Using Near Field Communication Technology with Voice Recognition to help Visually Impaired People in Clothes' Selection

Mostafa A. A. Badawy
Lecturer, Ready-Made Garments Technology Program, Faculty of Technology of Industry and Energy, Samannoud Technological University, mostafabadawy1990@gmail.com

Abstract:

Visually impaired People face significant challenges like reading and dressing, impacting their independence. Clothing selection is difficult due to the reliance on visual cues and inaccessible information on labels. Therefore, more advanced solutions are needed to support independent clothing selection. The research aims to develop a voice recognition system to help visually impaired people choose their clothes. A preliminary survey, conducted through personal interviews with eight visually impaired participants, gathered insights into how they select and care for their clothing. The survey identified their needs and preferences, which informed the content to be included on NFC Labels. The participants expressed a preference for receiving this information through voice recordings, enabling them to independently select their clothing. Both of the following were used for the Voice Recognition System: Voice Labels on NFC Label on Samsung Phones, and NFC Tools application on other phones that support NFC technology to attach the voice record link to the NFC Label. A survey was conducted on the use of mobile phones and NFC technology in Clothes' Selection through voice recognition found that participants agreed on the clarity and ease of the voice descriptions. The voice records effectively conveyed details about clothing specifications, and assisting individuals in choosing and caring for their clothes independently. This approach significantly supported their autonomy and reduced reliance on others. The study recommends expanding the use of NFC technology with voice recognition among visually impaired individuals and encouraging clothing stores to adopt this technology to support independent clothing selection.

Keywords:

Visually Impaired People, Near Field Communication, Voice Recognition, Clothes' Selection

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1- Introduction

Many visually impaired individuals face challenges with daily activities like reading and dressing, which can hinder their independence. They strongly desire to perform these tasks autonomously without relying on others. Most visually impaired people aim to live independently and pursue enriching hobbies and interests. Thus, developing systems that enhance autonomy for visually impaired and blind individuals is vital for improving their quality of life.

Choosing suitable attire, whether for a costume party or a work dress code, often depends on visual cues and references. This can be particularly difficult for visually impaired individuals, who cannot access printed labels in the textile industry that provide information about color, texture, and other visual elements. Daily clothing selection remains challenging, and many visually impaired people rely on family assistance, plastic Braille labels, stitching pattern tags, or clothing without patterns.

Recent technological advancements are playing a vital role in supporting individuals with disabilities, improving their quality of life, and fostering their integration into society. Assistive technologies, though still developing, enable disabled individuals to perform tasks that would otherwise be difficult or impossible. Advances in theories, sensors, and embedded computing suggest that computer vision techniques could help visually impaired individuals with clothing selection. However, current methods can only assist in matching colors and patterns, not in identifying specific clothing pattern categories. Thus, more advanced solutions are needed for independent clothing selection.

Research Problem: the problem of this research can be represented by these questions:

- How can visually impaired people identify, select and care for their clothing independently, without relying on assistance from others, to enhance their independence?

Research Aim

- This research aims to develop a voice recognition

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system to help the Visually Impaired People in choosing their clothes by identifying the specifications of their clothes and ways to care for them.

Methodology

- **Experimental approach by using** Voice Labels on NFC Label on Samsung Phones, and NFC Tools application on other phones that support NFC technology to attach the voice record link to the NFC Label.

Limitations

- Voice Labels on NFC Label on Samsung Phones.
- NFC Tools application on other phones that support NFC technology to attach the voice record link to the NFC Label.

Theoretical Framework

1-1 Visually Impaired People

Vision is the primary sense that shapes human existence, enabling us to perceive and understand the world around us, attributing significance to objects, concepts, and ideas. It serves as the predominant pathway through which we gather information from our surroundings, constituting approximately 80% of our sensory input (Rocha, Carvalho et al. 2018).

Visual impairment involves a decrease in the information the eye collects from the environment, thereby restricting the experiences individuals can derive from their surroundings. This condition varies from low vision to complete blindness. Total blindness is the absolute inability to see, while visual impairment or low vision is a considerable reduction in vision that cannot be improved with glasses or contact lenses (Garrido, Ruiz et al. 2012). Blind and visually impaired people rely on different senses to comprehend the world around them. It is vital to designers understands how these people discover and interact with new products.

Many visually impaired individuals face challenges not only with tasks like reading, but also with essential daily activities such as using public transportation, navigating unfamiliar places, and grocery shopping. Consequently, there is a strong desire among visually impaired individuals to enhance their autonomy, enabling them to accomplish these tasks independently, without relying on assistance from others. However, it is common for sighted individuals to assume that visually impaired people are incapable or unwilling to manage personal finances, shopping, and similar responsibilities on their own. In reality, most visually impaired individuals strive to maintain or achieve independence in their daily lives and pursue hobbies and interests that enrich their lives fully. Therefore, there is an urgent need to develop systems that promote independence for visually impaired and blind individuals, thereby enhancing their overall quality of life (Alnfiai 2014).

