

Development of a Mobile Application for Effective Mental Health Intervention

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Abstract

The global surge in depression and anxiety, intensified by challenges such as cost and stigma, emphasizes the pressing need for accessible, evidence-based digital solutions. The research centers on the creation of a mobile application specifically designed to address mental health challenges. By integrating cognitive behavioral therapy techniques and features like appointment bookings and mindfulness feedback tools, the app is positioned to improve user outcomes. Utilizing platforms like React Native and React, combined with NestJS for enhanced back-end security, the application adheres to the rigorous standards required for mental health interventions. Collaborative efforts with experts, notably the counseling unit of IIUM, ensure the app's alignment with contemporary best practices and research. Preliminary findings indicate a promising tool with the potential to address the global mental health treatment disparity.

Keywords:

Mental health, Depression, Anxiety, Digital interventions, Mobile application, Cognitive-behavioral therapy, Mindfulness React Native, React Dashboard tools

1. Introduction

Mental health plays a vital role in overall well-being, a fact that has become increasingly evident during the COVID-19 pandemic. Unfortunately, access to mental health care remains an obstacle for many, especially for college students grappling with high levels of stress. Factors impeding access to care include stigma surrounding mental health, the cost of treatment, and a shortage of mental health professionals. These barriers can result in delayed or inadequate treatment, leading to severe repercussions for those struggling with mental health concerns.

Moreover, the research will focus on understanding the unique stressors faced by college students and how mobile interventions can be tailored to address these specific needs effectively. The research also explores strategies to reduce the stigma associated with seeking mental health support, as well as identify methods to lower costs and increase the

availability of mental health professionals for those in need.

Mental health, as defined by the World Health Organization (WHO), pertains to an individual's ability to realize potential, maintain relationships, cope with stress, and contribute to society [1], [2]. It's not just the absence of mental illness but also encompasses cognitive functioning, allowing people to accomplish tasks and form good connections [2]. The WHO emphasizes the interrelation of mental and physical health, with research indicating that mental health issues can lead to physical ailments and vice versa what is [3]. The biopsychosocial model suggests health is influenced by biological, psychological, and social factors, emphasizing the importance of mental health in overall well-being. Modern definitions further highlight mental health's role in overall well-being, emphasizing self-acceptance, inner peace, and social functionality [3].

Mobile applications, or apps, are software for portable devices like smartphones and tablets [4]. Their definition has evolved with technological advancements. Initially limited in capabilities, today's apps access various device features, from GPS to cameras. The use of cross-platform frameworks allows apps to function on multiple platforms, like iOS and Android. Machine learning and artificial intelligence in app development enable personalized user experiences, with AI-powered chatbots and ML-powered health apps offering tailored recommendations.

Mobile platforms, or operating systems, manage mobile devices. The primary platforms include Android, iOS, and Windows Phone [5].

Android, an open-source system from Google and the Open Handset Alliance, has a vast developer community and its apps are available on Google Play. iOS, developed by Apple, offers a unique user experience and its apps are available on Apple's App Store.

Mindfulness-Based Interventions (MBIs), particularly Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT), have gained traction for their positive impact on mental health, especially in treating depression and anxiety disorders [6]. MBSR, developed by Jon Kabat-Zinn, is an eight-week program emphasizing mindfulness meditation, body awareness, and yoga [6]. Research, including a meta-analysis by Khoury et al., has confirmed MBSR's effectiveness in reducing depression and anxiety symptoms [6]. MBCT, integrating mindfulness with cognitive-behavioural therapy, was designed to prevent depressive relapse. While both interventions promote mindfulness, MBSR focuses on stress reduction, whereas MBCT targets recurrent depressive disorder [6]. MBIs have also been adapted for various settings, like schools and workplaces, showcasing their adaptability [7]. However, they might not suit everyone, emphasizing the need for professional guidance [7].

