The Elderly in the Digital World and Digital Inclusion of the Elderly: An Exemplary Mobile Application for the Elderly

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Abstract

In the modern day, technological developments are advancing exponentially, improving technology brings innovations in every corner of our lives, and with such innovations, the digital world is becoming more and more central to people's lives. It is particularly important that the elderly also take part in this digital world, where especially young and middle-aged people are more likely to be involved. Our elders are our dearest and most respected family members whom we dote on and want to take care of with utmost attention. It is one of the noblest duties to increase their welfare, happiness, and life satisfaction by providing them with a safe, secure, and comfortable living environment. The elderly need to be actively involved in the digital world in order to benefit from the developments brought about by the digital world in a way to make their lives easier, such as maintaining social connections, following up on their health, staying healthy, making financial, banking and e-government transactions, using applications that facilitate their daily lives and remind them of important appointments or medication times. By the end of 2023, approximately 10 out of every 100 people living in the world will be elderly, and this figure is expected to increase to 12 in 2030 and 16 in 2050. Of all the applications developed in our constantly aging world; the necessity for mobile applications specifically for the elderly has also gradually increased and become more and more crucial in the world of applications. The applications to be developed for the elderly will facilitate the lives of both the elderly and those who are obliged to take care of them. The aim of this research is to contribute to the advancement of knowledge in the field of mobile application design for the elderly and to create a more inclusive and user-friendly technology for this growing user group.

This article is analyzed in three parts. In the first section; the elderly population statistics of the Turkish Statistical Institute (TurkStat) for the year 2022 are studied on a detailed basis and the attributes of the elderly population aged 65 and over in Türkiye are examined by introducing a statistical overview of the subject. The second section deals with the topics about the elderly population; namely, what are the dangers ahead of the increasing elderly population, what are the challenges for families and individuals who are responsible for caring for the elderly, what are the most frequently diagnosed diseases in the elderly, what are the expectations of the elderly from their family members, what do the elderly feel most lonely about, and how should the city life be in order to facilitate the lives of the elderly. In light of the information put forth in the first part, the following topics are discussed in the second part: Why the elderly should be included in digitalization, what are the factors that increase the digital inclusion of the elderly, the obstacles to their digitalization, the dangers of their digitalization, the obstacles to the use of technology by the elderly, digital learning of the elderly, smart homes and wearable technologies. Although these issues may seem to be related to old age, they have been addressed because they are considered essential for understanding the elderly and identifying their needs for the mobile application to be developed. Finally, in the third part of the article, various applications developed for the elderly are reviewed and an exemplary mobile application for elderly is suggested.

Keywords: Old Age, Elderly, Elderly in the digital world, Mobile application for the elderly

1. Introduction

For human beings, age is an important concept that is celebrated almost every year and the concept of age is conceived as a synonym for the time itself. According to Dağlı (2018;12), age is a numeric expression of the rotations of the Earth around the Sun since the birth of an individual. In our social life, we often evaluate certain elements based on the age of individuals. Issues such as starting education, voting, military service, marriage, work, retirement, etc. are regulated on the basis of age (Gönüllü-Taşkesen, 2017: 7). Aging is defined as "a personal process that reduces the individual's ability to adapt to the changing social environment depending on the time

factor, can accelerate or slow down the physical changes in socio-psychological and similar factors, and occurs at different rates for each person" (Buz, Koçak and Gözen, 2018: 389). Old age, according to the World Health Organization (WHO, 2013), is identified as a decrease in the individual's ability to respond to environmental factors. While old age implies the state of "being old", aging refers to the continuous change in the chronological, biological, pathological, psychological, social, and economic aspects of the individual (Ceylan, 2015a: 27). Therefore, aging involves multidimensional and multifaceted processes (Tufan, 2014: 14). Aging has different dimensions such as chronological, biological, psychological, social, cultural and economic ones, and the classification is made accordingly (Kalınkara, 2016: 8). In the most recent age classification made by the World Health Organization (WHO) for developed countries, 18-65 years of age is classified as young, 66-79 as middle-aged, 80-99 as old and 99-100 as long-lived (Akgül, 2018: 57). Accordingly, the United Nations has classified countries with an elderly population of less than 4% as "young societies", between 4% and 7% as "adult societies", between 7% and 10% as "elderly societies" and over 10% as "very old societies" (Genç et al., 2018: 302). With an elderly population ratio of 9.9, Türkiye is at the upper limit of the category of elderly societies and is moving towards the category of very old societies. Today, global aging is a matter of discussion and this increasing trend is categorized as one of the most important problems of advanced industrial societies (Powell, 2014: 136). The elderly population is increasing rapidly all over the world with advances in medicine and the prolongation of life expectancy. According to the World Health Organization, demographic change will affect all aspects of societies, the population aged 60 and over will be around 2 billion, and one in every five people in the world will be over the age of 60, by 2050 (WHO, 2017).

People are in need of many different things at almost every stage of their lives and always expect these needs to be satisfied. People's needs multiply with aging and older people sometimes find it difficult to meet these needs on their own. The society's needs are determined by the minimum living conditions including physiological basic needs but not limited to this (Canatan, 2020: 116). People's needs are characterized and modified depending on the conditions favorable to the economic, cultural, and social structure of the society in which they live. There are various types of classifications for human needs in the literature. The most commonly recognized among these classifications is Abraham Maslow's hierarchy of needs: "physiological needs, safety and security, love and belonging, self-esteem and self-actualization" (Zastrow and Kirst-Ashman, 2015: 68). The basic needs that stand foreground in old age are as follows: the need for nutrition, sleep, rest, safety, health, shelter, having sufficient income and being able to meet health expenses, social security, social bonding, love, and respect (Yıldırım et al., 2014: 25). The growth in the elderly population of any country also entails social, sociological, psychological, economic, health, etc. concerns. The declining health, physical, biological, psychological, and social characteristics of the elderly with aging prevent them from solving some of their problems alone and result in the need for support. The elderly experience some problems that need to be solved by their social environment and at the institutional level, including physical, psychological, health, care, economic, social, and cultural ones (Ceylan, 2015a: 53). Non-governmental organizations, acting as representatives of voluntary participation, support the elderly in disadvantaged groups with social aids and social activities (Küçük and Güneş, 2013: 26). Since the demographic shift resulting from the rapid aging of the world affects almost all aspects of society, WHO has declared the period of 2020-2030 as the decade of healthy aging (WHO, 2020). This demonstrates the importance and seriousness of this matter.

In countries facing an accelerating rate of aging, such as Türkiye, it is important that the needs of the elderly population are thoroughly recognized and solutions are carefully formulated. For many older people, information and communication technologies are very complex subjects. However, today, with the integration of information and communication technologies into many areas of life, the elderly also enjoys the benefits of these technologies intensively as well. Mobile applications for the elderly are designed to simplify and assist their lives.

With the help of mobile applications, the elderly can sustain their social links, monitor their health, and manage their day-to-day problems, thereby making their lives much more simple. This allows them stay more independent and active without being reliant on others. In this regard, application development for the elderly has become particularly crucial over the last few years. Digital platforms can offer users a much wider range of functionalities than any single entity can achieve on its own (Eisenmann, Parker, and Van Alstyne, 2010). Examples include health apps, exercise apps, reminder apps, shopping apps, finance, banking, and e-government apps, and social interaction apps for the elderly. These applications enable older people to keep track of their health, remind them of their medications, perform routine tasks at home, shop online and stay in touch with their family, friends, and communities, and be available in case of emergencies.

