

Optimizing Wireless Networks to Enhance Daily Living for the Elderly: A User Experience Perspective

Simran Vats¹, Monica Singh², Ranganath M Singari³

¹Department of Design, Delhi Technological University, New Delhi, India.

² Visiting Faculty, UP Institute of Design, AKTU, New Delhi, India

³Department of Design, Delhi Technological University, New Delhi, India

^{1*}simranvats300@gmail.com

ABSTRACT

This paper analyzes the process of wireless communication system optimization in the effort to augment the daily lives of older adults, especially the central role played by User Experience. With the existing population trend of the world ageing, technology is finding its way into the routine lives of people and thus wireless access is no longer a luxury but rather a necessity. In this regard, there is the increasing need to make sure that wireless systems are user-friendly and accommodating to elderly. The research is based on the qualitative responses of about twenty-five respondents who are sixty years and above. Their reactions shed some light on repetitive challenges, behavior patterns and expectations that influence their interactions with wireless technologies. The results indicate that system design must be outright in considering the sensory and cognitive and motor constraints related to the ageing system. The findings add to a wider discussion of the inclusive digital infrastructure and provide a useful guideline in further studies, interface improvement, and the creation of wireless networks. The aspects of User Experience through the lens of ageing are critical to the process of developing digital space that would be not merely functional but also comforting, accommodating, and truly empowering to the older generation.

Keywords - Wireless Networks; User Experience; Elderly Users; Daily Living; Ageing; Accessibility; Technology Adoption; User-Centred Design; Connectivity; Quality of Life.

1. Introduction

The intersection of wireless communication systems and the user experience (UX) has become the subject of a significant scholarly interest over the past few years, especially in the framework of the rapid ageing society. Technological ecosystems have developed at an unparalleled rate over the past ten years and form the basis of most daily transactions, services and types of communication which now form the new literacy of daily living (see, for example, [1], [2]). This can be observed in particular in aged people whose wireless devices have since become a crucial tool in controlling their day-to-day activities, socializing, and obtaining important information.

The demographic changes are shifting, and the percentage of elderly people is increasing in the global population, which increases the necessity to adjust the digital tools to age-associated cognitive, sensory, and motor peculiarities (see, e.g., [2], [3]). To manage this issue, it is not enough to only improve the technical performance, but rather a coherent perception, comprehension and engagement of older users in wireless settings. Therefore, the wireless networks and UX convergence cannot be discussed as purely a technical field of work but as one that should also embrace active and empathic, human-related design, considerations that will facilitate inclusion, ease of use, and trust among geriatric users. This responsiveness during design is vital in establishing enabling digital ecosystems that will empower older citizens instead of sidelining them so that they can stay connected, independent, and digitally safe.

1.1 WLANs and User Experience.

Wireless communication networks are the structural pillars of the modern form of digital interaction. But these networks do not offer worth to the elderly based on the bandwidth or efficiency of the network but in terms of how users feel using these systems on the interface level. In the case of older generations especially, the optimisation process should not be limited to the technical infrastructure but instead, it should include human-oriented design reasoning. It is necessary that the wireless technologies should be designed in such a way that they facilitate intuitive interactions, proper feedback, lessen the cognitive load, and minimize navigational effort, as it has been implied in previous studies [1]. The focus on such UX-improvements can significantly increase the daily usability of wireless systems, which would have a positive effect on the autonomy, comfort, and confidence of older users.

1.2 Wireless Products and Aids to the Elderly.

The growing accessibility of assistive products which are designed to incorporate wireless has provided a new direction toward the ability of leading a more functional life later in life. Use of Smart-home controllers, wearable Internet-connected devices, fall-detection systems, remotely-monitored health devices now allow older adults to safely and with more autonomy carry out some of their daily tasks. There are opportunities of using these technologies to deal with challenges relating to aging in terms of mobility, forgetfulness, and constant monitoring. To attain significant benefits with these technologies, however, their implementation should be made discreet, reliable and without problems into the daily wireless systems. This can only be achieved through this integration to develop, which will help older users to be in control of their activity patterns and be socially active and safe.

