

PAPER

Dawwen: An Arabic Mental Health Mobile App Based on Natural Language Processing

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ABSTRACT

People are increasingly concerned about their mental health wellness. Scientific studies suggest that online counselling for anxiety and depression is just as effective as in-person treatment. Additionally, journaling interventions have shown promise for individuals dealing with mental and psychological issues. In recent years, a growing number of mobile applications have been developed to improve people's mental wellness and emotional communication. However, many of these applications are not available in Arabic but are available only in English or the native languages of their users, while other applications have feature limitations. This study presents a prototype of an interactive mental health mobile application, called Dawwen, to assist Arab individuals in freely expressing their feelings through online journaling, receiving recommendations for practices and activities, and locating nearby therapy centers based on their geolocation. Dawwen is augmented with an easy-to-use interface, a natural language processing (NLP) technique for analyzing the user input, and integrated features. The system is implemented using Android Studio and various cloud-based tools, making it adaptable for the integration of more advanced artificial intelligence (AI) technologies in the future. The System Usability Scale (SUS) scored an average of 88.25%, indicating high user satisfaction with the app's functionality and ease of use. The study highlights Dawwen's effectiveness in improving mental health support for Arabic-speaking users, filling a critical gap in existing digital mental health resources.

KEYWORDS

mental health mobile applications (MHapps), artificial intelligence (AI), natural language processing (NLP), journaling

1 INTRODUCTION

Mental health plays a significant role in human behavior and handling life's everyday challenges and difficulties, such as school and job problems as well as losing loved ones [1]. People with mental health issues cannot manage these types of difficulties and may need constant care [2]. These people may face frequent depression

Wali, A., Almagrabi, H., El-Feky, S., Jokhdar, M. (2025). Dawwen: An Arabic Mental Health Mobile App Based on Natural Language Processing. *International Journal of Interactive Mobile Technologies (iJIM)*, 19(4), pp. 108–131. <https://doi.org/10.3991/ijim.v19i04.51999>

Article submitted 2024-08-30. Revision uploaded 2024-11-14. Final acceptance 2024-11-23.

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because of stressful events. Nearly one in five (19%) adults in the United States experiences mental illness [3]. Because of misunderstandings about mental health, many people endure their struggles quietly and without seeking help, leading to untreated conditions [1].

Many treatments for mental illness have been proposed in various studies. The choice of treatment depends on the type of mental illness, its severity, and what is most effective for the patient [5]. Severe illness often requires special and urgent care from psychiatrists. Mild mental issues can be treated by counselling, support groups, psychotherapy (also called talk therapy) and journaling [4]. A combination of these treatments is effective in many cases. However, with growing concern about and awareness of mental health issues, people may face difficulty finding specialized care or booking appointments for counselling. This may be even more difficult for people with low income or those who live in developing or rural areas.

Journaling, or writing, is a common nonpharmacological, low-cost, and low-side-effect therapy used for the management of mental illness. The effectiveness comes from patients' ability to express their feelings, thoughts, and experiences freely and honestly without worrying about judgment, knowing that the journal will remain private and unread by others [6]. Across studies, writing therapy has demonstrated its capacity to reduce stress, improve health [7], and develop coping skills that help people recover from traumatic events [8]. Patients can distance themselves from painful emotions by writing regularly [9]. According to previous studies, one disadvantage of writing therapy is that it can raise individuals' level of anxiety and produce a negative effect on mood immediately after writing that may sometimes last for several months [10]. This can lead to patients' discouragement and reduced satisfaction with this form of treatment [8].

With advances in internet and information technology, scientific studies have shown that online treatments or interventions for mental health, also called online counseling or e-therapy, may be as effective as face-to-face treatment [11–14]. Online interventions include all methods that use distance communication technologies, such as phone conversations, email, chat rooms, instant messaging (e.g., short message service (SMS)), blogs, or video conferencing (e.g., Skype) [15]. These interventions are accessible, flexible, and cost-effective [16]. They are sometimes available in real time and allow patients to be more motivated, relaxed, and willing to engage while facilitating self-reflection [17]. They also improve therapists' sense of professional effectiveness and listening skills [18]. Many researchers report that patients' privacy and anonymity, as well as the permanent record keeping of therapy sessions that can be used for future treatment, are among the main advantages of online counselling [15].

Mobile devices have become increasingly popular, and this phenomenon has implications for the way mental health services are delivered. Mobile devices allow patients to receive online interventions using cellular or Wi-Fi communication technologies [19]. In recent years, a growing number of mental health mobile apps (MHapps) have been developed for different purposes and are available for smartphone users [20–23]. The aim of MHapps ranges from aiding in the recovery from mental illnesses to promoting positive behaviors that contribute to emotional health [21]. The main functionalities of MHapps include symptom and mood monitoring and assessment [19, 22], offering initial practices and health information for specific symptoms [20, 22], tracking and promoting engagement with therapy platform activity schedules and assignments (e.g., thought diaries) [22, 24], answering questions and providing feedback [24, 8], sending motivational messages, especially to discouraged patients, and employing user geolocation to find the best therapists or health centers [20].

Other features have been recommended for consideration in MHapps, including (1) providing cognitive behavioral therapy (CBT); (2) allowing the reporting of thoughts, feelings, and behaviors; (3) addressing anxiety and low mood; (4) providing recommended activities; (5) real-time engagement; (6) a simple, interactive, and intuitive interface; and (7) connecting to therapy and support service centers [25]. Self-guided and interactive apps can also provide patients with self-help steps and interventions, information, and interactive exercises [19]. However, these recommendations demonstrate gaps in the capabilities of many existing MHapps [21].

Many mobile applications have begun to use artificial intelligence (AI) to better determine the level of therapists' involvement based on patients' symptoms [26] and to provide more objective measurement and automatic monitoring for patient progress and analysis and facilitate the personalization of treatment plans [27, 28]. Natural language processing (NLP), which is a field of AI, has had an enormous impact on mental health care applications [29]. For mental health practices, NLP is used before AI algorithms to drive computer programs that can analyze and translate human language from clinical notes, counselling sessions [27], or journaling, extract information and understand semantic meaning from text, and summarize large volumes of text rapidly and effectively [30].

Open discussion of the topic of mental health and well-being is uncommon in Arab regions, which creates a hindrance for individuals seeking high-quality mental care and support [31]. Research addressing mental health in Arab countries increased by approximately 160% in 2018 (i.e., 4,506 unique peer-reviewed journal papers) [32], but there are still limitations in online resources and mobile applications for Arab people with mental health issues. Moreover, existing MHapps are not available in Arabic; instead, they are available in English or the native languages of the people who use them. Other applications have feature limitations.

To cope with the disadvantages of journaling and consider some of the recommended features for MHapps, this study aimed to present a prototype for an Arabic mobile application named “Dawwen – دَوِّنْ”, which means “write” in Arabic, augmented with artificial intelligence (AI) technologies, built-in functionalities, and a user-friendly and interactive interface to help users with mental health issues overcome daily yet overwhelming hardships using their native language. Dawwen includes the following main features:

- A journaling or writing space that allows users to report their feelings and receive real-time feedback, health information, and recommended practices and activities.
- A pre-trained NLP model that is used to analyze feelings and return users' emotional status, stress, anxiety, and depression. Users can favorite some of these recommendations for later.
- The ability to search for the closest centers based on patient geolocation using the Google Maps API.
- A history report that allows patients to display their emotional status over a past period, which can be used by therapists to detect a certain pattern or a risk that needs further treatment.

The rest of this paper is structured as follows. Section 2 discusses recent related work. Section 3 explains the methodology, including system analysis, design, and implementation. Section 4 illustrates the system evaluation. Section 5 concludes this paper with recommendations for future research directions.

2 RELATED WORK

There are an increasing number of MHapps to provide online treatments such as journaling, mood tracking, relaxing exercises, stress reduction techniques, and CBT. Many MHapps have been discussed and evaluated by scientific researchers [21, 22, 33, 34]. These applications are developed either for general mental health issues or for specific purposes (e.g., illness) or groups. Here, we attempt to classify MHapps into different categories based on their features or themes.

2.1 General supporting apps

Many general MHapps have been presented in app stores or in the literature. For example, SuperBetter [35] is a game-based app containing a set of clear and easy-to-achieve challenges that help reduce depression and anxiety in a controlled trial. DBT Diary Card Skills Coach [36] is a clinical psychologist-licensed application that helps users refresh their memory by entering their skills in daily records. The application keeps track of these skills and reminds the user about the behaviors he or she is trying to manage. The app also offers therapists coaching about what skills to use in different behaviors. The Healthy Minds Program [37] employs meditation and podcast-style lessons that are influenced by and built on pioneering scientific research. The app includes progress tracking features and assessment of the user's current mental and emotional well-being. The app integrates with Apple Health to track users' mindful minutes and provides recommendations accordingly.

