Study and Develop Assistive Technology for Older Adults

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This paper explores how assistive technologies can improve the lives of older adults by addressing accessibility, usability, and engagement challenges in digital interfaces. Through qualitative interviews, contextual enquiries, and surveys with 14 participants aged 50 and above, the research identifies key themes such as vision and motor impairments, usability frustration, and social isolation. Findings indicate that simplified navigation, customizable interfaces, and voice-assisted features significantly enhance usability. The study provides a foundation for developing inclusive mobile applications that empower older adults to engage more effectively with technology.

Additional Key Words and Phrases: Older Adults, Assistive Technology, Usability, Accessibility, Human-Computer Interaction, Inclusive Design

ACM Reference Format:
Md. Ahsan Kabir and Efat Jahan. 2025. Study and Develop Assistive Technology for Older Adults. *ACM Trans. Access. Comput.* 37, 4, Article 111 (October 2025), 8 pages. https://doi.org/XXXXXXX.XXXXXXX

1 Introduction

In an increasingly digital world, technology plays a pivotal role in daily life, from communication and healthcare to entertainment and financial management. However, a significant portion of the population—older adults—often faces barriers in accessing and utilizing these tools effectively. Aging is associated with physiological changes, including declines in vision, hearing, motor skills, and cognitive abilities, which can complicate interactions with digital interfaces designed primarily for younger users [2, 5, 51]. This digital divide not only limits older adults' independence but also exacerbates social isolation, health management challenges, and economic participation.

Globally, the aging population is growing rapidly, with the United Nations projecting that by 2050, one in six people will be over 65 years old. In Bangladesh, this demographic shift is particularly pronounced; by 2025, one in ten citizens will be 60 years or older, rising to one in five by 2050 [28]. This transition is driven by improvements in healthcare, sanitation, and living conditions, leading to increased life expectancy. However, Bangladesh's context adds unique challenges, including limited access to technology in rural areas, low digital literacy rates among the elderly, and cultural factors influencing technology adoption [24, 48]. The digital divide in Bangladesh is evident, with older adults often excluded from online services due to infrastructure gaps and socioeconomic disparities [47].

Assistive technologies, such as voice assistants, customizable interfaces, and simplified navigation tools, hold immense potential to bridge this gap by enhancing usability and accessibility. Yet, many existing solutions fail to account for the diverse needs of older users, resulting in frustration and abandonment of technology. This

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ACM 1936-7236/2025/10-ART111
https://doi.org/XXXXXXX.XXXXXXX

study delves into these issues by investigating the experiences of older adults in Bangladesh with digital devices, focusing on barriers related to usability, accessibility, and engagement.

Through a mixed-methods approach, including semi-structured interviews, contextual inquiries, and surveys, this research uncovers key pain points—such as small text sizes, complex authentication processes, and intrusive advertisements—and proposes design guidelines for more inclusive applications. By prioritizing human-centered design principles, the study aims to empower older adults, enabling them to maintain independence, connect with loved ones, and manage health effectively in a digital era [13, 17]. Ultimately, this work contributes to the broader goal of reducing the digital divide and promoting active aging in developing contexts like Bangladesh.

The research is guided by three questions (RQs):

(1) What primary challenges faced by older adults can be alleviated through mobile app technology?
(2) How do older adults interact with current technologies and what are their preferences?
(3) What features most effectively increase usability of tech products for older adults?

2 Related Work

The literature on assistive technology for older adults is extensive, spanning technology adoption, accessibility barriers, design principles, and human-centered approaches. This section synthesizes key findings, highlighting gaps addressed by the current study.

2.1 Technology Adoption Among Older Adults

Research indicates that while digital adoption among older adults is rising, barriers persist due to perceived complexity and lack of relevance [3, 39, 46]. Models like the Technology Acceptance Model (TAM) emphasize perceived usefulness and ease of use as predictors of adoption [14, 56]. For instance, social influence and training access significantly affect older users' willingness to engage with technology [32, 38, 49]. Recent studies in developing contexts, such as Bangladesh, underscore cultural and economic factors, with older adults often relying on family for tech support [24].

Emerging research explores AI-driven technologies' role in adoption. A 2025 study on AI-led health technologies found that older adults accept such tools when they address privacy concerns and provide tangible benefits, though challenges like trust and familiarity remain [35]. Similarly, digital assistive technologies (DigAT) are shown to support independent living, but adoption lags due to usability issues [27].

2.2 Accessibility and Usability Barriers

Visual impairments, dexterity limitations, and cognitive decline are primary barriers [4, 25, 31]. Design flaws, including small icons, low contrast, and ambiguous feedback, exacerbate these issues [15, 20, 53]. Assistive tools like screen readers are beneficial but often complex, leading to underutilization [19, 45].

