

Empowering the Visually Impaired: A Voice-Based Email Management System

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ABSTRACT—The research focuses on developing a voice-based email system to assist visually impaired users in sending and receiving emails independently. Existing systems, like screen readers, pose challenges when it comes to attaching files or navigating complex email interfaces. To address these issues, the proposed solution leverages Speech-to-Text (STT) and Text-to-Speech (TTS) technologies, along with Microsoft Speech Recognition, to allow users to manage emails and attachments through voice commands. This system simplifies tasks such as file searches, email composition, and sending attachments, reducing the need for keyboard navigation. Implemented using Python libraries like GTTS and speech recognition, it enables visually impaired users to interact with email systems autonomously. The approach focuses on improving accessibility, reducing cognitive load, and providing a user-friendly interface. Future extensions could include additional services like messaging and voice-controlled applications, further enhancing usability for both visually impaired and illiterate users.

Index Terms—Speech-to-Text (STT), Text-to-Speech (TTS), User accessibility, Email retrieval, Assistive features, User commands, IMAP protocol, Voice recognition technology, Cognitive load, Accessibility, User interface, File attachment.

I. INTRODUCTION

The "Voice-Based Email System for the Visually Impaired" is an innovative project aimed at addressing the communication challenges faced by individuals with visual disabilities. Traditional email systems require visual interaction, relying on graphical interfaces and text-based input, which can be difficult or impossible for visually impaired users to navigate. This voice-based system is designed to eliminate those barriers by leveraging speech recognition and text-to-speech (TTS) technologies. Through voice commands, users can compose, send, receive, and manage emails without

needing to see or type. The system relies on advanced natural language processing (NLP) to understand a variety of user instructions and respond naturally, allowing for a seamless, intuitive experience. In addition, voice-based authentication ensures privacy and security, safeguarding users' emails. This solution has a global relevance, particularly in India, which has one of the largest populations of visually impaired individuals—approximately 62 million people. In a country where digital literacy and accessibility are becoming increasingly important, a voice-driven email system empowers the visually impaired community by promoting digital inclusion. It enables them to stay connected, access information, and maintain their independence, aligning with India's digital accessibility goals and improving the quality of life for millions.

A. What Is A Voice-Activated Email System

A Voice-Based Email System is designed to assist visually impaired individuals by enabling them to send, receive, and manage emails using voice commands rather than visual interaction. This approach eliminates the reliance on traditional screen-based interfaces, making email communication more accessible. The system leverages speech recognition and text-to-speech technologies to interpret user commands and read aloud the email content. This solution not only improves independence for visually impaired users but also enhances accessibility, contributing to a more inclusive digital environment.

B. Technological Components Used In Voice Activated Email System

The Voice-Based Email System relies on a combination of specialized technologies:

1. **Speech Recognition:** This core component enables the system to convert spoken words into text, allowing users to dictate emails and give commands without needing to type or

click.

2. Text-to-Speech (TTS): To read incoming messages, a TTS engine converts email content into spoken words, providing users with an auditory experience of their inbox.
3. Natural Language Processing (NLP): NLP enhances the system's understanding of commands, helping it interpret various phrasings and responses. This layer ensures more natural and responsive interactions.
4. User Authentication: For secure access, the system incorporates voice-based authentication to protect user privacy and ensure that only authorized users can send and receive emails.

C. Global Statistics On Visual Impairment

According to the World Health Organization (WHO), around 2.2 billion people globally have some form of vision impairment. Among them, an estimated 36 million are blind, with many relying on assistive technologies for communication and access to digital platforms. The prevalence of visual impairment is especially high in low- and middle-income regions, where access to assistive technologies is often limited. Systems like voice-based email offer an essential solution, enabling those affected by visual disabilities to maintain autonomy and connection through accessible communication tools.