1.3 Ageing, Technology Dependence, and Barriers Associated.

The world statistics clearly reveal that the number of older individuals is rapidly growing, and the number of health-related issues to hinder the independence of the latter is on the rise [2]. On the other hand, the ageing population is becoming more sociable, transacting, information seeking and getting healthcare through digital tools, so they are becoming more reliant on technology when they are older. This change however comes with new challenges [2]. One of the most popular barriers is new ways of interaction, over-complicated interfaces, digital incompetence, and reading and access problems with services. Inclusive design, considerate UX choices, and context-related research approaches are important to be featured in the design of wireless systems. Without such precautions, the digital revolution will probably contribute to the exclusion and not reduce it.

1.4 Moving To Inclusive and Supportive Digital Ecosystems.

There is no technical goal but a social one that should be shared by all people in terms of digital participation of older adults. The process of installing wireless networks should be made in such a way that can allow the seniors not only to be end-users but also active participants in the digital world. Interfaces with a variety of perceptual and physical capabilities make truly inclusive settings, as opposed to those that make users adjust to systems [3]. By so doing, the wireless technologies will be able to maintain the social interactions of the elder generation, facilitate the access to the digital culture and strengthen a sense of agency and contribution [4].

Based on these insights, the current study is based on the experience of about 25 elderly participants to investigate the overlap between wireless networks, device ecosystem, and UX barriers. Investigating their challenges, hopes, and actions will add complexity to the scholarly discussion and open the pathway to the development of age-sensitive wireless spaces that will actually benefit the elderly demographic in their everyday lives based on the empirical evidence.

2. Literature Review

The connection between wireless network design, user experience and the ageing population requirements have gained growing academic interest over the last several years, as a measure of both the demographic change and the prevalence of services that rely on connectivity. An overview of the available literature proves that this research topic is a multidimensional concept, and its scope is quite extensive, including the domain of accessibility engineering, behavioural technology adoption, medical informatics, and inclusive interface design. The aggregate academic data indicate that the ability of the aged to effectively engage wirelessly with technologies is pre-determined by the technical architecture as well as the human factors that affect the understanding, comfort, and confidence.

Many studies involving user interfaces and healthcare-based digital platforms point to the prospects of elderly-specific solutions. The best-known example mentioned among others is the Silver Connect, a digitally integrated healthcare platform aimed at the elderly users. This site exemplifies how the age responsive interface approach, which is based on simplified navigation, easy iconography, big readable text, and easy access to help can greatly minimise the usual barriers to interaction older adults tend to encounter. Its basic functionalities are the ability to track prescriptions, remote physiological monitoring, and access to telemedicine consultation thus, allowing seniors to use healthcare services independently. More importantly, such tools support the active, but non-invasive surveillance of everyday life, health conditions and well-being, which enhances autonomy and the feeling of control in the later life [5].

Wireless Networks and Accessibility: According to different studies, access to a wireless network is paramount to involving the older adults in digital participation. The study of the wireless personal digital assistant indicates that the aging user base enjoys the ergonomic layouts, simple navigation routes, and distinct structures. The results of iterative design processes may produce significant results in accessibility of older adults, with the flow of interaction that is constantly tested and modified, based on real user behaviour, instead of the assumed abilities.

User Experience and Ageing: User experience momentarily became a key predictor of technology uptake in old age. The literature supports the need to have age friendly systems designed with the user centred design concept where the logic behind the interface is developed based on simple cognitive processing, clarity of perceptions and emotional confidence. The barriers faced by the older adults go beyond the hardware and software, but also due to the perceptual decay, diminished digital self efficiency and the digital literacy gaps [2]. To conclude, user-experience design of a digital system cannot be ignored to help facilitate ageing.