There is a growing recognition in society that the impact of impairments largely hinges on how individuals interact with their physical environment, as well as their social and cultural contexts, rather than solely on the physical disability itself. The configuration of the environment often creates barriers and constraints. Therefore, by making modifications to remove these barriers, it becomes possible to significantly reduce or even eliminate the obstacles that hinder individuals' autonomy (Garrido, Ruiz et al. 2012).

The definition of being human raises several important questions: To what extent do our differences define us? Can our society define humanity without considering aesthetics? Are our social, psychological, and technological capabilities sufficient to support citizens with disabilities? Is there adequate technology to minimize the daily obstacles faced by these individuals? While significant advancements have been made in this field, there are still gaps that need to be addressed (Rocha, Carvalho et al. 2018).

1-1-1 Choosing suitable clothes for blind or visually impaired people

Dressing up often involves making choices based on visual elements and references, such as selecting an outfit for a costume party or adhering to a dress code at work. These situations can pose challenges for visually impaired individuals, especially when it comes to choosing appropriate attire. Additionally, the textile industry typically provides useful instructions on printed labels, which are not accessible to the visually impaired community. This lack of accessibility prevents them from easily identifying features like color, texture, and other graphical elements of clothing (Gatis Filho, de Assumpção Macedo et al. 2018)..

In daily life, selecting appropriate clothing is a challenging task for blind or visually impaired individuals. They often rely on assistance from family members, use plastic Braille labels or different stitching pattern tags on their clothes, or opt for clothing without any patterns. Recent advancements in theories, sensors, and embedded computing offer the potential for computer vision techniques to address their needs. Although some methods have been developed to help blind individuals determine if the colors and patterns of clothes match, these methods cannot identify the specific categories of clothing patterns (Yang, Yuan et al. 2011).

1-1-2 The impact of disability on determining the clothing needs of the blind:

The biggest problem that blind people suffer from is how to choose and wear their clothes, and this problem may not appear clearly in the early stages

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of life. Because the blind child depends on his mother, but as he grows and determines his concept of himself and the concept of others about him, he considers clothing to be the means that defines this concept and connects him to his society.

Hence, we find that the blind person always tries to develop his senses of touch and hearing. Because they are the senses that are most relied upon in identifying his clothes and his surroundings, so by passing the blind person's fingers over different types of fabrics and mentioning their names, he can then, by simply touching them, recognize them and distinguish between them, in terms of roughness, softness, dryness and moisture. It is possible to distinguish the front from the back with some drawings or decorative additions, and also know the design lines, and the closing tools used. All of this is easy for a blind person to recognize with some training, but the process of compatibility and selection of pieces and coordination between colors is an obstacle to the blind person's clothing abilities (Rocha, Pinto et al. 2023).

In addition to the method of caring for clothes, whether the appropriate type of washing for the piece or the ironing temperature used, and the arrangement of the clothes closets, especially after the washing process of a large number of pieces and their mixing with each other; This poses difficulties that the blind person sees as one of the basic needs that must be available in the form of legible information on his clothes. Here the importance of the information card appears, which facilitates the necessary information for the blind person, ensuring psychological stability and social independence (Qadi 2023).

1-1-3 Storing clothes and ways to identify them:

- Blind people, just like us, need a special way to store clothes, but there are some useful guidelines in this regard:
- Arrange clothes according to their type: for example, shirts in one place, socks in one place, and pants or dresses in another place.
- Arranging clothes according to their use: For example, we place the clothes that we use frequently in the front position and the clothes that we use rarely in another shelf.
- We hang clothes that match each other on one hanger, for example in a shirt and pants that match it in color, and the same applies to a skirt and a blouse.
- Arranging clothes according to their colors: for example, white shirts in a rack... and so on (Qadi 2023).

1-1-4 A blind person can identify his clothes in several ways

- Touching the material from which the clothes are made.
- Touching some drawings on clothes or working with the embossed needle.
- Adding specific marks to the clothes, such as sewing a knot on the inner side of the collar or sewing a number of simple knots to distinguish between the colors and types of clothes. For example, a blue shirt has one knot, while a white shirt has two knots (Qadi 2023).

1-1-5 Some of the methods used to help blind people recognize clothes and their colors:

- Use the instruction card to identify the colors, fabric type, size, and method of caring for the piece of clothing.
- Adding a tape to the clothing item or a piece of metal sewn into the clothing to indicate the color of the clothing.
- Use a hanger that combines Braille and a specific symbol, such as a star or moon, to identify the color of clothing.
- Use a "clothing shape recognition device for the blind," which is an image-capturing camera installed in glasses that can recognize the colors and shapes of the material (plain - zigzag - striped - floral - plain) through headphones that describe the clothing to them, in order to make their lives easier.
- A device can be used to read the surface of clothes equipped with a camera to show the color and a scanner to show if there are wrinkles or stains in the clothes (Rocha, Pinto et al. 2023).