D. Relevance In India

India has one of the largest populations of visually impaired individuals, with approximately 20% of the world's blind population residing in the country. As of recent estimates, over 62 million Indians live with visual impairment, with around 8 million classified as completely blind. Given India's large population and the growing digital infrastructure, a voice-based email system holds significant potential to bridge communication gaps for millions of visually impaired individuals. A system like this could benefit nearly 5% of India's population, particularly in rural and underprivileged areas where access to traditional assistive tools is limited. By offering an intuitive, voice-controlled solution, this project aligns with India's broader initiatives for digital inclusion, helping visually impaired users participate more actively in digital communication, access critical information, and maintain their independence.

II. LITERATURE REVIEW

Kavi Prakash N et al. (2022) [1] proposed a voice-based email system designed to assist blind and visually impaired users in managing their

emails without the need for a keyboard or mouse. The system utilizes speech-to-text (STT) and text-to-speech (TTS) technologies to allow users to send, receive, and attach files to emails, a feature typically unavailable in previous systems for visually impaired individuals. Face recognition is incorporated for secure, hands-free user authentication. The system is built using Python and integrates libraries like Google Text-to-Speech (gTTS) and Pyaudio for audio processing. It supports standard protocols such as SMTP and IMAP for email handling, and MIME for managing attachments. This system improves accessibility and productivity for visually impaired users, but can also be used by non-impaired or illiterate individuals. Addressing limitations of earlier systems, it removes barriers with voice commands and plans to expand features like multi-language support and spam control.

Aditi Sharma et al. (2022) [2] proposed a speech-based email assistance system for visually impaired users, enabling them to operate Gmail functions through voice commands. The system integrates speech-to-text (STT) and text-to-speech (TTS) technologies, allowing users to compose, send, receive, delete, and search emails without relying on a mouse or keyboard. The Gmail API is used to access the email interface, and the system provides voice prompts for commands such as "create a mail" or "delete mail." The system confirms task completion via voice feedback, enhancing usability for visually impaired individuals. Implemented with Python and libraries like SpeechRecognition and pyttsx3, the platform ensures accurate speech recognition and processing. The proposed system improves accessibility to Gmail for users with visual impairments, while future enhancements could include support for multiple languages and mobile application development for broader accessibility.

Sherly Noel et al. (2020) [3] developed a Human-Computer Interaction (HCI)-based smart voice email (Vmail) application for visually impaired users (VIU). The system enables users to compose, read, and send emails using speech-to-text (STT) and text-to-speech (TTS) functionalities, eliminating the need for typing or mouse usage. The application uses Google WebKit API for voice recognition and includes modules that process user voice commands, compare them with pre-recorded samples, and convert voice to text for email composition. Commands like "compose mail," "edit subject," and "send email" simplify email management. The system also allows users to read emails using voice commands. Security is enhanced through voice sample authentication, and

noise elimination techniques improve speech recognition accuracy. Tested for factors like voice pitch, pace, and environmental noise, the system proves effective for both visually impaired and regular users. Future enhancements include additional voice commands and integration of fingerprint authentication.

The Voice Helper system, proposed by Kuei-Chun Liu et al. (2015) [4] is an Android-based assistive application designed for visually impaired persons (VIP). It integrates various open-source technologies, including Text-to-Speech (TTS) and Optical Character Recognition (OCR), to provide key functionalities such as message reading, voice dialing, and navigation. The system allows VIPs to receive voice notifications for emails, texts, and social media messages, as well as perform tasks like making calls and reading printed documents using OCR. Additionally, the Navigation Reader, based on Google Maps, offers real-time voice-guided navigation for walking and riding, helping users move independently. The app also supports QR code scanning for information gathering and provides a visually impaired dialer with enhanced gesture-based features for ease of use. The system has been tested and verified by VIPs and is designed to be low-cost and efficient.

Anand et al. (2013) [5] developed a web-based email system designed to improve accessibility for visually impaired users.

The application integrates key assistive technologies such as Text-to-Speech (TTS) synthesis, which converts email text into audible speech, and a screen magnification module to enlarge text and images for better readability. Users can also interact with the system through a Speech Recognition module, enabling them to compose and manage emails via voice commands. Furthermore, the system synchronizes with POP3 and IMAP servers to retrieve and manage emails seamlessly. The aim is to offer an inclusive email access solution that caters to visually impaired users while maintaining usability for all. Future improvements include adding features like file attachments to enhance email management capabilities.

