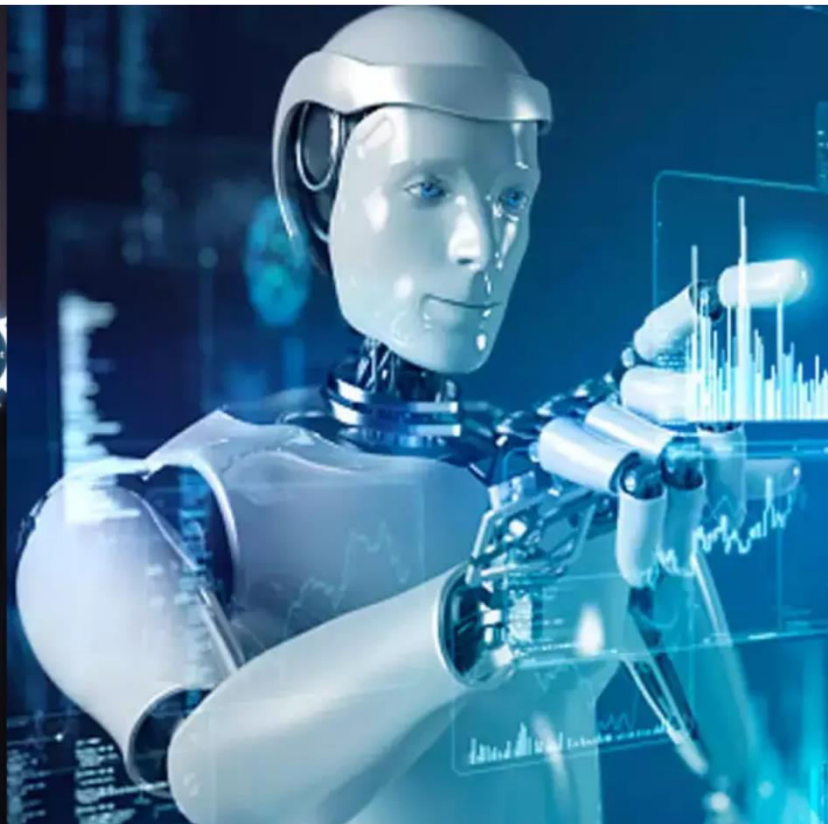




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Vision Assistant for Blind

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ABSTRACT- This research presents a novel assistive device in the form of smart glasses, specifically developed to support individuals with visual impairments. These glasses are equipped with a Raspberry Pi-powered camera module that captures images of printed text from sources such as books and newspapers. The captured images are processed using Optical Character Recognition (OCR) technology to extract textual data, which is then converted into speech through Text-toSpeech (TTS) technology. This enables users to listen to the content through a connected headset. In addition to reading assistance, the smart glasses incorporate a currency recognition system, allowing users to accurately identify different denominations. This feature enhances financial independence by enabling users to handle transactions more confidently. By converting printed text into real-time audio and assisting with currency recognition, these smart glasses aim to improve accessibility and independence for visually impaired individuals. This innovation represents a significant advancement in assistive technology, empowering users to interact with their environment more effectively and enhancing their quality of life.

KEYWORDS: - Assistive Technology, Raspberry Pi, Camera Module, Optical Character Recognition, Text-to-Speech, Currency Identification ,Accessibility.

I. INTRODUCTION

In today's technology-driven world, where visual content is a primary mode of communication, individuals with visual impairments face considerable difficulties in accessing printed text and navigating their environment independently. To address these challenges, this study introduces an advanced assistive solution—smart glasses designed to improve accessibility and support independent living. These smart glasses utilize an integrated camera module to capture images of printed text from sources such as books and newspapers. The captured content undergoes Optical Character Recognition (OCR) processing, converting it into digital text. This text is then transformed into speech using Text-to-Speech (TTS) technology, enabling users to listen to the information through a wireless headset. In addition to reading assistance, the device includes a currency recognition system that helps users distinguish between different enhancing financial independence. denominations, By converting printed text into real-time audio and accurately identifying currency, this innovation significantly enhances accessibility for visually impaired individuals. It plays a crucial role in reducing barriers, fostering inclusivity, and empowering users to interact with their surroundings more confidently. This paper explores the system's design, technological components, and its broader impact on assistive accessibility.

