Mobile application for Alzheimer patients (Remind me if I forget)

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Abstract

One of the main purposes of technology is to provide people with a quality life. Today, mobile systems and applications that can run on smart devices make life easier for people with smart devices. The rapid development of technology has also brought innovations in the field of health. Specifically, applications to improve the quality of life of individuals with mental and physical illnesses or certain disabilities are becoming more and more widespread. Alzheimer's disease is a neurological disorder that causes the death of brain cells over time, leading to memory loss, dementia, and a general decline in cognitive functions. The disease causes a decline in thinking, memory, and behavioral functions. In this study, we present the design stages of a unique mobile application called "Remind Me If I Forget ", which will help Alzheimer's patients to better adapt to life. Information about the development process, main features, the purpose of the application, and its differences from some similar applications are described in this article. Kotlin, a native programming language, was used in the project. Agile project management methodology was used in project management. Since the rate of Android device users worldwide is 87%, application development in the Android operating system was preferred. The application was developed in the Android Studio environment. The Mobile Application has been developed to be integrated into smartwatches.

Keywords: AIzheimer's, mobile app, quality life, GPS, reminder.

Alzheimer hastaları için mobil uygulama (unutursam hatırlat)

Öz

Teknolojinin temel amaçlarından biri insanlara kaliteli bir yaşam sağlamaktır. Günümüzde akıllı cihazlarda çalışabilen mobil sistemler ve uygulamalar akıllı cihazlara sahip insanların hayatını kolaylaştırmaktadır. Teknolojinin hızla gelişmesi sağlık alanında da yenilikler getirmiştir. Özellikle ruhsal ve bedensel rahatsızlıkları veya belirli engelleri olan bireylerin yaşam kalitesini artırmaya yönelik uygulamalar giderek yaygınlaşmaktadır. Alzheimer hastalığı, zamanla beyin hücrelerinin ölümüne neden olan, hafıza kaybına, bunamaya ve bilişsel işlevlerde genel bir düşüşe yol açan nörolojik bir hastalıktır. Hastalık düşünme, hafıza ve davranışsal işlevlerde düşüşe neden olur. Bu çalışmada Alzheimer hastalarının hayata daha iyi uyum sağlamalarına yardımcı olacak "Unutursam Bana Hatırlat" adlı benzersiz bir mobil uygulamanın tasarım aşamalarını sunuyoruz. Bu makalede geliştirme süreci, temel özellikleri, uygulamanın amacı ve bazı benzer uygulamalardan farklılıkları hakkında bilgiler anlatılmaktadır. Projede yerel bir programlama dili olan Kotlin kullanılmıştır. Proje yönetiminde çevik proje yönetim metodolojisi kullanılmıştır. Dünya genelinde Android cihaz kullanıcı oranı %87 olduğundan Android işletim sisteminde uygulama geliştirme tercih edildi. Uygulama Android Studio ortamında geliştirildi. Mobil Uygulama akıllı saatlere entegre edilebilecek şekilde geliştirildi.

Anahtar Kelimeler: AIzheimer's, mobil uygulama, kaliteli yaşam, GPS, hatırlatıcı.

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1. Introduction

Today, one of the most important developments in the field of technology is the production, use, and dissemination of information. With the development of technology, mobile applications are being developed to treat and support many diseases. Laptops, smart devices, wearable technologies, and cell phones have entered our lives with many applications. The need for mobile systems is increasing while exchanging information in transportation, trade, education, art, engineering, health, and many other fields [1].

Technological developments in health services are increasing day by day. Doctors utilize technology products in the diagnosis and treatment of diseases. Both physical and mental illnesses facilitate the disease process with various methods. The health information system has also been digitalized with the developing technology. Many different branches of technology such as mobile applications, artificial intelligence, and machine learning serve the health sector. For example, there are mobile applications in use for the dietitian and the client to progress the process in a controlled manner. Thanks to these applications, the health of the person is regularly recorded and a healthier process is built. There are mobile applications that provide control of physical health. In addition, mobile applications have an important place in the treatment and follow-up process of mental diseases such as forgetfulness and Alzheimer's. Applications integrated into mobile and smart devices represent an approach that aims to improve the quality of life of individuals with many diseases, including Alzheimer's disease.

