Navigation Assistance for the Visual Handicapped Persons through Mobile Computing

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Abstract: For a one-of-a-kind experience, this groundbreaking software provides voice-activated directions, object recognition, and conversation. The software can better interpret voice commands when the user speaks clearly. Detection of objects is the basis of the visual recognition system. To make things more accessible, users may use voice commands when they call or text. This software integrates with the user's address book and enables voice-activated contact addition. Object recognition and voice-driven commands bring a whole new dimension to user engagement with visual aids. This program exemplifies how a simple and welcoming interface may serve several functions.

1 INTRODUCTION

Technology has significantly transformed the way people interact with their surroundings, offering innovative solutions to enhance accessibility for individuals with disabilities. Among these advancements, mobile computing has emerged as a powerful tool to assist visually impaired individuals in navigating their environment with ease. Traditional navigation methods, such as guide dogs or walking canes, provide assistance but come with limitations in detecting obstacles and offering real-time directional guidance. To address these challenges, this project introduces a voice-driven mobile application that integrates speech recognition, object detection, and Google Maps navigation to facilitate hands-free movement and communication. The proposed system enables users to interact through voice commands, eliminating the need for manual input. The application listens to spoken words using Speech-to-Text (STT) technology, extracts meaningful information, and processes it to generate navigation routes. By integrating with Google Maps, the system allows users to receive step by-step directions to their desired location, supporting different travel modes such as walking, public transport, and driving. Additionally, the app extends its functionality by incorporating voice-activated contact management and messaging, allowing users to add new contacts and send SMS without physical interaction. Beyond navigation, the inclusion of object detection enhances safety and situational awareness by identifying obstacles in the user's path. This feature is particularly beneficial in unfamiliar environments, where visually impaired individuals might struggle with unexpected barriers. The application can provide voice alerts or haptic feedback to warn users about detected objects, making navigation safer and more efficient. The combination of these technologies not only improves accessibility but also fosters independence, enabling visually impaired individuals to move confidently in their surroundings. With a user-friendly interface and an emphasis on inclusivity, the proposed system aims to bridge the gap between accessibility needs and technological advancements. Future enhancements may include multi language support, offline navigation, and integration with wearable devices to further refine the user experience. By leveraging artificial intelligence, speech processing, and mobile computing, this project represents a significant step towards creating a smarter, more inclusive world for individuals with visual impairments.

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2 RELATED WORKS

Home appliances that operate via voice commands and run on the Android platform are detailed in this article. Disabled and older people can use this technology in the comfort of their own homes. Google is able to identify and analyse voice commands spoken into smartphones. This article explains how to use Android to record voice commands and transmit them to an Arduino Uno. The light and fan were turned on and off using the Arduino Uno's Bluetooth module. With its user-friendly interface and straightforward installation, the system was created to manage electrical appliances. Using Bluetooth, you may manage your household appliances up to 20 meters away (Norhafizah bt Aripin,et.al., 2014).

These days, we can't imagine life without our smartphones and other smart devices. These innovations can make daily life easier for people who are visually impaired. In this article, we take a look at an Android software that can scan text and objects and identify them in real time. A device doesn't need an external server to run an app. Our solution includes voice feedback that notifies the user of the object that has been found. The object may be detected by the app without the requirement for a snapshot. For strong detection, we separate the object from its background using the Tensorflow machine learning API and many diagram cuts. Then, we educate the user about the object via text-to-speech by transforming the recognition difficulty into an instance retrieval task. Those who are visually impaired can use the technology to better comprehend their environment. This app is compatible with all budget smartphones (Md. Amanat Khan Shishir,et.al., 2019).

Voice Assistant, a Serbian-supporting personal assistant app for Android phones, is introduced in this paper. A native- UI, open-source speech recognition framework called Kaldi underpins this massive vocabulary continuous voice recognition system. To train a variety of acoustic models with varying degrees of noise, a dataset of 70,000 utterances was utilised. With a vocabulary of more than 14,000 words and a test database of 4500 utterances, results are obtained (Branislav Popović,et.al., 2015).

Portable gadgets are used by people quite a bit. People who are visually impaired may benefit from these technologies on a daily basis. The research suggests an app for Android smartphones that might be useful for these individuals. Applications use microelectromechanical system (MEMS) sensors found in smartphones as well as a few third-party sensor modules. All of the parts work together to form a portable aid. Bluetooth and Wi-Fi allow smartphones and external modules to connect with each other. Customers who are visually impaired will find this app's UI to be suitable. Through text-to-speech software, smartphones are able to converse with their users. These modules do indoor/outdoor navigation and manage incoming phone calls. According to the results, the assistant system in this Android app is small, effective, easy to transport, cheap, and only needs a few hours of training (Laviniu Ţepelea,et.al., 2017).

Smart assistants, which allow us to converse with and question machines, are a boon to all humans in the modern day. Thanks to mobile phones, computers, desktops, etc., this technology is appealing to nearly everyone on the planet. A smart assistant that can recognise speech, understand text and voice input, and then verbalise search results. Smart assistants include Google Assistant, Apple's Siri, and Amazon's Alexa. They have trouble interacting and can't identify sounds. People may have difficulties in employing Google Assistant due to their language restrictions and the fact that they rely on WiFi and internet to communicate with people. You can find Google Assistant on Android smartphones. To use this program, you need to be online. You don't need the Internet to use our suggested system. With the help of the voice assistant, users may access data in several languages, including current apps, daily news, geolocation, and Wikipedia, thanks to the usage of raspberry pi for data loading and storage. Users utilising automation technology can benefit from voice help (Rajakumar P,et.al., 2022).