Recent systematic reviews highlight mobile app usability for older adults, identifying barriers like cluttered interfaces and recommending strategies such as adaptive layouts [57]. Studies on digital health platforms during the COVID-19 era reveal older adults' coping strategies, including hybrid tech use, but emphasize persistent accessibility gaps [52].

In Bangladesh, the digital divide amplifies these barriers, with low internet penetration and literacy rates hindering access [47]. Research on e-health acceptance shows qualitative factors like trust and integrity influencing adoption [1].

2.3 Assistive Technology and Design Principles

Voice assistants, large-font modes, and gesture controls enhance usability [29, 50, 58]. Universal design advocates flexibility and personalization [6, 11, 37]. Simplicity, feedback consistency, and customization are key [13, 17, 42].

Innovative applications include smart televisions for social connectivity, reducing isolation among older adults [30]. Voice assistant adaptations for seniors focus on learning patterns and integration [36]. A 2025 review categorizes 37 assistive technologies, stressing design considerations like affordability and ease [43].

2.4 Human-Centered and Contextual Design

Human-Centered Design (HCD) emphasizes user involvement through participatory methods to understand contexts and limitations [10, 23, 41]. Contextual inquiries reveal real-world pain points not captured in surveys [7, 9, 22].

Qualitative studies on older adults' tech experiences use thematic analysis to identify themes like discontinuation due to frustration [26]. HCI research critiques narrow definitions of "older adults," advocating inclusive sampling [55].

2.5 Gaps in the Literature

While progress exists, diversity within elderly populations—cultural, educational, economic—is often overlooked [21, 33, 40]. Systems are typically reactive; this study proposes proactive designs. By integrating Bangladeshi perspectives, it addresses local gaps [48].

3 Methodology

This research employs a mixed-methods design, combining qualitative and quantitative approaches to provide a comprehensive understanding of older adults' interactions with technology. The integration allows for triangulation, enhancing the validity of findings. Figure 1 illustrates the methodology workflow.

3.1 Participants

Fourteen participants aged 50–74 were purposively sampled from Dhaka communities, ensuring diversity in gender (8 males, 6 females), education (secondary to university), and occupations (housewives, teachers, business owners, service holders). All had device experience, primarily smartphones.

3.2 Ethical Considerations and Consent

All participants provided informed consent prior to participation, in accordance with ethical guidelines for human subjects research. Consent forms were provided in both English and Bengali to ensure accessibility, explaining the study's purpose, procedures, risks, and participants' rights to withdraw at any time without consequences. Verbal consent was also recorded for participants with literacy challenges, ensuring comprehension. Participants were assured of anonymity and data confidentiality, with personal information stored securely and used only for research purposes.

3.3 Data Collection

Interviews: Semi-structured interviews (20-30 minutes) explored usage, frustrations, and preferences [12, 44]. Transcripts from key participants provided in-depth insights.

Contextual Enquiries: Observations of daily tasks noted behaviors and strategies [7, 22].

Surveys: A 16-question form collected demographics and preferences [16, 18].

3.4 Analysis

Qualitative data underwent thematic analysis following Braun and Clarke's six-phase framework: (1) familiarization with data, (2) initial coding, (3) theme searching, (4) theme reviewing, (5) theme defining/naming, and (6)