The MHapp Moody Me [38] enables users to record their mood and daily activities along with detailed notes. For better visualization of users' lifestyles and moods, the app allows them to view reports and charts over a period of time and provides information about the best or worst days of the month with supporting notes. The app suggests activities to improve the lifestyle of users, such as a healthy routine of sleep, physical fitness, and food. SAM [39] is a community-backed well-being application designed with self-help methods selected and supported by clinical practitioners' recommendations and academic research in psychology using large-scale behavioral data [40]. The app provides tools for recording feelings over time and triggers particular situations for the cause of feelings. The app includes an optional social cloud feature that enables users to give and receive support with other users.

A prototype of a mobile telemedicine application, presented by Jauregui-Velarde et al. [41], designed to improve mental health care access during the COVID-19 pandemic. Key features include appointment booking and scheduling, clinical data management, visualization of patient medical records, searching for mental health professionals, real-time video consultations, and secure chat functionality. The app allows patients and specialists to easily access mental health services for the benefit of people's emotional, psychological, and social well-being in times of pandemic. Smiling Mind [42] is a nonprofit mental well-being app that provides many features, such as meditation, mental fitness, and a mood-tracking tool. The app was developed using psychology and educational strategies to develop mental fitness and encourage healthy activities such as good sleep and sport training and to suggest strategies to reduce stress and improve social skills.

2.2 Journaling-based apps

Online journaling plays an important role in many MHapps due to its significant effect in decreasing anxiety, stress, and depression issues. Some MHapps adopt CBT principles for journaling. For example, Moodfit [43] is designed to provide a comprehensive set of customizable tools, such as CBT thought records, mood and gratitude journals that allow patients to insert mood entries and view mood charts, as well as lifestyle activities that affect mood, such as breathing, sleep, and nutrition recommendations. Similarly, MindShift® CBT [44] includes thought journals, challenging experiments, calming audio, and the MindShift CBT community forum to share stories and learn about others' experiences. The application also provides exercises with much supporting information. Pocket CBT [45] adopts CBT principles to identify and overcome dysfunctional thoughts. The app enables users to record and identify their thoughts, physiological sensations, emotions, and behaviors related to a particular event. The app assists users by labeling dysfunctional thoughts and suggesting alternative and adaptive thoughts to overcome negative thoughts.

Other journaling-based MHapps have been introduced in previous work, such as iMoodJournal [46], which contains a journaling space and a mood-tracking tool. It is designed to track and explain the user's current mood, such as sleep, stress, anxiety, and energy level, and can help therapists diagnose mental conditions such as bipolar disorder. The application provides a tracking chart for medical conditions that have both physical and emotional symptoms, such as premenstrual syndrome (PMS) and premenstrual dysphoric disorder (PMDD). Moodkit [47] was designed and developed by experts to provide four effective tools guided by professional psychology: a journal tool that enables users to generate journal entries using custom templates designed to promote well-being, mood-enhancing activities implemented by psychological techniques, a thought-checker tool that guides the user through a process of identifying common patterns of negative feelings and evaluating the impact of those feelings, and a mood-tracker tool that helps users rate and record their mood over time. Happy Note [48] is a diary application that lets users record three positive things that happen every day, attach photos, and post part of the diary to social media platforms to spread positive thinking. Safer, a prototype presented by Diano et al. [49], is based on the dialectical behavior therapy (DBT) model and incorporates specific features such as the journal to write a diary, materials, and session notes, which can be used within psychotherapy or psychological support sessions, as well as breathing, relaxing, and grounding exercises.

2.3 Specific-purpose apps

Many MHapps are designed for a specific illness or group. For example, there are apps designed for young people, such as CBT [50], that use behavioral experimentation steps by introducing an interactive manga-style story to the user where the characters guide the users to complete planning, running, and reviewing behavioral steps. The app provides solutions to improve low mood and to manage anxiety. ReachOut WorryTime [51] allows young people to express themselves anonymously and with their own terms and conditions. The app facilitates one-to-one peer meetings to offer support and advice and provides tips, online community support, stories, and resources about mental health and well-being. REACH was presented by Patwardhan et al. [52] and includes a series of games for youth to accompany a school-based early intervention protocol. REACH includes self-monitoring and cognitive self-control

tools, notifications relevant to skill practice, and speech capture and offers activation for more tools based on performance. It allows for corrective feedback based on user data and creates personalized reports for weekly practice and response. Companion, presented by Lim et al. [53], was also designed to help students with mental health issues by providing a safe space for students to write their feelings and thoughts while they connect with and consult qualified doctors or therapists.

MHapps specifically for adolescents have also been developed, such as Crisis Care and CopeSmart. Crisis Care [54] was developed by two clinicians with experience working with suicidal adolescents and families in collaboration with an expert in the use of technology in behavioral interventions. Two modes can be implemented. First, an adolescent mode includes relaxing techniques, video clips or images that improve positive behaviors, activities that can distract adolescents from suicidal thoughts, and features to call parents or 911. Second, a parent mode includes guidance and videos on parents listening to their adolescents, a list for coaching coping skills that parents of adolescents have found helpful in reducing anxiety or other negative feelings, a list of actions parents can take to make their home physically safer for their suicidal adolescent, and features to call the adolescent's therapist or 911. CopeSmart, a prototype presented by Kenny et al. [55], represents a generic self-monitoring tool on which individuals can monitor and rate their mood and view coping strategies on a day-to-day basis, view the rating history, and express their problems through writing.

Other specific-purpose MHapps include PTSD Coach [56], which was developed for veterans experiencing symptoms of posttraumatic stress disorder (PTSD) by the Veterans' Affairs National Centre for PTSD and the U.S. Department of Defense's (DoD) National Centre for Telehealth & Technology. PTSD Coach includes tools for screening and tracking patients' stress symptoms, information about professional care, a self-assessment for PTSD and anger management, a direct link to support and help centers, self-help interventions and guided relaxation exercises, soothing sounds and images, and relationship tips. The Stress & Anxiety Companion [57] was designed for employees to enable them to produce a personalized mental well-being plan and receive a tailored strategy written by a team of experts based on their needs and feelings. The app offers a library of more than 150 expert audio guides across 40 topics on handling stress and balancing work and life activities. Users can also attend training workshops via video recordings and presentations to overcome their stress and anxiety.

IASO, presented by Kamoun et al. [58], is a prototype for interactive hospital patient self-reporting. IASO integrates the idea of mood-based adaptive art (MBAA), which activates animated digital art clips with background sounds based on patients' self-reported mood states. The app provides medical teams with improved, nearly real-time insights into patients' self-reported mood in various formats and over different time intervals. It provides patients with historical mood records, instant feedback in the form of artwork and accompanying music, and reward points each time they report their mood. The app includes an automatic SMS alerting mechanism for promptly sending messages to a clinician when the patient reports a specific alarming mood state (e.g., "fearful").

2.4 AI-based apps

Artificial intelligence techniques have been adopted by many MHapps to improve their functionality and prediction features. For example, Moodmap [59] is a mobile

application and a Chrome extension that can analyze users' computer usage and build a model of their attention and mood based on AI techniques (i.e., machine learning (ML) and facial recognition algorithms). It provides users with automatic reports and notifications that can help users understand and manage their emotions over time. The motivation for the development of this app came from the experience of managing attention-deficit/hyperactivity disorder (ADHD). Happify [60] includes science-based activities and games designed using AI. The methods used in this app were developed by experts in the fields of mindfulness, CBT, and positive psychology.

InTouch, developed by Lim [61], crowdsources volunteers for psychological first aid and provides users with easy and low-cost access to mental health support. The important feature of the app is that it uses AI technology, specifically face detection techniques from Google Cloud Vision API, to detect users' moods from their faces and generate mood analysis reports. InTouch includes a psychological first aid course, a consultation session, journaling, and a reward system. Mobile Sensing-and-Support (MOSS), presented by Wahle et al. [62], is based on real-time learning systems that collect context-sensitive sensor information and provide real-time recommended interventions derived from CBT based on users' time, location, and personal preference. Moreover, MOSS uses smartphone sensor information to infer a subject's behavior and to provide the best intervention for the subject. Based on the feedback received, the system learns the subject's preference and changes recommendations accordingly.