3 METHODOLOGY

3.1 Proposed System

For the vision challenged, there is a game-changing smartphone software that can identify objects, communicate, and issue voice orders. For the program to properly process spoken commands, it employs Speech-to Text (STT) technology. Upon destination recognition, the system utilises Google Maps to provide real-time, step-by step instructions for a variety of travel options. The software is much more user-friendly because it allows users to make contacts and send SMS using voice commands. To further enhance security, the system employs object detection in addition to navigation and communication. Making the user's environment safer for walking, the program alerts them to obstacles via voice or vibration. This feature gives the sight handicapped the confidence they need to move

around in unfamiliar environments. Because it integrates speech recognition, object identification, and smooth communication into a single platform, the application is especially accessible and inclusive for people with visual impairments. The incorporation of wearable devices, offline navigation, and support for several languages are all potential enhancements to the user experience.

3.2 System Architecture

The system architecture as shown in figure 1 is designed to facilitate seamless voice-based interaction for visually impaired users. The user initiates communication through voice input, which is captured by the microphone and processed by the speech recognizer. The recognized speech is converted into text, which is then analyzed to determine the appropriate function. Based on the extracted command, the system can perform various tasks, including navigation assistance, contact management, and message sending. The architecture also integrates a content provider module, which helps in retrieving and managing relevant data, ensuring smooth execution of user commands. One of the key components of the architecture is object detection, which enhances user safety by identifying obstacles in the environment. The system utilizes an object detection model to recognize surrounding objects and provide real-time feedback to the user. Additionally, the application allows users to add new contacts and send messages through voice commands, reducing the need for manual input. By combining speech recognition, object detection, and communication functionalities into a unified system, the architecture ensures an intuitive and accessible experience for visually impaired users, making navigation and communication more efficient and user-friendly.

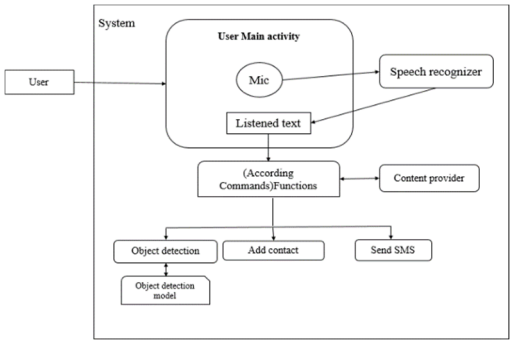

Figure 1: Architecture.

3.3 Modules Users

Go ahead and send the SMS. Input a name or number and use object detection to make a call. Just say "Google Maps" and add a contact. The incorporation of hands free features streamlines the management and connection of devices.

4 RESULTS AND ANALYSIS

The developed system successfully integrates voice-based commands, object detection, and communication features to enhance accessibility for visually impaired users. Through speech recognition, users can provide voice inputs to navigate, add contacts, and send messages seamlessly.

Figure 2: Application Interface.

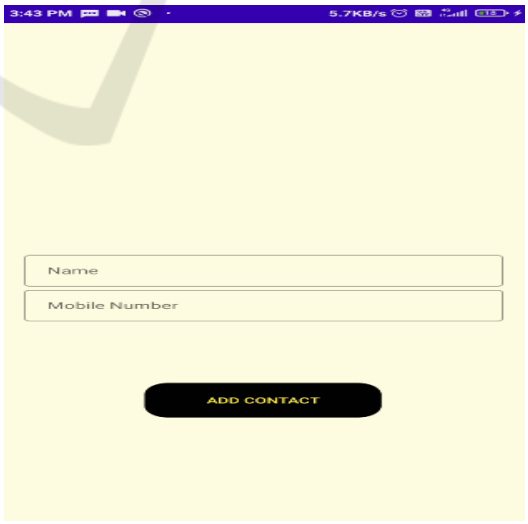

Figure 3: Add Contact Page.

Figure 2 shows the Application Interface page and figure 3 shows the Add Contact Page respectively.

The system effectively converts spoken words into text and processes commands with high accuracy, ensuring smooth user interaction. Google Maps integration enables real time navigation, allowing users to reach their destination hands-free. Additionally, the speech feedback mechanism confirms user commands before execution, reducing errors and improving usability. The object detection feature enhances safety by identifying obstacles in the user's path, providing timely alerts to assist in navigation. The hands- free communication system allows users to manage contacts and send messages effortlessly, making the application highly useful in daily activities. The proposed system outperforms existing solutions by offering a unified and intuitive interface that caters specifically to the needs of visually impaired individuals. Overall, the results demonstrate the effectiveness of the application in improving independence and mobility for visually challenged users, showcasing its potential for real-world implementation.

5 FUTURE WORK

The proposed system has the potential to enhance accessibility and user experience with significant upgrades. In the future, the program may be enhanced to support several languages, allowing individuals from varied backgrounds to easily utilise it. The system's adaptability and efficiency may be enhanced with the addition of AI and ML, which can improve item detection and speech recognition. Offline functionality can be developed to assist visually impaired folks who do not have access to the internet. Improving the app in the future may involve adding more language recognition features to attract a wider range of users. One way to improve the visual aid feature is to incorporate it with new technology, such as augmented reality. Constant updates have the potential to provide new features like improved voice commands and more compatibility, further establishing the app as a versatile and cutting-edge answer to a wide range of customer demands.

6 CONCLUSIONS

Users with visual impairments can benefit from a unified application that allows for spoken commands, object identification, and conversation. Speech recognition provides a seamless user experience by enabling hands free navigation, contact management, and messaging. Movement is made safer and easier with real-time obstacle alerts via object detection. It is a significant improvement over prior solutions because of the system's user-friendly and efficient interface for those with visual impairments. The software enhances user freedom, communication, and navigation, according to the results. To make the system more accessible and convenient in the real world, it might be improved by adding support for several languages and the ability to work offline.

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