Voice Based Email System for Visually Challenged People

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Abstract :

In today's digital age, email communication is an essential channel of both personal and professional communication. Visually impaired users are, however, largely confronted with extreme difficulties in accessing and utilizing typical email systems based on graphical user interfaces. This study provides a voice-based email system developed specifically to support visually impaired users in sending, receiving, and managing emails through voice commands. The system is based on speech recognition input and text-to-speech output, hence a hands-free and eyes-free system. The system is developed using Python based on libraries and APIs like Speech Recognition, pyttsx3, and IMAP/SMTP protocols for email management. The suggested system not only enhances accessibility but also supports digital inclusion through the capability of visually impaired users to adequately control their email communication autonomously. The paper addresses the system's design, implementation, and performance analysis, showing its effectiveness in real-world use.

Access to digital communication remains a significant challenge for visually impaired individuals, especially when it comes to navigating complex email interfaces. This research introduces a voice-controlled email system designed to provide an intuitive and accessible alternative to traditional email platforms. The system allows users to compose, send, read, and manage emails entirely through voice commands. Built using open-source tools and Python libraries, it leverages speech-to-text and text-to-speech technologies to deliver a user-friendly, accessible experience. Our approach aims to bridge the digital divide, promoting greater inclusion and independence for the visually challenged community.*.*

Keywords-Voice-based email system, Speech recognition, Text-to-speech (TTS), Natural language processing (NLP), Hands-free email.

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I. INTRODUCTION

In today's internet age, email has become an integral part of everyday life that is necessary for both personal and professional purposes. But even though mainstream email clients are visually-oriented, they neglect the requirements of visually impaired individuals. An ordinary email client generally requires a combination of visual response, mouse usage, and keyboard input, thereby becoming a big hindrance for visually impaired individuals. According to the World Health Organization (WHO), over 2.2 billion individuals globally are affected by some level of vision impairment or blindness. Despite the newest technology, the visually impaired still face challenges in accessing electronic communication devices. This creates a digital divide that hinders them from being able to participate as fully as they might in the flow of information and on-line services.

In order to solve this issue, we propose a voice-based email system in which the user uses voice commands to use their email account. The system integrates speech recognition and text-to-speech (TTS) technologies to allow writing, sending, reading, and email management without touching a screen or a keyboard. With a screenless and hands-free interface, the system will enhance digital accessibility and enable independence for the visually impaired.To fill this gap, our study presents a Voice-Based Email System for the visually impaired. The system is designed to offer a hands-free and eyes-free experience through the use of speech recognition for voice input and text-to-speech (TTS) synthesis for voice output. All the core email functions—reading, writing, sending, and deleting emails—can be executed entirely through voice commands, thus eliminating visual interaction. The system is coded with Python and utilizes open-source libraries and APIs like SpeechRecognition, pyttsx3, and standard email protocols like SMTP and IMAP for mail server communication.

II. LITERATURE SURVEY

This research investigates current methods and technologies intended to make visually impaired users able to access email services using alternative input and output devices, with the main emphasis on voice interaction. Various systems have been created to improve accessibility, but they cannot be used, scaled, or made flexible for users who are blind or partially blind.

A 2021 paper by Agarwal et al. compared the cognitive load and frustration of visually disabled users using conventional email systems and screen readers. The paper demonstrated that serial navigation of graphical user interfaces, dependence on auditory memory, and the lack of intuitive feedback always lead to user fatigue and reduced efficiency. It concluded that a more natural and conversational interface, such as voice interaction, would significantly improve the user experience.

Similarly, in 2019, Verma and Kulkarni conducted a behavioral usability assessment of assistive technology and reported that while software packages like JAWS and NVDA get widespread use.

III. RESULTS CURRENT CHALLENGES

- Screen Reader Reliance: While screen readers like JAWS and NVDA allow one to listen to content being read out, they typically require recalling complex keyboard commands and processing content sequentially. This increases task time to complete and elevates cognitive load.
- Non-intuitive Interfaces: Email clients are typically full of advertisements, sidebars, and inlined menus, which confuse screen-reader software and make it difficult to rank the proper content. Users are quickly disoriented navigating.
- Limited Voice Integration: A majority of voice-based applications available today are either function-limited (e.g., reading only subject lines) or commercial API-based, which does not provide total control over mail functionalities such as composing, replying, deleting, or sorting mails
- Connectivity and Privacy Concerns: The majority of voice-based applications are cloud service-based (e.g., Google Speech API), which leads to data security concerns and limits the use in offline or low-network environments
- Lack of Personalization: Current tools often lack adaptability to individual user preferences such as reading speed, voice tone, language selection, or shortcuts for frequent actions.