In addition, myGrACE, presented by Lush et al. [63], integrates self-assessment and self-management tools with augmented reality (AR) to provide users with easy access to relevant mental health resources. The app builds on the knowledge base of the GRiST system, powered by mathematical algorithms, AI technologies, and expert data, to provide personalized interventions and support. Many MHapps based on AI provide conversational support to users, perform risk assessments, and predict moods [64] [65]. Examples are AI chatbot apps that use NLP, such as Wysa [66] and Tess [67], which use text-based conversational interfaces and provide coping strategies and self-help CBT practices based on the emotional needs of users. Woebot performs mood tracking with AI-based automated conversational interfaces [68].

2.5 Non-English apps

While the above MHapps are available in English, many others have been presented in the literature in languages other than English. The Cuida tu Ánimo (CTA) app was developed to support university students in Chile in identifying their mental health problems, providing reliable and specific information, and accessing mental health support [69]. Additionally, Mendis et al. [70] presented an MHapp for Sri Lankans that uses the General Self-Efficacy (GSE) and Depression, Anxiety, and Stress Scale-21 (DASS 21) scales to identify users' levels of negative feelings. The app uses ML and image processing techniques to offer advice and various activities for relieving these feelings. Lusog-Isip was developed by Hechanova-Alampay et al. [71] to promote the mental health and well-being of Filipino users by providing self-assessment based on WHO-5 and Filipino coping strategies scales. The users are provided with interventions and support information, such as building awareness, grounding exercises, referral networks, and self-care tools. All Lusog-Isip materials are available in Filipino and English.

Cho et al. [72] proposed and evaluated a mental health app for South Koreans. The app contains two types of tools: self-care practices and other-care practices.

Self-care practices help users cope with mental health issues such as anger, sleeping issues, and self-talk, while other-care practices offer information on taking care of others with emotional and psychological symptoms. In addition, Ore-Lara et al. [73] presented an MHapp for older adults in the city of Trujillo. The app is designed to address emotional loneliness, social loneliness, depression and improve mood using neural networks. Many MHapps presented in French App and Google Play stores have been discussed and evaluated in [74] in terms of their functionality and quality.

2.6 Arabic apps

MHapps for Arab individuals are rare and have limited features. For example, Labayh [75] is an Arabic app based in Saudi Arabia that provides patients with family and personal consultation services by connecting them to thousands of licensed therapists and experts. Patients can also attend group sessions and webinars and can schedule private instant sessions at any time. Ayadi [76] is an online therapy platform for Arabic speakers around the world to connect with experienced, qualified, and bilingual (Arabic and English) therapists and experts from the Middle East via secure video therapy sessions. Finally, Haddy, presented by Almeqbaali et al. [77], is a biofeedback-based app with a series of games to help young adults with anxiety in the UAE. Examples include biofeedback-based games, card games, falcon games, and memory games. The app also includes other features, such as yoga videos, breathing exercises, a mood-tracking calendar, and positive messaging. Haddy is available in both Arabic and English.

Despite the many available MHapps in the literature, there is a lack of Arabic mobile applications that include significant interventions such as journaling, emotional status recording, and connecting to nearby therapy centers. This work focuses on developing Dawwen, an Arabic MHapp that mitigates the lack of functionality in previous research.

3 METHODOLOGY

This research employed the waterfall model, which is a widely used approach in the Software Development Life Cycle (SDLC) process. The waterfall model is a sequential development method in which each phase logically progresses into the next phase, similar to the way water flows over the edge of a cliff. The model includes analysis, design, implementation, testing, and maintenance phases. This model was selected because its requirements are concise and explicit, and it is straightforward and simple to control because each stage has distinct endpoints; that is, each phase concludes before the beginning of the next phase. Each of the phases will be discussed in detail in the following subsections.

3.1 Requirement analysis

The analysis of the proposed MHapp, Dawwen, is based on the related work gap (Section II) and on data collected through a Google Form questionnaire distributed online to individuals from various categories in society to evaluate the operational feasibility of the application's development and to identify its key features. Approximately 198 responses were received. Table 1 shows the questions and the number of responses for each question.

Table 1. Results of the operational feasibility questionnaire

Questions	Answers			
	Yes	No		
هل شعرت بالإحباط مؤخرا؟ Have you been feeling down lately?	181	17		
كم مره تشعر بمشاعر سلبية (حزين، متوتر، مكتئب)؟ How often do you feel negative emotions (sad, stressed, depressed)?	Always	Mostly	Sometimes	Rarely
	24	80	78	16
هل سمعت عن تدوين وكتابة يوميات عن مشاعرك؟ Have you ever heard of journaling about your feelings?	Yes	No		
	149	49		
هل ترغب باستخدام تطبيق يتيح لك تسجيل افكارك وعواطفك لإعطائك أفكار تساعد في تحسين صحتك النفسية؟ Would you like to use an app that allows you to record your thoughts and emotions to give ideas that help improve your mental health?	166	32		
إذا كانت هناك دروس لتقديم المشورة حول كيفية التعامل مع هذه المشكلات بعد تحليل مدوناتك اليومية في التطبيق، فهل ستجدها مفيدة؟ If there are lessons to give advice on how to deal with problems after analysing your daily journal in the app, would you find this useful?	Yes	No	Maybe	
	107	18	73	
هل ترغب في أن يقترح التطبيق عليك أقرب المراكز الصحية لك؟ Would you like the application to suggest the nearest health centres to you?	83	55	60	
هل تجد أنه من المناسب وجود تقرير شهري في التطبيق عن حالتك النفسية؟ Would you find it appropriate to have a monthly report in the app about your psychological state?	127	39	32	
ما اللغة التي تفضل استخدامها في الكتابة؟ What language do you prefer to use in journaling?	Arabic	English	Both	Other
	84	15	98	1

The questionnaire results (questions 1 and 2) show that approximately 91% of respondents had felt down lately and that 53% of people typically experience negative emotions. To define the main features for Dawwen, we further asked the respondents (questions 3–8) for their opinion on the main features. The results showed that approximately 75% of respondents knew about daily journaling of emotions and 84% thought it was important to have a mobile application to analyze their journaling and assist them in better understanding and managing their emotions and mental health. In addition, 54% of respondents wanted recommendations for medication to deal with stress or anxiety, 42% wanted the application to show them the closest therapy centers to their location, and 64% were interested in receiving a monthly report on their feelings and journal analysis. Despite the few Arabic daily journaling and mental health applications, only 42% of respondents selected Arabic as their preferred language, while 8% preferred English and 49% selected both Arabic and English. An interactive mobile application that supports Arab people with mental health issues is important to help users analyze their feelings and provide basic advice to improve their lives.

3.2 System design

The design of the system includes identifying the main actors, defining the primary functional and nonfunctional requirements that should meet end users' needs, presenting the main unified modeling language (UML) models (e.g., system architecture

and use case), and designing the databases required and the initial high-fidelity prototype graphical user interface (GUI), which will be presented in Section 3.3.

Figure 1 shows Dawwen's system architecture diagram and provides an overall view of the main components of the software system, the details of the actors' tasks, and their interactions with the system. The proposed system consists of two actors:

- The end user is the person with mental health issues, who can use different system functionalities.
- The admin controls the proposed system component.

The main functional requirements for the admin and the end user are summarized as follows.

