Rieaya: New Mobile Application for the Elderly Care Services at Home during the Covid19 Pandemic in Saudi Arabia

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Summary
The number of elderly people (65 years and over) is constantly increasing in the world. It is expected to exceed one billion by 2050. Due to this augmentation, issues related to the elderly (e.g., social isolation, loneliness, malnutrition, the difficulty of performing daily tasks forgetfulness, depression, etc.) have been given great attention in the last decades. With the COVID-19 pandemic resulting from severe acute respiratory syndrome coronavirus (SARS-CoV-2), the situation of elderly people has worsened in all countries. These persons become more exposed to the risk of suffering from severe illness if attacked by the virus. In this context and to limit the spread of the CORONA virus and protect this class of people from the bad effects of this new disease, Saudi Arabia took many measures and restrictions. We introduce, in the present work a healthcare application implemented in smartphones. This application uses a platform to provide digital solutions to help the elderly overcome social isolation, malnutrition and loneliness during the COVID-19 epidemic. We also develop a suitable action plan for the disabled elderly to perform their daily tasks such as medication appointments and psychological counseling.

Keywords:
Elderly care, Mobile application, COVID-19

1. Introduction

With the increasing use of the Internet in the world and the rise in the number of mobile phone users, the smart applications market reached 2.87 million applications in Google Play and 1.96 million in the App Store [1]. However, there is a considerable shortage of these applications in the Google Play Store and Apple store in the health care for the elderly.
Because of the lack of these technologies and the necessity to provide healthcare services for the elderly during the period of the COVID-19 crisis in the world and especially in Saudi Arabia. This paper proposes an application for health and psychological care as well as for the social integration of these individuals in the new social platform.
In the second section, we discuss the studies related to this problem. We also show the necessity of providing care to aging persons during COVID-19 in Saudi Arabia where the first case was registered on the 2nd of March 2020 [2].
Then, we define the examined problem and we present the suggested solution in the third section. In the fourth section, we demonstrate how the application was developed: starting from data collection, passing through the design of the introduced system, and ending by designing the user interface. Afterward, we describe the implementation of the suggested system. The last section states our future works.

2. Literature review

The recent demographic surveys have shown that population aging has dominated the twenty-first century. It is expected that, in 2050, 1.7 billion of the world's population will be over 65 years old [3].
Socially speaking, the number and quality of the relationships are affected by the mental health of this category of persons and the diseases these persons suffer from. [4]

In fact, social isolation which is prevalent among the elderly [5] has a detrimental impact on their health and well-being. It indirectly influences medication adherence [6]. As a solution, emotional support, daily conversations with the elderly, voice communication, as well as watching videos and listening to audios allow these individuals to communicate with each other and can effectively reduce their feeling of loneliness and social isolation [7].
Besides, teeth affect the process of swallowing and chewing. Their loss represents a major problem, especially for the elderly [8]. The lack of teeth and appetite leads also to malnutrition and physical weakness [9]. These problems may be solved by proper nutrition that protects them from depression and limits its symptoms [10]. Moreover, calorie restriction has a positive effect on the memory of the elderly [11] and a diet full of antioxidants, such as fresh fruits and vegetables, can reduce the aging process [12].
Besides, with age, the sensory, motor and cognitive functions decline in the human being [13] and the performance of daily activities becomes more difficult [14].

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Exercising is one of the behavioral strategies followed to promote healthy aging and improve the cardiovascular system, respiratory system, metabolism, immune system and body composition [15]. It also enhances memory, cognitive functions [16] and mid-thigh muscle density that declines due to aging [17].

Forgetfulness and the difficulty of administering medication are the most frequently-cited factors related to medication adherence by the elderly [18]

Dementia, which is the main cause of disability in the elderly, can be prevented by some factors like proper nutrition, exercise and social participation [19]. Furthermore, depression is one of the psychological problems disability [20] that can be treated by psychotherapy [21].

