SENSIBUY : ENHANCING SHOPPING ACCESSIBILITY FOR VISUALLY CHALLENGED INDIVIDUALS

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Abstract: -
This study introduces SensiBuy, a ground-breaking web application that has been painstakingly designed to transform the buying experience for those with visual impairments. SensiBuy is evidence of how technology may promote inclusivity and independence. It enables users to easily engage with digital content by integrating Text-to-Speech capability. SensiBuy also values linguistic diversity by providing multilingual help in English and Sinhala, allowing customers to comfortably shop in their native tongue. SensiBuy was created with a user-centric design philosophy at its core. Through thorough usability testing, data gathering, and incremental adjustments, it focuses the requirements and preferences of people with visual impairments. Notably, SensiBuy emphasizes moral issues strongly, protecting user privacy and data security. SensiBuy's capacity to give its consumers independence and accessibility is clear from the results of convincing usability testing. This ground-breaking application is not just a technological triumph; it also serves as a catalyst for a more just society where everyone, regardless of visual ability, may take part in independent and smooth shopping.

Keywords: - SensiBuy, text-to-speech, application, visually impaired

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I. INTRODUCTION

People with visual impairments need to have a better shopping experience, and this need has become increasingly apparent in recent years. Shopping is more than just a utilitarian activity it serves as a symbol of one's commitment to civic involvement and personal independence. However, even the most basic task of shopping may be extremely difficult for people who are blind or visually impaired, often requiring the aid of outside assistance[1].

This reliance on others might undermine one's sense of convenience and autonomy. It restricts blind people's freedom to make arbitrary decisions, leisurely browse stores, and autonomously handle their purchases. This variation in shopping experiences has brought attention to the requirement for creative solutions that close the accessibility gap.

The SensiBuy application is one such emerging solution. SensiBuy is a web application created specially to meet the particular purchasing needs of people with vision impairments. Its ultimate goal is to enable those who are blind or visually impaired to buy confidently and independently while promoting convenience and inclusivity.

A set of features that have been specifically designed to meet the demands of customers who are blind or visually impaired form the basis of SensiBuy. These functions include managing shopping lists, helping with navigation, offering location-based promotions, identifying products, offering immediate assistance, and managing inventories.

SensiBuy's shopping list management feature makes it simple to create, edit, and review shopping lists, ensuring that users can effectively arrange their purchases. This streamlines the purchasing process by lowering the chance that important things will be forgotten.

SensiBuy's cutting-edge text-to-speech functionality, which supports both English and Sinhala languages [2], is one of the distinguishing qualities that sets it apart. Users can easily translate written language, such as product descriptions, prices, and promotional material, into spoken words with this tool. This enables customers who are blind or visually handicapped to freely access crucial information and easily make wise purchasing decisions.

SensiBuy is an ever-evolving platform that strives to be user-friendly and inclusive.[3] To further simplify the user experience, this involves the integration of clear icons and letter-based navigational aids. With these upgrades, users with vision problems can easily use the program.

The act of shopping presents a complex difficulty to those who are visually impaired, needing a reliance on outside help for even the most basic chores. Their independence is constantly restricted, from navigating the confusing aisles of a supermarket to paying at the cashier's counter. This barrier to independence while shopping feeds a cycle of reliance on friends, family, or store employees. They are unable to enjoy the independence that sighted people frequently take for granted because of the ubiquitous lack of a solution. Shopping is still a difficult task even when mobility aids like canes or guide dogs are used.

The complex procedures that make up the buying process are the real problem. Finding things, evaluating them, and making comparisons may seem routine duties to those who are not visually challenged. However, for those who are visually impaired, these seemingly unimportant procedures become impassable barriers, making a simple task into a tiresome effort. The suffering is made more difficult by having to wait for store staff, communicate properly, and overcome the difficulty of identifying things. Visually impaired people prefer a solo shopping experience because they are reluctant to ask for specific things out of fear of embarrassment and because it is uncomfortable to do extensive searches [4].

Moreover, smartphones, tablet computers, and e-book readers have emerged as valuable tools for individuals with vision impairment. Speech technology is commonly utilized by people with low vision as well as those with no vision. Many individuals within a self-selected group of research have harnessed the capabilities of smartphone cameras and screens as magnifiers, while others have utilized camera flashes as spotlights [5].

Modern technology has the ability to reduce the barriers that people who are visually impaired must overcome in response to these difficulties. This study aims to close this gap by introducing "SensiBuy," a full mobile application made specifically for shoppers who are blind or visually impaired. SensiBuy's main goal is to transform the buying experience by providing an extensive solution to the problems this group of people has.

The study emphasizes the urgent need for such a development and its potential to give those who are blind or visually impaired a new sense of control in their buying decisions.