Smart Technologies and Ageing: The recent researches also demonstrate the growth of smart and ambient intelligence solutions, which are used to assist ageing-in-place. The linkage of smart home with routines that undertake automated environmental monitoring and environmental context detection can increase the autonomy of the elderly and make them feel secure [6]. Such systems are capable of assisting older people to engage themselves more safely in day to day activities as well as minimize the intervention of a caregiver.

Telehealth and Remote Care: Telehealth has emerged as a significant platform upon which remote healthcare and social healthness of the elderly are enabled. The existing prior literature suggests that telehealth may be a viable therapeutic intervention at the physical as well as mental levels provided it is used sparingly [7]. The studies of older adults residing alone indicate that remote platforms have potential to fight loneliness, provide care, and make clinics more efficient [8]. Additionally, telehealth can reduce the caregiver load, offer supplementary resources, and care coordination. However, the

adoption has been hindered by the lack of infrastructure, limited accessibility in suburbs, and the different levels of knowledge by caregivers in the digital tools [9].

Technological Aids in Dementia Care: In dementia care, digital assistive technology has received significant interest. Applications that are installed in mobile devices to guide people through outdoor activity mobility challenges take into consideration safety issues and autonomy [10]. The empirical studies address the beneficial effect of empathetic and user-centred design of technology on the lived experience of people with cognitive decline. Another new intervention, which has been implemented to improve communication, social interaction, and emotional reassurance, which have a significant impact on well-being in dementia settings, is the use of socially assistive robots [11].

Digital Inclusion and Social Connectivity: Digital inclusion is a theme that is also prevalent across ageing literature. According to the reports on the attitudes of older adults to smart home environments, wireless access contributes to the emotional well-being of older adults by promoting social communication and reducing isolation [12]. The empirical findings also prove that the use of smartphones is closely related to an increase in life satisfaction in older adults because of the emotional connectivity affordances and convenience of functions [13].

Difficulties in the Adoption of Wireless Technology: Although there are the potential benefits, there are several challenges recorded in the adoption of wireless technology. As an example, a study of digital television interfaces demonstrates that poor navigation, small controls, and unintuitive layouts are some of the elements degrading the comfort of the elderly to use. The wider examination of information technology relationships with the elderly proves that a bad-designed interface increases frustration, even in cases when people acknowledge the utility of the technology. In a number of instances, only when users developed a better sense of the benefit channels did they become willing to adopt wireless systems, a fact that necessitates the emphasis of the need to have clarity in communication as much as interface logic.

2.1 Critical Analysis of the frequent problems and creative ideas.

The generalization of the existing academic research, the examples of the cases, and the direct user feedback allow indicating that older adults face several common obstacles when using wireless systems. Simultaneously, there are other design-oriented and technological interventions to alleviate these impediments that are also proposed in contemporary literature. Combining these sources will enable us to create a more subtle viewpoint that will maximise the user outputs of the elderly demographics. This synthesis is not only the outline of the key challenges but also the demonstration of how the user-centred design might be provided in a way to make wireless technology accessible to older adults.

2.2 Common Challenges

Digital Literacy and Usability: It has been postulated that wireless health monitoring devices will be critical tools in improving personal security and well-being among the independent living elderly individuals. Nevertheless, empirical studies have found that empirical research has grossly failed to consider the cognitive and perceptual changes that are peculiar to older adults in the design and implementation process of such systems and thus among the reasons behind the low levels of adoption and acceptance of such systems [16]. A number of the aged have enormous problems navigating wireless devices because of complex interfaces, condensed features, uncertain iconography and a requirement of knowledge to troubleshoot. This results in the digital literacy gap between the elderly population and the digital and social world being the manifestation of the acute usability issues.

Physical Limitations: Aging leads to motor skill degradation, vision acuity, and hearing processing, which is a significant setback to older adults. The interface is overly challenging to older users with small interface elements and gestural controls, as well as vague iconography, despite any signs of willingness they may have to use the technology. The evidence based on the mobile-health applications indicates that even though these systems have been shown to be capable of increasing the levels of physical activity, assisting in self-care as well as decreasing the healthcare spending, they simultaneously create the feeling of anxiety related to the privacy. Research has also shown that when the safeguards against privacy invasion are disclosed, the anxiety is reduced and there will be increased desire to join health programmes [17].