3. Problem definition

In the elderly care centers, the elderly can meet and carry out various activities. However, in Arab societies, it is the family members that of provide the aged persons with home care and do not leave them in the nursing home because this doing is considered as "out of honor". However, as the living standards have been changed in the Arab countries and both as women and men become obliged to go out for work, the elderly remain alone at home, which aggravates their feeling of loneliness. With Covid 19, the afore-mentioned problems were exacerbated.

A cluster of a genus of the Coronaviridae family was officially declared from Wuhan, Hubei Province, China. This cluster was behind the appearance of the novel coronavirus disease (COVID-19) [22]. As the older population is the most exposed to the risk of mortality during this pandemic, its protection with social distancing and even social isolation were given great importance [23]. In this pandemic situation, Saudi Arabic took several measures, knowing that the number of elderly in Saudi Arabia is quickly expanding. It is expected that this number will rise to 20.9% from 2015 to 2050. The elderly population is quickly growing and the cost of their care will be a challenging issue in the future [24].

However, these preventive measures may cause many problems like depression, cognitive dysfunction, disability, cardiovascular diseases, and increased mortality among aged persons. In this context, the use of mobile technology solutions has become necessary to diminish the risk of cross-contamination resulting from the close contact between people, to provide self-care and to create a positive feeling within confined old persons. As shown in Table 1, a few mobile applications were developed in the literature to provide some services for the elderly.

Table 1. Comparison between the introduced healthcare application and some existing ones

Application name	Properties					
	social platform	nutrition plan	exercise and yoga	alerts	elderly tips	psychological counselling
Rieaya	✓	✓	✓	✓	✓	✓
ECare	×	×	×	✓		×
Elderly care tips	×	×	×	×	✓	×
Hearty Seniors - Workouts for Seniors	×	×	✓	×	×	×
Carer - Healthcare for the elderly	×	×	×	✓	×	×
Trusted Senior	×	×	×	✓	×	×
Yoga Exercises for seniors	×	×	✓	×	×	×
Exercise Plan for Seniors	×	×	✓	×	×	×

To deal with the problems that the elderly suffered from during the COVID crisis (e.g. social retirement, dementia, poor appetite, malnutrition, etc.) the (Rieaya) application proposes introduces a digital solution by providing:

•Social platforms to allow them to communicate with voice, image and video in order to enhance their social participation and help them overcome social isolation and loneliness,

•Diet plan rich in vitamins, vegetables, fruits and antioxidants. This plan restricts calories, reduces malnutrition and depression, improves memory and promotes healthy aging. Its objective is to provide recipes for the elderly according to their age and health problems.

•A sports program followed to minimize their physical weakness. It consists of aerobic and strength exercises practiced to raise muscle density and the level of cognition, improve heart health, strengthen the immune system, and promote healthy aging.

•Alerts to remind them about medications and medical appointments

•Online psychological counseling to help them overcome their psychological problems.

•Tips and advice to make them aware about their healthy aging.

4. Application development

In this section, we explain the stages of developing "Rieaya" application, as shown in Figure 1.

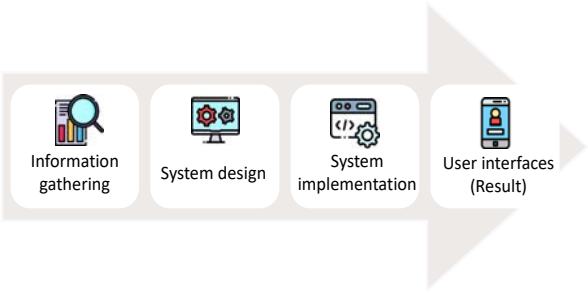

Fig 1. APPLICATION DEVELOPMENT PROCESS

In the following sub-section, we first show how data were collected. Then, we describe the development of the application and we present the user interfaces. Finally, we depict its implementation.

A. Data collection

First, the search process was carried out on the Saudi Ministry of Health website about aging and the health of the elderly to gather information about the problems and diseases of the elderly and their causes, the needs of these people and how to care for them.

Then, the search process was performed in Google Play and the App Store.

After that, an electronic survey was answered by 90 elderly people to investigate the effect of aging on their everyday life, as displayed below in Table 2

We also present the needs of the elderly and how our application can help them based on the responses to the questionnaire illustrated in the chart below (Figure 2).