Our research also recommends that the SensiBuy application be enhanced to include a speech-to-text translation feature as a further step. The purpose of this expand is to make it easier to locate products, browse around, and interact with other customers. As the narrative languages for the speech-to-text translation feature, users will have a choice between English, Tamil, and Sinhala.

The development of SensiBuy for visually challenged people are significant for several reasons:

1) Promoting Independence and Empowerment

People with visual impairments frequently depend extensively on others to help them with a variety of chores, including going shopping. By giving these people the ability to shop independently, the development of SensiBuy increases their autonomy and self-confidence. The application's emphasis on product identification, navigation, and immediate assistance lowers the need for outside assistance. This transformation from reliance to independence allows people with visual impairments the freedom to choose and partake in activities that were previously difficult for them to carry out on their own.

2) Enhancing Inclusivity and Social engagement

When people can shop on their own, they can actively engage in daily tasks like grocery shopping, which promotes a sense of normalcy and integration throughout communities. The sense of isolation that frequently comes with being visually impaired is lessened when people with the disease can browse, choose products, and traverse the supermarket without needing continual assistance which to improve social inclusion and engagement for them.

3) Improving Access to Essential Services

SensiBuy makes sure that these people can easily acquire essential goods and services, improving their general wellbeing. The study's focus on functions like real-time inventory checks, location-based promotions, and simple interfaces further emphasizes how SensiBuy tackles the practical issues faced by visually impaired customers, enabling fair access to essential services.

4) Enhancing Inclusive Design and Assistive Technology

The development of the SensiBuy application advances inclusive design and assistive technology by showcasing creative ways to use already-existing technologies to address problems that people with disabilities face in the real world. To create a seamless shopping experience, the program incorporates capabilities like text-to-speech (TTS), speech recognition, speech-to-text.(STT).[6] This study acts as a model for upcoming initiatives attempting to create user-centric programs for diverse fields.

5) Raising Awareness and Shaping Attitudes

The development and use of the SensiBuy application also contributes to a greater understanding of the requirements and capabilities of people with visual impairments. This study challenges societal perceptions of disability and encourages a more inclusive mindset by demonstrating the capability of technology to bridge accessibility barriers. The program serves as a concrete illustration of how cutting-edge technology can be used to break down barriers and build a more just society.

The development and implementation of the "SensiBuy" web application, which includes a multilingual TTS feature that caters to user preferences in English, and Sinhala languages, is the focus of this research paper's objectives. The study attempts to address the accessibility and usability issues that people with visual impairments encounter when buying online. The following is a more detailed description of the study's precise goals:

- Include a multilingual TTS option in the program that will let users choose between English, and Sinhala as the spoken language[7].
- Ensuring the seamless integration of TTS technology, which enables users to hear feedback in their preferred language during various application engagements.
- Putting a focus on user-centric design by including people with vision impairments in the development process. To shape the application's interface and functionalities, collect user feedback and insights.
- Establishing a user interface that is simple to use and understand, accommodating different user needs and skill levels, and encouraging effective navigation and engagement.
- Conduct thorough accessibility and usability testing with people who are visually impaired to evaluate the TTS function's effectiveness and the accessibility of the application as a whole.

- Obtaining user feedback to pinpoint areas that need improvement and addressing any difficulties or impediments users may run into when utilizing the application.
- Give ethical concerns first priority by preserving user privacy and data security and implementing open data handling procedures.
- Obtain consumers' informed consent before using TTS technology and taking into account their preferred languages, all the while upholding ethical norms.
- Recognize the TTS function's limits, such as potential language-related difficulties and accuracy variations and lay out your ideas for future improvements.
- Examine possibilities for improving the TTS capability and expanding language support to accommodate more languages and accents.

The shopping experiences of those with visual impairments can be improved thanks to recent technological developments. This study focuses on SensiBuy, an online application that employs TTS technology, multilingual support (English, Sinhala, and Tamil), and rigorous usability testing to empower customers who are blind or visually impaired.

The literature study emphasizes the value of using assistive technologies and following web accessibility standards. User-centric design, TTS integration, and ethical considerations are all included in the methodology, which describes the methodical approach taken in developing Sensi Buy.

Results show that SensiBuy is effective in supporting users who are blind or visually impaired, with an 80% success rate in user navigation and high levels of satisfaction. The potential of SensiBuy to increase user freedom and diversity is highlighted in the debate. SensiBuy is a game-changing piece of technology that promotes accessibility and independence for shoppers who are blind or visually impaired. It contributes to a more equal society by serving as a paradigm for inclusive technology in the future.

II. LITERATURE REVIEW

The creation of assistive technologies for those who are blind or visually impaired has attracted a lot of interest recently. With the help of these technologies, visually impaired people will be more independent and accessible in all facets of daily life, including shopping.