Especially in the field of health, applications developed for the elderly are widely used. In many countries, the use of mobile applications is becoming more prevalent in the provision of healthcare services in order to improve

patient outcomes, increase the effectiveness of treatment and care practices, support the autonomy of the elderly who live on their own, lower the rate of hospital admission, increase patients' satisfaction and quality of life, reduce the stress of caregivers and respond increasing health needs accordingly (Kalender and Özdemir, 2014; Garcia-Penalvo, Conde-Gonzalez and Matellan Olivera, 2014).

Following the rise in the elderly population, it is essential for countries to establish tailored policies to serve the needs of the elderly population. These policies should not only satisfy multiple needs of the elderly but also the needs of their caregivers, reducing their stress, anxiety, and responsibilities. Ensuring the digital inclusion of the elderly should be high priority. In the process of digital inclusion, first of all, the elderly should become digitally literate. To this end, training programs should be made available on different platforms or in person, if necessary, public service announcements should be prepared, educational films and documentaries should be produced, special television programs or channels should be broadcasted only for the elderly, and online awareness should be promoted. The digital safety of the elderly should be secured, abuse and harassment should be eliminated, cities should be made more friendly for the elderly, and technology companies should prioritize the elderly in wearable technologies. Wearable technologies and smart homes should be able to track the exact location of the elderly, analyze recorded health data, and provide daily reports to their caregivers. Architects and designers should prioritize the elderly in terms of smart homes, and urban planners and municipalities should design more livable cities for the elderly. Within the scope of the social state and municipalism, elderly shelters and special age group socialization, handicraft, etc. activities should be organized. Thanks to the special games that digital game developers will develop for the elderly; the elderly should be able to both socialize with their age groups and prevent Alzheimer's and dementia diseases. With the special elderly applications, they will design, IT professionals should help the elderly to maintain their social connections, monitor their health, and make their daily lives easier by helping them solve the problems in their daily lives, and thus help them to live a more independent and active life without depending on others.

2. Turksat 2022 Old Age Statistics Data and Old Age

Figure 1. TurkStat 2022 Türkiye Elderly Statistics Data

Proportion of Elderly Population in Total Population
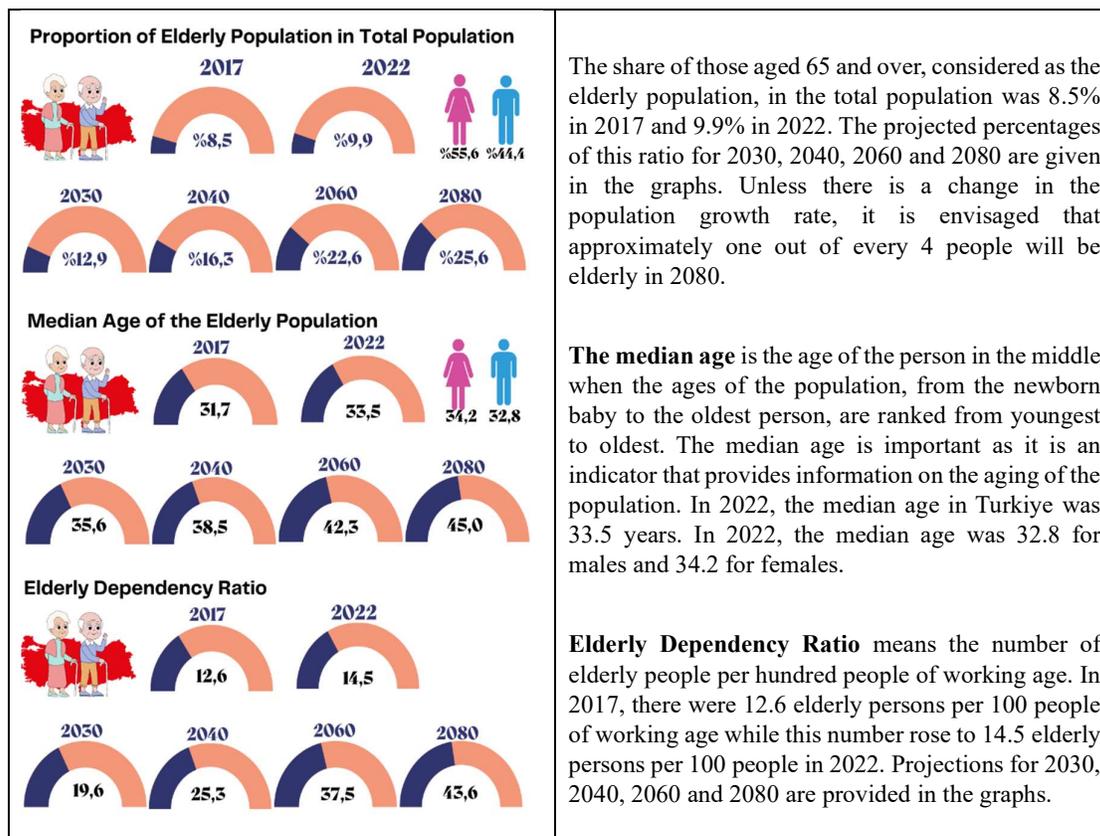
The share of those aged 65 and over, considered as the elderly population, in the total population was 8.5% in 2017 and 9.9% in 2022. The projected percentages of this ratio for 2030, 2040, 2060 and 2080 are given in the graphs. Unless there is a change in the population growth rate, it is envisaged that approximately one out of every 4 people will be elderly in 2080.

The median age is the age of the person in the middle when the ages of the population, from the newborn baby to the oldest person, are ranked from youngest to oldest. The median age is important as it is an indicator that provides information on the aging of the population. In 2022, the median age in Turkiye was 33.5 years. In 2022, the median age was 32.8 for males and 34.2 for females.

Elderly Dependency Ratio means the number of elderly people per hundred people of working age. In 2017, there were 12.6 elderly persons per 100 people of working age while this number rose to 14.5 elderly persons per 100 people in 2022. Projections for 2030, 2040, 2060 and 2080 are provided in the graphs.

Graph 1. TurkStat 2022 Türkiye Elderly Statistics Data on Elderly Population Ratios

It is estimated that unless there is a change in the population growth rate, approximately one in every 4 people will be elderly in 2080.
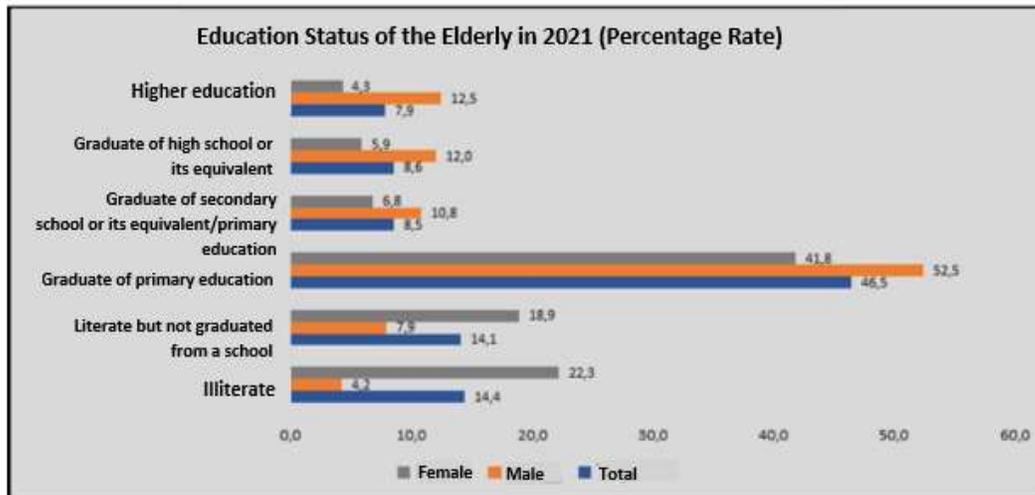
Since the ratio of the elderly population to the total population exceeding 10.0% is considered an indicator of population aging, it is seen that our population is aging and may continue to age rapidly.
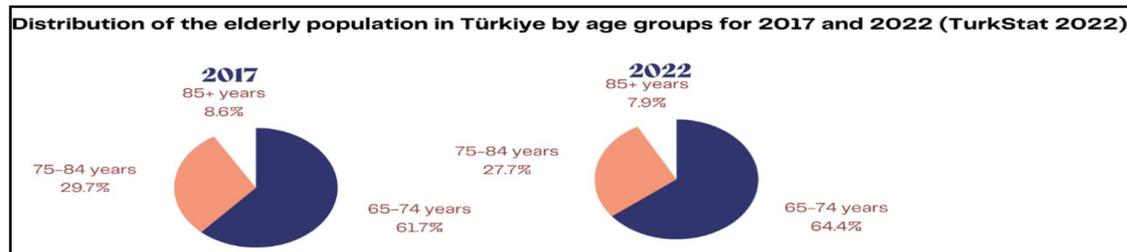