Social Isolation: social isolation is especially prone to senior citizens, and the lack of access to digital communication exacerbates the issue. In the case of video functionality, the elderly users cannot activate them, or use such modalities of communication as text-based communication, they face a lack of connection to the wider community [4]. The issue of communicative shortcoming among the elderly is a major requirement that must first be addressed before technological interventions are established.

Privacy and Security Concerns: Resistance to the use of wireless systems is also informed by fears of digital exploitation. Frequently, reports and user testimonies exhibit fears of internet fraud, mishandling of personal information, and privacy invasion [18]. These fears are intensified among the elderly users who might not be confident in determining the veracity or authenticity of online demands thus creating obstacles to the continuous use of wireless services.

2.3 Innovative Solutions

User-Centered Design: The modern research has continually found user-centered design as one of the best methods of minimizing the usability barriers in the older adults. The rest of the design recommendations can be simplification of interface architecture, improvement of predictability of navigational behavior, and explicit instructional support. The voice interaction, scalable text elements, icons with high contrast, and simple visual hierarchies are some features that directly enhance the comfort of the user and operational clarity.

Assistive Technologies: The current development of assistive technology presents essential options to resolve the physical constraints that come with old age. There are voice-controlled smart-home appliances, screen-reader programs that change visual data into audio results, and keyboards especially made to be low-suppleness and to lack fine-motor control [19].

Telehealth and Remote Support: The development of remote-care ecosystem is one of the key aspects of digital support of older adults. Telehealth services offer online medical care, social networking, interaction with peers, and online support groups, which reduce the effects of social isolation and include the users into the network of ongoing care [9]. These systems are aimed at ensuring that physical mobility or geographic proximity is not a limiting factor to access to healthcare.

Cybersecurity Education: The fear associated with privacy may be reduced through providing the elderly users with personalized cybersecurity awareness training. According to case-studies evidence, security concepts need to be explained in non-complex way, complemented by salient features, including two-factor authentication, simplified privacy dashboard, and clearly labeled secure connections, which leads to a significant rise in trust [20]. The positive relation between the trust in personal safety and the attitude towards activity in the digital world is observed.

Together, empirical studies, usability studies, and deployments prove that, though older adults face significant obstacles to communicating with wireless networks, an equally large set of innovations is

available to overcome these barriers. The key ways to improve the user experience of older adults are the practices of user-centered design, assistive digital tools, telehealth services, and specific cybersecurity education. These innovations are indicative of a changing awareness of the need to develop inclusive and equitable wireless technologies that can assist people in independent ageing. Such solutions will be inevitable as the digital infrastructures keep developing to minimize inequality in access and provide meaningful, secure, and confident use of wireless technologies by older adults.

3. Research Design

The current research assumed a qualitative exploratory approach and semi-structured personal interviews. The process of communication was between about 40 elderly people of 60 years and more as they were the study participants. Gender representation, residential background (urban and rural) and pre-exposure levels to digital technologies were subjected to intentional diversity. The purpose of this stage of the study did not involve the statistical generalization, but gaining insight into the experiences, views, and interactions of older adults with wireless technologies.

The interviews were conducted by use of open-ended questions that would enable interviewees to explain their experience about wireless technologies in their own words. The questionnaire used covered the demographic factors, the trends in technological use, challenges met, suggestions to improve the interface, the degree of telehealth experience, and the familiarity with the video-based communication tools. The participants were contacted through the research team in different forms of communication such as face-to-face interactions, over the phone call, and the video meeting all of which were arranged to fit the convenience of the participants and provide the different communicational backgrounds.