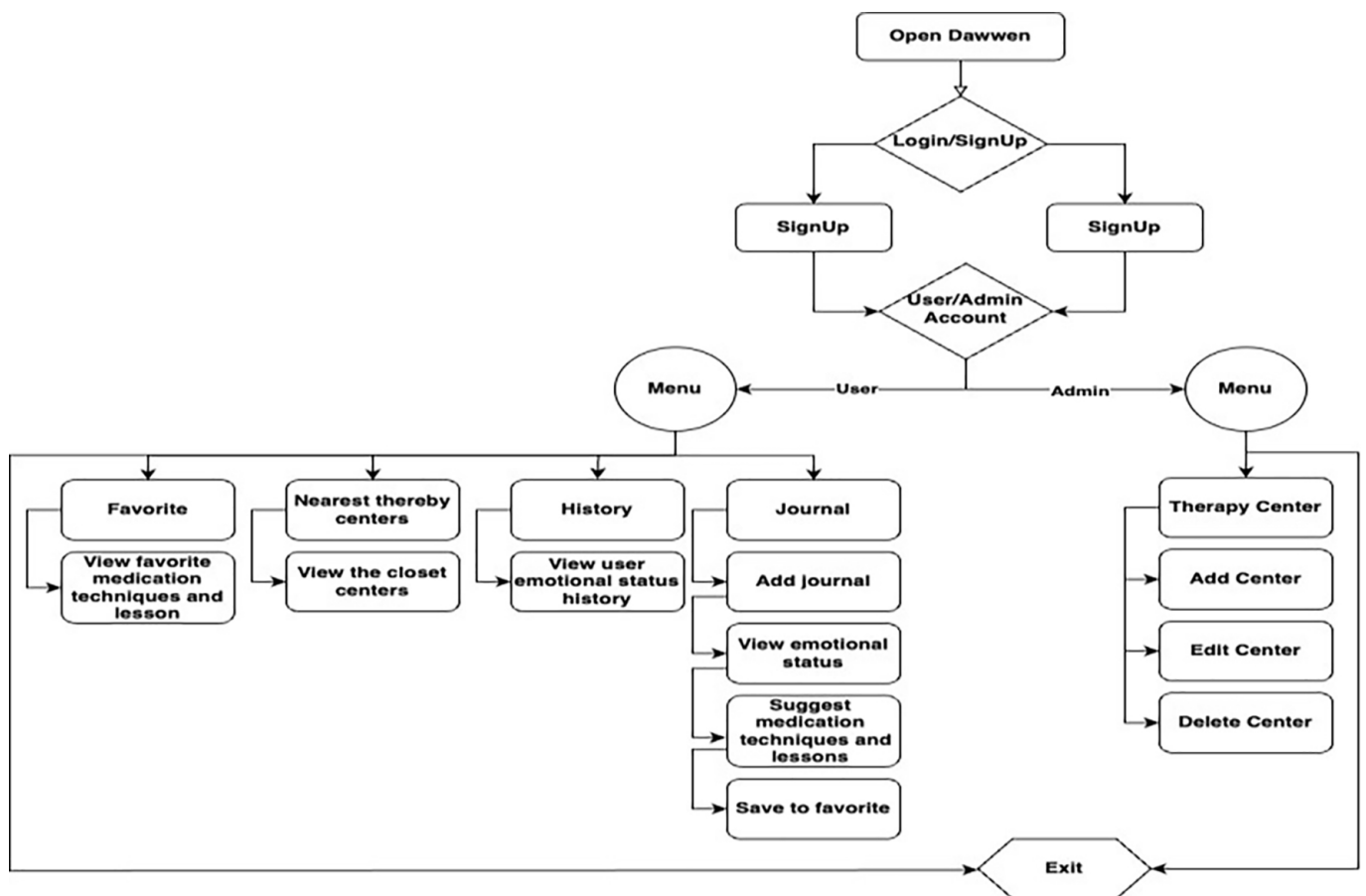


Fig. 1. Dawwen system architecture diagram

After logging in or signing up with the app, the user has the following options:

- Journal, which allows the user to write a daily journal in Arabic and analyse the text based on the NLP model to identify the user's emotional status. Based on this status, the system suggests videos and meditation techniques to the user. The user can save some of these suggestions as favourites and view them later.
- The history report contains the user's emotional status history with dates.
- The nearest therapy centres, which presents the user with the closest health and therapy centres on Google maps based on the user's current location.
- Favourites saves user-preferred videos and meditation techniques.

Additionally, the system allows the admin to add, edit, or delete health and therapy centres. Four non-functional requirements were considered in the development of Dawwen. 1) Usability: Because the system targets people with mental health issues, it should be easy to use and understand. 2) Security: All user information should be protected in the system using encryption techniques. 3) Availability: Since the system helps people with mental health issues write their feelings, it should be available to users 24/7 so they can use it whenever they feel the need. 4) Reliability: The system should be maintainable and should include updates to eliminate any bugs.

Figure 2 shows the database schema that defines the main entities of the system and the relationships between them. The database contains the following tables.

- User: Contains all personal information of Dawwen end users, including their name, email, password, and age.
- Journal: Contains the journal contents with the submission date and status.
- Therapy centres: Contains all therapy centres added by the system administration and includes centre names and centre location coordinates (i.e., latitude, longitude).
- Favourites: Contains the web link for the meditation techniques or YouTube videos preferred by the user.

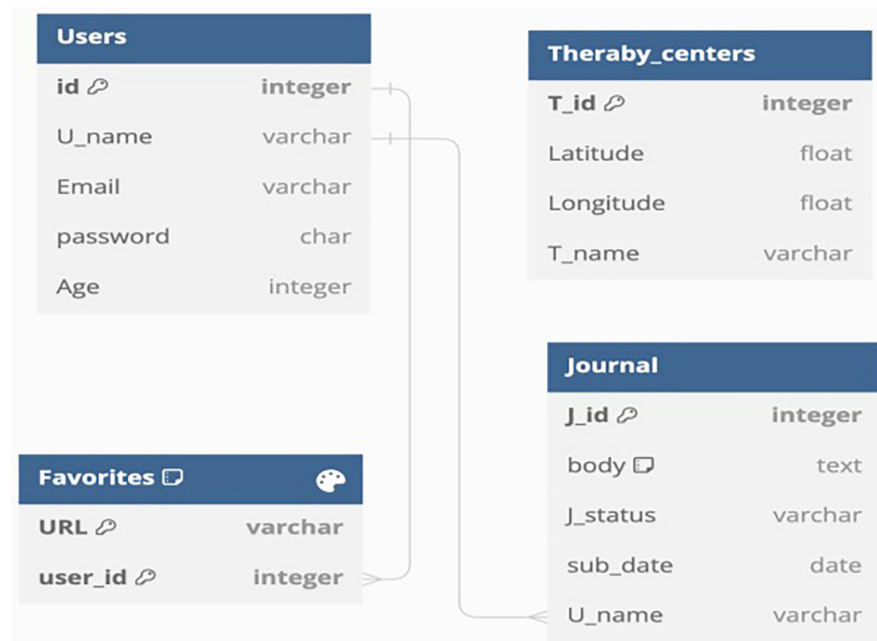


Fig. 2. Dawwen database design

3.3 System implementation and testing

Since Dawwen is an Android application compatible with all Android operating system-based smartphones, no other hardware specifications are needed. To implement Dawwen, Android Studio is used as an official integrated development environment (IDE). The graphical user interface (GUI) is created using Flutter, an open-source mobile user interface (UI) framework created by Google, and the mobile application is coded using the DART programming language. The cloud-based database Firebase, also a product of Google, is used to save tables in Dawwen.

Hugging Face’s Inference API is used to connect Dawwen with a pretrained and fine-tuned BERT base language model for Arabic (Asafaya) [78]. Asafaya is an NLP

model implemented in the transformer library that uses the Python programming language. The model is used for an emotional analysis of the user's journal text to predict its status (e.g., angry, anxiety, sadness, joy). Hugging Face's Inference API serves as an endpoint for querying the model with HTTP GET requests with the input sentence, and the API returns to the DART code the model's classification of the sentence. The full code of Dawwen is available at GitHub [79].

The white box testing technique was used to check the overall system functional requirements and to ensure that the application was working correctly. The virtual mobile device emulator provided by Android Studio was used to test the system's UI and software code. The overall testing was successful; that is, the interaction and UI design functioned as expected.

In the following subsections, the main five scenarios of the Dawwen application are described.

Sign Up/Login page. Figure 3 shows the login and home pages. The user can log in to the system by entering his or her email and password. After the Firebase authentication checks the user's existence, the user can continue to the homepage (Figure 3a–b). If the user enters the incorrect credentials, access will be denied, and an error message (e.g., “email is incorrect” or “password is incorrect”) will appear (Figure 3c). If the user forgets the password, he or she can reset it by clicking the “forgot password?” link, which leads to a page where the user can insert his or her email address to receive a password reset link (Figure 4).

If the user account does not exist, the user can sign up by clicking the “register now” link at the bottom of the login page. On the sign-up page (Figure 5), the user must enter his or her credentials (first and last name, age, email, password, and confirm password) and click the “new account” button. The application will validate the inputs, which are then sent to the Firebase database that stores the data. The user must fill all input fields, and the password must be between six and eight digits. If the password and confirm password fields do not match, an error message will appear; otherwise, the registration is complete, and the user will be transferred to the homepage to use the application. The credentials are sent to the Firebase database, which stores the user's data.