Graph 2. Distribution of the elderly population in Türkiye by age groups for 2017 and 2022 (TurkStat 2022)

In 2022, the majority of the elderly population consisted of individuals aged 65-74 with 64.5%. It is observed that the 65-74 age group increased in 2022, while the other two age groups decreased compared to 2017.

Note: The sum of the figures in both graphs may not add up to 100% due to rounding

Graph 3. Educational statuses of the elderly population in Türkiye in 2021 (Percentage Rate) (TÜİK 2022)
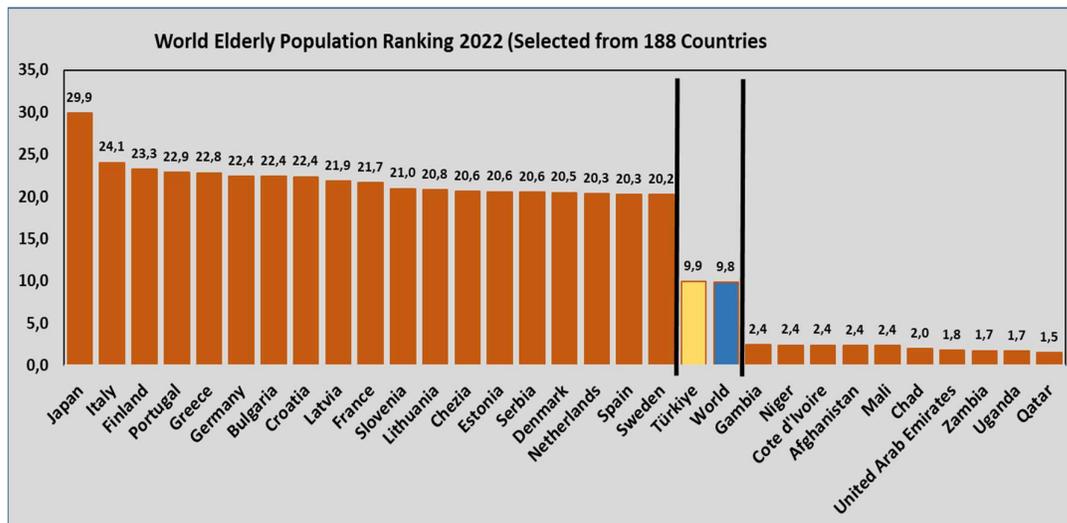
Graph 4. World Ranking of the Ratio of Elderly Population to Total Population in Türkiye (TurkStat 2022)

According to TurkStat 2022 data; the world average of the ratio of the elderly population to the total population is 9.8. Türkiye's average is 9.9. This means that 9.8 out of 100 people in the world are aged 65 and over. It is seen that our proportion of the elderly population is slightly above the world average. According to TurkStat 2022 data; Türkiye ranks 66th among 184 countries in the World Elderly Population Ratio ranking. Since it is not possible to show all 148 countries in this graph, the graph includes the first 19 countries with the highest proportion of elderly population among 148 countries, Türkiye as the 66th country, the world average, and the 10 countries with the lowest proportion of elderly population. According to the Meltwater (2023) Digital 2023 report; the world population is 8.01 billion and the world population aged 65 and over is 795.3 thousand. The median age of the world is 30.4 years. The world's top two countries with the largest elderly populations are Japan and Italy. The median age is 49 years in Japan and 47.6 years in Italy. The median age is 31.6 years in Türkiye which has the 18th largest population in the world.
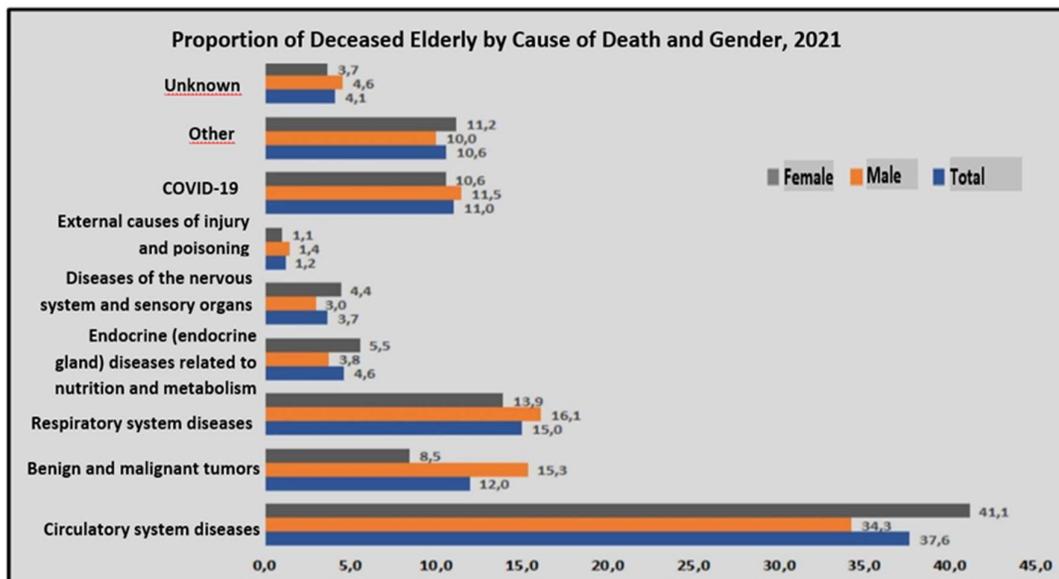
Graph 5. Proportion of Deceased Elderly in Türkiye by Cause of Death and Gender (TurkStat 2022)

According to TurkStat death and cause of death statistics; 37.6% of the elderly who lost their lives in 2021 died due to circulatory system diseases, 15.0% due to respiratory system diseases, and 12.0% due to benign and malignant tumors. The number of people who lost their lives due to COVID-19, the pandemic of our age, is 11%. This figure is an important value. The rate of elderly people dying from Alzheimer's disease is 3.0%.
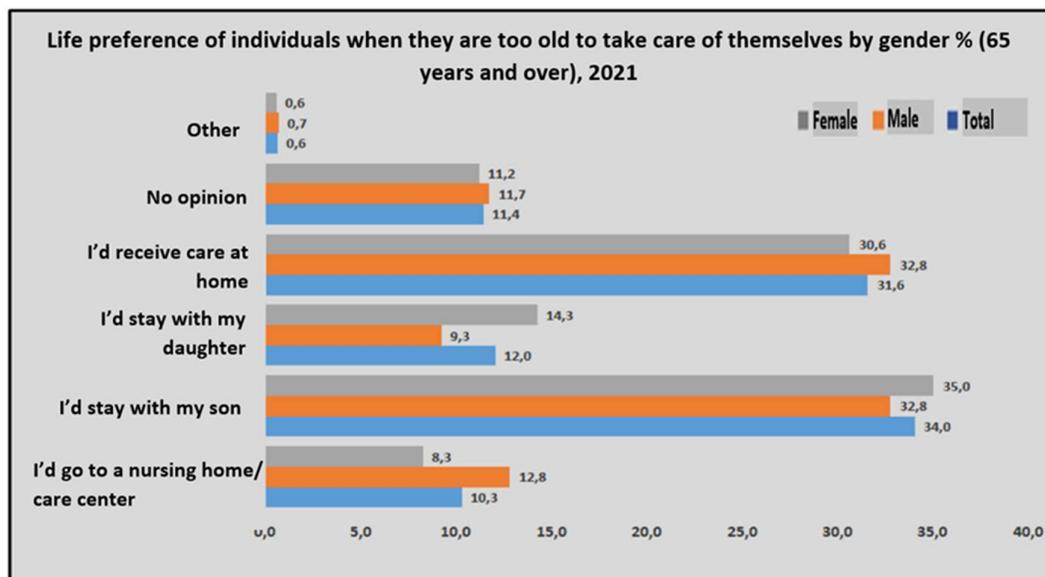
Graph 6. Life preferences of the elderly when they are too old to take care of themselves 2021 (TurkStat 2022)

