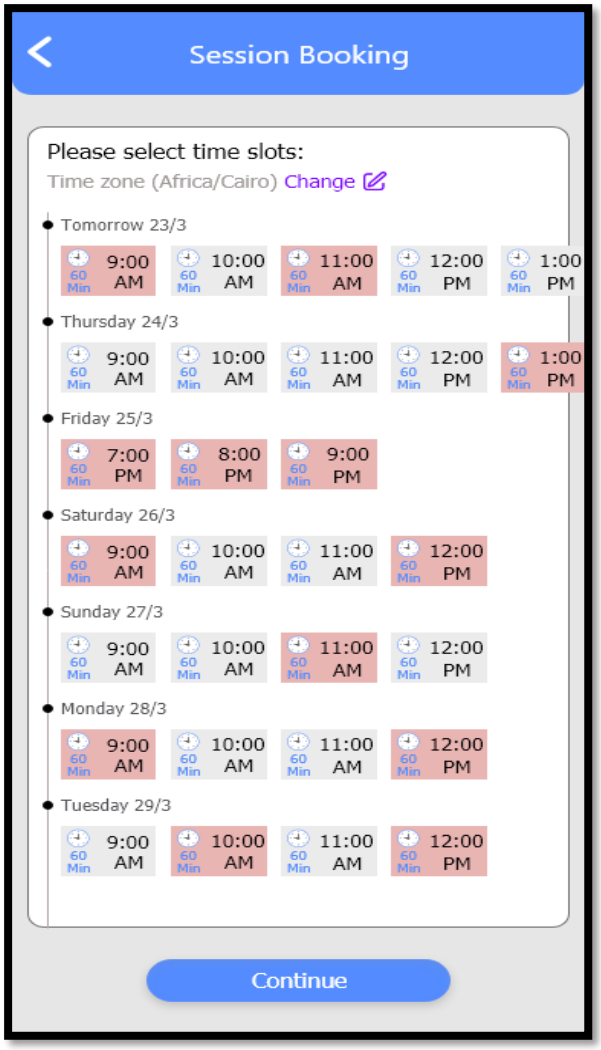

Figure 10: Booking Details Screen

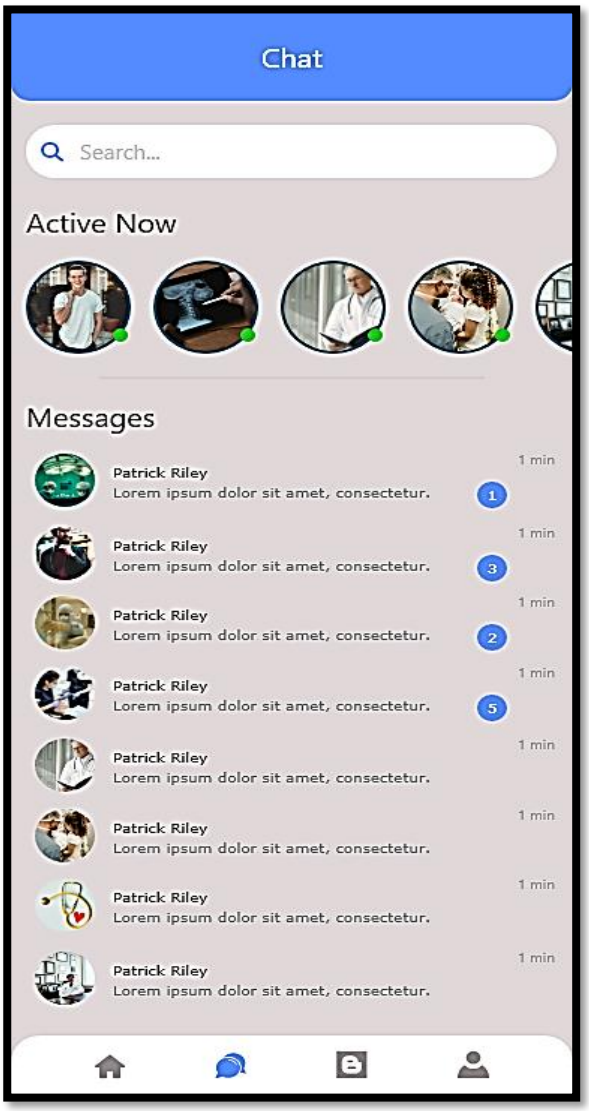

Figure 11: Chat Screen.