Interpersonal therapy (IPT) centres on the relationship between an individual's ongoing relationships and psychological symptoms. Developed by Gerald Klerman and Myrna Weissman in the 1970s, IPT focuses on current social roles and relationships, addressing the root of distress [8]. It emphasizes four interpersonal problem areas: unresolved grief, role transitions, role disputes, or interpersonal deficits. IPT's efficacy in treating depression is well-documented, and its benefits extend to other disorders, such as bulimia nervosa and PTSD [8][9]. Adaptations like IPT-A for adolescents have also shown promise. IPT's flexibility, with versions like group formats and internet-based adaptations, enhances its accessibility [10]. In essence, IPT's focus on interpersonal relationships makes it a potent tool in mental health management [10].

2. Methodology

This project's centrepiece is a mobile application designed to address mental health challenges holistically. Developed in line with a specific system framework, the app integrates evidence-based cognitive behavioural therapy and mindfulness techniques, providing users with validated mental health tools.

The proposed system shown in detail in Figure 1 comprises three fundamental components:

- End-User Mobile Application (Front-end) developed using React Native.
- Admin Dashboard (Front-end) developed using React.
- Back-End System built with NestJS, hosted on AWS, and integrated with Firebase for added functionalities.

The first step in the development process involves designing the user interface (UI) for both the mobile application and the Admin Dashboard. Given that target users are individuals struggling with mental health disorders the research utilizes User Centered Design (UCD) as the research approach. This approach prioritizes the needs, preferences, and experiences of the end users through iterative prototyping and validation testing. To ensure that the app is effective.

The research utilizes techniques such as user interviews, focus groups, and usability testing. In terms of backend infrastructure, the research aims to create a real time system due to the time critical nature of mental health intervention. This requires blending two architectures: REST architecture for non-time critical functionalities like blog posts and a Publish/Subscribe (Pub/Sub) model for real time features like chat and notifications. The choice of NestJS as the system back-end system because of its modularity, scalability, and maintainability.

For reliable cloud services deployment and management purposes, AWS was selected. Additionally, Firebase is integrated for push notification and user third party user authentication capabilities, and other cloud services. To assess how effective the application is in fostering better mental health outcomes. Survey research was also conducted

as a part of the thesis. Surveys allow us to gather extensive data from a diverse group of participants. Through the survey. The user attitude will be evaluated, behaviours, and perceptions regarding the effectiveness of the application' impact on their mental health. In summary, a hybrid research methodology, combining user-centered design principles for app development followed by survey research for user experience evaluation, offers a promising approach for constructing a highly effective mental health prevention mobile app. This approach seamlessly amalgamates the technology of React Native, React, AWS, Firebase, and NestJS to revolutionize.

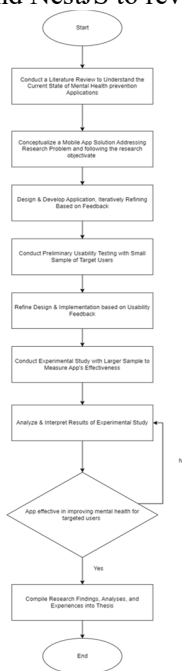


Figure 1 Proposed model of the system

2.1 Front-End Architecture

The front-end architecture shown in figure 1 combines React, Redux, and Socket.IO. The "React Application" package is central, connecting various components like Login, Registration, and Chat. Redux ensures efficient state management, while middleware bridges the Redux Store, handling API Calls and Socket.IO Client operations.

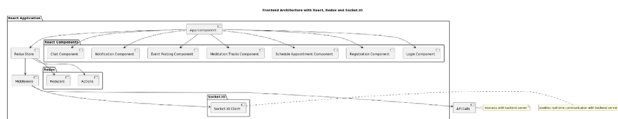


Figure 2 Front-End Architecture

2.2 Back-End Architecture

Built on the NestJS framework, the backend architecture shown in Figure 2 is organized and maintainable. Controllers manage HTTP requests, Services handle business logic, and the Data Access Layer interacts with MongoDB and Redis cache. Socket.IO enables real-time communication. Overall, the architecture showcases a cohesive, adaptable design, integrating various technologies for a robust system.