Although both elderly individuals and their children prefer home care, there are studies indicating that it is becoming increasingly difficult for family members to provide this service (Karahan and Güven, 2002). It has been reported that social and psychological problems are seen especially in adult children who take care of elderly people with deteriorating health. In studies conducted in many parts of the world and in our country, it is noteworthy that the majority of primary caregivers of the elderly are in middle age (40-59 years), women, and children of the elderly (Toseland, Smith and Mccallion, 2001; Altay and Avci, 2009; HASUDER, 2012, Action Plan, 2007). In the surveys on Turkish family structure, it was reported that 10.3% of those who want to go to a nursing home when they are too old to take care of themselves are individuals aged 65 and over (TÜİK, 2022). In this regard, it is noteworthy that caregivers have problems such as their income status, lack of appropriate

conditions in the care environment, time problems, women's employment, health status, caregiver's lifestyle, social supports, and the difficulty of assuming the care burden (Tufan, 2006). Based on the strong family ties in Turkish society, there is a prevailing view of caring for and sheltering the elderly in the family. A high level of social support is important for the elderly to cope with their psychological problems and the problems brought about by old age (Bilir, 2004; Altay & Avcı, 2009).

3. Information from Various Categories Related to the Elderly Population

In this section, we categorize the issues that elderly people face in general. This will help us to develop an empathetic relationship with them and serve as a reference point for addressing their digital needs when creating special applications for the elderly. In terms of taking care of for the elderly, either in a nursing home, in their own home, or in our own house, where we try to adapt their care to our routines, each of us must first put ourselves in their shoes and then understand them, their expectations and their fears. First, we should get to know them sociologically, psychologically, physically, cognitively, and biologically, and then we should aim to offer the best for them in the digital world. Since this research article deals with the importance of designing mobile applications taking into account the needs of elderly people; firstly, the elderly and their problems, old age and digitalization issues were taken with details, and then the existing mobile and computer applications related to old age were examined in detail.

3.1. The Elderly and Their Problems
What are the dangers in the lives of elderly people?

Falls and injuries: Declining balance and mobility in old age can lead to falls and injuries such as falls from heights, slips, or trips in the home. **Chronic diseases:** Older people often have health problems, including chronic diseases such as heart disease, diabetes, hypertension, obesity, and respiratory problems. **Loneliness and social isolation:** Older people are at risk of social isolation due to factors such as bereavement, retirement, or life changes. This also negatively affects the mental and emotional health of the elderly. **Sensory disorders:** Decline in vision, hearing, and other sensory functions is a common problem for the elderly. This problem makes it difficult for older people to fully perceive their surroundings, leading to problems in communication. **Irregular use of medication:** Older people often take more than one medicine. This situation leads to problems such as medicines not being taken regularly and correctly, being forgotten, or the occurrence of adverse interactions. **Digital security risks:** With the increasing use of technology, seniors may face digital security risks. Internet scams, abuse, harassment, theft of personal information, or fraud pose a significant danger to older people.

For elderly specific mobile applications to be developed will be extremely critical in combating these potential dangers affecting the elderly. Besides the various problems of the elderly, there are many other concerns for the families in custody of the elderly or the individuals who are obliged to take care of them. The caregiving for the elderly in the family raises many physical, psychological, emotional, social, and economic complexities for caregivers (HASUDER, 2012; Action Plan, 2007). Since caregivers regulate their lives towards the needs of their loved ones, deprivation of caregivers from social activities (such as limited involvement in recreational, relaxing, and leisure activities and friendships) leads to a decrease in social support, isolation, feeling left alone in the caregiving role, depression and anxiety (Toprak, İ., Soydal, T., Bal, E., İnan, F., Aksakal, N., & Altınyollar, H. (2002); Karahan and Güven, 2002; Tufan, 2006; HASUDER, 2012; Action Plan, 2007).

What are the problems of families or individuals responsible for older people?

Time management: Caring for the elderly is a responsibility that requires time and energy. Older people often need more care and this affects the daily routines of families or individuals. This leaves families struggling to balance other work, family, or personal needs. **Financial difficulties:** Caring for the elderly is costly. Medical costs, medicines, special care services, and other needs can strain the financial resources of families or individuals. This requires special planning and budgeting to deal with financial challenges. **Physical and emotional fatigue:** Caring for the elderly is physically and emotionally exhausting. The daily care and assistance needs sometimes cause families or individuals to feel exhausted. Emotional difficulties can be associated with worries and sadness about illness or the aging process. **Work and career balance:** Caring for older people makes it difficult for families or individuals to balance work and career. It requires them to find solutions for nursing hours, such as flexible working schedules at work, time off, or alternative nursing solutions. In addition, individuals need to make time for their own care and needs in addition to caring for the elderly and often may not be able to do so for themselves. This causes various problems for individuals. **Anxiety and stress:** Caring for older people increases anxiety and stress levels within families or between individuals. It may be necessary to cope with the health situation of older people, emergencies, or unexpected challenges. Access to support systems, counseling services, or support groups can be helpful in dealing with these issues. **Personal dedication:** Caring for the elderly requires a great deal of

dedication on the part of families or individuals. They may have to put their own needs on the back burner and limit personal time and freedom. This makes it important for families or individuals to pay attention to their own well-being and use the resources available to them for support.

What are the most common diseases the elderly suffers from?

Heart disease: The risk of heart disease increases with aging. Conditions such as coronary artery disease, heart attack, heart failure, and high blood pressure (hypertension) are common among the elderly. **Cancer:** Cancer risk increases in old age. Various types of cancer such as lung cancer, breast cancer, colorectal (bowel) cancer, and prostate cancer are more common in the elderly. **Osteoarthritis:** Osteoarthritis, a joint disease caused by wear and degeneration of the joints, is the most common joint disease in older people and often affects large joints such as the knees, hips, hands, and spine. **Osteoporosis:** Osteoporosis, a condition that causes bones to weaken and become brittle over time, is more common in the elderly due to decreased bone density and increases the risk of fractures. **Diabetes:** Diabetes is more common in the elderly. Both insulin-dependent type 1 diabetes and insulin-resistant type 2 diabetes are frequently seen in the elderly. **Respiratory diseases:** As respiratory function declines with age, the risk of respiratory diseases such as chronic obstructive pulmonary disease (COPD), pneumonia, and asthma, which are more common in the elderly, increases. **Stroke (Paralysis):** In the elderly, due to risk factors such as hypertension, diabetes, heart disease, and smoking, the risk of stroke (paralysis) occurs due to sudden deterioration of brain functions as a result of blockage or bleeding of cerebral blood vessels. **Alzheimer's disease and other forms of dementia:** Dementia, especially Alzheimer's disease, is common in old age as a result of changes in brain function. This leads to memory loss, cognitive impairment, and behavioral changes.