Table 2. Survey Questions

NO	Survey Questions
1	Have you ever forgotten to take your medications?
2	Do you forget to attend your medical appointments?
3	Do you feel a loss of interest or pleasure in performing some or all of your daily activities?
4	Do you have a healthy diet?
5	Do you suffer from problems or difficulties when exercising?
6	Do you feel lonely?
7	Watching videos and listening to audio is your favorite pastime?

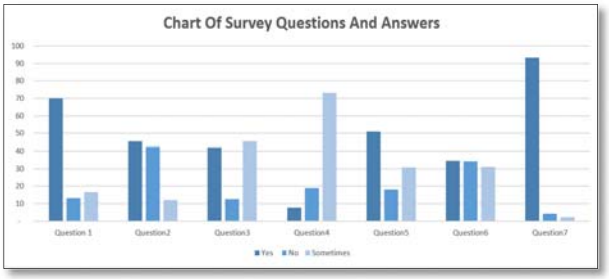

Fig 2. Chart showing the respondents' answers

At the end of the information gathering process, the collected information was considered in the system design process.

B. System design

The (Rieaya) application was designed to take care of the elderly socially, healthily and psychologically.

We focus, in this part, on the application requirements in terms of connection, storage, and processing, as well as on the development of mobile phones to implement a suitable application that can be easily used by the elderly.

The architecture of the proposed application is composed of admin, user and psychological consultant, as revealed in Figure 3.

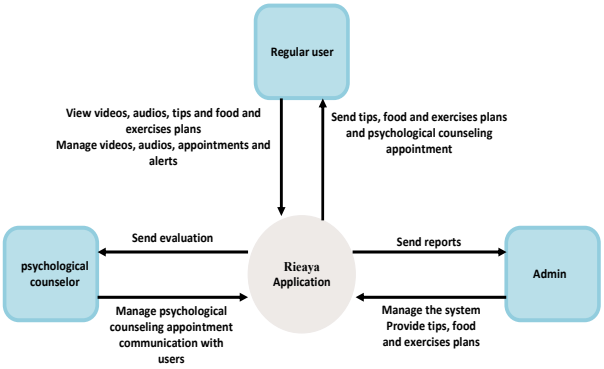

Fig 3. The Architecture of the proposed application

C. System Implementation

The process was implemented using the MacBook laptop and XCode platform officially used to develop applications that run on the iOS system. The Swift language was chosen to program the system. Firebase was considered as the database of the application because it is a real-time database that provides high storage space. Besides, two high-security interface applications were developed: one for the ordinary user and the other for the psychological counselor.
Firebase was utilized to save the user's data, the shared videos, and audios, as well as his/her medical appointments, medications and the psychological consultations. It was also employed, to save the counselors' data the appointments that appear to the users.
After that, the system was tested using the emulator on the XCode platform. The process is presented in Figure 4.

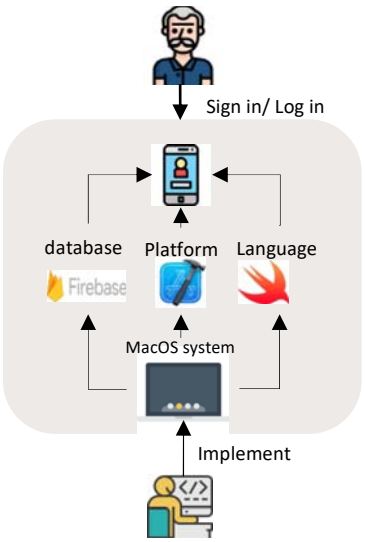

Fig 4. System Implementation Requirements

D. User Interfaces

As old people cannot use well mobile phones, we implement in this work application interfaces that are written in the Arabic language and can be easily utilized by the target people.
In this section, sample screenshots of the user interfaces in our application are presented after implementing the system and running it in the Xcode emulator

To use the application, the utilizer should first enter the login page. If the user does not have an account, he/she presses the new registration button, to access a page containing boxes (to be filled with his/her name, email, password and profile picture (Figure5)). After that, the user can access the application and he/she will appear on the interface of the program containing, at the bottom, a bar consisting of five elements:

- The home page.
- The page for adding or recording a new video.
- The page for adding or recording a new audio.
- The page for checking the registered psychological counselling appointments.
- The personal page.