The qualitative thematic analysis was utilized to coded and categorize all the responses to interviews into reoccurring themes and patterns of meaning. In line with the small sample size, analytical emphasis was on the interpretation depth as opposed to a quantitative measure. This way helped create the contextual specifics that led to a better understanding of the way older users formulate the difficulties and expectations of using wireless systems.

4. Inference and Findings

4.1 Descriptive Statistics for Age

The descriptive analysis shows that the concentration of the age distribution is concentrated in the upper segment. The average age of the respondents was, on the one hand, about 71 years of age, thus validating the fact that the sample is mainly made of the older generation of respondents. An average age of 72 years further supports this distribution where half of the respondents are situated above and below this. That modal age, which is reported to be 68 years, indicates that the age range made a significant portion of the data.

These descriptive results are in line with the main aim of the research, which aimed to examine the interaction patterns of the older adults with the wireless technologies. The age range makes sure the views gathered are the result of a segment of the population that is of specific interest to the user experience study that is about aging. Because digital competence, comfort and technology expectations vary significantly depending on age, the focus on this group will give valuable contextual background to the interpretation of the findings. It also makes the study more applicable to design researchers and developers who will be interested in developing wireless environments that capture, more closely, the lived realities of older users.

4.2 Frequency of Smartphone Use

A smart phone use frequency analysis has shown that there is a difference in the use of mobile devices among older adults. The average usage rating, which is estimated to be 3.68, indicates that the participants use smartphones a few times a week, on average, meaning that digital involvement of the elderly is becoming more normalized and partially integrated into daily activity.

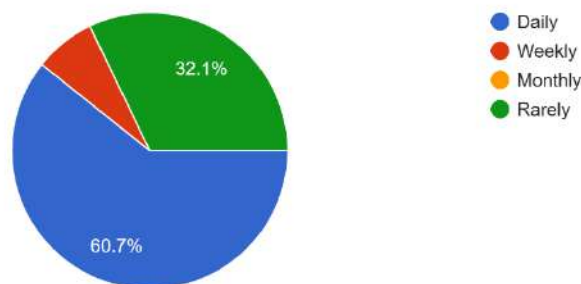


Fig 1 Use of Smartphones and Mobile phones by elderly.

On the other hand, the median usage type was recorded as Monthly which means that a good number of participants infrequently use their phones, but mostly a select few activities instead of using it throughout the day. This trend provides a demonstration that the manifestation of mobile engagement in older adults is not homogeneous and uniformly intensive but is, rather, stratified in the background of different personal needs, motivations, and previous exposure.

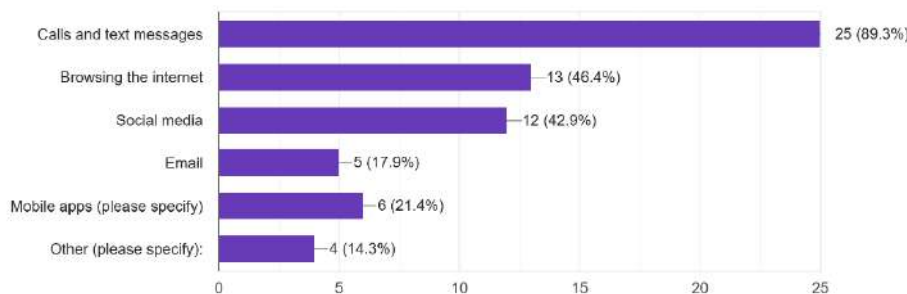


Fig 2 Primarily use of Smart phones and Mobile phones by elders.

However, the fact that the largest segment of the sample uses their devices daily suggests that there is a strong segment of the sample that uses its devices frequently (see Fig. 1). That is, in the case of many senior citizens, the use of devices nowadays is no longer done in an occasional, off-period manner. This communication is not the only form of such everyday interaction, despite the fact that calling and texting are the main functions of the phone, the participants also use it to connect with others through messaging applications, light browsing, and occasional use of certain applications (see Fig. 2). This trend refers to a progressive change in the perception of technology as devices transform to be less like an unknown appendix into becoming part of the media that enables social presence, personal communication and dissemination of information to a wider audience in old age.