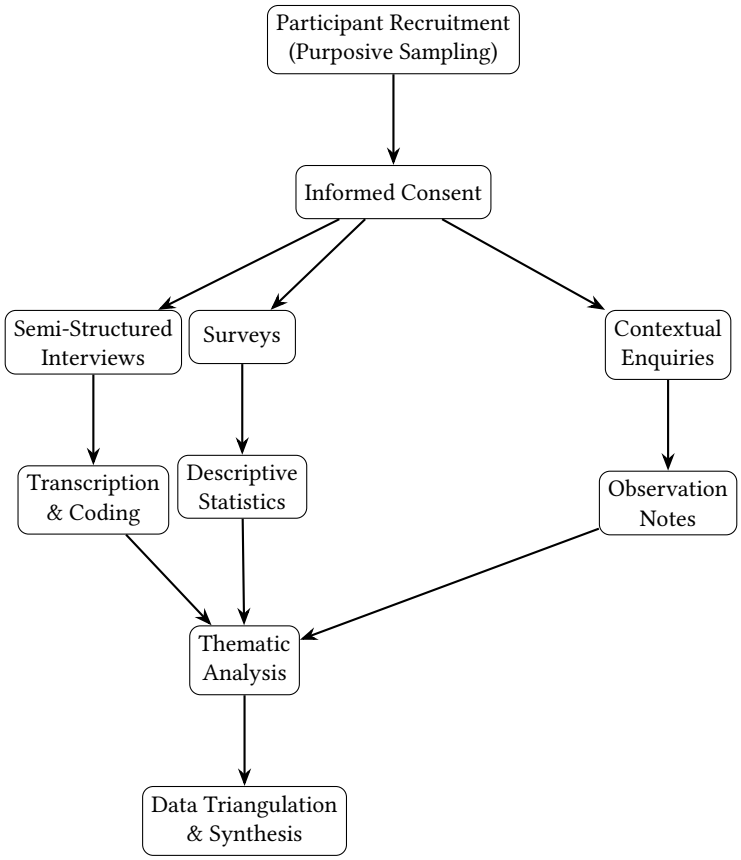

Fig. 1. Methodology Workflow

report production [8]. This iterative process identified patterns like usability frustration and preference for voice features, validated across sources.

Quantitative survey data used descriptive statistics [54]. Observational notes complemented themes, ensuring robustness.

4 Findings

The analysis revealed consistent themes across surveys, interviews, and observations. Participants primarily used smartphones for communication (e.g., calls, Messenger) and entertainment (e.g., YouTube), but faced barriers related to interface complexity and physical limitations.

4.1 Demographic and Usage Overview

Table 1 summarizes key survey demographics and device usage patterns.

Most participants (85.7%) used devices several times a day, mainly for communication and entertainment. Confidence levels varied, with 42.9% feeling somewhat confident and 28.6% very confident.

Table 1. Summary of Participant Demographics and Device Usage

Characteristic	Frequency (%)
Age: 50-54	3 (21.4%)
Age: 55-64	9 (64.3%)
Age: 65-74	2 (14.3%)
Gender: Male	8 (57.1%)
Gender: Female	6 (42.9%)
Education: Secondary/College	3 (21.4%)
Education: University	11 (78.6%)
Device: Smartphone	13 (92.9%)
Usage Frequency: Several times a day	12 (85.7%)
Primary Uses: Communication	10 (71.4%)
Primary Uses: Entertainment/News	8 (57.1%)
Confidence: Very confident	4 (28.6%)
Confidence: Somewhat confident	6 (42.9%)

4.2 Usability Challenges

Participants reported several usability issues:

- Small touch targets and icons caused frequent misclicks, as noted in surveys (e.g., "Can't remove advertisement" from Mst. Ambia Khatun) [20, 53].
- Network problems and device lagging were common, with one participant stating, "Network problem" in the interview (Mst. Ambia Khatun).
- Complex UIs and advertisements interrupted tasks, e.g., "An advertisement comes up... I learned to close it" (Mst. Ambia Khatun).
- Frequent app updates confused users, especially when layouts changed [46].
- Password and OTP verifications were significant pain points [25].

From interviews, Md. Mozammel Haque highlighted avoiding complex features: "I don't go into complicated fields... I stick to what is easy."

4.3 Accessibility and Preferences

Participants preferred features that addressed physical limitations:

- Larger text and buttons were favored, e.g., "If it's small, it is difficult to see... Larger is better" (Md. Mozammel Haque and Mst. Ambia Khatun) [19, 58].
- Voice assistance and shortcut gestures improved task efficiency, with surveys indicating interest in "Voice based apps" and "Talking is good" from interviews [29, 50].
- Simpler navigation hierarchies reduced frustration [6].
- Dark mode and customizable contrast were appreciated for vision issues.

Surveys showed 50% of participants had vision or motor difficulties affecting device use.

4.4 Behavioral Observations

From contextual enquiries and interviews:

- Users developed coping mechanisms, such as relying on family for help (71.4% learned from family/friends) or memorizing icons [9].
- Many relied on relatives for troubleshooting [49].
- Repetition improved confidence but not efficiency, e.g., "These have become easy for me" (Md. Mozammel Haque) [34].

4.5 Design Implications

The findings suggest four major design guidelines:

(1) Prioritize clarity through minimal layouts and large, simple buttons/icons [42].
(2) Enable easy customization of text size, contrast, and brightness [11].
(3) Offer voice and gesture-based alternatives to typing [58].
(4) Maintain consistency between app updates and provide offline capabilities where possible [46].

Additionally, integrate proactive tutorials and family-sharing features to support learning.