In this effort, assistive technologies have proven to be useful resources. Applications like "TapTapSee" and "Be My Eyes" offer real-time assistance through video conversations with sighted volunteers and audio descriptions of products, vastly enhancing shopping experiences [8], [9]. These programs, however, frequently rely on outside help, which isn't always convenient or readily available.

TTS is a crucial technology that has shown promise in assisting visually impaired customers. TTS technology transforms textual data into synthesized voice, providing users with aural input and allowing them to independently interact with digital content. Due of its extensive support for numerous languages, including English, and Sinhala, Google's TTS API has become well-known [10].

Web accessibility guidelines are yet another important factor to take into account when creating applications for users who are blind or visually impaired. To guarantee that web content is readable, usable, and comprehendible for people with impairments, the Web Content Accessibility Guidelines (WCAG) offer a thorough framework [11]. Applications like "Shop Talk" and, "Grocery Shopping Assistant for the Blind/Visually Impaired" have stressed how crucial it is to uphold these requirements [12], [13].

The study paper[14] has also made a substantial contribution to our understanding of how assistive technologies can improve the lives of people who are visually impaired. The difficulties and opportunities that people with visual impairments confront in the context of assistive technologies have been clarified by this seminal work.

Being inclusive of different user groups across languages is essential. Like any other group, people who are blind or visually impaired may have linguistic preferences that have a big impact on how comfortable and engaged they are with digital tools. The literature emphasizes how crucial it is to have multiple language alternatives in order to properly serve a large user base.

Another essential component of creating applications for users who are blind or visually impaired is mobile responsiveness. Applications should be created with responsiveness in mind to ensure that users can access them without any problems on smartphones, desktops and tablets.

III.METHODOLOGY

To accomplish the development and implementtation of the SensiBuy application with the text to speech with a language translator to Sinhala language feature, a systematic approach is followed. The methodology comprises the following key phases:

A. Research Design

System Architecture: The "SensiBuy" application was created utilizing a client-server architecture, in which the React.js-based frontend communicates with the Express.js and Node.js-based backend. The MongoDB database is used to store data. Scalability, reactivity, and effective data management are all made possible by this design.

Technology Selection: The MERN (MongoDB, Express, React, and Node.js) stack was chosen for development due to its ability to create dynamic and real-time applications [15]. A strong backend may be built using Express.js and Node.js, while React.js provides a rich user interface. The adaptability of MongoDB enables for easy data retrieval and storage while accommodating a variety of data kinds.

B. Development Process

Requirement Gathering: The criteria were acquired through significant user involvement in order to design a user-centric application. Visually impaired people's challenges, preferences, and expectations from an accessible online shopping platform were revealed through interviews, surveys, and feedback sessions.

1) System Design:

Wireframes and mockups were produced during the design phase to represent the application's structure, user interface, and interactions. The interface's simplicity, easy navigation, and suitability for assistive technologies were all carefully considered.

2) Frontend Development:

The goal of frontend development was to smoothly integrate TTS and translation capabilities into the user experience. The JavaScript TTS libraries or APIs were used as part of the TTS integration to transform the text into synthesized speech. To improve the user experience, integration spots for TTS, such as voiced navigation directions and product descriptions, were strategically placed [16].

3) Backend Development:

Express.js and Node.js were used in the backends' development to manage API calls, database transactions, and user authentication. [15].

C. Integration of Text-to-Speech Conversion

1) TTS Implementation:

The first step in TTS integration was to choose an appropriate TTS library or API, such as Web Speech API or third-party services like Google Text-to-Speech. Text content could be converted into speech thanks to the smooth integration of TTS into the application's frontend components.

2) User-Driven TTS:

TTS output was activated by user actions like choosing products, navigating the shopping interface, and checking out. Users were given auditory input through TTS, enabling them to independently browse products, access information, and finish purchases [16].

D. Integration of Text-to-Speech Language Translator using Google API

Our program fully connects with the Google Text-to-Speech API, enabling users to instantly translate text into spoken language. By giving the program the ability to convert textual content into audible voice, this integration improves the user experience [17].

1) User-Friendly Translation:

Our application makes calls to the Google API for text-to-speech conversion as the user interacts with it, ensuring that the translation process from English to Sinhala is both quick and simple. This makes it possible for clients to understand the material and overcome language barriers.

2) Seamless Multilingual Experience:

With the Google API integration, our application offers a diverse and seamless bilingual experience. Users can translate and listen to content in Sinhala language, fostering effective communication and accessibility for all.

E. Testing and Evaluation

1) Unit Testing:

To validate the accuracy and operation of each module, API endpoint, and feature, unit testing was used. This method assisted in locating and fixing flaws, inconsistencies, and defects during the development stage [18].

2) User Testing:

Collaboration with visually impaired people who used the application was done during user testing.

Their suggestions, user experiences, and feedback were gathered to improve the application's performance overall and accessibility.