Alzheimer's disease is an advanced age disease in which deterioration in all mental activities, especially memory, daily functions, and behaviors is observed due to the loss of certain cells of the brain over time. It is a gradual brain disorder that leads to behavioral changes and gradual deterioration in the ability to learn, speak, reason, perceive, communicate, and perform activities of daily living. Although the cause is not yet known, its severity gradually increases as the years progress [2]. The rate of Alzheimer's disease progression varies from person to person. Some individuals may live with mild cognitive impairment for an extended period, while others may experience a quicker onset of symptoms and a more rapid progression of the disease. Individuals with this disease often forget the location of their home, the daily activities they need to do, the people around them, and even vital factors in their daily lives (eating, drinking, etc.). These and similar situations cause great distress for both themselves and their relatives. While there isn't a permanent treatment for the illness, there are steps you may take to slow or stop its progression. Some of

these measures include eating a balanced and regular diet, doing sports, solving crossword puzzles (sudoku), solving memory-enhancing tests, playing games that provide brain training, keeping social relations alive, avoiding stress, and leading a calm life.

According to worldwide research, there are an estimated 35 million people with Alzheimer's disease and this number is increasing dramatically every day. Alzheimer's disease ranks as the sixth most prevalent cause of mortality for people in the United States, according to the Centers for Disease Control and Prevention (CDC). It is regarded as the fifth most common cause of death for those over 65[3]. According to the analysis of the Turkish Statistical Institute, it is estimated that the proportion of the elderly population over 65 will exceed 10% in 2023 and the prevalence of Alzheimer's disease will continue to increase rapidly. If this increase continues, the number of patients is expected to reach 66 million in 2030 and 135 million in 2050 [4].

2. Technological Applications For Alzheimer's Disease

There are many mobile applications developed for Alzheimer's patients. In addition to these, applications integrated into other smart devices and wearable technologies have also been implemented. Advanced technologies such as humanoid robots, artificial intelligence, and virtual reality are used in the treatment of Alzheimer's patients. All of these technological applications have been developed for individuals with Alzheimer's disease to live a better quality of life.

Although existing practices include certain features that can help Alzheimer's patients organize their lives, they do not offer them as a whole. Therefore, they are insufficient. In this case, one of the most important features that distinguishes Forget If I Remember from other applications is that it includes features that Alzheimer's patients may need. In addition, the psychological and physical competencies of Alzheimer's patients were also taken into consideration while developing the application. For example, the colors, font, and font size used in the UI design phase were carefully selected so that Alzheimer's patients could benefit from the application in the best way.

"In 'Using Molecular Communication Systems and LSTM in the Classification of Alzheimer's Disease,' Amyloid Beta (Aβ) molecules, which cause Alzheimer's disease, were classified using a molecular communication model based on Long Short-Term Memory (LSTM).

Designed for people with dementia and Alzheimer's disease, the mobile app is inspired by caregivers' anecdotes and aims to improve the quality of life of people with Alzheimer's disease by providing content including favorite music and family photos to make life easier for people diagnosed with Alzheimer's disease [6]. An app called Alzheimer's Assistant aims to improve the daily communication of Alzheimer's patients, support them in performing their daily tasks more effectively, and ensure their overall safety, using features such as facial recognition technology and Google Maps [7].

Although existing mobile applications offer features such as recording the patient's location and reminding the patient of tasks through notifications, there is no single application that includes all of these features. This is a disadvantage for Alzheimer's patients. In addition to the additional features it provides to the user, Remind Me If I Forget offers all these features in a single application. The solutions offered by the app aim to reduce the negative impact of the disease on the lives of patients and their relatives. Other mobile applications that have been developed do not offer any solution in case the patient forgets their mobile device. Due to the importance of the disease and the majority of the population it affects, there is a need for more advanced and integrated applications in this field. Existing applications are insufficient to meet all the needs of Alzheimer's patients and their relatives.

3. Model Suggestion

When designing a mobile application for the use of Alzheimer's patients, it is important for the accessibility of the application to be simple, clear, and understandable. Focusing on these points in design is important for a positive user experience[8].

The design should be customized for the needs of the patient/caregiver. One of the most important points to be emphasized is that the application should be designed taking into account the cognitive functions lost by Alzheimer's patients[9].