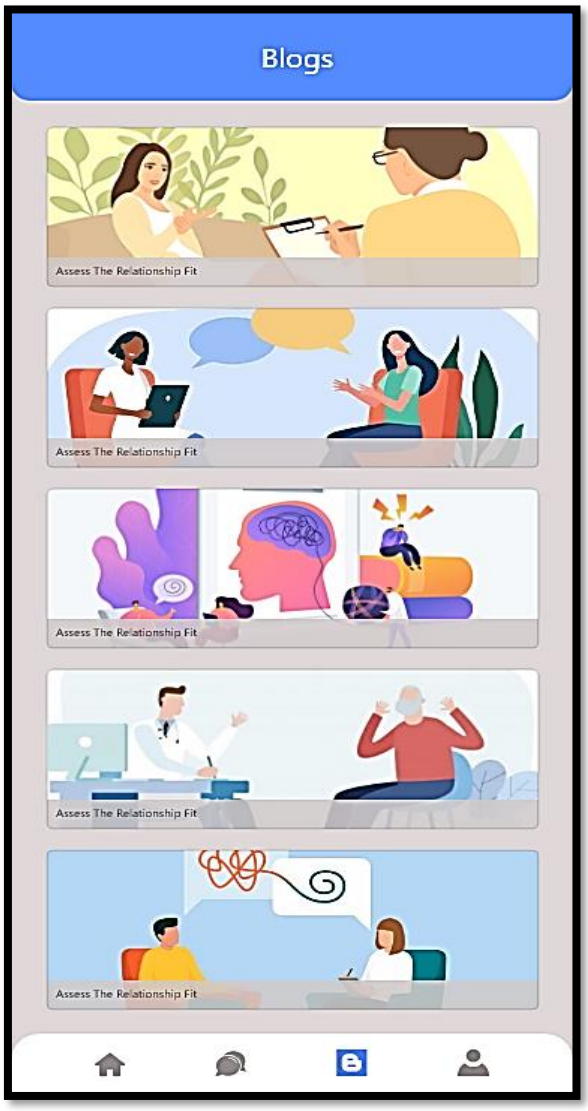

Figure 12: Blogs Screen.

4. Validation and Usability Assessment

For the psychotherapy mobile application validation and evaluation purpose; the ISO/IEC 9126 Software Quality Characteristics standard is used, this evaluation aims to rate the developed mobile application's usability, functionality, and dependability. The questionnaire method was conducted as a subjective evaluation technique for checking this objective.

A Likert scale with five possible outcomes, from "Strongly disagree" to "Strongly agree", was actually employed in the psychotherapy mobile application survey. In reality, the questionnaire was distributed and answered by 10 psychiatrists at a hospital, Zagazig, Egypt, and five volunteers' users. The questionnaire consists of 11 questions. In details, three questions were considered to measure the reliability, three questions were used to measure the usability, and five questions were used to measure the functionality. Normally for each question in the questionnaire, the participants were requested to

circle the appropriate response which best described their level of agreement towards the psychotherapy mobile application. Table 2 below displays the evaluation outcomes with the average mean of 15 answers for every criterion through applying **Equation 1**. From the detailed analysis of the respondents' answers, the result shows that respondents agreed with 4.3 mean average of the psychotherapy mobile application.

$$A = \frac{1}{n}\sum_{i=1}^{n} a(i) \qquad (1)$$

A : is the average score for each criterion
N : is the number of participants.
a (i): is the score obtained for each question.

Table 2. The evaluation results of the Psychotherapy Mobile Application.