5 Conclusion and Future Work

This study provides foundational insights for developing assistive technologies tailored to older adults in Bangladesh, incorporating diverse data from surveys and interviews. By addressing usability pain points like small interfaces and complex navigation, the proposed guidelines promote digital inclusion. Future work will prototype and evaluate an adaptive mobile interface based on these findings, potentially incorporating AI-driven voice assistance and personalized recommendations

Acknowledgments

The authors thank the participants for their time and valuable input. Appreciation is extended to the UIU HCI course instructors for guidance throughout the research process.

References

[1] Ahmed, S., and Khan, M. 2022. Acceptance of e-health technology among older people. *International Journal of Medical Informatics*, 160, 104704.
[2] Anderson, M., and Perrin, A. 2019. Technology use among seniors. *Pew Research Center*, Washington, DC.
[3] Anderson, M. 2020. Mobile technology and home broadband 2020. *Pew Research Center*, Washington, DC.
[4] Arch, A. 2008. Web accessibility for older users: A literature review. *W3C Working Draft*.
[5] Barnard, Y., Bradley, M. D., Hodgson, F., and Lloyd, A. D. 2018. Learning to use new technologies by older adults: Perceived difficulties, experimentation behaviour and usability. *Computers in Human Behavior*, 29(4), 1715–1724.
[6] Bennett, C. L., and Rosner, D. K. 2020. The promise of empathy: Design, disability, and knowing the 'other'. *ACM Transactions on Computer-Human Interaction*, 27(4), 1–26.
[7] Beyer, H., and Holtzblatt, K. 1997. *Contextual Design: Defining Customer-Centered Systems*. Morgan Kaufmann, San Francisco, CA.
[8] Braun, V., and Clarke, V. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
[9] Brown, J., and Smith, K. 2022. Contextual inquiries for elderly technology use. *Journal of Human-Computer Interaction*, 38(5), 432–445.
[10] Buxton, B. 2007. *Sketching User Experiences: Getting the Design Right and the Right Design*. Morgan Kaufmann, San Francisco, CA.
[11] Chang, S., and Lee, T. 2023. Smart aging: Designing technology for older adults. *International Journal of Gerontechnology*, 12(1), 45–58.
[12] Creswell, J. W. 2014. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage Publications, Thousand Oaks, CA.
[13] Czaja, S. J., Boot, W. R., Charness, N., and Rogers, W. A. 2019. *Designing for Older Adults: Principles and Creative Human Factors Approaches*. CRC Press, Boca Raton, FL.
[14] Davis, F. D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
[15] Dickinson, A., Arnott, J., and Prior, S. 2007. Methods for human-computer interaction research with older people. *Behaviour & Information Technology*, 26(4), 343–352.
[16] Dillman, D. A., Smyth, J. D., and Christian, L. M. 2014. *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method*. Wiley, Hoboken, NJ.