In the design of the "Remind Me If I Forget" application, large and easy-to-read fonts, high-contrast color schemes, and intuitive iconography were used. By prioritizing usability, user-centeredness, and accessibility in the design process, it was aimed to provide a supportive environment for Alzheimer's patients to meet their personal needs and to develop a user-friendly application. Figure 1. shows an example of the main screen of the "Remind me if I forget" application interface.
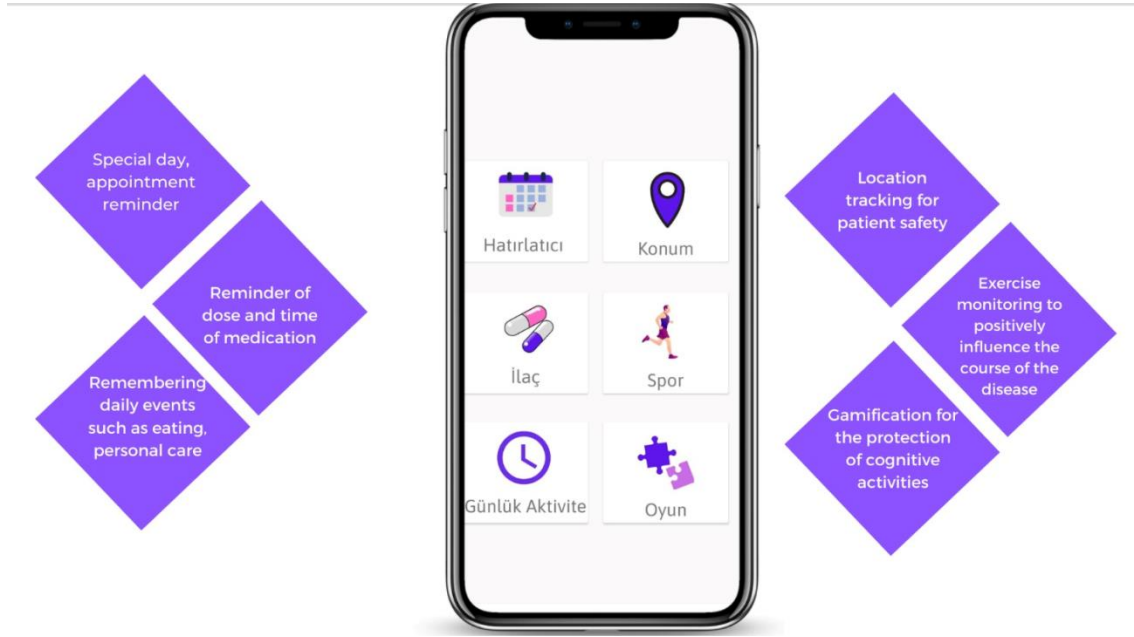

Fig. 1. An image from the interface of the application named Remind Me If I Forget

With features such as daily activity reminders, sports suggestions, games to stimulate the mind, medication reminders, and location tracking, our Remind Me If I Forget application offers solutions to problems that may arise in the lives of patients, relatives, or caregivers.

3.1 Materials and Methods

Before the implementation of the application, a SWOT Analysis was conducted to determine its strengths and weaknesses and to evaluate possible opportunities and threats. Therefore, it was aimed to follow the most appropriate path.
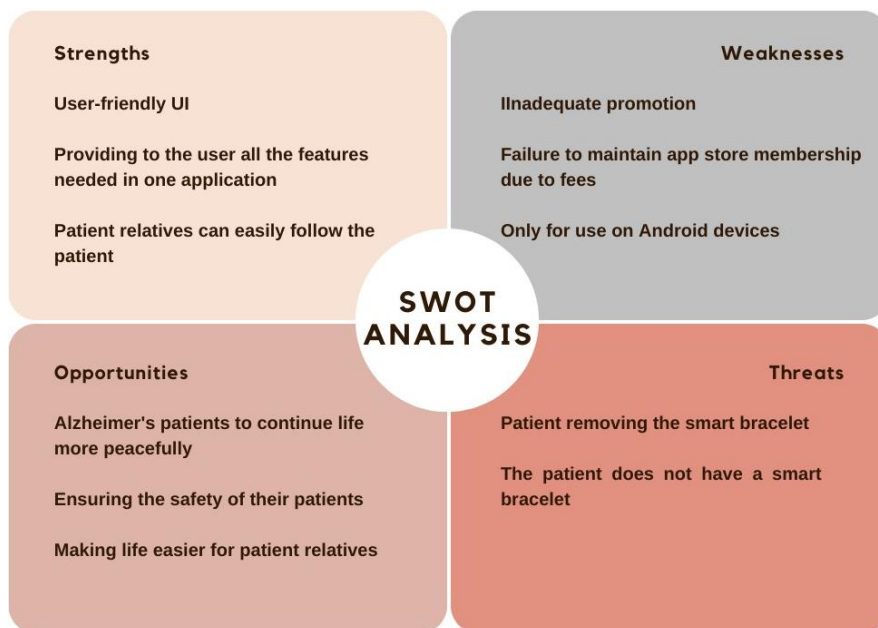
Fig. 2. Strengths and weaknesses of our app.