The voice-based email system developed by Bhavani V Patil et al. (2022) [6] is designed to assist visually impaired users by enabling them to access, compose, and retrieve emails using only voice commands. The system utilizes speech-to-text and text-to-speech technologies, allowing users to send emails without needing a keyboard or mouse. It offers functionalities such as reading out received messages, composing new emails through voice inputs, and sending them to specified recipients. By

converting spoken commands into text, it simplifies email management. The system's interface is user-friendly, enabling users to navigate and operate the application through voice commands. This innovation aims to provide an efficient, hands-free communication tool, enhancing accessibility for visually impaired individuals.

The email assistant system by Bharat Sharma et al. (2023)

[8] enables visually impaired users to manage emails using voice commands. The system utilizes Speech-to-Text (STT) and Text-to-Speech (TTS) technologies to facilitate tasks like composing, reading, and managing emails without a keyboard. It ensures secure access through voice authentication and includes features such as document attachment. The system is user-friendly and designed to improve accessibility, empowering visually impaired users to interact with emails independently.

The voice-based email system developed by Malathi D. et al. (2023) [7] is designed to help visually impaired individuals send and receive emails without needing visual assistance. By utilizing technologies like Speech-to-Text (STT) and Text-to-Speech (TTS), the system enables users to perform email-related tasks using voice commands. The system simplifies tasks such as composing emails, checking the inbox, and reading out messages, making it accessible to users without sight. This hands-free solution, implemented using Python, improves communication for visually impaired individuals by eliminating the need for keyboards or mice. The interface is user-friendly and focuses on ease of navigation through voice instructions, offering an effective alternative to conventional email systems. This innovation aims to make email communication more inclusive, empowering visually impaired individuals to independently manage their emails and expanding its future scope to include additional services like messaging and other voice-activated applications.

The voice-based email system developed by Harsh D. Shah et al. (2021) [9] is designed to enable users, including those with disabilities, to manage their emails using only voice commands. This system integrates speech recognition and text-to-speech technologies, allowing users to send, compose, and retrieve emails without manual typing. It facilitates tasks such as structuring emails, selecting recipients, and sending messages, all through voice input. The system's intuitive interface eliminates the need for a keyboard or mouse, making it highly accessible and efficient for hands-free communication. The aim is to simplify email management, especially for

users with disabilities, by providing a convenient and automated solution.

The voice-based email system presented by Gaurav Kumar Rajput et al. (2023) [10] aims to empower blind and visually impaired users by enabling them to access and manage emails through voice commands. This system integrates speech-to-text and text-to-speech converters, allowing users to compose, send, and retrieve emails without needing to interact with a keyboard or display. By leveraging artificial intelligence (AI) and natural language processing (NLP), the system provides an accessible and efficient interface. It recognizes spoken input, converts it to text, and vice versa, allowing users to navigate and perform tasks within the email system seamlessly. The core objective is to create a reliable, user-friendly platform for individuals with visual impairments, enhancing their ability to communicate independently through email.

III. CONCLUSION

The development of voice-based email systems for visually impaired users represents a significant step toward enhancing digital accessibility. These systems utilize Speech-to-Text (STT) and Text-to-Speech (TTS) technologies, allowing users to send and receive emails independently without visual aids or keyboard input. By incorporating Microsoft Speech Recognition, the applications simplify email management through intuitive voice commands. This approach effectively addresses the challenges that visually impaired individuals face, particularly in file attachment and content reading. The user-friendly design emphasizes accessibility, making it easier for those with limited technical skills to engage in digital communication. Furthermore, these innovations promote social inclusion by enabling visually impaired individuals to participate fully in today's digital landscape. Future developments could enhance functionality, incorporating features like instant messaging and voice-activated applications. Ultimately, these voice-based systems not only facilitate communication but also empower visually impaired users, providing them with equal opportunities in an increasingly digital world. As technology evolves, these solutions will play a crucial role in bridging the accessibility gap.

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