1-1-6 Recent technological developments to help visually impaired people

Recent technological advancements provide crucial support for individuals with disabilities, enhancing their quality of life and enabling their integration into society. Assistive technologies, although relatively new, help disabled individuals perform tasks that would otherwise be challenging or impossible. These technologies include both hardware and software designed for assistance. However, tools for visual impairments are limited due to high costs and current technological constraints, especially at the local level where there is a noticeable lack of adapted environments (AlZuhair, Najjar et al. 2014).

In recent years, significant efforts have been made to develop technologies granting people with disabilities access to information and knowledge. Various solutions have been proposed to assist blind individuals with daily routines. Despite these advancements, blind individuals still face difficulties with basic tasks like selecting clothing, as identifying garment features remains slow and challenging, leading to a loss of autonomy (Silva, Rocha et al. 2023).

Today, new technologies allow visually impaired individuals to use digital systems effectively through specific adaptations. Mobile phone advancements also cater to the needs of the blind and visually impaired, ensuring equal access to communication, which is vital for their societal integration. Recent research and technological developments focus on two types of solutions (Garrido, Ruiz et al. 2012):

- Developing specialized devices tailored for individuals with disabilities.
- Utilizing existing devices but incorporating specific applications to enhance various aspects of daily life for visually impaired individuals.

Software solutions for individuals with visual disabilities can be categorized into five groups:

1. Personal and Practical Applications: These tools support daily activities such as color-coding objects (e.g., clothing), performing basic calculations, recording voice memos, and playing music on a mobile phone.
2. Mobility Aids: These apps assist blind individuals in navigating to their destinations more efficiently and finding the best routes.
3. Reading Tools: These applications allow visually impaired users to read documents in various formats.
4. Remote Access: These programs enable users to perform tasks remotely on their mobile phones, even without a screen reader or magnifier.
5. Fun and Learning: These include games designed for entertainment, relaxation, and skill development (Garrido, Ruiz et al. 2012).

1-1-7 Assistive Technologies for the visually impaired people

- B Smart Touch Phone: These phones, created specifically for visually impaired users, present commands as raised letters or symbols that can be touched and comprehended. They also offer support for phone calls and e-book reading.

Figure. (1) B Smart Touch Phone

- Braille E Book: This e-book is a digital adaptation of the Braille method, utilizing electromagnetic signals to create and modify tactile symbols, enabling blind users to move through pages.

Figure. (2) Braille E Book:

- Vision Glasses: Developed by Philips, these glasses are equipped with a camera and acceleration sensors to identify moving objects. They are linked to a portable computer that scans the surroundings and provides audio feedback to the user. This technology assists with navigation and mobility, eliminating the need for an escort.

Figure. (3) Vision Glasses

- Smart Ring: Equipped with a high-resolution camera and a powerful processor, this ring captures and analyzes images of objects pointed to by the user's finger. It then relays the details of these objects through an ear speaker. The ring can assist with reading, identifying currency, and detecting obstacles, but it currently lacks the financial backing needed for market release.

Figure. (4) B Smart Touch Phone

- Voice Headphones: These headphones are equipped with an integrated camera that scans the surroundings and transforms visual information into soundscapes. Louder sounds correspond to objects located below the visual

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field, while softer sounds indicate objects above, enabling blind individuals to better understand their environment

Figure. (5) Voice Headphones

- Smart Mobility Stick: Fitted with laser and ultrasonic sensors, this stick identifies obstacles such as potholes, stairs, and barriers. It delivers audio or vibration alerts to enhance reaction time and boost confidence while navigating. These sticks are cost-effective and frequently provided at no charge through charitable organizations. (Qadi 2023).

Figure. (6) Smart Mobility Stick

1-2 Near Field Communication (NFC)

In the last years, the use of mobile devices has increased notably, hence, applications to achieve the full use of these device are being developed massively. Nowadays, a mobile phone is more that a tool to make calls, it could be used for many different tasks such as information exchange, access to public services like payment and so on.

NFC is a wireless technology originally derived from Radio Frequency Identification (RFID) and operates at a global frequency of 13.56 MHz. Developed by Sony and Philips in late 2002, NFC now enjoys the support of 140 NFC Forums and the participation of 130 countries in its continuous development (Du 2013) .

Both NFC and RFID use interacting electromagnetic radio fields for wireless connectivity. However, unlike RFID, NFC operates over short distances (up to 4 cm), though some NFC tags can transmit data over longer ranges, and is primarily used in mobile phones. Additionally, NFC technology supports only one-to-one connections. Transponder data capacities range from 48 bytes to 9 kilobytes. The NFC standard supports various data rates, including 106kbps, 212kbps, and 424kbps. NFC tags can be rewritable, read-only, or write-once, and each tag has a unique identifier (UID). Notably, NFC utilizes two communication modes for data exchange (Alnfiai 2014):

- ❖ In active mode, two NFC devices both produce a radio field while they communicate. Each device uses an amplitude shift keying (ASK) modulation scheme to modify its RF field in order to transmit data to another device. Each device in this mode generates an electromagnetic field, potentially leading to an RF field collision. To prevent collision, the sending device produces an RF field and, while listening, the receiving device turns off its RF field.
- ❖ In passive mode, only the NFC-enabled device produces a radio field and begins the communication session; only the initiator from the mobile device emits the 13.56 MHz carrier field. The receiver (NFC tag) draws energy from the device and does not produce a carrier field. The initiator transmits information directly by modulating the existing radio field, and interacts with the target NFC tag through load-modulation. This mode enables NFC-capable devices to communicate with contactless smart cards (Peraković, Periša et al. 2014).