The implications of these observations to the design of future wireless systems targeting older adults are enormous. The knowledge of the consistency and variability of smartphone engagement has

* Corresponding Author:

Simran Vats, DTU, Delhi, simranvats300@email.com:

informed interface design, which should be made available, flexible, and usable at different levels of comfort. Due to the inclusion of frequent and light users in the sample, the results provide a balanced representation of how mobile technologies are used by seniors and highlights the need to have an ecosystem that is flexible and user-centered, which can accommodate diverse usage patterns and not just assume that all seniors use technology in a single way. With knowledge about how the elderly embrace, perceive and incorporate technology in their day-to-day activities, the designers can create environments that have the capacity to truly assist the older adults to make them even more comfortable, more confident, and more digitally included.

4.3 Challenges Faced

Most common issue

The answers of the participants have shown that the greatest obstacle in communication with wireless devices is the inability to navigate the interface (see Fig. 3). The majority of interviewees complained about being confused or unable to understand menu layouts, nested environments, and multi-step interaction channels. This trend is a consistent usability issue among elderly people who use smartphones or other wireless computer networks. The elderly with little technical training and/or limited manual dexterity struggle to perform simple tasks where the order of interaction is not clearly available or the visual choices are extremely high and/or abstract. This supports the simplification of interface as priority in age-responsive wireless technologies.

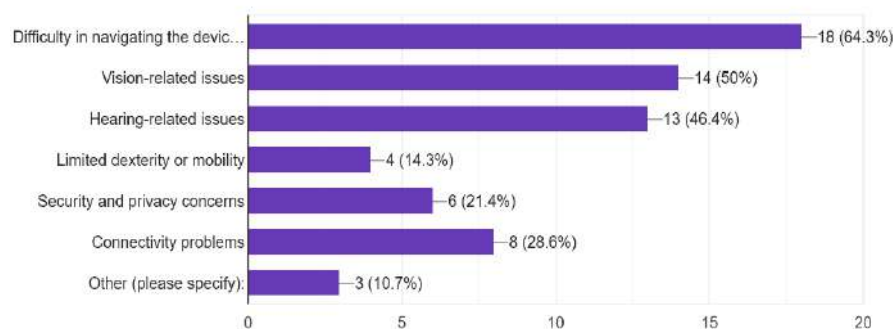


Fig 3 Challenges or difficulties have you encountered while using wireless technologies.

In addition to navigation problems, numerous participants also noted that they were faced with issues due to physical changes of old age (poor vision and low motor control) which influence the degree of comfort with which older adults can use wireless devices in their daily lives. Small buttons and close spacing of touch targets and even fine print hinder proper selection of options or reading of content. Reduced sight means that it becomes harder to identify icons or screen objects, whereas reduced dexterity makes typing or use of the touchscreen harder. Hearing impairment was also cited as one of the challenges to digital communication. The participants during the interviews indicated that hearing loss may hinder activities like taking part in calls, verbal notification, or voice-operated machines. All these sensory motor constraints, combined, define the perceived confidence of older adults regarding their communicative capabilities, as well as their ability to operate in wireless situations.

- The most common challenge that was mentioned by participants:
- Interface/navigation difficulty
- This was referred to by 12 out of 25 participants.

- Most frequent Request for Improvement:
- Large fonts and icon size.
- This was requested by 14 out of 25 participants.

These figures also suggest that, in spite of the expressed willingness of older adults to be involved in the activities of wireless devices, the design vocabulary of the majority of digital contexts is not well-adapted to perceptual and motor abilities of these patients.

