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VisionAid: An Android-Based Assistant for Visually Impaired

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***Abstract*— Visually impaired individuals encounter numerous challenges in their daily lives. We might be surrounded by some of them. Performing everyday tasks can be daunting for someone with a visual impairment. Thus, this study aims to develop a tool that serves as a personal assistant for visually impaired individuals. This research outlines the interconnected modules and functions of a proposed application designed to aid individuals who are blind. The concept revolves around providing visually impaired individuals with an Android-based system equipped with a virtual assistant, enabling them to independently perform certain simple tasks without relying on assistance from others. The objective of the system is to provide voice-guided assistance to blind individuals for tasks such as reading, object identification, navigation assistance, and understanding their surroundings. The project comprises a camera, mobile device and audio system. Our project aims to address these issues comprehensively by focusing on every aspect of the challenges faced by visually impaired individuals, thereby developing an Android system to enhance their daily lives.**

Keywords: Visually impaired people, Android system, Virtual assistant, Speech Commands, Mobile device, Object detection, Navigation assistance, Optical Character Recognition

I. INTRODUCTION

Millions of people worldwide struggle with visual impairment that make it difficult for them to comprehend their surroundings. One of the main difficulties visually impaired persons encounter is getting around and understanding their surroundings.

Along with other challenges like reading text written on walls or on desktop unless and desktop has auto reader on. They find it challenging to move on their own since they are unable to judge the relative positions of the items and people around them. They require assistance from another person to navigate or know about their surroundings. One of the most popular assistive devices for the blind is the blind stick. The blind stick is useful for navigation, but it doesn't alert the user to the different obstacles until they are almost directly in front of them.

As a result of these conventional solutions'

limitations, extensive research is being done to provide more effective and sophisticated devices to help the blind and visually impaired. An android system, utilising the camera on the phone to identify objects, text. Using Tensorflow's API, the application will identify the surrounding and notify the user via audio of the object detected.

The visually impaired user will get the audio message through the use of an audio device, such as headphones or the speaker on their phone. Since the system will be using the phone's camera to accomplish those tasks, it does not require an extra camera. This paper presents an overview of an android application, modalities, and functionalities for visually impaired people in order to illustrate how this java and kotlin based application can support independent mobility for the visually impaired.

II. LITERATURE REVIEW

The paper includes a literature survey that explores existing research and technologies related to assisting visually impaired individuals.

In 2021 Kanchan Patil, Avinash Kharat, Pratik Chaudhary, Shrikant Bidgar, Rushikesh Gavhane published the paper "Guidance System for Visually Impaired People" which introduces a wearable device featuring a virtual assistant system. The device aims to aid in fundamental tasks such as environmental perception, object localization, facial recognition, and text reading. Comprising five integral components, the system facilitates navigation via both hardware buttons and voice-over commands. Leveraging deep learning methodologies and core libraries of the Python language, the project endeavors to streamline daily activities for visually impaired individuals.

In 2020 Vinayak Iyer, Kshitij Shah, Sahil Sheth, Kailas Devadkar published the paper "Virtual assistant for the visually impaired" conducted research which indicates that individuals with visual impairments face significant barriers to accessing the internet, resulting in lower rates. This paper introduces a software solution designed to facilitate internet access for the visually impaired, thereby improving usability and enabling interaction with websites through voice commands The software integrates speech-to-text and text-to-speech modules along with Selenium, enabling automation of various websites. Additionally, it offers a summary of content and answers user questions.

In 2023 Prof. Supriya Gupta, Divya Wandhare, Harshal Jodangade, Aayushi Pandit, Bhargavi Chendke published the paper "Voice Assistant For Visually Impaired People" which describes an application where Blind individuals can now read printed text and use a talking calculator through a speech engine and camera. The application also provides weather information, object detection, and a voice-based payment system. The project aims to make everyday life easier for blind individuals, as voice recognition techniques are increasingly needed due to the rapid growth of wireless communications. The application speaks in response to voice commands, allowing users to focus on their work without additional eye or hand movement.