1-2-1 How Does NFC Work?

1. **Signal Generation**: The NFC reader emits a radio frequency (RF) signal, a sine waves at 13.56 MHz, to transmit energy to the NFC tag and retrieve its content.
2. **Energy Transfer**: The sine wave signals generate magnetic fluxes, from which any NFC tag within this area derives energy. The NFC tag then creates a counter frequency, altering the original sine wave frequency produced by the NFC reader.
3. **Tag Detection**: The smartphone detects these changes, indicating the presence of an NFC tag nearby.
4. **Close Coupling System**: Data transfer between devices or between devices and tags occurs within a range of 4 cm or less. This short distance eliminates the need for a power supply, as the tag extracts sufficient signal processing energy from the magnetic field. Additionally, the short range provides a high level of security (Alnfiai 2014).

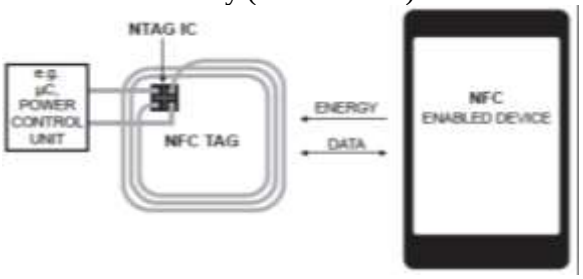

Figure (7) NFC tag interacting with device capable with NFC

1-2-2 Advantages of NFC Technology

Near Field Communication (NFC) technology presents several advantages, making it a preferred choice across various applications. Its ease of use is a key benefit, requiring just a simple tap or wave to initiate a connection, with instant setup that avoids complex configurations. NFC's security features are robust, with its short range reducing interception risks and support for encrypted communication ensuring secure data transmission.

The versatility of NFC allows it to be utilized in diverse applications such as mobile payments, access control, and data exchange. Its ability to integrate seamlessly with other systems like Bluetooth and Wi-Fi broadens its applicability across different platforms. NFC also offers significant convenience, enabling quick contactless payments and effortless data sharing between devices.

Cost-effectiveness is another strong point, with NFC being affordable to implement and energy-efficient, making it suitable for battery-powered devices. It enhances user experience by enabling interactive engagements and personalized services through NFC tags. The technology's growing adoption is evident in the increasing number of NFC-enabled devices and the continuous development of new applications.

Moreover, NFC's interoperability is strengthened by standardized protocols, ensuring compatibility across various devices and platforms. Its cross-platform functionality allows it to operate smoothly across different operating systems, further solidifying its value in a diverse technological landscape.

1-2-3 Disadvantages of NFC Technology

Despite its numerous benefits, Near Field Communication (NFC) technology has several disadvantages that may restrict its effectiveness in various applications. A significant limitation is its short range, typically confined to just a few centimeters, which can be limiting for scenarios requiring greater flexibility or distance.

Security is another area of concern. Although NFC is designed to be secure, it remains vulnerable to data theft and hacking if not properly managed. Additionally, many users may not fully understand the associated security risks, leading to potentially careless usage.

From an infrastructure perspective, NFC can be costly to implement. Businesses may incur high initial setup expenses, and there could be compatibility issues with older devices that do not support NFC, making adoption more challenging.

Battery consumption is another drawback, as continuous use of NFC can lead to increased power drain on devices, which is especially problematic for battery-operated devices. Furthermore, the data transfer speed of NFC is slower than that of other wireless technologies like Wi-Fi or Bluetooth, making it less suitable for applications requiring rapid data exchange.

NFC's market penetration varies by region, resulting in inconsistent availability and usage, which can hinder widespread adoption. The technology also has limited functionality, being well-suited for simple interactions but not for more complex data transfers or communication needs.

Lastly, NFC is susceptible to environmental interference. Physical obstructions or environmental factors can affect its performance**, limiting its reliability in certain situations.**

NFC technology offers numerous benefits, including ease of use, security, and versatility, but it also has drawbacks such as limited range, potential security risks, and slower data transfer speeds. Balancing these advantages and disadvantages is crucial for effectively leveraging NFC in various applications.

1-2-4 NFC for Visually Impaired People

NFC technology is spearheading a contactless revolution by delivering widespread services and information to users across various contexts and locations. It plays an essential role in actualizing the Internet of Things (IoT) through seamless interactions between devices. Numerous initiatives have harnessed NFC to develop assistive tools for visually impaired individuals, catering to needs such as object identification and indoor navigation (Garrido, Ruiz et al. 2012).