The application was started to be developed as a result of the information obtained by conducting the necessary research on the disease. The mobile application, developed in Kotlin using the Android Studio IDE, stores data including user information, games, sports, and daily activity logs in a Postgresql database. The users' password information is specially hashed to store it securely in the database so that it is protected according to security standards.

The application named "Remind Me If I Forget" was made available to patients and their relatives in the Google Play application store. In this way, it can be easily downloaded and used on devices with the Android operating system.

Gestalt Principles were used in the UI/UX design of the application. The purpose of using this principle is to provide a user-friendly interface for Alzheimer's patients. Design principles were utilized while developing the application. In line with the principle of simple and intuitive use, the application is easy to use regardless of the user's experience, knowledge, language skills, or current level of concentration. Thus, the application can be used at any stage of Alzheimer's disease. With the principle of perceivable information, since it is designed to appeal to the patient's senses, the necessary information is effectively communicated to the patient, making the information more permanent in the patient's memory. For this purpose, information is presented in different forms (visual, auditory, written, etc.) [10].

3.1.1 Home Screen

The application is registered with two different user options: patient and patient's relatives. Thanks to the application, the patient's daily life will be easier, while the patient's relatives will be able to follow the patient remotely. The reminder is used to remind Alzheimer's patients of the plans they need to remember in daily life. The location feature allows the patient's relatives to track the patient's location in case the patient gets lost. The medication feature aims to remind the patient of the doses of medication they should take on a daily basis. Daily activity allows the patient to regularly perform activities that are important in the patient's life such as drinking water, pet feeding, personal care.

3.1.2 User Login Page

The user registered in the system logs into the system by using their e-mail or username. Thanks to this feature, on the one hand, the security of user data is ensured, and on the other hand, the consistency of the data entered into the application by the patient and the patient's relatives is ensured.

3.1.3 Main Menu

While designing the main menu of the mobile application, the most important problems that Alzheimer's patients frequently encounter in their daily lives and that cause a decrease in their quality of life were researched and analyzed. As a result of the analysis and research, features were developed to solve these problems. The main menu includes reminders, location, medication reminders, sports, daily activity, and game features. These features are of great importance in terms of facilitating the lives of patients and their relatives. The main menu interface is presented in Fig. 3.

Fig. 3. Main Menu Design.

3.1.4. Reminder Feature

Alzheimer's patients may forget important plans they need to make during the day. The reminder feature helps the patient in this regard. Activities such as planned events, and meetings are saved in the reminder and the user is reminded via notification when the time comes.

