

Apparel Product Development to Improve the Quality of Life for People with Visual Impairments Using NFC Technology

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Background. Vision impairment (VI), affecting over 2.2 billion people worldwide (WHO, 2023), significantly impacts self-perception and social engagement, often leading to isolation and decreased well-being (Klauke et al., 2023; Senra et al., 2011). In South Korea, individuals with VI face additional social prejudice, limiting their participation and independence (Lee et al., 2024). Appropriate clothing is essential for this target population, serving as a tool for self-expression and aiding physical mobility. Individuals with VI encounter numerous challenges in selecting, managing, and coordinating clothing, often relying on family assistance due to limited access to color and care information (Williams et al., 2013). Previous studies indicate that these individuals have a strong desire for self-expression through clothing (Ahn & Lee, 2007). However, comfort, utility perception, and ease of dressing are also critical needs, especially given their heightened tactile sensitivity (Lai & Chen, 2006). Although assistive technologies like video call systems and electronic textiles (Bigham et al., 2010; Ye et al., 2014) have improved their clothing management, such technologies often require costly additional devices, limiting accessibility for low-income individuals. This research addresses the need for a cost-effective, accessible solution, aiming to enhance clothing perception through Near Field Communication (NFC). NFC is a secure, short-range wireless communication technology, commonly used in personal devices and industries for tasks like payments, access control, and information sharing.

Theoretical Framework. User-centered design (UCD) prioritizes user needs and the demands of the context in which the product will be used. The process begins with product development, where user needs are identified, and the purpose statements of the prototypes were based on clothing values and attributes suggested by Rosenblad-Wallin (1985).

Research Purpose. To resolve challenges observed in previous studies (e.g., Bigham et al., 2010, Cho et al., 2020, Ye et al., 2014, Miyake et al., 2016, Tateno et al., 2020), this study explored the potential of NFC-integrated garments for individuals with VI to enhance utility perception and aimed to identify:

- (a) selecting the ideal size for the NFC sticker,
- (b) identifying the best placement for the NFC sticker, and
- (c) evaluating the overall usability of the NFC-integrated garment for people with VI.

Methods. In-depth interviews were conducted with semi-structured questions. After receiving Institutional Review Board approval, participants were recruited from support organizations for

individuals with VI, including the Metropolitan Federation of the Blind. Purposive and snowball sampling methods were employed, initially contacting six participants and expanding the sample through referrals to reach students, teachers, and others in the visually impaired community. Totally, twenty participants (Female: 9, Male: 11), ages 20–70, were interviewed for approximately 30 minutes each. Each participant tried on a prototype jacket to determine optimal NFC sticker size and placement. Participants who wanted to engage in NFC testing downloaded the relevant mobile app and used their phones to read the NFC tags (Shin, 2024).

Results. Participants assessed the size and placement of NFC stickers on garments, preferring a 5x2.5 cm label for T-shirts and recommending that the NFC sticker be discreetly attached to the care label inside. For NFC sticker placement, 13 participants selected the cuffs of the T-shirt, while

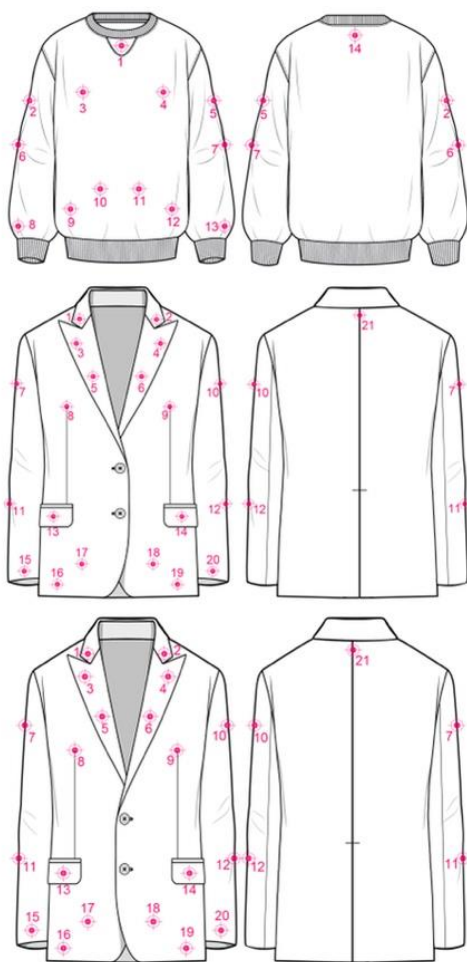


Figure 1 Flat Sketches of the Prototypes, indicating Possible Placement of the Label Associated with NFC Technology

12 preferred the care label area; for jackets, 12 also preferred the care label, with others choosing the cuffs, lapel, or neck area. When testing the NFC functionality, most participants were able to access clothing information, including color, fabric, care instructions, and styling options, using a mobile NFC app. Participants suggested features to enhance the user experience, such as customizable voice speed and selective information access. Some expressed interest in less visible NFC labels, and feedback indicated that embedding NFC directly into garments would improve durability. Overall, participants viewed the NFC-integrated garment as practical, supporting independent clothing management and aiding in outfit coordination. They anticipated benefits from broader adoption of NFC in clothing, allowing easier selection, purchasing, and enhanced confidence in their appearance.

Conclusions & Implications. This research highlighted the potential of NFC-integrated garments to improve clothing accessibility and independence for individuals with visual impairments. By enabling quick access to information on fabric, care instructions, and styling tips, NFC technology can help address key challenges faced by this population, including difficulty in distinguishing clothing types and accessing care information. Participants expressed positive feedback on the utility and functionality of NFC tags, particularly when discreetly placed and securely embedded into garments. Overall, this study suggested that NFC-enhanced clothing can contribute to greater self-sufficiency, confidence, and social participation for visually impaired individuals.

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