Joe Whitworth (2012) examined the potential of NFC technology for providing audio information to users, particularly with everyday items like medical bottles and food packages. These items can be fitted with NFC tags that convey crucial information, which can be audibly delivered or downloaded and shared on web pages or blogs. Furthermore, NFC tags can direct users to specific web pages or facilitate the download of applications, thereby improving accessibility and user experience (Alnfiai 2014).

Garrido et al. (2012) introduced a practical model for object identification through context-aware labeling scenarios. In this model, both visually impaired and sighted individuals interact with labeled objects via their NFC-enabled mobile devices. This method facilitates the creation of augmented scenarios that offer personalized services based on user-defined rules. It was successfully tested at the Baena Olive-Grove and Olive Oil Museum, receiving favorable feedback from users (Alnfiai 2014).

The literature also underscores several other

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applications of NFC technology in assistive tools for visually impaired individuals. For example, previous studies have suggested using NFC tags for object identification in specific contexts and for providing indoor navigation assistance. These applications highlight the versatility and efficacy of NFC technology in promoting independence and enhancing the quality of life for visually impaired individuals (Garrido, Ruiz et al. 2012).

NFC technology holds substantial promise in developing assistive tools for visually impaired people. Its capability to deliver real-time, context-aware information and services makes it a crucial resource for fostering a more accessible and inclusive environment.

Since 2008 we are using NFC and other mobile technologies to design and develop mobile applications. We are looking for new and better ways of interaction for older or disabled people. Some of these projects are:

- **DIAMI**: a distributed architecture for facilitating the integration of blind musicians in symphonic orchestras.
- **MASEL**: a mobile assistant for the elder, specially designed for this people, in collaboration with ESGRA Asistencia, that have many resi- dences like ESGRA Mozarbez and ESGRA Residencial La Vega. Thanks to this collaboration we can test our applications with many old persons in this residences (Sánchez, Beato et al. 2011).
- **PharmaFabula**: an NFC application that was developed in collabo- ration with ONCE, the main Spanish blind. It is a mobile application that recognizes medicines and then reports a description of it in audio format (Pérez, Fernández et al. 2011). It only requires an NFC mobile and to incorporate an RFID tag in the medicament box. In addition, PharmaFabula can provide personal information like dosage or treatment duration of each patient (Sánchez, Mateos et al. 2012).

1-3 Voice labels on Samsung phones

Voice labels on Samsung phones represent a significant advancement in accessibility technology, offering enhanced user experiences for individuals with visual impairments. These labels allow users to assign custom voice recordings to various objects or functions, providing audible cues that facilitate easier navigation and interaction with their devices. This feature exemplifies the integration of assistive technologies in mainstream smartphones, highlighting Samsung's commitment to inclusivity and user-centric design.

1-3-1 Functionality of Voice Labels

The voice label feature on Samsung phones is designed to aid visually impaired users by allowing them to tag objects with voice recordings. This is achieved through the following steps:

- Label Creation: Users can create a voice label by recording a short voice message and associating it with an NFC tag. This tag can then be attached to physical objects such as medication bottles, food containers, or household items.
- Tag Scanning: When the user scans the tagged object with their Samsung phone, the recorded voice message is played back, providing information about the object.
- Customization: The voice label feature allows for extensive customization, enabling users to create detailed and personalized audio descriptions that suit their specific needs (Samsung, 2021).

1-3-2 Benefits of Voice Labels

Voice labels offer several benefits, particularly for visually impaired users:

- Enhanced Independence: By providing audible information about everyday objects, voice labels empower visually impaired users to perform daily tasks more independently (Kim & Lee, 2020).
- Increased Efficiency: The ability to quickly identify objects through voice labels saves time and reduces the frustration associated with locating and recognizing items.
- Personalization: Users can tailor voice labels to their preferences, making the technology adaptable to a wide range of individual needs and contexts (Choi et al., 2019).

1-3-3 Comparative Analysis with Other Technologies

While Samsung's voice label feature is a pioneering innovation, it is essential to compare it with other existing technologies to understand its unique advantages and potential limitations. Other smartphones offer similar accessibility features, such as Apple's Voice Over and Google's Talk Back. However, the voice label's ability to create and use NFC tags for object identification sets it apart by providing a tangible and interactive solution for visually impaired users.

Apple's Voice Over and Google's Talk Back primarily focus on screen reader functionalities, which read out the content on the screen. In contrast, Samsung's voice labels extend this concept to the physical environment, allowing users to tag and identify real-world objects with ease. This tangible interaction enhances the overall user experience, making it more practical for everyday use (Lee & Kim, 2020).

Voice labels on Samsung phones represent a significant advancement in accessibility technology, providing visually impaired users with a powerful tool to navigate and interact with their

environment. By allowing users to create custom voice recordings associated with NFC tags, Samsung enhances user independence, efficiency, and personalization. This feature underscores the importance of inclusive design in technology, ensuring that all users, regardless of their abilities, can benefit from advancements in mobile technology.