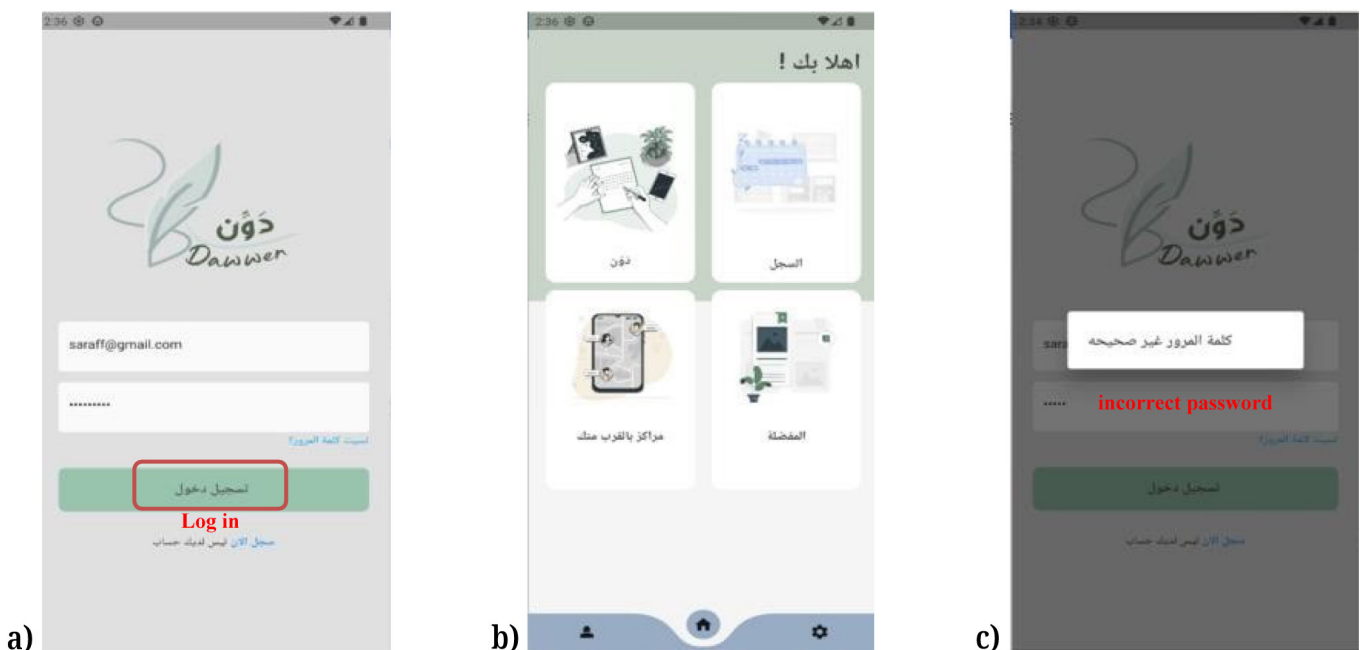


Fig. 3. The login page (a) leads to the home page (b) if the user's email and password are inserted correctly; otherwise, the user receives an “incorrect password” message (c)

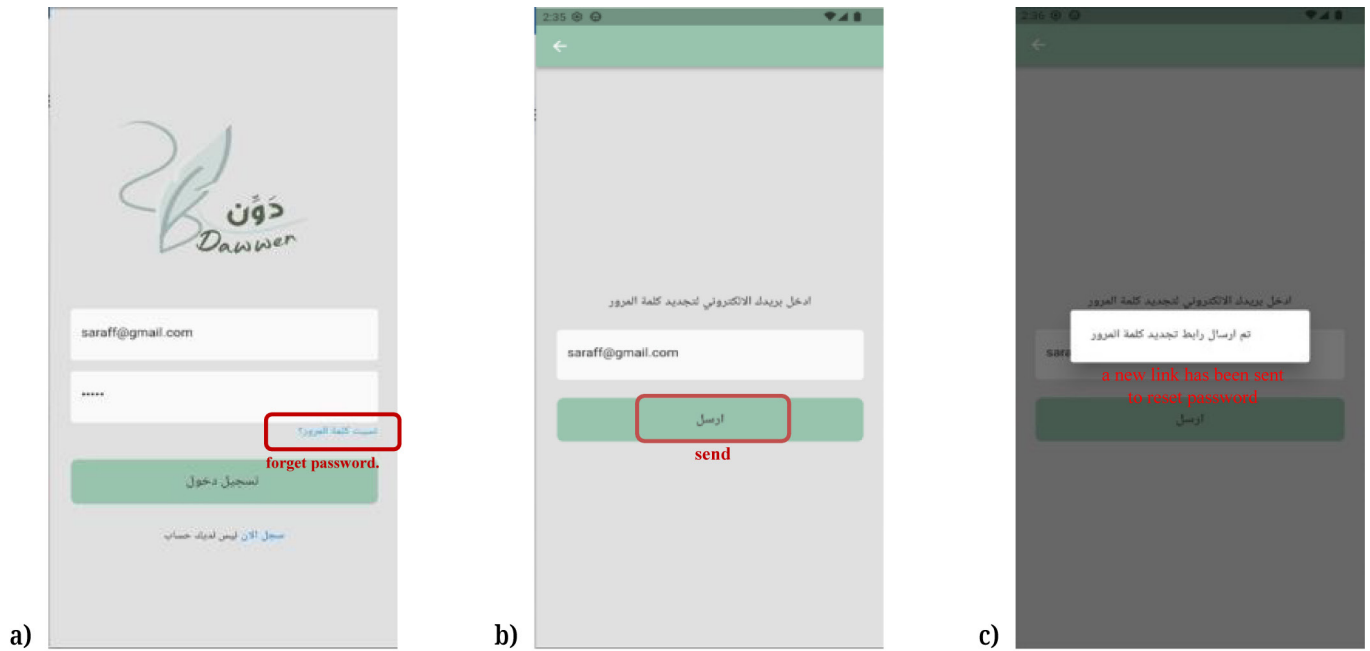


Fig. 4. The “forget password” link in the login page (a) leads to the “insert your email” page (b) to receive the message “a new link has been sent to reset password” (c)

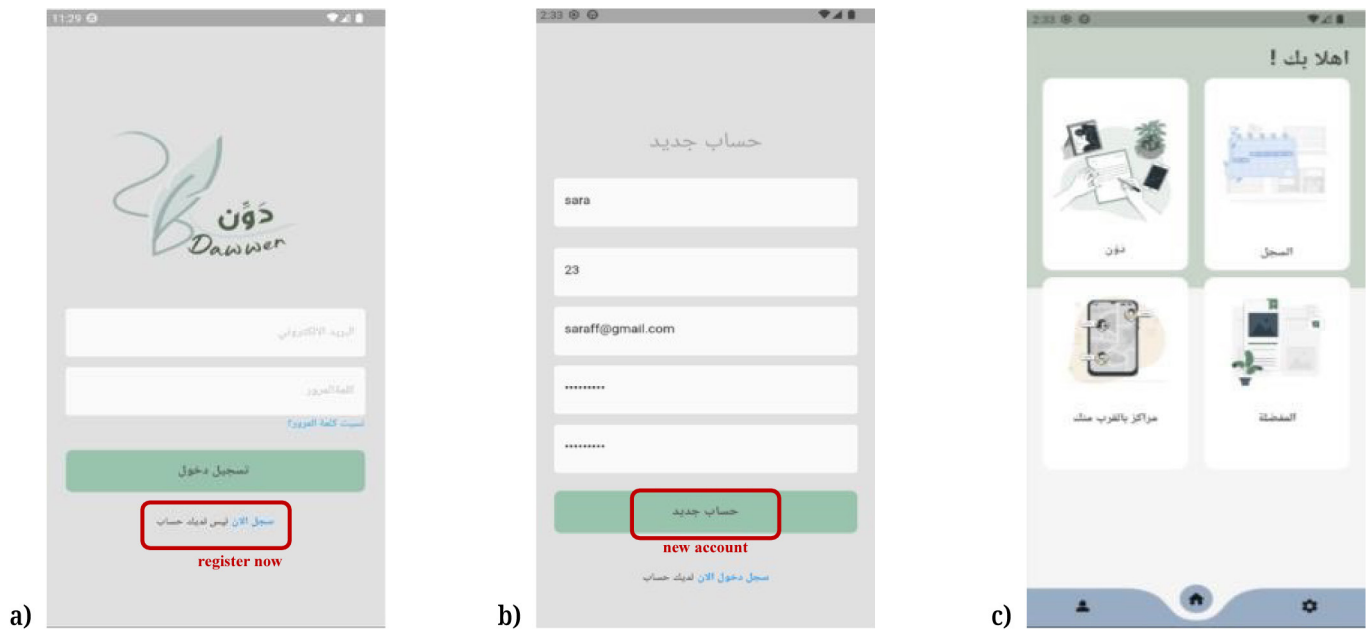


Fig. 5. The “register now” link in the login page (a) leads to the “new account” page (b) where a new user can insert his or her information to navigate to the homepage (c)

Homepage. The homepage is the main screen of the application that allows users to navigate to four options, journal, favorite, history, and nearest therapy centers, and two sub-options in the navigation bar, the profile and settings pages. The profile page includes the user’s main information and allows the user to log out and go back to the login page (Figure 6a). The settings page includes three links to the subpages titled “about us,” “FAQs,” and “contact us” (Figures 6b–e). The four main options will be described in the following subsections.