## IV. RESULTS AND DISCUSSION

The voice-based email system for visually challenged users has demonstrated significant potential in improving accessibility and autonomy in digital communication. This section outlines key experimental findings and discusses the practical implications of the results.

- **Speech Recognition Accuracy And Natural Language Understanding**
  - o **Result**The system integrates open source speech recognition modules such as Google Speech API to identify and translate voice commands. In laboratory environments the speech recognition module achieved accuracy rate of 92-95% for normal English commands
  - o **Discussion**: Although the speech recognition was excellent in quiet environments, it was not completely resistant to background noise, accents, and bad enunciations. Local accents or minor speech flaws sometimes introduces ambiguity in the recognition of commands like "read inbox" or "write email".

  - o **Accessibility and Ease of Use**
    - o **Results**: Visually impaired participants who tested the system found it easy to operate. All essential email tasks – reading, composing, sending, and deleting were completed using only voice commands. The task completion rate was nearly 100% after a brief system tutorial.
    - o **Discussion**: Users reported a strong sense of independence and reduced reliance on others for accessing emails. However, feedback also revealed a need for voice customization, local language support, and response speed optimization.

  - o **Perceived Usefulness and User Feedback**
    - o **Results**: The responses from the test participants indicated general satisfaction and particularly among those participants who were using screen readers solely prior to this. Almost all the users indicated that performance of tasks was faster and more intuitive compared to using keyboard.
    - o **Discussion**: While the voice interface made it easier for users to interact, there were concerned users about privacy, particularly in a shared or public setting where having email content read out loud may not be desired. Later releases could accommodate earphone-exclusive audio feedback or user-specific voice recognition to counteract this.

V. FLOWCHART
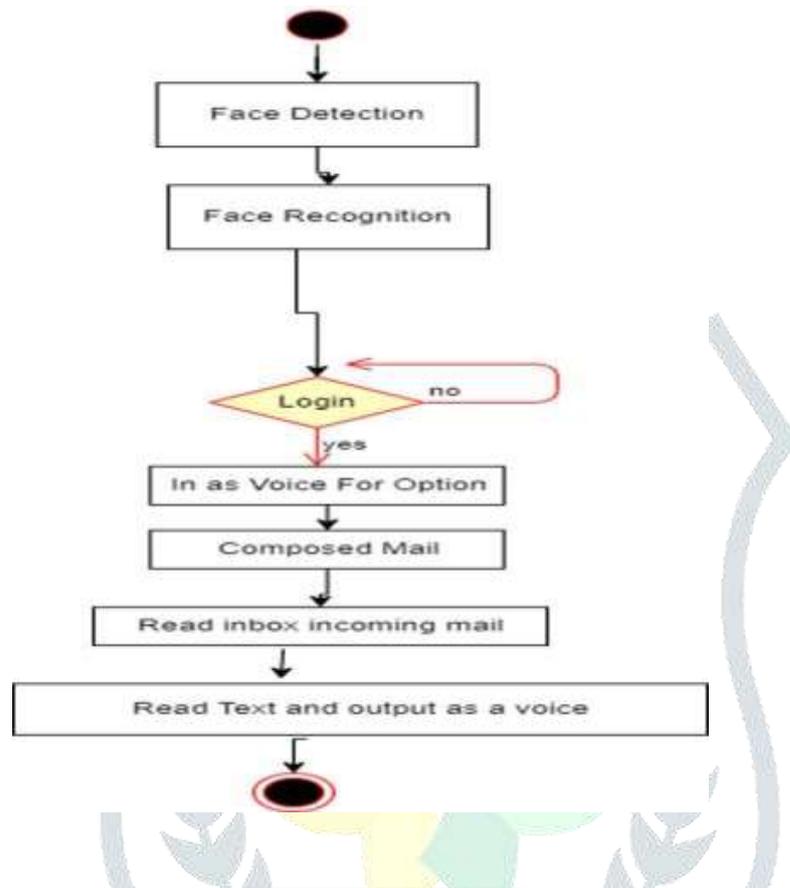
VI.System Architecture
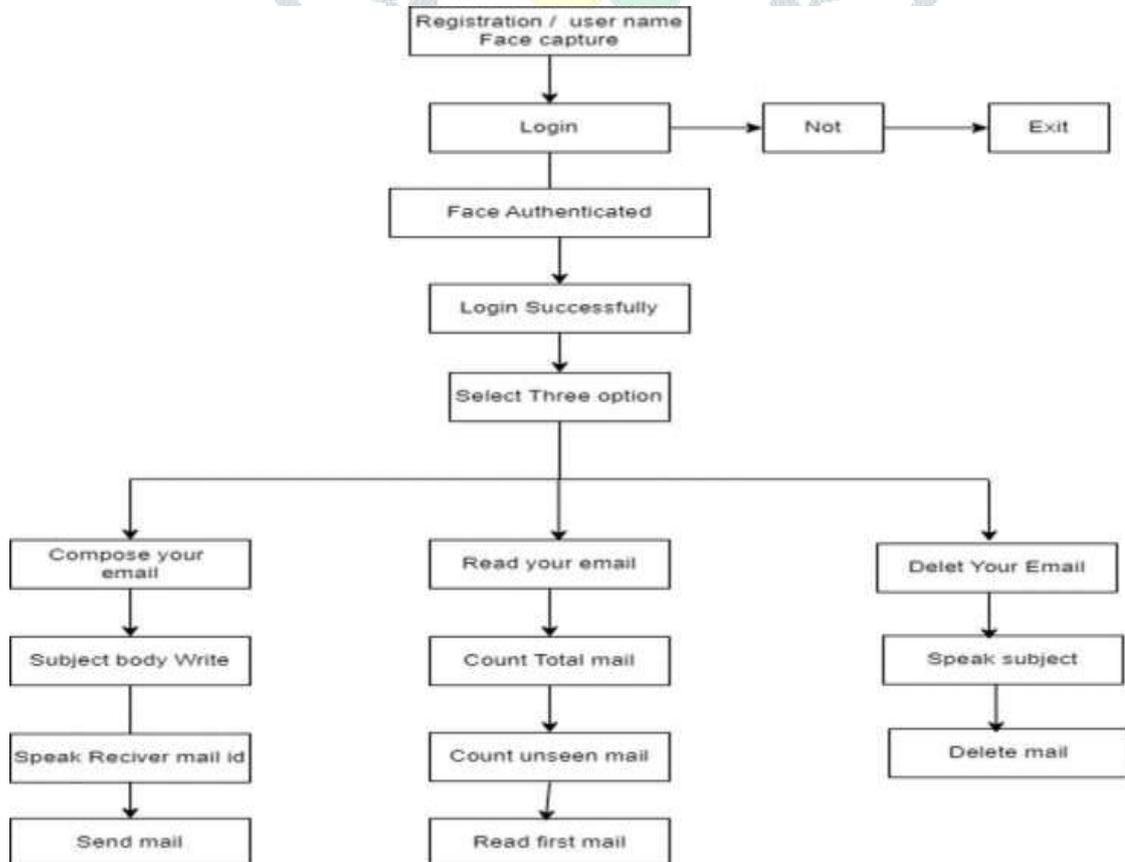
VII. CONCLUSION