What are the expectations of the elderly from family members?

Older people seek love and affection, nurturing and support, social contacts, health surveillance, communication and listening, safety, freedom, and independence within family members. The elderly deserve love, respect, and attention from family members A sympathetic and nurturing relationship is key to meeting the emotional needs of older people. The elderly needs and expects assistance in meeting their daily care and basic needs such as nutrition, hygiene, dressing, and medication management. Older people may be vulnerable to social seclusion and loneliness. They rely on family members to support social interactions, spend time with them and encourage them to attend social gatherings. Older people appreciate help in monitoring their health and referral to regular medical check-ups. Family members need to remain actively committed to the health of the elderly and take the necessary health precautions. Older people have the right to express their opinions, feelings, and concerns and hope that family members will lend a sympathetic ear and listen carefully to understand them. Having open communication and mutual understanding is extremely important. Older people wish to feel safe and protected. They anticipate family members' assistance and taking precautions on issues such as home security, preventing falls, and safe transportation. Older people want to live with a sense of independence and self-determination. They expect family members to respect and support this autonomy.

What do older people feel most lonely about?

Overwhelmingly, older people experience loneliness in terms of social interactions, technology and the Internet, relationships with family and friends, activities and hobbies. Losing friends and family members, elderly people tend to disconnect from the people around them, which leads to a lack of social interaction and a feeling of loneliness. Older people may face barriers in accessing digital technology and the Internet. Having difficulty in accessing technology, physical health problems, or limited mobility can lower participation in social activities and increase the feeling of loneliness. As a result, they may feel left behind in the digital age and experience limited opportunities to connect with other people. Older people may experience that spending time with family members may decrease and friendships may change at different stages of life. This makes them feel lonely. In old age, some older people may experience more limited mobility and energy levels. This can reduce the possibility of doing some old activities and limit the chance to engage in new hobbies or social activities.

To help older people cope with the feeling of social isolation and loneliness, their participation in social activities should be encouraged through applications in the digital world, regular communication with family and friends should be ensured, their happiness in finding friends they have lost track of and their participation in community-based organizations and support groups should be encouraged. To support their social connections, we need to first ensure that they are in the digital world.

How should city life be to make life easier for the elderly?

It must be accessible. Elements of urban infrastructure such as walkways, ramps, disabled access, and elderly-friendly arrangements in public transportation should be designed in a way to facilitate the mobility of the elderly. There should be Health Care Services. In the city, facilities such as hospitals and health centers should be designed

to meet the healthcare needs of the elderly and provide access to healthcare services. Housing should have features. In the city, elderly-friendly houses should be designed with disabled access and security, with elevators and low thresholds that enable the elderly to live independently. According to TurkStat 2022 data; 57.2% of households with elderly people in Türkiye live in houses with 3 or more floors and 60.1% of them do not have elevators. This poses a major problem for both the elderly and their caregivers and limits accessibility. There should be Social Services. In order for the elderly to maintain their social connections, there should be social services for the elderly, such as support centers for the elderly, activity areas, community centers, etc. There should be Entertainment and Recreation. There should be entertainment and recreational areas such as parks, gardens, libraries, and cultural activities for the elderly that enable them to have a pleasant time. It must be secure. Cities should have lighting, surveillance cameras, and accessibility of police and emergency services to support older people to live safely and comfortably. There should be an Ease of Transportation. Special transportation services for the elderly or arrangements suitable for the elderly in public transportation vehicles should be provided to ensure that the elderly can easily reach where they want to go. There should be Knowledge and Education. Information and education programs for the elderly such as technology training, health seminars, and cultural events should be organized in the city.

3.2. Aging and Digitalization

Why is digital inclusion of the elderly important?

Digital inclusion of the elderly is an urgent issue in the modern world, where technological developments are accelerating and are increasingly taking place in people's lives. In order for the elderly to benefit from digital developments and make their lives easier, they need to be in the digital world and learn to use digital devices. By digitalizing, older people access information and resources, strengthen social connections, take a more active role in social life, have better access to health care services, can manage their own affairs, improve their quality of life, and engage in mental and cognitive activity. Digitalization gives older people access to a wide network of information and resources, giving them opportunities for self-improvement. The Internet gives older people easy access to news, health information, content about their hobbies and interests, educational materials, and more. Digital technologies enable older people to stay connected with their relatives, friends, and communities by keeping in touch with them through social media, email, video calls, chatting, and sharing posts. The digital world, which also offers the opportunity to communicate with new people, reduces the feeling of loneliness of the elderly and supports their social relations. Elderly people who use digital technologies by staying in touch with family and friends through social media, playing digital games, traveling with virtual and augmented reality, and visiting museums or art exhibitions, are more active in their social lives. The elderly can make their lives easier by using digital health applications to make online appointments, see a doctor via telemedicine, and access health reports digitally. Elderly people who use digital technologies to carry out banking transactions, online shopping, online access to public services, tax declarations, etc. without leaving home save time and energy and can handle their affairs at home independently of others. Digital technologies that enable the elderly to take their medication regularly thanks to a smartwatch, smart home systems, smart devices, and assistive technologies designed for the elderly, improve their quality of life. Digital tools such as games, puzzles, mental exercises, and educational applications keep seniors' brains active, enabling them to maintain their mental and cognitive health.

What are the factors driving the digital inclusion of the elderly?

Older people's digitalization is enhanced by factors such as age, income, education, gender, health condition, social connections, technology awareness, more experience in the use of technology, more access to technology, and physical health status. The tendency of the elderly to use digital technologies decreases in direct proportion to their age. Younger adults use digital devices more easily and frequently than older adults. Older people with higher incomes have greater ownership of and access to digital devices. This increases the use of digital technologies by older people with higher incomes. More educated elders are more aware of and confident in accessing and using technology and thus use digital technologies more frequently and easily. Although the gap is closing gradually, men use digital technologies more than women. This is directly related to education as well. Older people in good health use digital technologies more frequently to monitor their health and access health services. The propensity of older people to use digital technologies increases when they see that digital technologies help to increase and maintain social connections. Older people's interest in digital technologies is also related to their awareness and consciousness about technology. Older people with higher education are more aware of access to and use of technology. Therefore, providing information and education about the benefits of digital technologies will increase the tendency of older people to use digital technologies. Experience in using technology is another factor that increases the digital inclusion of the elderly. Older people who have used technology before adapt to new

technologies more quickly. Another factor driving the digital inclusion of the elderly is access to technology. Elderly people who can easily access technological devices are more active in the digital world. Older people in good physical health are more active in using technology than those with vision or hearing loss.

What are the barriers to the use of technology by the elderly?

Paul and Stegbauer (2005) state that there are various barriers to the use of new technologies by the elderly, with technical barriers being the most important; among these barriers, many difficulties can be listed such as the inability to distinguish the images on technological products, the inability to use the tools easily due to their small size or touchscreens inappropriate for the elderly, the inability of the elderly person with poor eyesight to read the font size, the inability to use public transportation due to physical disabilities, etc. In addition, they suggested that there are also some psychological barriers such as older people's lack of confidence in using technology, fear of being ridiculed, and their opinion that digital technology is privacy invasive due to the possibility of personal information getting into the hands of others (Abbey and Hyde, 2009, p. 228). Older people use technological devices according to their needs, as long as the design is appropriate for them. Common barriers that limit older people's use of technology include fear of technology, limited access to technology, physical barriers, language, and cultural barriers, lack of training and knowledge, user-unfriendly interfaces, and lack of social support. To overcome these barriers, it is important to design technology training programs for the elderly, design user-friendly interfaces, provide resources to enable access to technology and build social support networks.