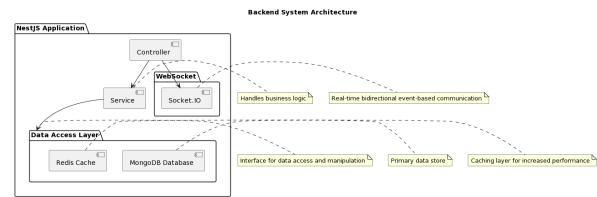


Figure 3 Back-End Architecture

2.3 User Interface

The application design should follow design one of the design principles. Moreover, the user interface (UI) of a mobile application plays a critical role in determining its effectiveness and user engagement. This is especially true for mental health prevention applications where UI design can directly influence the user's experience, including stress levels and the overall emotional state. The design principles applied to this application specifically target the relief of stress through mindfulness, in alignment with psychological and human-computer interaction research, Figure 4 shows the Mobile app screens.

3. RESULTS

The research introduces a developed application, which focuses on the field of mental health prevention. Taking inspiration from Mindfulness and Cognitive Behavioral Therapy (CBT) the application combines proven strategies that promote wellbeing and prevent health disorders. This section explores the resulted features of the application each designed to provide users with resources and tools to better understand health and take proactive measures to maintain balance. Later sections will discuss user feedback, providing insights into the application's usability, functionality, and overall impact.

3.1 Mental Health Mobile Application

If The research presents a designed application built using React Native, which serves as a tool in the field of mental health prevention. The application incorporates principles from Mindfulness and Cognitive Behavioral Therapy (CBT) two evidence-based approaches known for their effectiveness in promoting wellbeing and preventing health disorders.

Within the application the "Blogs" section offers users a curated collection of articles and insights that explore the concepts of Mindfulness and CBT. By reading these blogs users can deepen their understanding of techniques and strategies that can be integrated into life to maintain mental balance. These articles not. Also empower users to recognize early signs of mental distress equipping them with tools to navigate challenges.

Another important feature is the "Tracks Listening" section, where users can engage in guided mindfulness meditation sessions. These sessions play a role, in facilitating present moment awareness helping users stay grounded reduce stress and encourage judgmental self-reflection through regular practice. Over time regularly practicing this approach can greatly enhance resilience. Act as a protective factor against the development of mental health problems.

The "Chat" section takes inspiration from Cognitive Behavioral Therapy principles. It provides users with a platform where they can engage in real time conversations with trained professionals or AI powered chatbots. These conversations are designed to help users identify, challenge, and reframe thought patterns that often contribute to mental health challenges. By offering feedback and presenting perspectives the chat feature assists users in cultivating healthier cognitive habits thereby preventing minor stressors from escalating into more serious mental health issues.

Additionally, the "Booking and Appointments" section simplifies the process of scheduling sessions with health experts. Acknowledging the significance of intervention, in halting the progression of health disorders, this feature ensures that users can promptly access expert guidance. Whether individuals seek an understanding of practices, want to explore CBT techniques or simply require a space to express and process their emotions, this section facilitates these interactions by making professional support easily available.

In essence the research application is a platform that seamlessly integrates Mindfulness and Cognitive Behavioral Therapy principles

The Application also includes a web version shown in Figure 7 which has all the functionalities of the mobile version but also includes a peer, and admin dashboard shown in figure 6 which manages the content of the app, users, and other app related settings. Peer can also manage appointments using the web version of the app. The peer dashboard can be shown in figure 5.