Criteria	Result
Functionality	4.9
Reliability	4
Usability	3.9
Mean Average	4.3

5. Conclusion and Future Work

Generally, guaranteeing remote and continuity of care via teleconsultation can decrease the threat of psychopathological aggravation and subsequent requisite hospitalization for patients, with approval articulated together by psychiatrists and patients. Hence, the mobile application psychotherapy system in this research is necessary for any person who suffers from some distress because of the various life pressures, which make it difficult for him to live this life due to psychological problems. This person can treat his psychological complaint without needing to go to a doctor physically and communicate with psychiatrists anywhere easily through this application. A person can also read some critical topics, and guidelines about psychiatry, diseases, and information that may benefit him during their journey in treating their illness. This application is crucial to adapt and overcome the psychological problems we face throughout daily life in this fast changeable era; it is a simple application that everyone can use through all phone types.

Normally in order to overcome the limitation of this psychotherapy application; in the future, it can be improved and modified in various ways, such as;

- adding an intelligent recommender system for perfect and automatic psychological diagnosis,
- releasing various updated versions for IOS, Web and Desktop app,
- supporting live and interactive chat, and
- offering several payment methods.

References

Activity Diagrams, [Online] available at: https://www.uml-diagrams.org/activity-diagrams.html (Last access 6/12/2022)

Ahmed A., Ali N., Giannicchi A., Abd-alrazaq A. A., Ahmed M. A. S., Aziz S., and Househ M., "Mobile applications for mental health self-care: A scoping review", Science Direct, Elsevier, Computer Methods and Programs in Biomedicine Update, Volume 1, 2021, 100041, ISSN 2666-9900, https://doi.org/10.1016/j.cmpbup.2021.100041.

Al-Alawi M., McCall R., Sultan A., Al Balushi N., Al-Mahrouqi T., Al Ghailani A., Al Sabti H., Al-Maniri A., Panchatcharam S., Al Sinawi H., " Efficacy of a Six-Week-Long Therapist-Guided Online Therapy Versus Self-help Internet-Based Therapy for COVID-19–Induced Anxiety and Depression: Open-label, Pragmatic, Randomized Controlled Trial", JMIR Ment Health 2021;8(2):e26683,URL: https://mental.jmir.org/2021/2/e26683 DOI: 10.2196/26683.

Amerio A, Vai E, Bruno E, Costanza A, Escelsior A, Odone A, De Berardis D, Aguglia A, Serafini G, Amore M, Ghaemi SN. COVID-19 Impact on the Italian Community-based System of Mental Health Care: Reflections and Lessons Learned for the Future**.** Clin Psychopharmacol Neurosci 2023; 21:2-9. https://doi.org/10.9758/cpn.2023.21.1.2

Antor M. B., Jamil A. H. M. S., Mamtaz M., Khan M. M., Alshamrani S. S., and Masud M., " Development of a Web-Based Telemedicine System for Covid-19 Patients ", Intelligent Automation & Soft Computing, 30 (3) , *pp.*899-915, 2021.

Bokolo AJ.; "Application of telemedicine and eHealth technology for clinical services in response to COVID-19 pandemic". Health Technol (Berl). 2021;11(2):359-366. doi: 10.1007/s12553-020-00516-4. Epub 2021 Jan 14. PMID: 33469474; PMCID: PMC7808733.

Chakraborty I., Edirippulige S., and Ilavarasan P. V.; The role of telehealth startups in healthcare service delivery: A systematic review, International Journal of Medical Informatics, Volume 174, June 2023, 105048.

Chaves A., Guimar˜aes T., Duarte J., Peixoto H., Abelha A., Machado J., "Development of FHIR based web applications for appointment management in healthcare", Science Direct, Procedia Computer Science 184 (2021), *pp.* 917–922

Christoforou M., Sáez Fonseca J., Tsakanikos E., "Two Novel Cognitive Behavioral Therapy–Based Mobile Apps for Agoraphobia: Randomized Controlled Trial", J Med Internet Res 2017; 19 (11):e398, URL: https://www.jmir.org/2017/11/e398 , DOI: 10.2196/jmir.7747.

Educative Answers Team, "What is Firebase?", [Online] available at https://www.educative.io/answers/what-is-firebase (last access 6 December 2022).