The home page (Figure5) contains eight buttons.

Fig 5. The new user registration page and the main page of the designed application

The first one presents the video explorer (Figure 6). It allows accessing the video page added by the user.
On the other hand, the second button is the audio explorer that makes the user access the audio page.

Fig 6. Explore page for both audio and video sequences

However, the third button is that showing the food plan (Figure 7).
By clicking on it, the user can go to the food recipes review page in the application within the food plan page. This button demonstrates five options: breakfast recipes, lunch recipes, dinner recipes, cold drinks and hot drinks.

Fig 7. The food plan page for the elderly

The fourth button transfers the user to a 7-day sports plan (Figure 8).

Fig 8. exercise plan page

However, the fifth button allows the user to access the medications page (Figure 9).

Fig 9. List of the medicines and their names and the number of the required doses

through which he/she reviews, adds, or deletes the medications. The sixth button (medical appointments button) transfers the user to the medical appointments page through which he/she can review, add or delete the medical appointments (Figure 10).

Fig 10. Appointments attendance alerts interface

By clicking on the seventh button, the user accesses the tips and instructions page (Figure 11) through which he/she can review the advice and instructions given to the elderly.

Fig 11. Tips and instructions page

The final button on the first page is that of psychological counseling (Figure 12).

It makes the user able to review contact the psychological counselors in the application, select the consultant and make an appointment.

Fig 12. medical appointments

In (Figure 13),
the user can consult the shared videos and audios, check his/her personal information and modify them.

Fig13. The user's personal interface contains the shared

5. Conclusion

This paper presented an application used to take care of the elderly socially, healthily and psychologically.

This application was introduced to solve the problem of social isolation and malnutrition faced by the aged persons, particularly during COVID-19.

It provides a social platform through which these individuals can share video, audio, a nutritional plans, sports exercise plans, alerts for medicines and medical appointments. This platform gives also advice and psychological counseling to the elderly in Saudi Arabia.

6. Future work

In our future work, the designed application will support Android devices. We will also present an application version written in English to facilitate its marketing and make it widely used by a larger target population.

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References

[1] https://buildfire.com/app-statistics/

[2] Alyami, M. H., Alyami, H. S., & Warraich, A. (2020). Middle East Respiratory Syndrome (MERS) and novel coronavirus disease-2019 (COVID-19): From causes to preventions in Saudi Arabia. Saudi Pharmaceutical Journal, 28(11), 1481-1491.

[3]https://www.elibrary.imf.org/view/journals/022/0057/001/article-A002-en.xml

[4] Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: a meta-analytic review. PLoS medicine, 7(7), e1000316.

[5] Dickens, A. P., Richards, S. H., Greaves, C. J., & Campbell, J. L. (2011). Interventions targeting social isolation in older people: a systematic review. BMC public health, 11(1), 1-22.

[6].Lu, J., Zhang, N., Mao, D., Wang, Y., & Wang, X. (2020). How social isolation and loneliness effect maffection adherence among elderly with chronic diseases: An integrated theory and validated cross-sectional study. Archives of Gerontology and Geriatrics, 90, 104154.

[7] Choi, H. K., & Lee, S. H. (2021, March). Trends and Effectiveness of ICT Interventions for the Elderly to Reduce Loneliness: A Systematic Review. In Healthcare (Vol. 9, No. 3, p. 293). Multidisciplinary Digital Publishing Institute.

[8] Yuan, J. Q., Lv, Y. B., Kraus, V. B., Gao, X., Yin, Z. X., Chen, H. S., ... & Shi, X. M. (2020). Number oA numberral teeth, denture use and mortality in Chinese elderly: a population-based prospective cohort study. BMC oral health, 20(1), 1-11.

[9] Mathewson, S. L., Azevedo, P. S., Gordon, A. L., Phillips, B. E., & Greig, C. A. (2021). Overcoming protein-energy malnutrition in older adults in the residential care setting: A narrative review of causes and interventions. Ageing research reviews, 70, 101401.