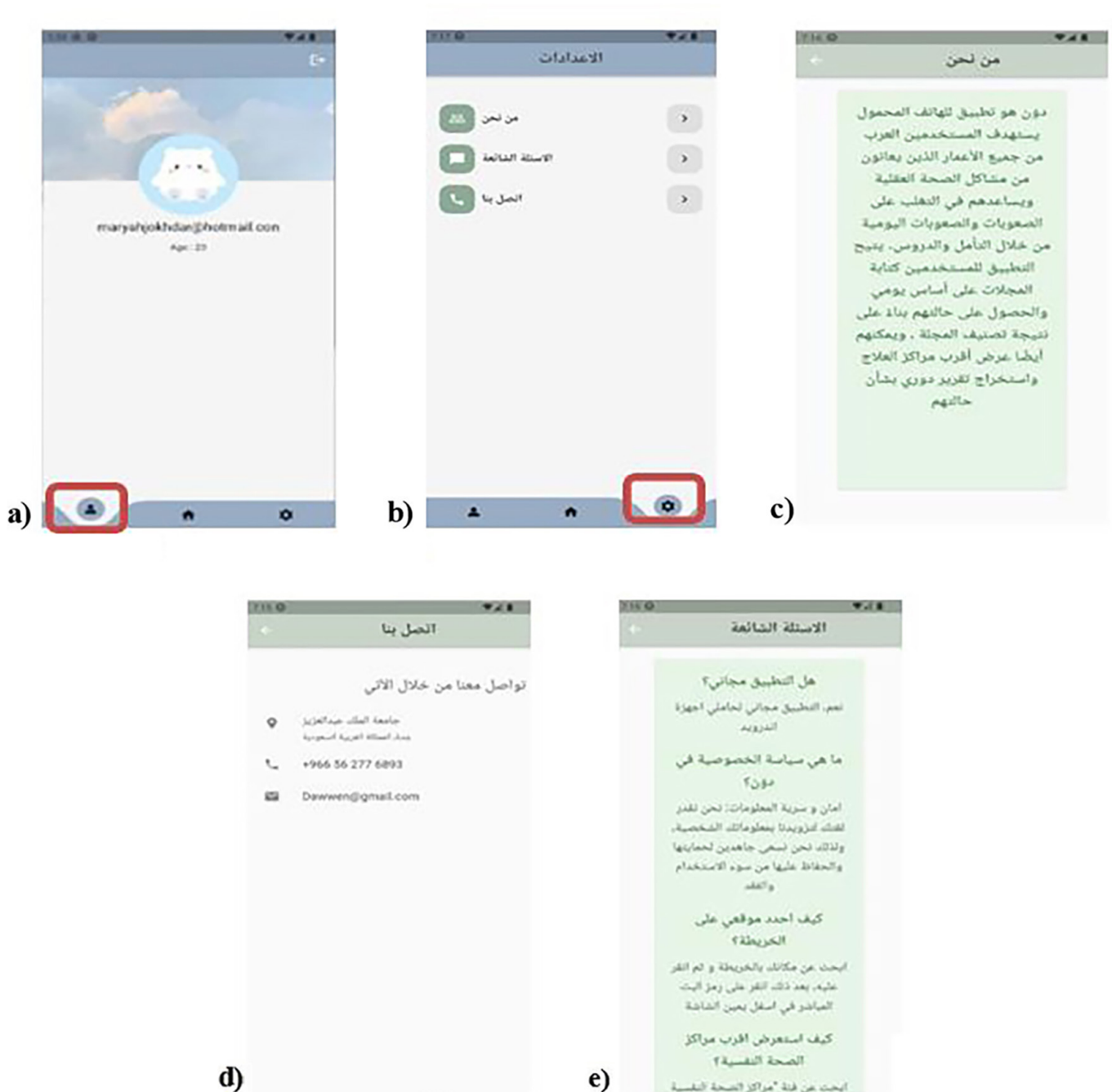


Fig. 6. The two sub-options of the homepage, the profile page (a), and the settings page (b), which leads to three pages, “about us” (c), “contact us” (d), and FAQs (e)

Journal page. This page provides a journaling space where the user can write about his or her feelings and status on the same day (if any). When the user clicks on the submit button, the text is sent to the NLP model, which analyzes the text and sends the emotional status (class) back to the user. The inserted text, emotional status, and submission date are saved in the Firebase database. Furthermore, based on the user status, the user will either receive encouraging feedback (e.g., joy) or view a recommendation for meditation techniques and videos for that status (e.g., anger, sadness, or anxiety). By clicking on the star icon, the user can further mark some

of the recommendations to be added to his or her favorites for fast access at any time and then view the recommendations list later from the Favorites page. Figures (7–10) show examples of different scenarios of journals and how the system reacts to each journal.

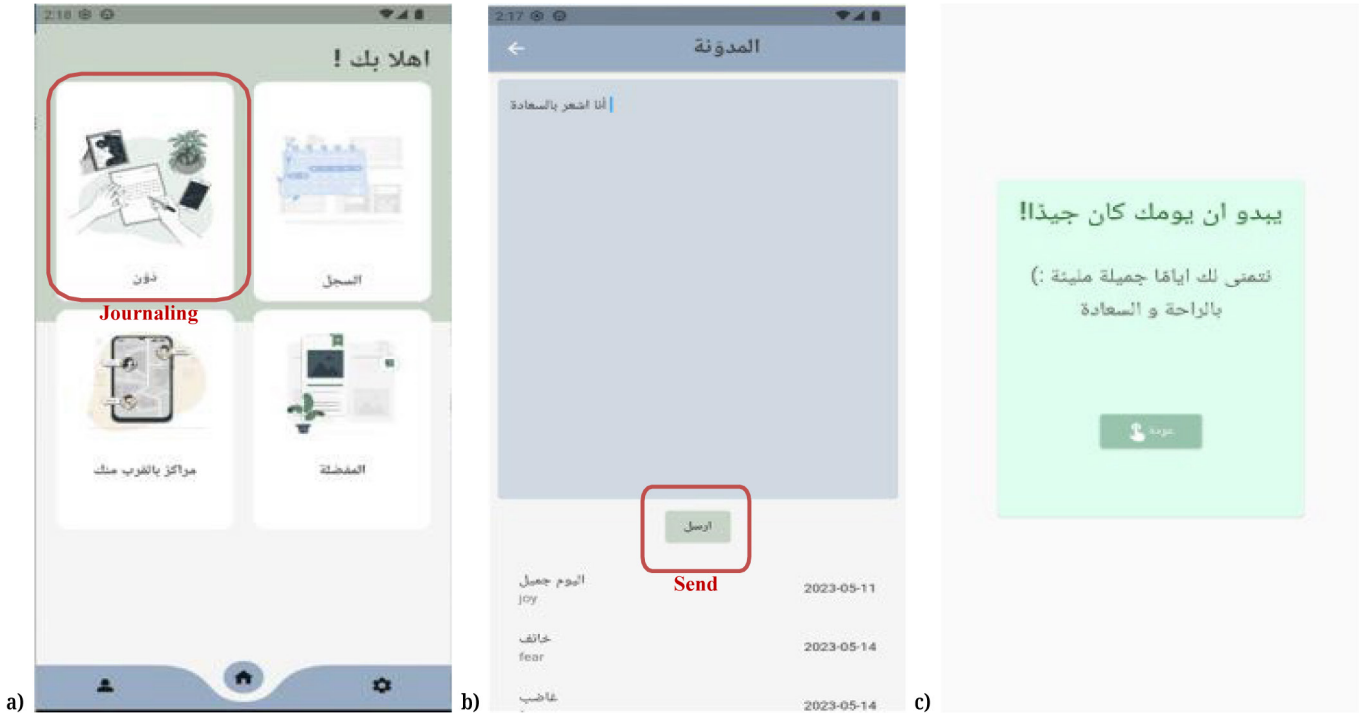


Fig. 7. Scenario 1: The journal option on the homepage (a) leads to the “journal space” page, where the user inserted a positive feeling (b), pressed the “send” button, and received encouragement feedback based on the NLP analysis (c)