In 2021 Sulaiman Khan, Shah Nazir, And Habib Ullah Khan published the paper "Analysis of Navigation Assistants for Blind and Visually Impaired People: A Systematic Review" which describes The advancement of navigation and routing devices has encountered obstacles in the development of intelligent guiding mechanisms for individuals who are blind and visually impaired (BVIPs). Existing approaches encompass e-canes, infrared-based canes, and laser-based walkers; however, they are plagued by limitations such as limited object detection ranges and potential user harm. This systematic research endeavor aims to systematically identify primary studies, offer a comprehensive overview of emerging trends The study includes 191 relevant articles from 2011 to 2020. The findings will help researchers, engineers, and practitioners make informed decisions to improve navigation assistants and reduce fatalities and injuries for BVIPs.

In 2022 Xuhui Hu, Student Member, Aiguo Song, Hong Zeng, and Dapeng Chen published the paper "Xuhui Hu, Student Member, Aiguo Song, Hong Zeng, and Dapeng Chen" which describes that Blind amputees struggle to quickly and intuitively convey environmental information, which is crucial for their daily living ability. A virtual scene and sound source were created using spatial audio reasoning (SAR), allowing real-time simulation of three-dimensional motion. A prosthetic control system was developed to assist blind amputees in daily activities. SAR significantly improved information transfer rate and reduced completion time, demonstrating potential applications for reconstructing control and sensory loops.

Overall, the literature survey provides a comprehensive overview of the current state of research and technology in the field of assisting visually impaired individuals. It also highlights the need for innovative solutions to make visually impaired individuals more independent and aware of their surroundings, considering the expected increase in the number of blind people.

III. SYSTEM OVERVIEW

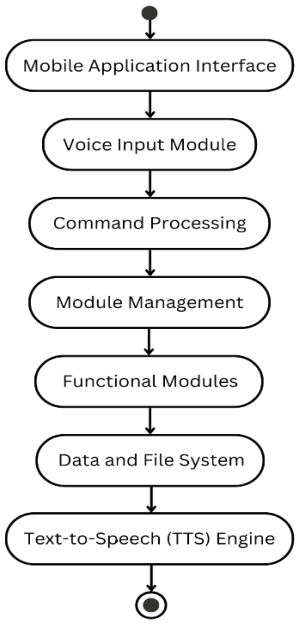

Fig 3.1: System workflow

1. Mobile Application Interface:

- The interface serves as the user-facing part of the system, operating on an Android device.
- Provides the user with an intuitive interface to facilitate user interaction with the application

2. Voice Input Module:

- Responsible for capturing user voice commands.
- Utilizes voice recognition technology to convert spoken words into text format.

3. Command Processing:

- Receives the recognized voice command from the Voice Input Module.
- Analyzes the command to determine which module the user intends to switch to (e.g., object detection, navigation, or optical character recognition).

4. Module Management:

- Android's Intent system is used to navigate between different modules based on the user's command.
- Launches the appropriate module corresponding to the user's request.

5. Functional Modules:

- Object Detection Module: Utilizes image processing techniques to identify and classify objects present in the environment.
- Navigation Module: Utilizes GPS data and mapping algorithms to provide real-time directional guidance and route planning for navigation purposes.
- Optical Character Recognition (OCR) Module: Analyzes images to extract and convert text into machine-readable format, enabling text recognition and reading capabilities.

6. Data and File System:

- Manages and stores data necessary for the functionality of different modules within the system.

7. Text-to-Speech (TTS) Engine:

- Converts text-based information into audible speech output, aiding in effective communication for the user.
- Facilitates seamless delivery of audio information, enhancing accessibility and user experience.
- Offers flexibility to integrate multiple TTS engines or voice assistants to cater to diverse user preferences and requirements.