3.1.5. Location Feature

When Alzheimer's patients go out for any purpose, they may forget or be confused on the way back. This is a very common situation for patients. For this reason, the patient is victimized. At the same time, the patient's relatives are also anxious. Thanks to this vital feature, when the patient goes outside the security boundaries set by the patient's relatives, the patient and the patient's relatives are notified. The patient is warned with an audible warning. In addition, the location of the patient is shared with the patient's relatives upon request. In this way, the patient is always controlled by his/her companion, and any negative situation is prevented.
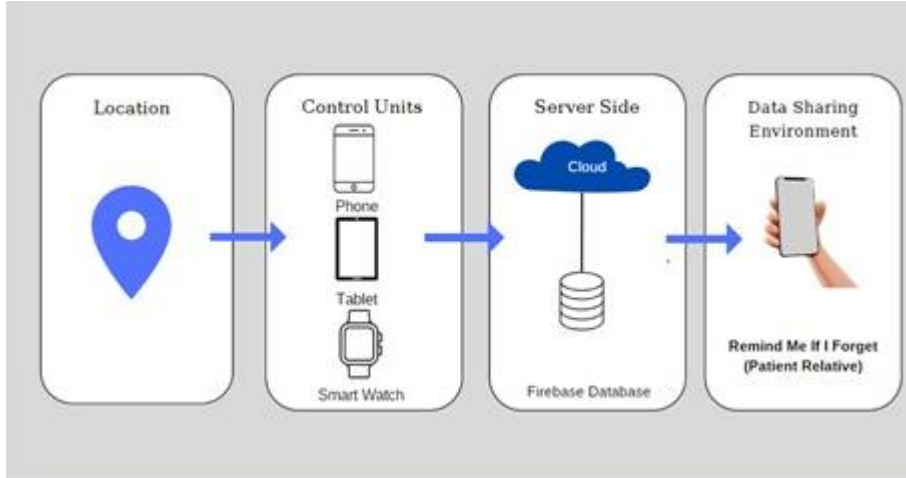

Fig. 4. General working structure of our application.

3.1.6. Medication Reminder Feature

People with Alzheimer's often forget to take their medication or take it incorrectly. Therefore, they may have difficulty in receiving regular treatment [11]. Thanks to the medication reminder feature of the mobile application, daily medications are recorded. When the time comes, a notification is sent to the patient indicating that the medication is due. This feature aims to ensure that the patient does not forget to take their medication and to ensure continuity of treatment.

3.1.7. Sports and Exercises

As with all individuals, regular exercise in Alzheimer's patients improves the immune system and increases muscle strength and endurance. Regular exercise is also beneficial for some symptoms of Alzheimer's disease. Medical studies have shown that patients who exercise have fewer mental and behavioral problems and improved memory and social skills. The sports menu interface and counter interface are presented in Fig. 5.
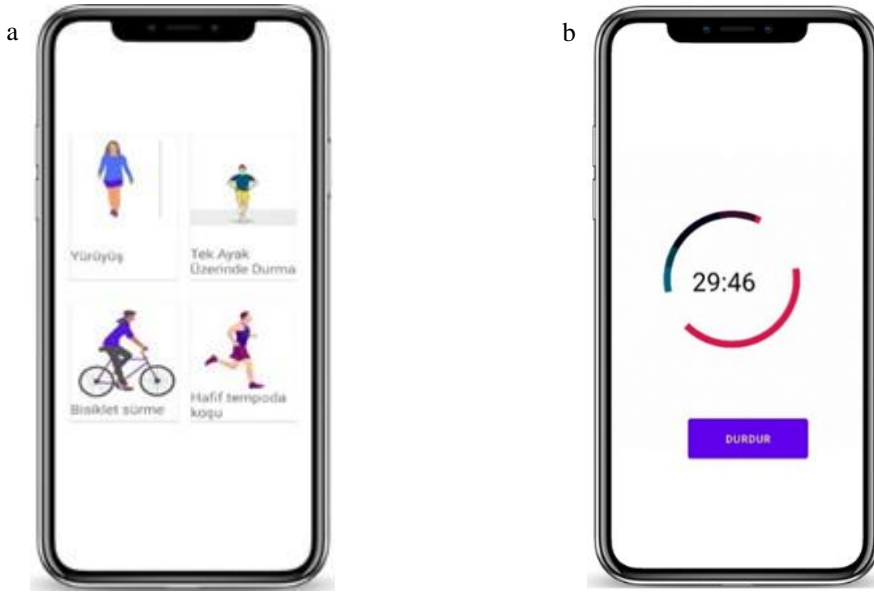
Fig. 5. (a) Sports Menu Design; (b) Time Counter.

Exercises and sports that are generally suitable for Alzheimer's patients are walking, standing on one leg, cycling, and jogging. When the user selects the desired sport, the timer is displayed. The user starts the timer. The counter can be stopped when desired.

