Exploring Assistive Technology for Older Adults

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This study investigates the role of assistive technologies in enhancing the quality of life for older adults by addressing challenges related to accessibility, usability, and engagement in digital interfaces. Employing a mixed-methods approach, the research incorporates qualitative interviews, contextual inquiries, and surveys conducted with 14 participants aged 50 and older. The analysis reveals critical themes, including visual and motor impairments, usability frustrations, and social isolation, which hinder effective interaction with technology. Results demonstrate that features such as simplified navigation, customizable interfaces, and voice-assisted functionalities significantly improve usability and user experience. These findings provide a robust foundation for designing inclusive mobile applications that empower older adults to interact more effectively and confidently with digital technologies, thereby fostering greater independence and social connectivity.

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

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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

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to account for the diverse needs of older users, resulting in frustration and abandonment of technology. This 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 UI design, 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, 55]. 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 [56]. 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, 57]. 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 [54].

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 and Meherpur 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 their informed consent before participation, in accordance with ethical guidelines for human subjects research. Verbal Consent was obtained in Bengali to ensure that the study's purpose, procedures, risks, and participants' rights to withdraw at any time without consequences were explained. Participants were assured of anonymity and data confidentiality, with personal information stored securely and used only for research purposes.

3.3 Data Collection

We faced lots of challenges in finding older adults to collect data. Here, we mainly used the purposive sampling method for participant recruitment.

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].

All related questionnaires can be found in the Questionnaires section A.

Fig. 1. Methodology Workflow

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) 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. 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. Fig 2, Fig 3, Fig 4, and Fig 5 are some examples of contextual enquiries.

Fig. 2. Example of Opening App during contextual interview

Fig. 3. Example of Seeing Video during contextual interview.

Fig. 4. Example of Closing Advertisement during contextual interview.

Fig. 5. Example of Closing App during contextual interview.

4.1 Demographic and Usage Overview

Table 1 summarizes key survey demographics and device usage patterns.

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%)

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% feeling very confident.

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 a 65-74 year-old female in a rural area) [20, 53]. Also, we found it in a contextual interview, e.g., "Yes, if these are large, it's easier for me to see well because my eyesight is weaker. The small ones are hard to see because if one's eyesight is a bit weak, bigger is better." (from a 55-64 year-old female in a rural area)
- Network problems and device lagging were common, with one participant stating, "Network problem" in the interview (from a 65-74 year-old female in a rural area).
- Complex UIs and advertisements interrupted tasks, e.g., "An advertisement comes up... I learned to close it" (from a 65-74 year-old female in a rural area).
- Shorts video does not properly complete, making it frustrating. e.g., "One thing, yes, when watching, it is just small, they say "short," it's not that big. " (from a 65-74 year-old female in a rural area).
- Sensitive info sometimes goes to the story! as noted in a contextual enquiry (from a 65-74 year-old female in a rural area).
- Users rely on relatives for troubleshooting, as noted in the interview/contextual enquiry for most of the users.

From interviews, a 65-74 year-old male in a rural area 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" (from a 65-74 year-old male in a rural area and from a 65-74 year-old female in a rural area) [19, 57]. For color, there is no preference.

- Voice assistance and shortcut gestures improved task efficiency, with surveys indicating interest in "Voice based apps" and "Talking is good" from interviews [29, 50].
- Simple layouts improve navigation to avoid confusion. [6].
- Both Voice and Picture based applications are preferable.
- Learning tool like how to send photo/file to other, suggest islamic content playlist etc. One user suggested if possible offline application as internet is still not cheap or available sometimes.

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" (from a 65-74 year-old male in a rural area) [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 [57].
(4) Maintain consistency between app updates and provide offline capabilities where possible [46].
(5) Avoid too much advertising.
(6) Add a sensitive information check before upload, or give a proper alert to the user.
(7) Provide the onboarding content for how to use this application.
(8) Provide the common troubleshooting content or make a helpdesk.

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

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A Questionnaires

This appendix contains the full list of questionnaires used in the study, organized thematically. These questions were designed to explore older adults' challenges, interactions, and preferences related to mobile app technology. The questions were developed in alignment with our main research questions:

- RQ1: What are the primary challenges faced by older adults that can be alleviated through mobile app technology?
- RQ2: How do older adults interact with current technologies, and what are their preferences?
- RQ3: What features are most effective in increasing the usability of tech products for older adults?

A.1 Demographic Questions (Survey)

A.1.1 Section 1: Basic Demographic Information.

(1) Could you please tell me your age range?
- ( ) 55–64
- ( ) 65–74
- ( ) 75–84
- ( ) 85 or above
- ( ) Other: _____

(2) What is your gender?
- ( ) Male
- ( ) Female
- ( ) Prefer not to say
- ( ) Other: _____

(3) What is the highest level of education you have completed?
- ( ) No formal education
- ( ) Primary school
- ( ) Secondary school
- ( ) College
- ( ) University
- ( ) Other: _____

(4) What is (or was) your primary occupation?
- _____

(5) What is your current living arrangement?
- ( ) Alone
- ( ) With spouse
- ( ) With family
- ( ) Assisted living facility
- ( ) Other: _____

A.1.2 Section 2: Technology Access and Usage.