Eichenberg C., Aranyi G., Rach P., and Winter L., "Therapeutic alliance in psychotherapy across online and face-to-face settings: A quantitative analysis", Science Direct, Elsevier B.V, Internet Interventions 29 (2022) 100556.

Fernandez, E., Woldgabreal, Y., Day, A., Pham, T., Gleich, B., Aboujaoude, E., 2021 "Live psychotherapy by video versus in-person: A meta-analysis of efficacy and its relationship to types and targets of treatment. Clinical Psychology & Psychotherapy. vol. 28, issue 6, pp. 1535-1549
Google Firebase [Online] available at https://firebase.google.com/ (last access 9 December 2022).

JAKOBSEN M. W. and BABIC A., "Intellicor: Mobile design for monitoring phonographic signals", Information and Technology in Clinical and Public Health, J. Mantas et al. (Eds.) 2022, *pp.* 140-143.

Kuhn, E., Kanuri, N., Hoffman, J. E., Garvert, D. W., Ruzek, J. I., & Taylor, C. B. (2017). "A randomized controlled trial of a smartphone app for posttraumatic stress disorder symptoms". *Journal of Consulting and Clinical Psychology, 85*(3), 267–273. https://doi.org/10.1037/ccp0000163

Landi, D., Ponzano, M., Nicoletti, C.G. *et al.*, " Patient's point of view on the use of telemedicine in multiple sclerosis: a web-based survey", *Neurological Sciences* 43, 1197–1205 (2022). https://doi.org/10.1007/s10072-021-05398-6

Richards, P.; Simpson, S.; Bastiampillai, T.; Pietrabissa, G.; and Castelnuovo, G., "The impact of technology on therapeutic alliance and engagement in psychotherapy: The therapist's perspective", CLINICAL PSYCHOLOGIST, Volume 22, Issue 2, pp: 171-181SI, DOI: 10.1111/cp.12102, JUL 2018.

Savoldelli A., Vitali A., Remuzzi A., and Giudici V.**,** " Improving the user experience of televisits and telemonitoring for heart failure patients in less than 6 months: a methodological approach", International Journal of Medical Informatics 161 (2022) 104717, 1386-5056/© 2022 Elsevier.

Socarrás M. R., Loeb S., Teoh J. Y., Ribal M. J., Bloemberg J., Catto J., N'Dow J., Poppel H. V., Rivas J. G.; "Telemedicine and Smart Working: Recommendations of the European Association of Urology, European Urology", https://www.sciencedirect.com/search?qs=Online%20Psychotherapy Volume 78, Issue 6, 2020, Pages 812-819, ISSN 0302-2838.

UML Class and Object Diagrams Overview, [Online] available at: https://www.uml-diagrams.org/class-diagrams-overview.html (Last access 6/12/2022)

UML Sequence Diagrams, **[**Online**]** available at: https://www.uml-diagrams.org/sequence-diagrams.html (Last access 6/12/2022)

UML, The Unified Modeling Language, [Online] available at: https://www.uml-diagrams.org/ (Last access 6/12/2022)

Witteveen A.B., Young S., Cuijpers P., Ayuso-Mateos J.L., Barbui C., Bertolini F., Cabello M., Cadorin C., Downes N., Franzoi D., Gasior M., John A., Melchior M., McDaid D., Palantza C., Purgato M., Van der Waerden J., Wang S., and Sijbrandij M., " Remote mental health care interventions during the COVID-19 pandemic: An umbrella review", Science Direct, Elsevier, Behaviour Research and Therapy, Volume 159, 2022, 104226, ISSN 0005-7967, https://doi.org/10.1016/j.brat.2022.104226.

WYNN R., "Drawing on the Doctor-Patient Relationship in e-Health Services", Information and Technology in Clinical and Public Health, J. Mantas et al. (Eds.) 2022, pp. 160-161.

Yao L., Xu Z., Zhao X., Chen Y., Liu L., Fu X., and Chen F., " Therapists and psychotherapy side effects in China: A machine learning-based study", Science Direct, Elsevier B.V, Heliyon 8 (2022) e11821.