According to the Meltwater (2023) report on concerns about online misinformation, the percentage of adults aged 65 and over who are concerned about what is real or fake on the Internet is 56.4% for women and 58.0% for men. Another problem is technological security for the elderly. These issues include fraud and dishonesty, poor information security, abuse and harassment, fake websites and software, social media and the right to privacy, and up-to-dateness of technology and security updates. To overcome these problems, the elderly should be educated about using technology safely, learn to get information from reliable sources, and be encouraged to use technology consciously. They should also be guided to use reliable antivirus software, password managers and secure Internet connections.

What are wearable technologies for the elderly and their features?

Wearable technologies refer to the devices which can be fitted on a person's body or worn by a person, such as wearable wristbands, smart watches, smart glasses, smart wristbands, smart shoes, and other medical devices, usually with basic functions such as health and fitness monitoring, messaging and making calls, managing calendars and reminders. Wearable technologies first started in the 1970s with a Pulsar digital watch, but only became widespread in the early 21st century. The first smartwatches were launched by Sony and Samsung in 2013 and by Apple in 2015.

Wearable technologies for the elderly are smart devices and clothing developed to improve health monitoring, safety, independence, and quality of life. **Smartwatches** for seniors help them track their health data, exercise, count their steps, measure their heart rate, and monitor their sleep patterns. It also helps them to answer their calls, check their messages, and organize reminders. **Smart wristbands** help seniors track their activity levels, step counts, heart rate, sleep quality, and stress levels. It can also detect falls and automatically call for help in emergencies. **Smart shoes** have sensors that count steps, analyze walking, and monitor balance. It helps older people assess their walking performance and reduce the risk of falls. These devices can also be used while jogging or walking, collecting data such as step count, running distance, and running speed. **Smart clothing** has integrated sensors to monitor body temperature, heart rate, respiration rate, and activity level. These garments allow older people to keep track of their health status and share data with health professionals when needed. **Smart devices** are used to facilitate the daily lives of older people. For example, smart glasses can provide guidance and reminders using augmented reality technology. Smart pillows can monitor sleep quality and optimize wake-up times. **Smart glasses** feature a camera, speaker, and microphone to make phone calls, send text messages, take pictures, and record videos. With **augmented reality glasses**, they can make virtual travels on the Internet, attend virtual art exhibitions, and visit virtual museums. With **virtual reality glasses**, they can travel in an unreal world, such as going into space or playing games by taking part as a character in games. As can be seen, wearable technologies for the elderly offer many advantages such as health monitoring, fall prevention, emergency assistance, travel, and independence. These technologies improve the quality of life of older people and provide family members with a greater sense of trust and security. It should not be forgotten that proper training and support are required for the use and monitoring of wearable technologies. In addition, since new technology can be created every day in the digital world, these new technologies should be followed and adapted to the elderly, and continuous training should be provided to the elderly in this respect.

What is digital learning for older adults and what topics should it cover?

Digital learning for older adults is a process that enables older adults to improve their knowledge and skills by learning to use digital technologies. This learning process offers older people the opportunity to explore the digital world, communicate, monitor their health, access information, receive education and ensure their personal development. Digital learning for older adults should include basic computer and Internet skills, Internet security, e-mail and messaging, social media, online search and information resources, video calls and video chat, online shopping and banking, education and learning resources, health and health monitoring, and finally digital entertainment and hobbies.

What is a smart home and what should smart homes for the elderly look like?

Smart home refers to a home automation system that has become part of our lives with the 4th Industrial Revolution and that uses what we call the Internet of Things, i.e., the devices and systems connected to each other through the Internet. In this system, various devices and equipment in the home communicate with each other, making the home safer, more comfortable, and more energy efficient. Smart home technologies are specially designed in homes to facilitate the daily lives of the elderly, increase their independence and improve their quality of life. Smart homes for the elderly can be used for many purposes. For security and emergencies; security equipment such as smart camera systems, door sensors, motion detectors, and smoke detectors can monitor hazards in and around the home and send automatic alerts in emergencies. For fall detection and calling for help; the risk of falls can be reduced with sensors and devices that can detect falls of the elderly. These systems can automatically call for emergency help or send alerts to family members when an elderly person falls. With automatic lighting and motion sensors, lighting systems that automatically turn lights on and off by monitoring the movements of the elderly can be developed. This system not only improves the safety of the elderly at night but also saves energy. Motion sensors can detect the movements of the elderly in the home and make adjustments according to their needs. With a smart fridge, the products in an elderly person's fridge can be checked and new ones can be ordered. In remote control and management, seniors can control appliances in the home, adjust heating and cooling systems, lock doors, etc. via smartphones or tablets. In this way, they can remotely control and manage their smart home systems. Smart home systems also help seniors keep track of their health status besides helping their memory and giving reminders. With health monitoring, devices that can track health data, such as blood pressure monitors, heart rate monitors, or glucose meters, can be used and these data can be shared with doctors or family members.

4. Aging-Related Mobile and Computer Applications

The aim of the applications to be developed is to facilitate the daily lives of the elderly and to help them keep track of their health. For this reason; in the design of mobile applications to be developed for the elderly; a clear and understandable, user-friendly interface, ease of use, simple design, and accessibility are the most striking features that are suitable for the needs of the elderly. There is also a need to provide training and support on the use of mobile applications for older people. Digital trainings for the elderly can also be included in the applications. Having these trainings in the form of videos with visual narration will increase the effectiveness of the training. In fact, as a mobile application, only applications with digital trainings may also be developed.

Health monitoring is an important issue for older people. Therefore, applications should allow users to track blood pressure, heart rate, blood sugar, and other important health indicators. Some of the applications allow users to measure their health values and enter them manually into the applications, while others may automatically transfer the measurements to the application via a device. In addition, applications' reminder systems should also help users remember the times to take medicine or important appointments.

Social connection plays an important role in the lives of older people. Applications can help older people to communicate with their friends and family members. Some applications offer users features such as chatting or sharing photos, while others can bring people with similar interests together by creating a community.

Emergency calls in applications that allow users to easily access emergency numbers are also important for older people. Some applications should also allow users to quickly call for help in emergencies by detecting their location.

Many of the applications available to older people are not designed just for them. Many applications used by younger age groups are also used by older people. However, some applications have been created for only the elderly, and many of them are used for health monitoring. When we categorize the applications to be used by the elderly according to the intended use, we can list them as follows.

Known and used mobile applications for the elderly by category:

Applications related to socialization: These are applications such as WhatsApp, BiP, Telegram, Facebook Messenger, Viber, Skype, LINE, KakaoTalk, WeChat, Signal, and Kik Messenger, which provide instant messaging with voice and video calling for communication. Social media platforms like Facebook and Instagram maintain social connections, share photos, follow news, and interact with communities. Facebook is an application mostly preferred by the elderly. Applications like YouTube, TikTok, etc. provide access to video content in various categories such as music, documentaries, exercise, etc., and allow you to watch educational, entertaining, or informative videos on various topics. Increasingly popular streaming platforms such as Netflix, and Disney+, where video content such as digital films and TV series can be watched, offer a wide range of content and can be a fun way to spend time with seniors. Today, examples of these streaming platforms include Crackle, TubiTV, Popcornflix, Vudu, Pluto TV, Peacock, Kanopy, Hoopla, IMDb TV, Internet Archive, The Roku Channel, Yidio, SnagFilms, Puhu TV, FOXPlay, Vimeo, Xumo, FilmRise, Spread, The Word, and Documentary Storm. Applications such as SeniorMate, which accompanies seniors like a friend to help them fulfill the many functions they need in their daily lives, and GoldenYears, which are designed to help seniors make the most of the most precious times of their lives.