3.1.8. Daily Activity Feature

Alzheimer's patients can forget even the basic vital activities they need to do during the day. Thanks to this feature, activities such as eating, drinking water, and housework are reminded to the user at regular intervals. The patient is provided with a better quality of life. The daily activity menu interface is presented in Fig. 6.

Fig. 6. Daily Activity.

3.1.9. Game Feature

Researchers say that logic and problem-solving games can be developed for Alzheimer's disease and that digital games can prevent these disorders. It is observed that when elderly people play digital games, inactive areas of the brain are activated, brain movements increase significantly, and recall skills improve. Therefore, digital games suitable for Alzheimer's patients can be developed. In line with this research, a game feature has been added to the application. There is a test-type game consisting of questions that will be useful for the patient in daily life, including concepts that the patient needs to know. When the patient plays this game, the patient does not forget the basic information he/she needs to know, and the permanence of the information is ensured. The game start menu, test initialization and test result screen designs are shown in Figure 7.
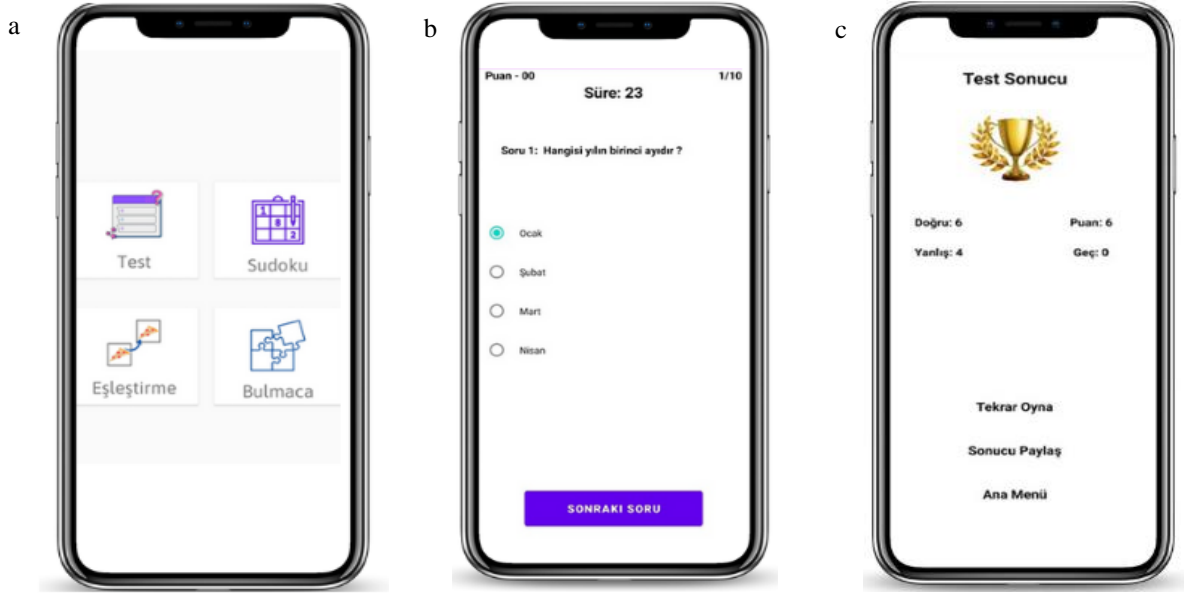

Fig. 7. (a) Game Start Menu Design; (b) Test Start Screen Design; (c) Test Result Screen Design

4. Conclusion And Discussion

This paper describes the development of a mobile application that integrates with smartwatches to significantly simplify the lives of Alzheimer's patients and their relatives (caregivers). Compared to other applications that have been developed for the same purpose, this application has many of the required features. This application is expected to be useful for patients and researchers. This study aims to describe the usability of a mobile application developed to improve the quality of life of Alzheimer's patients. The application is designed to help users keep track of their daily activities, participate in memory exercises (games, sudoku), and maintain social connections. In addition, the sports feature aims to keep the patient physically and mentally active. The medication reminder feature ensures that the patient takes their medication regularly, preventing interruptions in treatment. Going forward, further research on the potential benefits of using the app in combination with other interventions such as medication and cognitive behavioral therapy would be beneficial. The app's features could also be expanded to provide more personalized and adaptive support for patients with different levels of cognitive impairment.

Acknowledgments

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