2- Experimental work

2-1 Determine the information a visually impaired people in Clothes' Selection

The data needed by the visually impaired people to identify their different clothes was determined through a preliminary survey conducted on a group of (8) visually impaired people, 3 males and 5 females, through a personal interview to find out how they choose their clothes and how to take care of them and to determine their needs and preferences in order to add them to the information carried by the NFC Label.

The educational level of the sample individuals under study was The Primary Grades (12.5%), Preparatory grade (37.5%), Secondary grade (25%), while university grade was (25%).

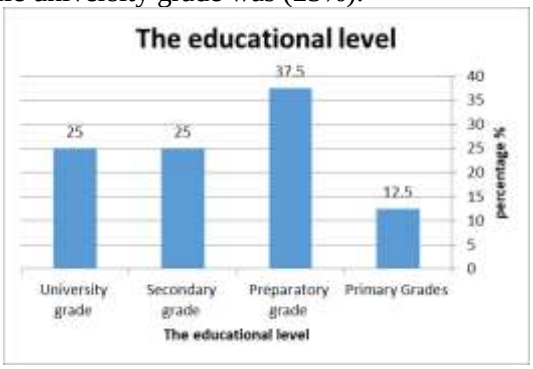

Figure. (8) Educational level of the sample members under study

There was also a difference in the type of visual impairment of the sample members under study between total blindness, partial blindness, and visual impairment, as the percentage of total blindness for the sample under study was (62.5%), while the percentage of partial blindness was (25%), while the percentage of visual impairment was (12.5%).

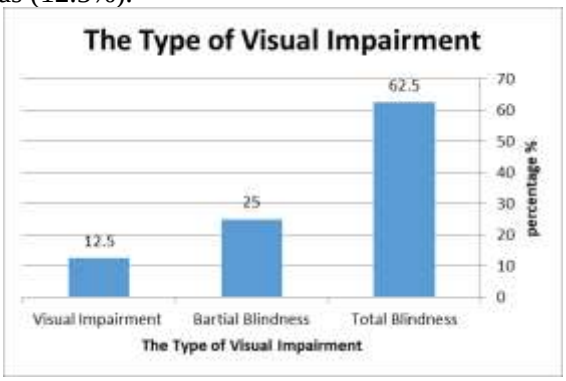

Figure. (9) The Type of Visual Impairment of the sample members under study

The results of this initial survey on "their choice of clothes" were that 75% of the study sample members find it difficult to find clothes that meet their needs and cannot identify clothes for different occasions, and these clothes do not make them feel comfortable, happy and confident because others are the ones who help them in choosing their clothes.

There is also a percentage of 87.5% of the study sample who are unable to identify colors, and cannot recognize clothes that are in line with current fashion.

While 62.5% of the study sample could not easily identify the type of fabric used in clothing, or parts of clothing, and were unable to coordinate the upper and lower clothing pieces, or distinguish between different clothing sizes.

The results of this survey on "clothing care" were that 75% of the study sample members find it difficult to organize their wardrobes according to: type of clothing, frequency of use of clothing, color of clothing, and coordination between clothing pieces.

While 87.5% of the study sample members were unable to identify the correct method of washing clothes, the correct method of ironing clothes, and identifying clothes by adding certain marks to the clothes.

As for the technological expertise that the sample members of the study used before, they do not have any technological expertise in using techniques that help you choose clothes without relying on someone else.

The results of this survey study were that the sample members of the study find it difficult to find clothes that meet their needs and cannot identify the parts of the clothes or distinguish between different sizes, with the inability to identify colors, and cannot identify the type of fabric used in the clothes, or the clothes that keep up with the current fashion, or coordinate between the upper and lower clothing pieces, and cannot organize their closets themselves, as they are in dire need of knowing the necessary information about the clothes they wear or new clothes they want to buy in order to make them feel comfortable and confident when wearing them without needing the help of another person.

Through these results obtained, it was shown that the information that the blind person needs to know how to choose his clothes, how to take care of them, and to determine his needs and preferences. This information is: "Describing the model of the piece of clothing, the type of the piece of clothing, the size, the color, the material, and the coordination of the upper and lower pieces, and explaining the washing method and the ironing temperature".

They also preferred that this information be provided through voice recognition using voice record, so that they could identify, select and care

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for their clothing independently, without relying on assistance from others, to enhance their independence.

NFC Labels are not new to the ready-made garment industry. For example, we can see them attached to clothes with different Labels and written on it "cut before washing or wearing".

Figure. (10) NFC Labels attached to clothes, written on it "cut before washing or wearing".

2-2 NFC Label Design and attach it to the clothes

The NFC Labels is covered with a plastic layer to protect it from damage or exposure to water during repeated washing of clothes.

Figure. (11) The NFC Labels is covered with a plastic layer.

The NFC Label was designed with embroidery on the letter (N), so that the blind can easily access it, and scan the NFC Label to listen to the voice record.

The NFC Label has been attached to the clothing along with labels and size labels so that it is easy for the blind person to access them.

Figure. (12) NFC Label Design and attach it to the clothes.