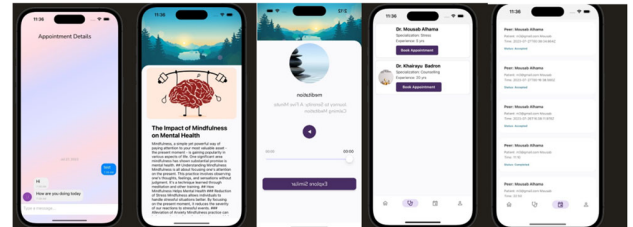


Figure 1 Mobile App screens

Your Appointments

Appointment ID	Appointment Date	Appointment Time	Status	Action	Action	Action
1000	2023-07-10	07:00:00	Completed	COMPLETE	ACCEPT	GO TO CHAT
1001	2023-07-10	07:00:00	Completed	COMPLETE	ACCEPT	GO TO CHAT
1002	2023-07-10	07:00:00	Completed	COMPLETE	ACCEPT	GO TO CHAT
1003	2023-07-10	07:00:00	Completed	COMPLETE	ACCEPT	GO TO CHAT
1004	2023-07-10	07:00:00	Completed	COMPLETE	ACCEPT	GO TO CHAT
1005	2023-07-10	07:00:00	Completed	COMPLETE	ACCEPT	GO TO CHAT
1006	2023-07-10	07:00:00	Completed	COMPLETE	ACCEPT	GO TO CHAT
1007	2023-07-10	07:00:00	Completed	COMPLETE	ACCEPT	GO TO CHAT
1008	2023-07-10	07:00:00	Completed	COMPLETE	ACCEPT	GO TO CHAT
1009	2023-07-10	07:00:00	Completed	COMPLETE	ACCEPT	GO TO CHAT
1010	2023-07-10	07:00:00	Completed	COMPLETE	ACCEPT	GO TO CHAT

Figure 2 Appointment management

Mental Health App

Home Dashboard **Logout**

All Users

S.No	Pic	First Name	Last Name	Email	Mobile No.	Age
1		Mousab	Alhama	m2@gmail.com		
2		Mousab 3	Alhamada	mosab3@gmail.com		
3		m3@gmail.com	Mousab	m3@gmail.com		
4		Mousab Patient	Alahamada	mosab1@gmail.com		
5		Khairayu	Badran	khairayu@iium.edu.my		
6		Mousab	mousab	mousab@gmail.com		
7		mousab	testing	testing@gmail.com		
8		test	test	test@gmail.com		

Logout

Figure 3 Admin Dashboard

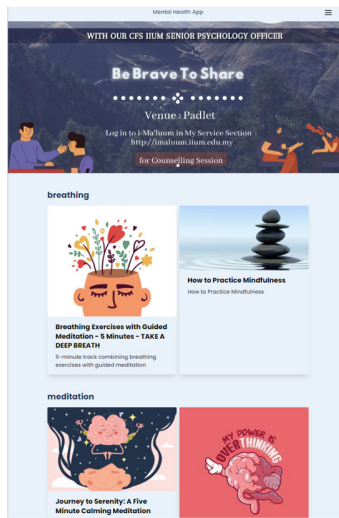


Figure 4 Main web page

3.1 Survey Results:

A survey was conducted to collect feedback on the usability, functionality, and effectiveness of the mental health mindfulness app. The survey included a mix of quantitative and qualitative questions designed to assess user experience and satisfaction with the app's features and content.

The results of the survey were quite interesting, 36% of users gave the app a 7 point on the overall experience, most of users found the resources helpful while some reported the need for more diverse content. Figure 8 shows the overall results from the survey.

On a scale of 1-10, how would you rate the over all user experience of the app

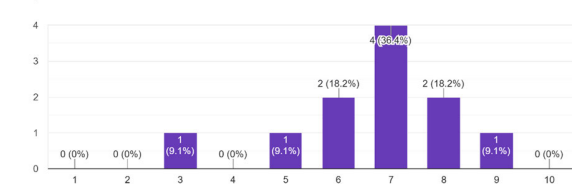


Figure 5 User experience Result

As shown in Figure 9 , 53.8% of users reported having no immediate mental health improvement affect, that could be because the app was not given enough testing time.

Have you observed any discernible positive changes in your mental health or emotional well-being since you started using our app?
13 responses

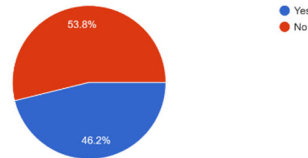


Figure 6 Mental health effect results

Users reported using the app with varying frequencies ranging from times a day to a times a week. However as shown in figure 10 about 38.5% were using the app more than once a day, this could mean that the app needs more diverse content to keep users interested.

How frequently do you engage with our mental health since you received it .
13 responses

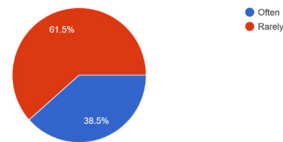


Figure 7 User engagement results

Figure 11 shows that around 84.6 % of users thought the resources of the application were helpful.