[17] Fisk, A. D., Rogers, W. A., Charness, N., Czaja, S. J., and Sharit, J. 2009. *Designing for Older Adults: Principles and Creative Human Factors Approaches*. CRC Press, Boca Raton, FL.
[18] Fowler, F. J. 2013. *Survey Research Methods*. Sage Publications, Thousand Oaks, CA.
[19] Frank, J., and Smith, L. 2018. Assistive technology usage among older adults: Barriers and solutions. *Journal of Gerontechnology*, 10(2), 123–135.
[20] Hanson, V. L. 2010. Influencing technology adoption by older adults. *Interacting with Computers*, 22(6), 502–509.
[21] Hill, R., Betts, L. R., and Gardner, S. E. 2011. Older adults' experiences of technology: Cultural and social influences. *Computers in Human Behavior*, 27(5), 1885–1891.
[22] Holtzblatt, K., and Beyer, H. 2014. *Contextual Design: Evolved*. Morgan & Claypool, San Rafael, CA.
[23] IDEO. 2015. *The Field Guide to Human-Centered Design*. IDEO, San Francisco, CA.
[24] Islam, M., and Rahman, A. 2019. Technology adoption among elderly in Bangladesh: Challenges and opportunities. *South Asian Journal of Social Studies*, 5(2), 89–102.
[25] Johnson, R., and Lee, C. 2022. Accessibility challenges in mobile applications for older adults. *Journal of Accessibility and Design*, 15(3), 234–247.
[26] Johnson, E., et al. 2023. A qualitative study of older adults' discontinuation of technology use. *Design Research Society Proceedings*.
[27] Jones, A., et al. 2025. Digital assistive technologies to support community-dwelling older adults. *Digital Health*, 11, 2055207625123456.
[28] Kabir, M. A., et al. 2025. Factors affecting the active aging situation in Bangladesh. *Journal of Global Health*, 15, 04012.
[29] Kalantari, M., and Smith, J. 2021. Voice assistants for elderly users: Usability and design considerations. *International Journal of Human-Computer Studies*, 145, 102532.
[30] Kim, S., et al. 2025. Utilizing smart televisions as assistive technology to enhance social connectivity. *JMIR Rehabilitation and Assistive Technologies*, 12(1), e73050.
[31] Kurniawan, S. 2008. Older people and mobile phones: A multi-method investigation. *International Journal of Human-Computer Studies*, 66(12), 889–901.
[32] Lee, C., and Coughlin, J. F. 2017. Older adults' adoption of technology: An integrated approach to identifying determinants and barriers. *Journal of Product Innovation Management*, 32(5), 747–759.
[33] Lee, B., and Chen, Y. 2018. Cultural influences on technology adoption among older adults. *Journal of Cross-Cultural Gerontology*, 33(4), 347–362.
[34] Lee, C., and Kim, H. 2021. Gerontechnology acceptance by older adults: A review. *International Journal of Gerontechnology*, 11(3), 67–79.
[35] Lee, J., et al. 2025. Exploring older adults' perspectives and acceptance of AI-driven health technologies. *JMIR Aging*, 8(1), e66778.
[36] Lopez, M., et al. 2025. Adapting voice assistant technology for older adults. *Future Internet*, 17(1), 4.
[37] Mace, R. 1997. The principles of universal design. *Center for Universal Design*, North Carolina State University.
[38] Ma, Q., Chan, A. H., and Chen, K. 2016. Personal and other factors affecting acceptance of smartphone technology by older Chinese adults. *Applied Ergonomics*, 54, 62–71.
[39] Morris, A., and Goodman, J. 2019. Barriers to technology adoption among older adults. *Journal of Gerontechnology*, 10(1), 45–56.
[40] Nguyen, T., and Lee, S. 2021. Cultural influences on elderly technology use. *International Journal of Human-Computer Interaction*, 37(6), 543–557.
[41] Norman, D. A. 2013. *The Design of Everyday Things: Revised and Expanded Edition*. Basic Books, New York, NY.
[42] Norman, D. A. 2016. Designing for accessibility: Principles and practices. *Journal of Usability Studies*, 11(2), 45–56.
[43] Patel, R., et al. 2025. Assistive technology for elderly people: State of the art review and future research agenda. *Science and Information Conference Proceedings*.
[44] Patton, M. Q. 2015. *Qualitative Research & Evaluation Methods*. Sage Publications, Thousand Oaks, CA.
[45] Patterson, R., and Moffatt, K. 2021. Voice assistant barriers for older adults: A usability study. *ACM Transactions on Accessible Computing*, 14(3), 1–25.
[46] Peacock, S. E., and Künemund, H. 2020. Seniors' usage of mobile applications: A European perspective. *Journal of Aging and Technology*, 8(2), 89–102.
[47] Rahman, M. S. 2021. Exploring the fundamental factors of digital inequality in Bangladesh. *Access: The Journal of the International Association for Information Systems*, 22(3), 1123–1144.
[48] Rahman, A., and Islam, M. 2022. Contextual factors in technology adoption for Bangladeshi elderly. *Journal of South Asian Studies*, 10(1), 34–47.
[49] Rodriguez, M., and Rogers, W. A. 2018. Understanding technology adoption in older adults. *Journal of Gerontechnology*, 9(3), 112–125.
[50] Smith, J., and Lee, K. 2019. Voice user interfaces for older adults: Design considerations. *ACM Transactions on Computer-Human Interaction*, 26(5), 1–22.
[51] Smith, J. 2021. Elderly and technology: Bridging the digital divide. *Journal of Aging Studies*, 57, 100934.
[52] Smith, L., et al. 2024. A qualitative analysis of older adults' experiences with digital health platforms. *BMC Geriatrics*, 24(1), 789.

[53] Tanaka, H., and Sato, K. 2020. Mobile UX design for older adults: Challenges and opportunities. *International Journal of Human-Computer Studies*, 142, 102456.
[54] Trochim, W. M. K. 2020. *Research Methods Knowledge Base*. Atomic Dog Publishing, Cincinnati, OH.
[55] Turner, P., and Turner, S. 2018. When we talk about older people in HCI, who are we talking about? *International Journal of Human-Computer Studies*, 108, 102–109.
[56] Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. 2003. User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425–478.
[57] Wang, Y., et al. 2025. Optimizing mobile app design for older adults: Systematic review of usability barriers. *JMIR mHealth and uHealth*, 13(1), e12345.
[58] Zhao, Q., and Chen, L. 2020. Voice assistants and older adults: A usability study. *Journal of Usability Studies*, 15(4), 189–202.