Health-related applications: Applications such as Lumosity and LibriVox, offer mental exercises and include games to increase mental activity and improve cognitive abilities by engaging the brain to improve skills such as memory, attention, and problem-solving. Applications such as Medisafe and Pillboxie LuminoCity, help to remind medicines and ensure that they are taken regularly, remind the time to take medication, and help to keep track of their dosage. Applications such as LibriVox, an audiobook application that offers an enjoyable reading experience for the elderly by offering paid/free audio versions of classic books. Applications like MyFitnessPal with features like calorie counting, food logging, and exercise planning to track nutrition and maintain a healthy lifestyle. Applications such as Doctor On Demand and HealthTap, which offer online doctor consultancy services such as remote doctor appointments and telemedicine services, where you can consult doctors about health problems via video calls or by sending messages, and get medical advice quickly by asking them health-related questions. Applications such as Heart Rate Monitor, which monitors the heart health of the elderly, checks their pulse rate during exercise and measures their pulse rate; Instant Heart Rate, which enables quick and easy pulse rate measurement using a fingerprint sensor; and Blood Pressure Monitor, which can measure blood pressure, facilitates blood pressure monitoring and helps them record their blood pressure values regularly. Applications such as WebMD provide access to health information and disease symptoms by providing access to resources such as disease diagnoses, medication information, and health articles. Applications for seniors, such as ARP Now, provide AARP members with information on topics such as health, finance, travel, and lifestyle and access to specialized information and resources. Applications such as AgeWell, ElderlyCare, and Seniorify, are designed to facilitate the lives of the elderly and improve their quality of life, helping them to lead a healthy and active life, designed for the care, health, and well-being of the elderly.

The applications that can be used by the elderly are not limited to the applications mentioned above, one should note that application stores are getting enriched with the inclusion of new applications every day. However, serious health problems should always be referred to a health professional.

Smart home-related applications: Google Home, Amazon Alexa, Apple HomeKit and Samsung SmartThings, Philips Hue, and Google Nest, which are used to control and manage smart devices in the home, such as controlling the lights of the house, adjusting the thermostat, playing music, controlling smart plugs, etc. with voice commands. The August Home application offers smart door locks and video doorbells and has functions such as remotely unlocking/locking doors, monitoring entry logs, and providing guest access. Ring applications with functions such as smart video doorbells, monitoring the surroundings of the house via security cameras, controlling the video doorbell, setting motion sensors, etc. ElderlySafe, GoldenHome, SeniorHome, SeniorComfort, and ElderTech applications are designed to help seniors in emergencies by making their homes smart, helping to make their lives safer, more convenient, and more comfortable.

These applications help older people to make their lives easier, more accessible, more comfortable, and safer. It is important to keep in mind that more and more applications are being added every day.

5. Developing An Exemplary Mobile Application for the Elderly

In the design and development of mobile applications, the elderly population often comes across as an overlooked demographic group. This research article aims to explore the basic features and functions required to develop a mobile application designed specifically for the elderly. When developing suitable mobile applications for the

elderly, it is very important to understand the problems, limitations, concerns and expectations of senior citizens first. For this reason; in the article, these issues related to the elderly are discussed in detail first.

The interface design should be kept simple in applications, simple touch menus should be used, avoiding complex floating menus, each operation should consist of an easily accessible menu by itself, there should be appropriate sitemaps and live hyperlinks in the application. It should be taken into account that the elderly may have different levels of technological and cognitive abilities, and the design should be made taking into account the potential impact of physical disorders such as limited manual dexterity or visual impairments that the elderly may have. For the elderly who experience difficulties with touch interaction, voice commands or voice recognition technology should be included in applications to ensure accessibility.

The mobile application developed for the elderly should be easy to use, functional, and oriented to the needs of the elderly. This application is not only a mobile application but also designed to facilitate the adaptation of the elderly to the digital world and support them in their daily lives.

The modules envisaged to be included in our exemplary elderly mobile application in this article are listed below. Each module has sub-modules that are used for different purposes. The applications in these sub-modules are given in the figures below. Some of the applications in the sub-modules are applications to be developed and some are existing applications such as WhatsApp, Facebook, and YouTube. The purpose of using existing applications here is to enable them to perform all operations through a single application.

- **Elderly Safety Module:** The applications are designed to improve safety in older people's homes by providing a range of alerts and observations for the safety of older people through the use of sensors and smart devices in the home.
- **Health Monitoring and Tracking Module:** It helps the elderly to monitor their health measurements such as pulse, blood pressure, and blood sugar, and facilitates intervention in any emergency situation by informing the necessary people and places. Applications are designed to monitor and track the daily activities of older people through wearable technology tools and other monitoring and tracking tools. This makes it easier to stay informed about older people's routines and to keep track of their health and safety.
- **Emergency Calls Module:** The applications are designed to enable older people to call for help in emergencies, and with this feature, older people and their caregivers can quickly request assistance.
- **Caregiver Notifications Module:** By providing carer notifications for the elderly, applications can enable carers to be better informed about the elderly and thus provide better care services to the elderly.
- **Social Connections Module:** It is designed for older people to use existing applications to ensure their social interaction. Most of the sub-modules here consist of existing platforms and applications.
- **Exercise Module:** It recommends exercises for the elderly and enables them to track their exercises.
- **Reminders Module:** It reminds the elderly of medicines, doctor's appointments, and shopping.
- **Mobile Rehabilitation Application Module for the Elderly:** This application is designed to monitor the health status of the elderly and manage their rehabilitation process. The application can help older people exercise at home and monitor their health condition.
- **Mobile Service Application Module according to Needs:** Applications are designed to address the needs of the elderly according to their specific needs, including but not limited to home care, cleaning services, health services, and catering services.

The visual of the application whose design is considered is **MY APPS** and its name is "My Apps". This application is the main application and will be displayed as a single image on the mobile of the elderly. Others will be displayed by clicking this main application. The first visual (Figure-2) that will appear on the screen is the main module applications categorized according to the subject headings. Currently there are 12 main module implementations and can be changed according to need. There are many sub-modules in the content of each categorized main module. In the article; 3 of 12 main modules; There are images of security (Figure-3), social connection (Figure-4) and exercise (Figure-5) submodules. Each submodule works with touch and is used for different functions and purposes according to the module's feature. Other submodule visuals were not included in the study.

Figure 2. Applications Main Module

Figure 3. Applications Security Sub-Module

Figure 4. Social Connection Sub-Module

Figure 5. Exercise Sub-Module

6. Conclusions and Evaluations

The elderly population is increasing rapidly all over the world with advances in medicine and the prolongation of life expectancy. The increase in the elderly population of a country affects society in all aspects; it brings along social, sociological, psychological, economic, health, etc. problems and becomes a serious burden on the economy of countries.

Various findings have been obtained in studies on different topics related to the elderly. Bilir (2004) considers old age as being respected (84.4%), retirement (74.7%), resting (63.8%), having less responsibility (50.8%), and having more time for everything (35.7%). Olak and Tümer (2017) state that the lives of the elderly are limited to a moderate level. Morris, Goodman, and Brading (2007,113) state that most of the elderly feel isolated because they are dependent on their homes. In the studies conducted, the majority of the elderly (70%) defined old age as an unpleasant event they have experienced, illness and death (Bilir, 2004), while students defined it as hopelessness, dependency, loneliness, the end of productivity and waiting for death (Kulakçı, 2010; Şenol-Çelik, Kapucu, Tuna and Akkuş, 2010). These definitions are worrisome. Aging is a natural process of life, like birth and death, and every person will grow old one day. Like every age, old age has its good sides as well. It is necessary to see them and aim for old age accordingly.