II. LITERATURE SURVEY

Assistive technology for visually impaired individuals has seen significant advancements particularly in the development of smart glasses various studies have introduced innovative solutions that integrate sensors deep learning and speech conversion to enhance mobility navigation and accessibility 1 a smart glasses system with ultrasonic sensors has been designed to detect obstacles within a range of 5-6 meters it provides multilingual voice feedback allowing users to navigate their surroundings safely and independently the system aims to enhance mobility by offering real-time auditory alerts 2 another study proposed a low-cost ultrasonic smart glasses prototype that employs ultrasonic sensors and a buzzer for obstacle detection this solution is focused on affordability and simplicity ensuring that visually impaired individuals can access a reliable and user friendly navigation aid 3 in addition to navigation smart glasses have also been explored for

educational purposes a deep learning-assisted smart glasses system was developed to assist visually challenged students this system incorporates text recognition and speech conversion enabling users to access academic materials effectively furthermore rfid-based navigation aids in movement within educational environments promoting independent learning 4 another research study introduced a smart glasses system that combines ultrasonic sensors for obstacle detection with a gsm module for emergency alerts this dual-functionality system provides real-time vocal feedback to enhance mobility while ensuring immediate communication in emergencies further improving user safety and autonomy.

III. PROPOSED METHODOLOGY

The proposed system is designed to assist visually impaired individuals by transforming printed text into speech. This process is divided into three main stages: image acquisition, text extraction, and audio conversion, ensuring efficient real-time accessibility.

1. Image Capture and Text Recognition: The system utilizes a high-resolution camera to capture images of printed materials, such as newspapers, books, and documents. Once the image is captured, Optical Character Recognition (OCR) technology is applied to extract textual information from the visuals. To achieve accurate text detection, the Tesseract OCR library is integrated with the Raspberry Pi, which serves as the central processing unit. This module processes the captured image, isolates the text, and converts it into a digital format that can be further processed.
2. Conversion of Text to Speech: After extracting the text, the system employs a Text to-Speech (TTS) module to generate corresponding audio output. The Raspberry Pi is responsible for converting the textual data into synthesized speech, ensuring that users can access the information audibly. To enhance clarity, the TTS system fine-tunes speech elements such as speed, pitch, and volume to create natural and comprehensible audio output. This customization ensures that users receive spoken feedback that is both clear and easy to understand.
3. Wireless Audio Output for Accessibility: The generated speech is transmitted wirelessly to a Bluetooth-enabled headset, allowing users to listen to the converted text without requiring physical interaction with the system. By integrating hands-free audio transmission, the system ensures convenience and accessibility, enabling visually impaired individuals to engage with printed content in real-time.

SYSTEM ARCHITECTURE-

By transforming written text and currency information into audio files the advised smart glasses solution is meant to help people who are blind or visually handicapped the architecture is made up comprises several essential elements working together to provide a real-time support figure the raspberry pi system architecture is a crucial component of adaptive equipment for individuals with visual impairments due to its processing power and versatility the raspberry pi is the central processing unit that handles essential tasks like image processing text-to-speech conversion optical character recognition and optical character recognition it executes the devices control software two camera modules are included in the system one of which is a 5-megapixel pi camera that works in unison with the raspberry pi its main purpose is to take pictures and send them for processing at a resolution of 5 megapixels its primary function is to take pictures and send them for processing a 5 megapixel resolution is sufficient to guarantee crisp picture capture allowing precise text and currency detection three bluetooth headphones the user can access the processed data simply and hands-free by using a bluetooth headset to get the extracted information in an audio format.

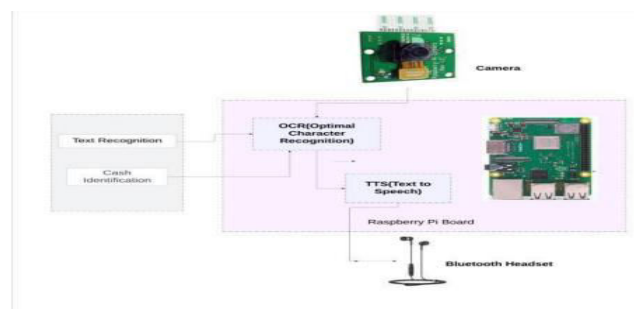


Fig.1 System architecture

1.Processing Unit (Raspberry Pi): The core of the system is the Raspberry Pi, which manages critical functions such as image analysis, text extraction using Optical Character Recognition (OCR), and speech conversion through Text-to-Speech (TTS) technology. It operates the software responsible for system control, making it a key component due to its efficiency and flexibility in handling assistive tasks.

2.Image Capture Module (Camera): The device includes a 5-megapixel Pi Camera, which works in coordination with the Raspberry Pi to capture visual data. This camera ensures high-resolution image acquisition, enabling the accurate recognition of both text and currency for further processing.

3.Audio Output Module (Bluetooth Headset): A Bluetooth-enabled headset provides the user with real-time audio feedback, delivering extracted information in a handsfree manner. This allows for effortless access to processed content, enhancing convenience and usability.

IV. RESULTS

The smart glasses project, utilizing Optical Character Recognition (OCR) and Text-to-Speech (TTS) technology, has demonstrated significant potential in improving daily life.