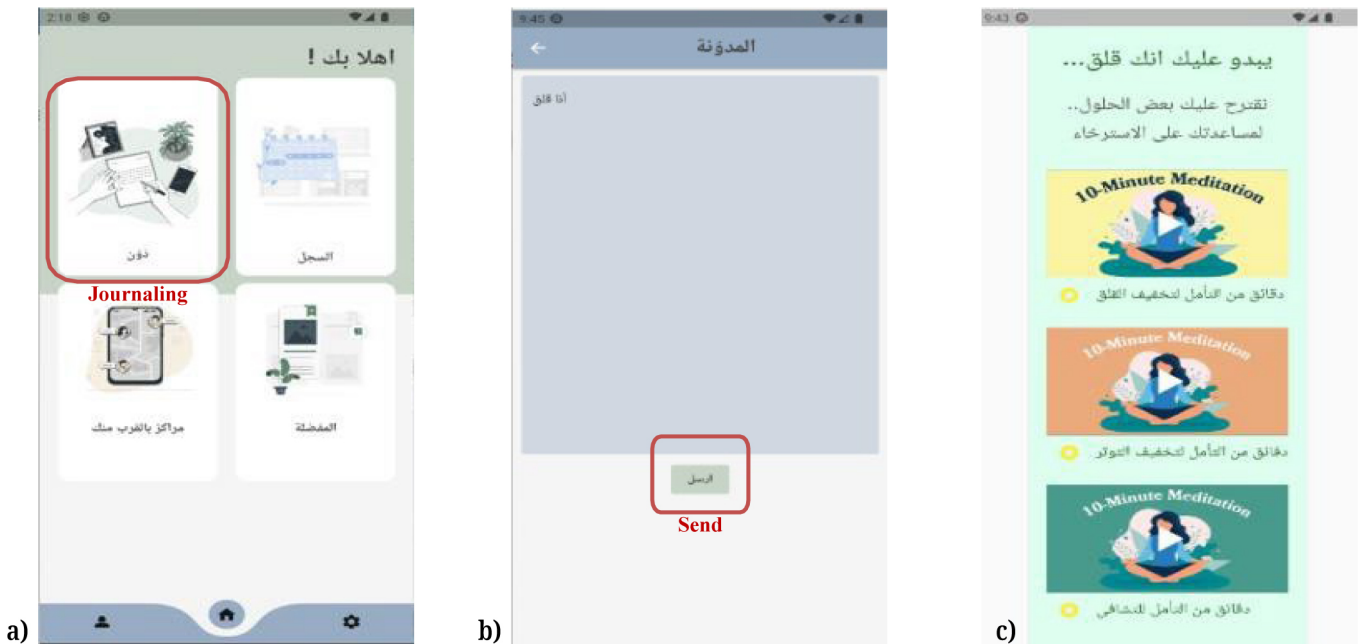


Fig. 8. Scenario 2: The journal option on the homepage (a) leads to the “journal space” page, where the user inserted an anxiety feeling (b) and received recommended anxiety meditation and practices based on the NLP analysis (c)



Fig. 9. Scenario 3: The journal option on the homepage (a) leads to the “journal space” page, where the user inserted an anger feeling (b) and received recommended anger meditation and practices based on the NLP analysis (c)

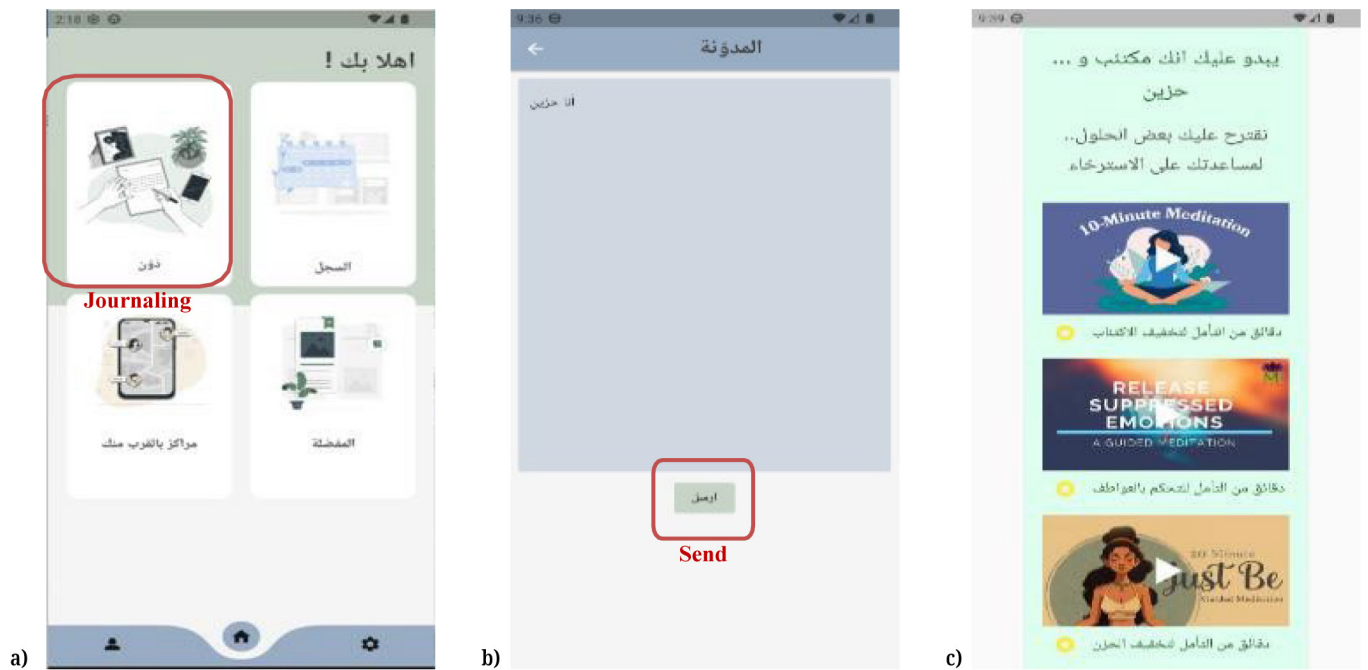


Fig. 10. Scenario 4: The journal option in the homepage (a) leads to the “journal space” page, where the user inserted a sad feeling (b) and received recommended sadness meditation and practices based on the NLP analysis (c)

History page. A historical record of the user’s previous entries and status with submission dates can be viewed on this page (Figure 11).

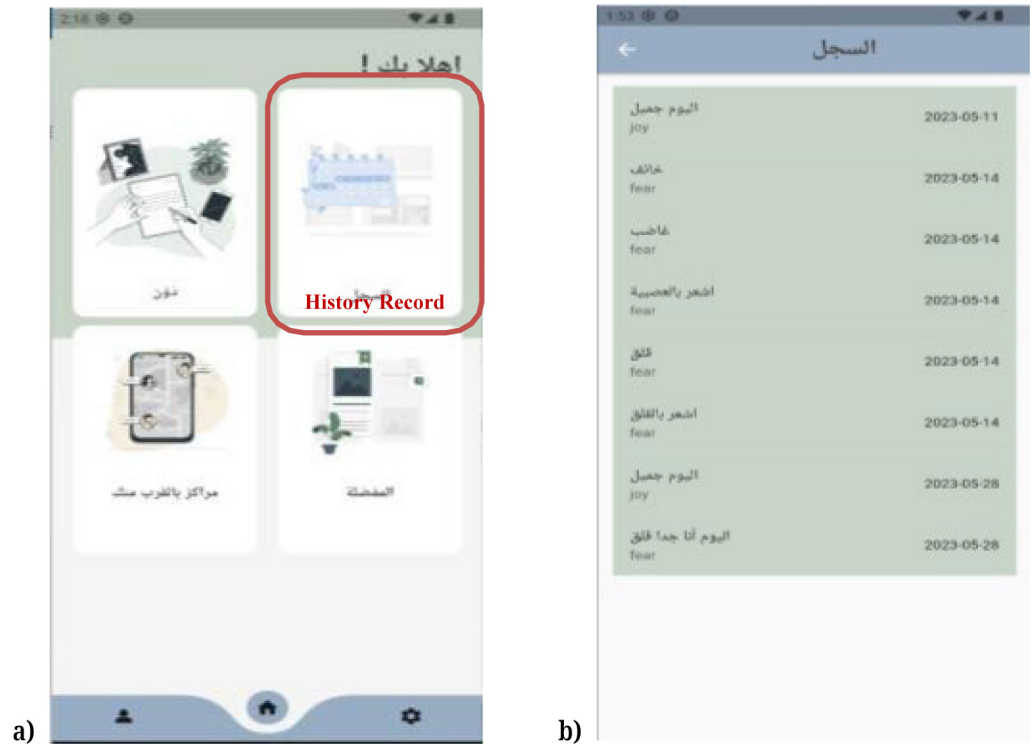


Fig. 11. The “History Record” option in the homepage (left) leads to the user’s emotional status record (right)

Nearest therapy centers page. This page (Figure 12) allows the user to select his or her current location on Google Maps by clicking the “determine your location” button. The nearest therapy centers appear on the map, and the user can view each center’s information (e.g., address, name).