Does the app offer a comprehensive and diverse set of coping strategies, therapeutic techniques, and resources to support your mental health needs?
13 responses

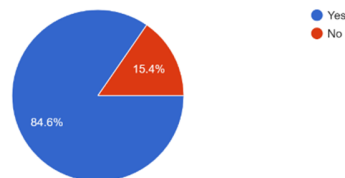


Figure 8 User Engagement results

Most users 61.5 % were excited about sharing the app with their friends struggling with mental health issues, these results are shown in figure 12.

Would you advocate for the use of this mental health app among individuals who are grappling with similar mental health conditions as yours?
13 responses

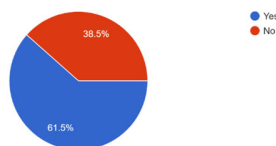


Figure 9 Mental Health management results

The highlight of the results were how many users thought the app could better manage their mental health as shown in figure 13, with 92.3% thinking the app empowered them to take control of their mental health.

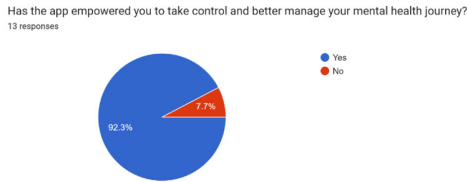


Figure 10 User app recommendation results

The responses from users on how the application can improve suggest several potential areas for improvement and additional features they'd like to see in the mental health app:

Content Enhancement: Users expressed the desire for more content in general, but specifically more interactive content. They suggested the addition of features like quizzes, games, and video tutorials or guided meditations that focus on mental health. These suggestions indicate a preference for active learning experiences.

Community Interaction: Users value the opportunity to connect and interact with others who are using the app. The idea of adding a community forum or chat feature was popular, demonstrating a need for peer support and shared experiences.

Personalization: Several users requested more personalized content, including the ability to customize their own daily mental health plans and recommendations based on their usage patterns or identified areas of concern.

Improved Navigation: Better search functionality was requested to make it easier for users to navigate the resources available in the app.

Video-Based Therapy: The idea of adding video-based therapy sessions was mentioned, illustrating a demand for more comprehensive therapeutic resources within the app.

The responses illustrate a range of experiences regarding the relevance and alignment of the app's resources and activities to the users' specific mental health concerns and treatment goals.

A considerable portion of users expressed positive feedback, affirming that the app's resources align well with their mental health needs and have contributed to a greater sense of empowerment and control over their mental health. These users praised the personalized content, indicating that the app's effort to tailor its resources to individual needs is well-received and effective. Specific components, such as mindfulness exercises, were noted as particularly beneficial. However, some users voiced mixed feelings. They found some of the activities and resources to be relevant and beneficial, but not all. This implies that while the app

successfully caters to certain aspects of their mental health needs, there are areas which could be addressed more accurately or thoroughly. This may suggest a need for further diversification of content to encompass a broader spectrum of mental health conditions and coping strategies. Users provided feedback on areas for improvement or additional features, including content, real time support personalized coping strategies and a wider range of resources.

In conclusion, users are seeking an enriched, interactive, and more personalized experience, improved app performance, and enhanced community interaction features. These enhancements could increase user satisfaction and engagement with the app.

4. CONCLUSION

In this research, the research aimed to determine how a mobile application could assist individuals with health challenges. The research focused on aligning the app with Cognitive Behavioural Therapy (CBT) and Mindfulness Based Stress Reduction (MBSR), recognized treatments for mental health disorders. The development process involved usability analysis, simulating user experiences, gathering user feedback, and consulting mental health professionals. These methods illuminated the app's effectiveness and relevance in health support.

Usability analysis assessed the app's interface design, while simulated user experiences identified potential user challenges. Feedback from users and health experts bridged the gap between technological design and real-world utility. Users highlighted the app's benefits and areas for improvement, while professionals evaluated its potential in mental health treatment contexts.

The evaluations suggest the app is a promising mental health resource, with features like appointment scheduling and progress tracking. However, user and expert enthusiasm levels varied, indicating the need for further refinement. The app is believed to offer accessible and engaging mental health support, especially where traditional therapy is challenging.

Future work should address limitations, such as the small evaluation sample size. Enhancing personalization, integrating machine learning for user behaviour prediction, and expanding the app's scope beyond depression and anxiety are potential improvements. In sum, while this research is foundational, there's vast potential for digital technology in mental health care.

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