(1) Do you own or regularly use any of the following devices? (Select all that apply)
- Smartphone
- Tablet
- Laptop or desktop computer
- Smartwatch or wearable device
- Other: _____

(2) How often do you use the device?
- ( ) Several times a day
- ( ) Once a day
- ( ) A few times a week
- ( ) Rarely
- ( ) Never

(3) What do you mainly use your device (phone, computer etc) for?
- _____

(4) How confident do you feel using mobile apps or new technologies?
- ( ) Very confident
- ( ) Somewhat confident
- ( ) Neutral
- ( ) Not very confident
- ( ) Not confident at all

A.1.3 Section 3: Support and Barriers.

(1) Have you ever received help learning to use technology? If yes, from whom?
- ( ) Family or friends
- ( ) Formal training/workshop
- ( ) Online tutorials or videos
- ( ) Self-taught

- ( ) Other: _____

(2) What are the biggest difficulties you face when using mobile apps or devices?
- _____

(3) What kinds of app features make technology easier or harder for you to use?
- _____

(4) Do you have any vision, hearing, or motor difficulties that affect your interaction with devices?
- ( ) Yes
- ( ) No
- If yes, please specify: _____

A.1.4 Section 4: Preferences and Attitudes.

(1) What do you enjoy most about using technology or mobile apps?
- _____

(2) What kind of app or feature would make your daily life easier or more enjoyable?
- _____

(3) Would you be interested in using apps designed specifically for older adults?
- ( ) Yes
- ( ) Maybe
- ( ) No

A.2 Qualitative Interview Questionnaires

A.2.1 RQ 1: Challenges Alleviated by Mobile App Technology. Objective: Identify the primary challenges older adults face that can be mitigated through the use of technology.

Subtopics & Questions:

- Daily Activities
  (1) What daily activities do you find challenging as you age?
  (2) Are there any tools or devices you currently use to assist with these activities?
- Health Management
  (1) What difficulties do you encounter when managing your health or medical conditions?
  (2) Do you use any technological solutions to monitor or manage your health?
- Social Interaction
  (1) How do you stay connected with friends and family?
  (2) What challenges do you face when using current communication technologies?
- Mobility and Transportation
  (1) Do mobility issues limit your ability to travel or move around the house?
  (2) Are there technologies or devices that you think could improve your mobility?

A.2.2 RQ 2: Interaction and Preferences with Current Technologies. Objective: Investigate how older adults utilize current technologies and identify their preferences.

Subtopics & Questions:

- Technology Usage
  (1) What types of technology devices (smartphone, tablet, computer) do you use regularly?
  (2) Describe how you learned to use these technologies.

- User Experience
  (1) Can you share any positive or negative experiences you've had with these technologies?
  (2) What features do you appreciate most in the technologies you use?
- Preference and Comfort
  (1) Which technologies do you find easiest to use and why?
  (2) Are there any technologies you avoid using? Please explain.

A.2.3 RQ 3: Usability Features for Tech Products. Objective: Identify key features that enhance the usability of technological products for older adults.

Subtopics & Questions:

- Design Preferences
  (1) What design elements (e.g., button size, screen brightness) make a device easier for you to use?
  (2) How important is the size of text or icons on your devices?
- Functionality Needs
  (1) What functions or features do you wish were simpler to use on your current devices?
  (2) Do you prefer voice commands over traditional typing or tapping methods?
- Accessibility Features
  (1) Are there accessibility features you currently use (like text-to-speech, magnifiers)?
  (2) What additional accessibility features would you suggest for future technology designs?

A.3 Contextual Inquiry Questions for Older Adults

(1) Understanding Daily Challenges (RQ1)
  - Can you tell me about a typical day and what activities you use your phone for?
  - Are there any things you find difficult or frustrating when using your phone or apps?
  - Have you ever stopped using an app because it was too confusing or hard to use?
  - What kind of help do you usually need when using your phone or an app?
  - What do you wish your phone could do to make your life easier?

(2) Interaction and Experience with Technology (RQ2)
  - What kinds of apps or digital tools do you use most often (e.g., calling, messaging, health, news)?
  - How do you usually learn to use a new app or feature?
  - Do you prefer using your phone, tablet, or computer? Why?
  - When something goes wrong with your device, what do you usually do?
  - Do you use any apps to stay in touch with family or friends? How do you feel about them?

(3) Design Preferences and Usability (RQ3)
  - What makes an app easy or hard for you to use?
  - What kind of buttons, colors, or text sizes do you find most comfortable?
  - Do you prefer apps with more pictures or more words?
  - How do you feel about notifications or reminders from apps?
  - If you could design an app for people your age, what would it look like or do?

A.3.1 Optional: Follow-up & Observation Prompts.

- Can you show me how you usually open and use your favorite app?
- What parts do you find most useful or confusing on this screen?
- Is there anything here you avoid touching or using? Why?