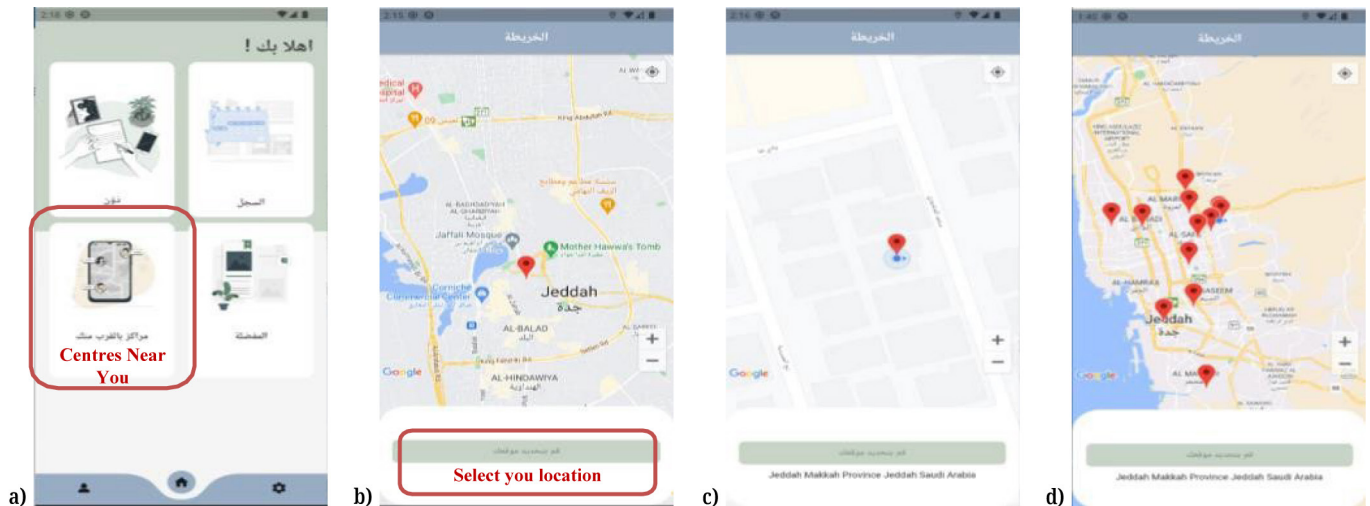


Fig. 12. The “Centers Near You” option on the homepage (a) leads to the Google Map (b), where the user can select his or her geolocation as shown in (c) and then zoom out to see the closest therapy centers (d)

4 SYSTEM EVALUATION

To measure the usability and effectiveness of the Dawwen application, the system usability scale (SUS) [80] is used, which consists of ten statements. Each statement

has five response options from 1–5, where 1 means “strongly disagree” and 5 means “strongly agree” (refer to Table 2). We obtained a total of 10 responses after testing different functionalities of the Dawwen application (login/sign up, journal, nearest centers, etc.). The overall results of these responses are shown in Figure 13. The average SUS score for the results is 88.25%.

Table 2. System usability scale statements

SUS Statements	
1.	I like to use this system frequently.
2.	I find this system to be more complicated than it should be.
3.	I think the system is simple and easy to use.
4.	I need technical support to use this system.
5.	I find that the system functions smoothly and is well integrated.
6.	I think there are a lot of irregularities in the system.
7.	I think most people can learn this system quickly.
8.	I find this system to be time consuming.
9.	I feel confident about using this system.
10.	I think there are a lot of things to learn before I can start using this system.

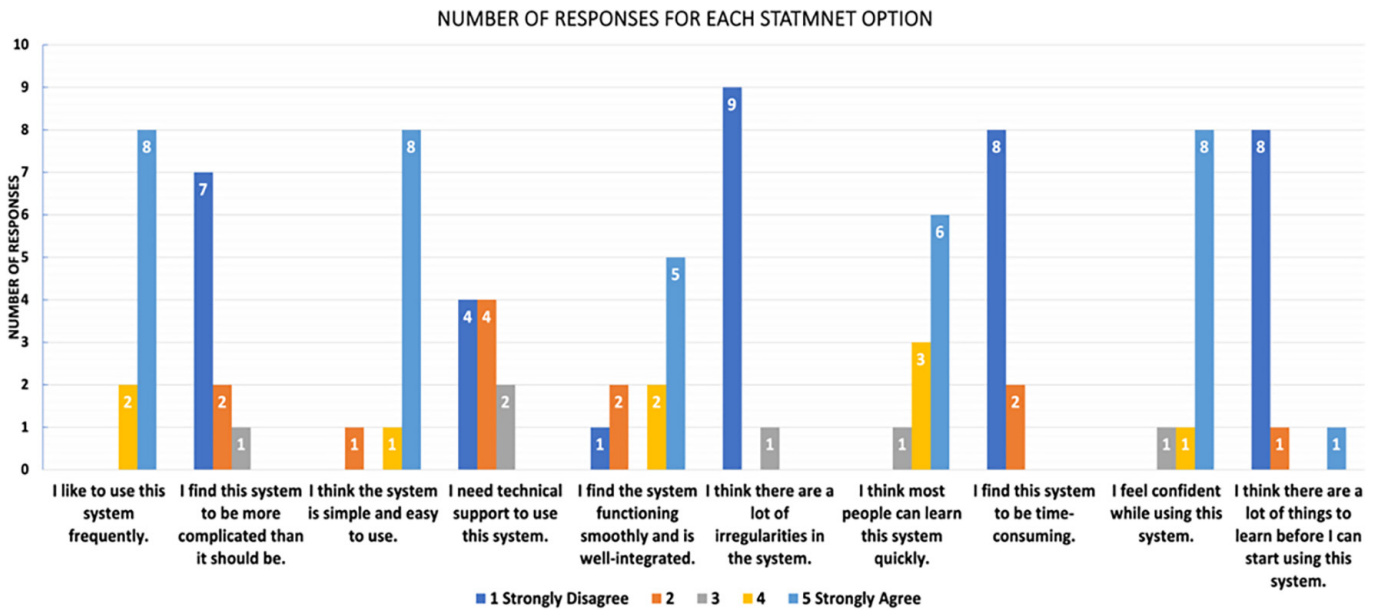


Fig. 13. The SUS statement results for Dawwen

The survey results indicate flawless usability and an excellent user experience with the Dawwen mobile application features and activities. On average, 90% of the respondents found the application easy to use and easy to learn, and they felt confident while using the system. Furthermore, 70% agreed that the system had smooth functionality and good integration. We conclude that an interactive mobile application that supports Arab people with mental health issues is important to help users with online journaling and finding real-time therapy with meditation recommendations. The use of smartphones and mobile apps for mental health should be considered and increased.

5 CONCLUSION

People who suffer from mental health issues such as depression, anxiety, anger, and stress are increasingly concerned about their mental health and wellness. Some people prefer online counselling instead of face-to-face counselling because it is more efficient. As mobile apps have grown in popularity, mental health services-based mobile apps (MHapps) have shown great promise in enhancing behaviors, facilitating therapist support, increasing the quality of care, allowing access to many treatments and online interventions, and prompting self-monitoring.

In many Arab countries, however, there is limited availability of online resources and mobile applications that can help people express their feelings and provide real-time medication recommendations. Therefore, we presented an interactive Android mobile application prototype, Dawwen, to assist Arab people with mental health issues in overcoming their daily challenges by providing online journaling and suggesting medication techniques based on users' emotional status analyzed from the text.

The prototype of Dawwen has been augmented with NLP technologies, an easy-to-use and intuitive user interface, and integrated features. To define the importance of Dawwen and its main features, we distributed an online questionnaire to individuals from various categories of society. We found that 84% of respondents thought it was important to have such MHapps to analyze their journaling and help them better understand and manage their emotions and mental health. The average SUS usability measurement score for Dawwen was 88.25%, which clearly indicates the intuitiveness and usefulness of the overall functionality of the application.

There are many future opportunities to enhance Dawwen by including more features and services. Examples include specific health reports based on the inserted date range, quizzes, online messaging with mental health caregivers, including reminders for participation and engagement, appointments scheduling with health centers, implementing ongoing user feedback mechanisms for continuous enhancement, creating community-oriented features to foster user connection and support, ensuring robust data privacy and security measures, with clear communication on user data handling, and expanding the content library with educational materials, articles, and videos on mental health topics.

It is also important to add AI-based services such as audio journaling with emotion recognition using speech analysis as a simpler method for expressing feelings because mobile typing can be difficult for some people with mental health issues. Other AI-based services include utilizing machine learning algorithms for tailored content and recommendations based on user journaling patterns and enhancing accessibility features such as text-to-speech and adjustable text sizes. In addition, stronger evidence is required for the effectiveness of Dawwen in a large population.

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