[10] Klimova, B., Novotny, M., & Valis, M. (2020). The Impact of Nutrition and Intestinal Microbiome on Elderly Depression—A Systematic Review. Nutrients, 12(3), 710.

[11] Witte, A. V., Fobker, M., Gellner, R., Knecht, S., & Flöel, A. (2009). Caloric restriction improves memory in elderly humans. Proceedings of the National Academy of Sciences, 106(4), 1255-1260.

[12] Hussain, F., & Kayani, H. U. R. (2020). Aging-Oxidative stress, antioxidants and computational modeling. Heliyon, 6(5), e04107.

[13] Adcock, M., Sonder, F., Schättin, A., Gennaro, F., & de Bruin, E. D. (2020). A usability study of a multicomponent video game-based training for older adults. European review of aging and physical activity, 17(1), 1-15.

[14] Feger, D. M., Willis, S. L., Thomas, K. R., Marsiske, M., Rebok, G. W., Felix, C., & Gross, A. L. (2020). Incident instrumental activities of daily living difficulty in older adults: Which comes first? Findings from the advanced cognitive training for independent and vital elderly study. Frontiers in neurology, 11.

[15] Adcock, M., Fankhauser, M., Post, J., Lutz, K., Zizlsperger, L., Luft, A. R., ... & De Bruin, E. D. (2020). Effects of an in-home multicomponent exergame training on physical functions, cognition, and brain volume of older adults: A randomized controlled trial. Frontiers in medicine, 6, 321.

[16] Ten Brinke, L. F., Best, J. R., Chan, J. L., Ghag, C., Erickson, K. I., Handy, T. C., & Liu-Ambrose, T. (2020). The effects of computerized cognitive training with and without physical exercise on cognitive function in older adults: an 8-week randomized controlled trial. The Journals of Gerontology: Series A, 75(4), 755-763.

[17] Aas, S. N., Breit, M., Karsrud, S., Aase, O. J., Rognlien, S. H., Cumming, K. T., ... & Raastad, T. (2020). Musculoskeletal adaptations to strength training in frail elderly: a matter of quantity or quality?. Journal of cachexia, sarcopenia and muscle, 11(3), 663-677.

[18] Gomes, D., Placido, A. I., Mó, R., Simões, J. L., Amaral, O., Fernandes, I., ... & Roque, F. (2020). Daily medication management and adherence in the polymedicated elderly: A cross-sectional study in Portugal. International journal of environmental research and public health, 17(1), 200.

[19] Lisko, I., Kulmala, J., Annetorp, M., Ngandu, T., Mangialasche, F., & Kivipelto, M. (2021). How can dementia and disability be prevented in older adults: where are we today and where are we going?. Journal of internal medicine, 289(6), 807-830.

[20] Aajami, Z. (2020). Relationship between depression and cognitive impairment among elderly: A cross-sectional study. Journal of Caring Sciences, 9(3), 148.

[21] Agüera-Ortiz, L., Claver-Martín, M. D., Franco-Fernández, M. D., López-Álvarez, J., Martín-Carrasco, M., Ramos-García, M. I., & Sánchez-Pérez, M. (2020). Depression in the Elderly. consensus statement of the Spanish Psychogeriatric Association. Frontiers in psychiatry, 11, 380.

[22] Park, S. E. (2020). Epidemiology, virology, and clinical features of severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2; Coronavirus Disease-19). Clinical and experimental pediatrics, 63(4), 119.

[23] Hwang, T. J., Rabheru, K., Peisah, C., Reichman, W., & Ikeda, M. (2020). Loneliness and social isolation during the COVID-19 pandemic. International psychogeriatrics, 32(10), 1217-1220.
[24] Alsulami, M. H., Atkins, A. S., Sorour, A. S., & Campion, R. J. (2022). Aging population supported by ambient-assisted living in the Kingdom of Saudi Arabia. In Smart Home Technologies and Services for Geriatric Rehabilitation (pp. 43-78). Academic Press

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