It is important to organize and implement policies on old age in our country and in the world. These policies will not only meet the many needs of the elderly but also the needs of their caregivers, reducing their stress, anxiety, and responsibilities. Governments, non-governmental organizations, international organizations, media, professionals, academics, health professionals, sociologists, and psychologists should come together for global cooperation on the issue. Since the demographic change brought about by the rapid aging in the world affects almost all aspects of society, WHO has declared the period of 2020-2030 as the decade of healthy aging (WHO, 2020). This decision is an indication of how important and serious this issue is. The main topics included in the perspective of the Decade of Healthy Ageing include examining the perspectives of societies on the concepts of old age and aging, taking measures against age discrimination, improving the ability of the elderly to participate

in and contribute to the society and communities in which they live and expanding their opportunities, expanding the concept of age(ing)-friendly environment in this context, providing integrated care and basic health services that meet the needs of elderly individuals and providing access to long-term care for elderly individuals in need (web address.aile.gov.tr (2023)). In Türkiye, the "Status of the Elderly in Türkiye and National Action Plan on Aging" conducts studies and sets policies on aging. In order to achieve these policies, the elderly should be digitalized within the determined framework and the applications should be developed for them by taking into account the importance of these issues. A perspective on aging should include more than just providing care; it should also prevent the social isolation of older people, support them to regain their status and role and encourage them to engage in health-protective and health-promoting activities. Mobile applications can be designed in a way to offer this much-needed support to the elderly.

When we look at the 2023 data on the digital world, we see that digital platforms can offer users a much wider variety of functions than any single entity can achieve alone (Eisenmann, Parker, and Van Alstyne, 2010). According to Meltwater's (2023) "2023 Global Digital Report" data; the world's population is 8.01 billion. 49.7% of the world population is female and 50.3% is male. Approximately 10% of the world's population is aged 65 and over. 64.4% of the world's population are Internet users, 59.4% are active social media users, 95.5% own a mobile phone, 58.0% own a laptop or computer, 33.3% own a tablet, 20.3% own a game console, 29.9% own a smartwatch, 16.5% own a smart television using the Internet, 16.4% own smart home devices, and 5.6% own virtual or augmented reality glasses. In the world, the time spent on the Internet in a day is 6 hours 37 minutes, time spent in front of television is 3 hours 23 minutes, time spent on social media is 2 hours 31 minutes, time spent on game consoles is 1 hour 14 minutes and time spent on Internet media is 2 hours 10 minutes. In the world population, 61.6% of Internet users are women and 67.2% are men. 92.3% of the world's Internet users connect to the Internet via smartphone and 65.6% via tablet or computer. Of those who connect to the Internet, 78.3% are from cities and 45.8% from rural areas. According to the Meltwater (2023) report, the percentage of adults aged 65 and over who are concerned about what is real or fake on the Internet is 56.4% for women and 58.0% for men. Of the world's social media users, 4.8% female, and 4.2% male users are aged 60 and over. (In the report, the value for the age group of 60 years and over, not the age group of 65 years and over within the population for the whole world, is given).

The decrease in physical and mental capacity with aging, and the loss of productive functions, lack of financial security, and loss of independence may cause the elderly to become isolated (Toprak, İ., Soydal, T., Bal, E., İnan, F., Aksakal, N., & Altınyollar, H., 2002; Action Plan, 2007, Action Plan, 2015). Smartphones, which can be accessed from anywhere with their capabilities and functionality brought about by developing technology, have become an indispensable part of the daily lives of the elderly. For many older people, information and communication technologies can be difficult to understand. Cell phones are frequently used by older adults to communicate with their children and their close environment (Barnard, Bradley, Hodgson, and Lloyd, 2013). According to studies, the use of information and communication technologies by the aging population supports adult learning, access to health information, and communication with family and friends (Hernández-Encuentra, Pousada, Gómez-Zúñiga, 2009). The elderly use and adopt digital technologies in many areas. Adaptation to technology can improve the quality of life of older adults, facilitate their independent living for longer times, and build a bridge with technology across generations by teaching older adults to use technological devices (Garcia-Penalvo et al., 2014). Along with these developments, the occurrence of physical, mental, and social changes in individuals during the aging process reveals various barriers to the use of new technologies by older adults (Orpwood, Chadd, Howcroft, Sixsmith, Torrington, Gibson, and Chalfont, 2010; Bilir Paksoy and Erbaydar, 2015).

Applications should be able to remotely control lighting, temperature, security, and other features in the home using smart home devices. In this way, even when seniors are at home, they can control everything and make adjustments according to their needs. For example, the elderly can read by providing appropriate lighting or feel comfortable by remotely controlling the temperature in the home. It also offers many features for emergencies. For example, if the elderly fall or feel that they are in an emergency, the application can make an automatic call or send an urgent message for emergency services. In this way, the elderly can get help quickly. It also offers many features for families and caregivers of the elderly. For example, the application can track movements in the home and send an alert to families or caregivers. This way, older people's movements can be controlled and assistance can be provided according to their needs. It also allows families and caregivers to monitor the condition of the elderly. Health data of the elderly can be automatically transmitted to family members and caregivers for health status checks.

It is important to acknowledge that older people may need help to learn how to use smart home devices and to provide them with adequate training and support to use the application. In order for the applications to achieve

their goals, it should be kept in mind that the elderly is unfamiliar with technology and therefore may experience some problems. One of the problems could be device compatibility issues. Having different brands and models of smart home devices in the homes of the elderly exacerbates this problem. Applications must be compatible with these devices to avoid compatibility problems. Another problem is the question of affordability. Smart home devices and applications are often costly. As most seniors are retired, it is important that the application and devices are cost-effective. Another issue is privacy and security. As smart home devices collect personal data, applications with poor security can lead to these data being shared with third parties. Therefore, seniors and their families should carefully examine whether the application's privacy and security measures are adequate. Another problem is physical limitations. Physical limitations of older people, such as tremors or limited mobility in their hands, may prevent the use of some features of the application or make the devices difficult to control.

As a result, by providing a safe, secure, and comfortable living environment to the elderly, we need to increase their well-being, happiness, and life satisfaction. The elderly need to be actively involved in the digital world in order to benefit from the developments brought about by the digital world in a way to make their lives easier such as maintaining social connections, keeping track of their health status, staying healthy, making financial, banking and e-government transactions, benefiting from applications that make their daily lives easier, using reminder systems of applications that help them remember important appointments or times to take medications. Mobile applications for the elderly are applications designed to make their lives easier and help them. This helps them to live a more independent and active life without being dependent on others. Mobile applications to be developed for the elderly should ensure the safety of the elderly, have monitoring and tracking features, help in emergencies and provide guidance with calls, send notifications to family members and caregivers, provide various mobile services according to their needs, strengthen their social connections, help in their rehabilitation, provide exercise support suitable for their age and physical characteristics, and monitor all health procedures such as blood pressure and pulse measurement, especially medication reminders.

Healthy aging is the process of optimizing and sustaining opportunities to maintain and improve physical and mental health, independence, and quality of life throughout life (Pan American Health INSAC 2023 New Trends in Health Sciences Chapter 17 252 Organization, 2023). Healthy aging aims at contributing to the development of older people's independence, autonomy, self-care, self-esteem, and thus quality of life (Cardoso et al., 2021). Healthy aging is the fundamental right of every individual in the world.

The aim of this research is to contribute to the advancement of knowledge in the field of mobile application design for the elderly and to create a more inclusive and user-friendly technology for this growing user group. In conclusion; More research in the field is needed to address the results of this study and to explore additional features and functions that may meet the various needs of the elderly. Research on this subject should not only consist of informatics, but also interdisciplinary studies consisting of many disciplines.

Note: All infographics **_canva.com_** it is organized on the site as a Pro subscriber.

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