By integrating OCR, the smart glasses can detect and interpret both printed and handwritten text from the environment, making them particularly beneficial for individuals with visual impairments.

Additionally, they serve as a practical tool for instant translation and information access. The seamless combination of OCR and TTS enhances accessibility and productivity, bridging the gap between physical text and digital interaction.

This innovation offers a wide range of applications, including assisting visually impaired users, enabling multilingual communication, and facilitating efficient information retrieval across different scenarios.

Table I.1.Text Recognition Performance (OCR)

Feature	Precision(%)	Recall(%)	Accuracy(%)
Printed Text	95.2	92.8	94.1
Handwritten Text	87.5	84.3	86.0

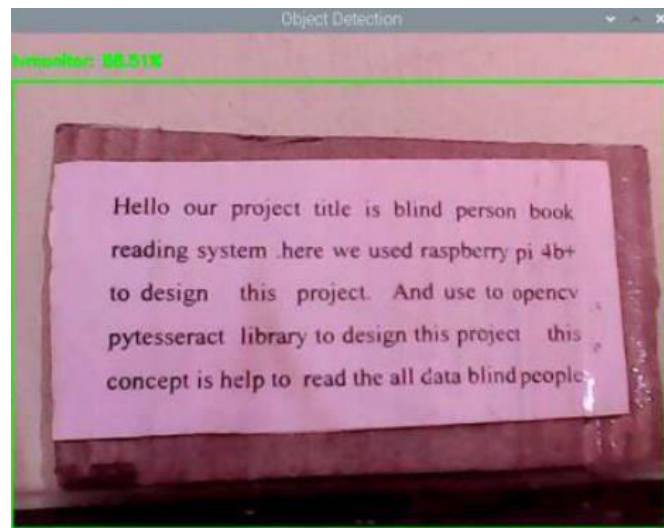
Text to Speech Conversion (TTS)

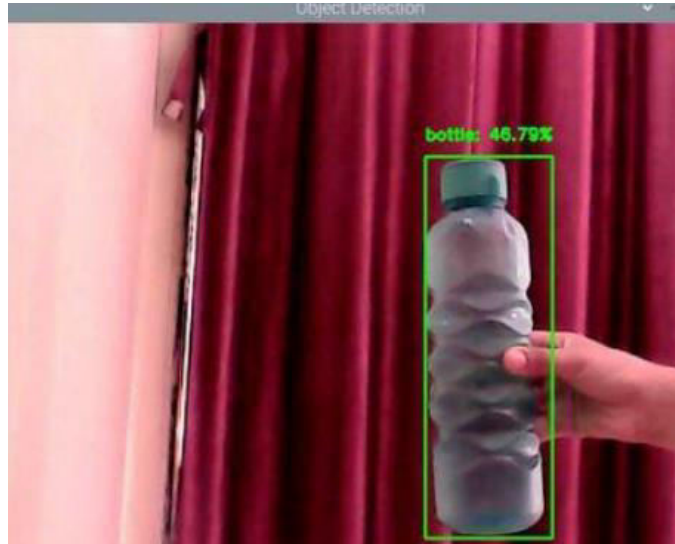
Converts extracted text into clear and understandable speech and achieves 97.8% accuracy in pronunciation and fluency.

Table II. 3.Currency Recognition

Feature	Precision(%)	Recall(%)	Accuracy(%)
Currency Recognition	91.3	89.7	90.5

Usability and Real-World Testing Visually impaired users found the system intuitive and easy to use. Challenges includes Background noise which affects speech clarity. Low light conditions reduce OCR accuracy.





V. CONCLUSION

The innovative smart glasses designed for individuals with visual impairments mark a significant breakthrough in assistive technology. By integrating cutting-edge camera functionality with advanced Optical Character Recognition (OCR) technology, these glasses transform visual content into real-time audio output.

Their primary goal is to enhance the independence of visually impaired users by granting them instant access to printed text and facilitating seamless interaction with written information. Additionally, the inclusion of a cash recognition module further enhances accessibility and autonomy.

By continuously converting printed text into speech and ensuring accurate currency identification, these smart glasses have the potential to redefine how visually impaired individuals navigate their surroundings. The innovative smart glasses designed for individuals with visual impairments mark a significant breakthrough in assistive technology.

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By continuously converting printed text into speech and ensuring accurate currency identification, these smart glasses have the potential to redefine how visually impaired individuals navigate their surroundings. They play a crucial role in improving information accessibility and financial confidence, ultimately contributing to a better quality of life.

Ongoing research and technological advancements continue to drive the development of these devices, paving the way for a more inclusive and accessible future where technology empowers individuals to lead more independent and fulfilling lives.

Overall, this system presents a user friendly and cost effective solution that empowers visually impaired individuals, promoting independence in daily activities.

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