2-3 Create a voice record to be attached to NFC Label

Mobile phones that support NFC technology have been used to create a voice record that is attached to NFC cards.

There are two ways to create a voice records and attach it to an NFC sticker:

- Use Samsung phones that support NFC technology
- Use the NFC Tools application on other phones that support NFC technology to attach the voice records link to the NFC Label.

2-3-1 Creating Voice Labels on NFC Tags on Samsung Phones

Samsung's voice label feature allows users to create custom voice recordings linked to NFC tags, enhancing accessibility for visually impaired individuals. To create and use voice labels on Samsung phones:

Check NFC Compatibility: Ensure your Samsung phone has NFC capabilities. This feature is typically available on most modern Samsung smartphones.

❖ **Enable NFC:**

Go to Settings on your Samsung phone. -------►Select Connections. -------►Toggle NFC to On.

Figure. (13) An introductory message about how to use NFC Labels on mobile phones.

❖ **Create a New Voice Label:**

Go to Settings on your Samsung phone ----► Select Accessibility

Figure. (14) "Accessibility" on Samsung phones.

From Accessibility -------► Tap on the Vision enhancements

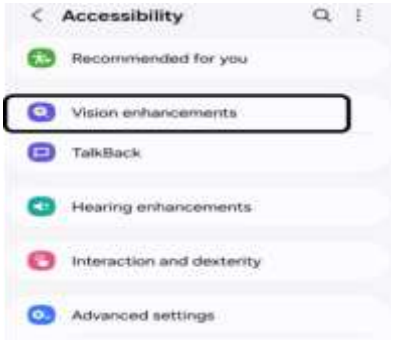

Figure. (15) "Vision enhancements" on Samsung phones.

From The Spoken assistance in the Vision enhancements -------► tap to the Voice Label

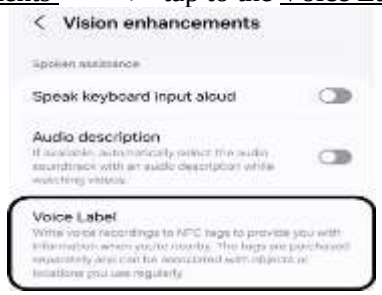

Figure. (16) "Voice Label" on Samsung phones.

Press the Record button to start recording your voice message.

Figure. (17) record voice message on phone.

Speak clearly and concisely about the object you are tagging.

Tap the Stop button once you have finished recording.

Figure. (18) To finish the record voice message on Samsung phones.

You can Play the recording to review it. If satisfied, proceed to the next step; otherwise, re-record the message.

❖ **Write the Voice Label to an NFC label:**

Hold an NFC tag near the back of your phone.

The app will prompt you to Tap to Write. Tap on the screen to write the recorded voice label to the NFC tag.

Figure. (19) Write "Voice Label" form Samsung phones to NFC label.

Once the process is complete, a confirmation message will appear indicating the voice label has been successfully written to the NFC label.

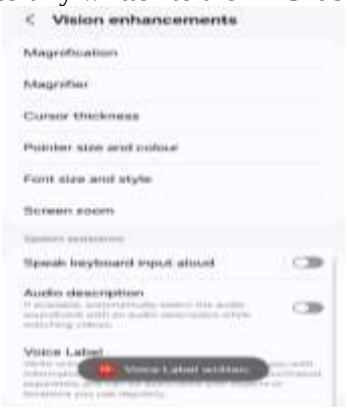

Figure. (20) Confirmation Message voice label successfully written to the NFC label.

❖ **Test the Voice Label:**

To test the voice label, simply hold the NFC-tagged object near the back of your phone.

The phone will automatically play the recorded voice message, providing the information you recorded earlier.

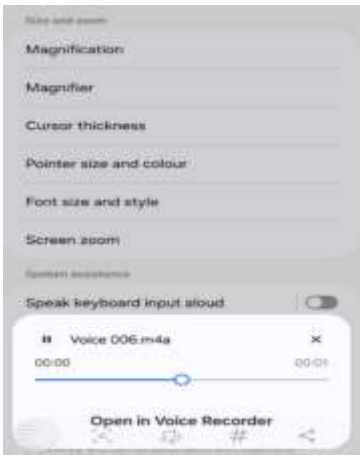

Figure. (21) The phone plays the recorded voice message automatically.

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2-3-2 Use the NFC Tools application on other phones that support NFC technology to attach the voice record link to the NFC Label

- Create a voice records and upload it to the website
- Copy the voice record link
- Using a phone with a feature NFC, and installing an application to read and copy the NFC Label, such as (NFC Tools Application).

Figure. (22) NFC Tools Application

- activate its (NFC) feature, open the application from the phone, then place the NFC Label near the phone, then read the data for the NFC Label.