4.4 Comfort with Video Calls

The current findings indicate that there is a high level of heterogeneity in the comfort of the older adults with the use of video-based communication tools as shown in Figure 4. Even though the percentage of participants indicating that they felt very comfortable was quite interesting, the average and median of the comfort score suggest a less confident outlook of the whole cohort. Therefore, some older individuals have adopted video calling as an everyday activity, whereas some are still at an underdeveloped level of usage and skill. These different levels of comfort are to be identified in order to inform the design of streamlined interfaces, specific support resources and customized instructional programmes. In order to make sure that the video-mediated interaction transforms into a more convenient and a more sustainable communication modality in the future, the training resources and architecture of the system should be adjusted according to the actual comfort thresholds of older adults. The analysis therefore gives a clear picture of the comfort of participants in video-calling as the average comfort score was moderate although around 36 per cent of the respondents stated that they experienced high levels of comfort when using such platforms.

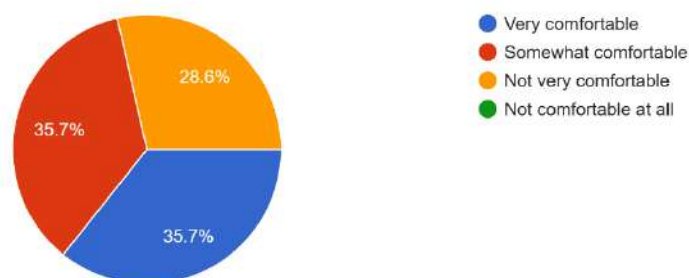


Fig 4 Comfortable level with using video calls or online communication tools to connect with family and friends

The average age of the sample of about 68.75 years is a confirmation that it targets older adults. The majority of usage patterns that were the most commonly reported were day to day, which indicated persistent digital interaction among a large percentage of respondents. However, challenges with interface navigation and sensory concerns remain the crucial problem, which emphasizes the importance of wireless systems, focusing more on the simplicity, clarity of perceptions, and ergonomic interaction. The need to increase typeface size, the need to make the icons more visible, and more straightforward help are additional indicators of the necessity of the improved accessibility provisions. The use of telehealth is apparent, but confidence levels are also quite different, indicating that they can adopt it but it depends on the confidence of users.

What all these trends show is that wireless technology design needs to be more responsive to the age factor. More inclusive wireless spaces could be achieved through an improvement of navigational flow, strengthening accessibility features, and offering precise teaching aids. Digital spaces can be fostered in a way which encourages, feels intuitive and empowering to older people by optimizing the system.

5. Conclusion

The study provides a detailed analysis of the way elderly people use wireless technologies and explains the peculiarities of their experience, the issues they face, and their expectations. By examining the answers of the participants, it can be observed that the most common challenges allowed by age-related participants more than 65 years old include the challenges of multi-step navigation, the interface design and the physical constraints of working with small or highly-dense visualized items on gadgets. Their experience is also complicated by age-related sensory alterations, such as decreased vision, dexterity and hearing difficulties. These results lead to an interesting case in favor of age-specific wireless systems sensitive to the age-related abilities, which could be accomplished by making visual hierarchies clear and simplifying interaction channels, increasing the size of interface items, and placing help resources in convenient places on the content.

The research is also part of the discussion of the adoption of telehealth. Although remote consultations can reduce travel strain and improve continuity of care and support ageing-in-place, privacy issues, digital confidence and usability continue to be major barriers to remote participation. To achieve the potential of telehealth practices in later life, interfaces have to be designed in a way that is age responsive, trustworthy, and user-friendly. To bring about these types of improvements, there must be a unified, multifaceted undertaking at all levels, including designers, engineers, policymakers, and health institutions, to make sure that digital health systems are reflected in the lived experience of its target audience.

To sum up, the results of the current research demonstrate the need to develop more inclusive approaches in digital environments among older adults. It is necessary to incorporate empathic and user-centered design strategies, community-based digital literacy assistance, and iterative usability testing into the process of development of wireless systems. Wireless technologies can be designed to be inclusive and at the very heart of it, thus can be used not as a barrier but a means to attain independence, social engagement, and trust in later years. In the event that these values are integrated, they will be useful in future innovation and will serve to give a chance that technological progress can fortify the well-being of older people in an equal manner.

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