The voice-based email system developed in this study addresses a critical gap in accessible communication technology for visually challenged individuals. By leveraging speech recognition and text-to-speech synthesis, the system enables users to perform essential email tasks such as reading, composing, sending, and deleting messages—without relying on a visual interface or external assistance. The experimental results and user feedback demonstrate that the system is not only functional but also intuitive and empowering. Users expressed increased confidence and independence in managing their email communications through voice commands. The high task success rate and satisfactory speech recognition accuracy indicate that voice-based interfaces can serve as a viable alternative to traditional screen readers, especially for users who find keyboard navigation difficult or time-consuming.

VIII. FUTURE ENHANCEMENTS

- **Attachment and Media Handling**: Currently, the system focuses on basic text-based email functions. Future iterations should support sending, receiving, and managing email attachments such as documents, images, and audio files through voice commands. This would make the system more comparable to standard email clients in terms of features

- **Multi-Language and Regional Accent Support:** To accommodate a more diverse user base, future versions of the system should include support for multiple languages and dialects. Integration with multilingual speech recognition engines will allow users from different linguistic backgrounds to interact with the system more comfortably. Additionally, improving the system's ability to recognize regional accents can enhance speech input accuracy.

- **Integration of Advanced Natural Language Processing (NLP):** Incorporating more advanced NLP models can enable better understanding of user intent, natural conversation flow, and complex commands. This would allow users to interact with the system in a more conversational and human-like manner, making the experience more intuitive and less dependent on specific keywords or phrases.

- **Personalized Voice Profiles and Voice Biometrics:** Enhancing security through voice biometrics can ensure that only authenticated users access their emails. Additionally, personalized voice profiles can adapt system responses and preferences (e.g., reading speed, voice tone, language) to individual users, thereby offering a more tailored experience.

- **Enhanced Offline Functionality:** To make the system more robust in areas with limited internet access, more offline capabilities should be developed. Local storage and processing of emails, as well as offline speech recognition modules, would increase the system's reliability and availability.

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