Figure. (23) Reading the data of the NFC Label

❖ **write on the NFC Label**

- To write on the NFC Label, click on the (write) icon in the application, and choose (Add record)

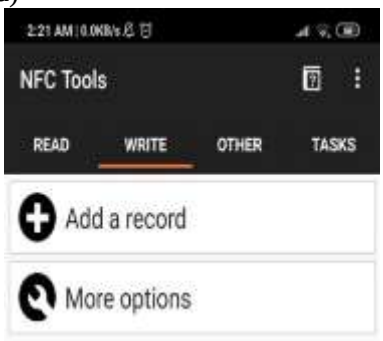

Figure. (24) Add record of the NFC Tools Application

- Choose the type of record to write on the NFC Label, then (Add URL Record) is selected.

Figure. (25) The types of records for typing the data of the NFC Label.

- Place the link to the voice record that we want to save copied onto the NFC Label, and choose (Write).

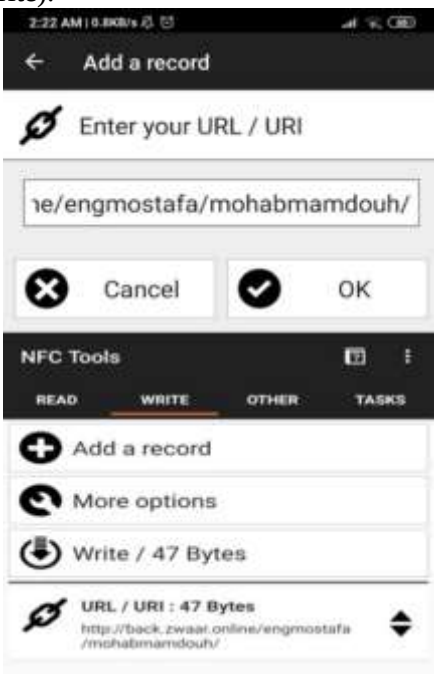

Figure (26) Place the link to the voice record on the NFC Label

- A message (Approach NFC Tag) appears, to bring the NFC Label closer to the phone

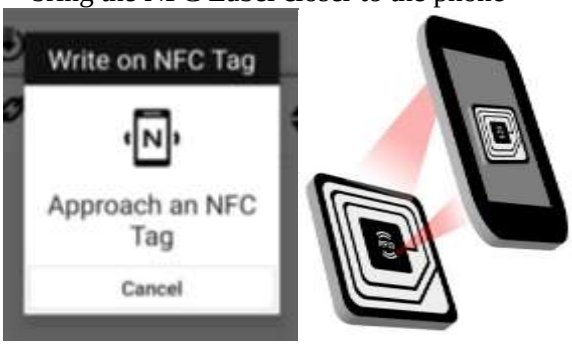

Figure (27) Message to approach the NFC Label from the phone

- If the writing process is done correctly, another

message will appear stating that (write Complete) then the NFC Label is ready and loaded with the link of the voice record, and it can be read from any phone that has the feature (NFC).

Figure (28) Message stating (Write Complete)

❖ **Read voice record link**

As for the NFC card, the phone with the NFC feature was placed near the NFC Label to move to the voice record link automatically.

3- Results and Discussions

In order for the sample members to identify their clothing specifications through Voice Recognition System, both of the following were used: Voice Labels on NFC Label on Samsung Phones, and NFC Tools application on other phones that support NFC technology to attach the voice record link to the NFC Label.

When using the Voice Labels on NFC Label on Samsung phones can only be read on one phone, which is the phone on which the NFC tag is written, and cannot be read on any other phone.

When using the NFC Tools application that support the NFC feature to link the voice record link to the NFC Labels, the NFC Labels can be read on any phone with NFC, and is not restricted to the phone on which the voice record link was written to the NFC Labels.

A survey was conducted on the use of mobile phones and NFC technology by the sample members of the study to identify their clothing specifications through voice record description.

The results of this survey were that 87.5% of the sample members responded that this technology is easy to use and does not require assistance from anyone else.

While there was complete agreement in the clarity and ease of the voice record in describing each of: the piece of clothing, the color of the piece of clothing, and the type of material. The voice record also helped in choosing the pieces of clothing easily, and the methods of caring for the pieces of clothing easily. The voice record helped the individuals in the study sample to identify, select and care for their clothing independently, without relying on assistance from others, to enhance their independence.

4-Conclusion

A Voice Recognition System was developed on the target sample under study of help visually impaired people, using the voice labels on the NFC Labels on Samsung phones, and the NFC Tools application on other NFC-enabled phones to attach the voice record link to the NFC Labels.

While there was complete agreement in the clarity and ease of the voice record in describing each of: the piece of clothing, the color of the piece of clothing, and the type of material. The voice record also helped in choosing the pieces of clothing easily, and the methods of caring for the pieces of clothing easily. The voice record helped the target sample under study to identify, select and care for their clothing independently, without relying on assistance from others, to enhance their independence.

5-Recommendations

- Expanding the use of Near Field Communication Technology with Voice Recognition to a larger sample size than the target sample under study from visually impaired people, to identify, select and care for their clothing independently, without relying on assistance from others, to enhance their independence.
- Encouraging clothing stores to use Near Field Communication Technology to facilitate the process of buying, identifying, choosing and caring for their clothes independently for the blind and visually impaired, without relying on the help of others, to enhance their independence.

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