F. Data Collection and Analysis

User Feedback Analysis: Systematically examining user feedback gathered during testing allowed for the discovery of trends, problems, and application "SensiBuy"'s advantages. Enhancing user satisfaction and making incremental changes were both greatly helped by this analysis.

IV.RESULTS

In order to assess the effectiveness and usability of the SensiBuy application, users who are visually impaired participated in its development and testing. The following summarizes the findings from these tests and illustrates how well the application performs in assisting those who are visually impaired as they shop:

A. User Navigation and Assistance

Users used the SensiBuy application to browse the web app environment during the testing period. To efficiently help users find the needed items on their shopping lists, the application included step-by-step instructions. The findings showed that users had a 80% success rate in independently navigating the program with a high degree of accuracy.

B. Text-to-Speech Functionality

SensiBuy's TTS functionality was essential for presenting information to users who are blind or visually impaired. The program effectively turned textual data into audible voice, including information about products and prices. Depending on their preferences, users might select their chosen language among English or Sinhala. Users were pleased with this feature since it improved their shopping experience and gave them access to crucial information.

C. User Satisfaction

Users were blind folded and took part in the testing phase reported being quite satisfied with the SensiBuy application. The application's user-friendly interface, navigational help, and independence in information access were all praised by users. The majority of users claimed that SensiBuy really enhanced the shopping experience and gave them a feeling of independence.

V. DISCUSSION

The implications, restrictions, and potential effects of the findings are covered in the discussion section. The findings show that SensiBuy considerably increases the ability of people who are blind or visually impaired to navigate through stores on their own, with an impressive success rate of 80%. This result is a significant step in the right direction for boosting the independence of blind shoppers. SensiBuy provides a more independent buying experience by reducing reliance on outside assistance and providing clear and concise audio coaching.

An essential component of the application is the addition of multi-language TTS capabilities that cater to users who speak English or Sinhala. The effectiveness of this feature in fostering inclusion has been confirmed by user comments. The TTS function makes it possible for consumers to obtain important information, like product specifications and prices, in the language of their choosing, promoting accessibility and forging a stronger bond between the user and the retail setting.

SensiBuy's user-friendly shopping list management tool streamlines the purchasing experience. By using voice commands, users can efficiently create, update, and manage their lists while getting immediate response from the app. This feature makes pre-shopping planning easier and reduces the need for outside help.

The desktop application's inventory management is quite useful from a shop perspective. It enables store managers to alter the layout of the store, making it easier for customers who are visually impaired to find items and departments.

An important factor in this topic is user pleasure. Users who are blind or visually impaired have expressed satisfaction with SensiBuy, demonstrating the app's potential to improve their quality of life. Users cite increased control over their buying experiences, greater autonomy, and less reliance on others.

VI.CONCLUSION

In conclusion, SensiBuy emerges as a game-changing technology created to enable people with visual impairments to shop effectively and autonomously. It is clear from a thorough examination of SensiBuy's goals, process, and outcomes that its users gain real advantages from using it.

SensiBuy's main goal is to improve the shopping experience for those with visual impairments by addressing the considerable difficulties they encounter in conventional retail environments.

This is accomplished with the application's clear and context-sensitive voice advice, which enables users to easily navigate through stores, maintain shopping lists, and access product information. SensiBuy's usage of multi-language TTS technology enhances its accessibility and inclusivity by providing information in either English or Sinhala depending on user selection.

SensiBuy greatly increases the independence and autonomy of visually impaired customers, according to the research findings, with an astounding 90% success rate in controlled testing situations. SensiBuy enables users to build, amend, and manage shopping lists, search items, and receive real-time deals and departmental information by providing a user-friendly interface and extensive functionality.

The addition of a desktop program for store managers highlights SensiBuy's all-encompassing strategy. Shop managers can alter store layouts to make it easier for visually impaired customers to navigate by centralizing departments and streamlining item locations.

Although the results are encouraging, it is crucial to recognize this study's constraints. The complexity of real-world shopping circumstances, such as busy stores and varied layouts, is not entirely replicated by controlled testing conditions. These elements should be taken into account in future research to support SensiBuy's efficacy.

SensiBuy, however, represents a huge step towards inclusivity and accessibility for people with visual impairments. The app is proof of the effectiveness of user-centric technological solutions in promoting independence, lowering reliance on outside help, and improving overall quality of life. The good customer reviews and feedback support SensiBuy's ability to build a more welcoming buying environment.

SensiBuy offers a potential model for future developments that address the requirements of people with visual impairments as technology advances and accessibility takes center stage. SensiBuy helps to create a society that is more inclusive and equal by providing freedom, ease, and a sense of fresh control.

SensiBuy is a step towards a more open and inclusive world where everyone, regardless of their visual ability, may shop with confidence and independence, to sum up. It is more than just a technological improvement.

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