Data Flow:

The user speaks a voice command, which is captured by the Voice Input Module. The recognized voice command is then sent to the Command Processing module for analysis. The Command Processing module determines the user's intended module (e.g., object detection). It communicates with the Module Management component, which employs Android's Intent system to switch to the appropriate functional module. The selected functional module processes the user's request (e.g., performs object detection). Relevant data is stored or retrieved from the Data and File System. Results from the functional modules are converted into speech using the TTS engine. The TTS engine provides voice output to convey information back to the user.

IV. PROPOSED SYSTEM

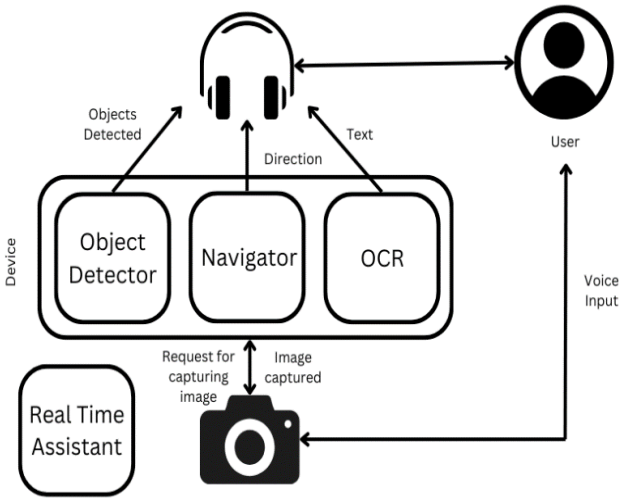

Fig 4.1: System Architecture

The proposed system architecture for an application for visually impaired individuals is based on the Android platform, consisting of interconnected modules that provide voice-over assistance for tasks like reading, object detection, navigation, and OCR. The system requires components like a camera, microphone, and speakers, which can be integrated into the device or connected via a headset. The three main modules include object detection using Tensorflow and XML, navigation through Google Maps API, and OCR using Google's Mobile Vision API Tesseract OCR. Voice inputs and outputs are facilitated through Android's built-in speech recognition and text-to-speech capabilities. The system architecture also includes a graphical user interface (GUI) to showcase the working modules. The implementation involves selecting algorithms, testing cases, and a project plan with a schedule of tasks and development activities.

Flow of execution: The user speaks a voice command, which is captured by the Voice Input Module. The recognized voice command is then sent to the Command Processing module for analysis. The Command Processing module determines the user's intended module (e.g., object detection). It communicates with the Module Management component, which employs Android's Intent system to switch to the appropriate functional module.

V. CONCLUSON

In conclusion, the report addresses the significant challenges faced by visually impaired individuals in their daily lives and the aim of creating a personal assistant tool to assist them. The proposed gadget comprises interconnected modules and functions designed to provide voice-over assistance for various tasks, including reading, object detection, facial recognition, and environmental comprehension. The report highlights the obstacles that visually impaired individuals encounter, including difficulties in recognizing faces, detecting objects, navigating, sending messages, making calls, and reading. The project seeks to offer a comprehensive solution to these challenges by developing an Android system with a virtual assistant. The key components of this project include a camera, mobile device, and audio system, with voice-over commands enabling seamless navigation across these components. The ultimate goal is to empower visually impaired individuals, allowing them to perform everyday tasks independently and enhance their quality of life. In summary, this research project aims to create a holistic and integrated solution to address the multifaceted challenges faced by visually impaired individuals, offering them a greater degree of autonomy and accessibility in their daily routines.

VII. FUTURE WORK

In the future, virtual assistants for visually impaired individuals could focus on seamless navigation through advanced spatial awareness, providing real-time environmental descriptions, and assisting with complex tasks like identifying objects and reading handwritten text. Integration with emerging technologies, such as augmented reality, could enhance the overall user experience, empowering individuals with visual impairments to navigate the world more independently. Ongoing developments in AI may also lead to more personalized and context-aware virtual assistants tailored to individual needs. Advances in voice recognition, natural language processing, and wearable technology could enhance accessibility and independence, making daily tasks more manageable. Improved integration with smart devices and evolving AI capabilities may further enrich the virtual assistant experience for the visually impaired.

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