

Visionary Companion: Revolutionizing Email Accessibility for the Visually Impaired

Ragini Sharma^{1*}, Raj Pawar², Omkar Phadatare³, Sahil Yadav⁴, Rishikumar Yadav⁵

Abstract

The efficiency demands of technology have surged, particularly with the rise of virtual work, necessitating extensive communication resources. Email serves as a vital means for international communication and group messaging. While those with clear vision can easily utilize typing and emailing, individuals with color blindness or visual impairments face obstacles. Fortunately, numerous resources cater to those with visual disorders. This project aims to bridge this gap by creating a voice-based emailing website, enabling visually impaired individuals to seamlessly engage with technology. Through an attractive, accessibility-focused interface design employing vibrant colors, the system ensures inclusivity. Email, being crucial for private communication, guarantees authenticity. Users can effortlessly navigate the system solely through voice commands, eliminating the need for typing or pointing devices. Leveraging Google speech converter, this project meets the pressing need for accessible emailing systems, significantly benefiting individuals with disabilities and fulfilling the demand for efficient communication tools in today's world.

Keywords: Voice-based email, voice assistance, emailing system, visually impaired, poor visual, Django

INTRODUCTION

Vision-impaired individuals face barriers in accessing conventional email methods widely used by others. To cater to their needs, various assistive technologies such as screen readers, automatic speech viewers, and text-to-speech converters are provided. However, these technologies often fall short of delivering accurate results. The primary objective of developing a voice-based email system for vision-impaired individuals is to provide easy and effective access to emails with minimal effort. This system notifies users through voice prompts for specific tasks and allows them to respond accordingly. Voice-based email systems enable users to compose, send, and manage emails without the need for typing or manual keyboard interaction. This hands-free operation proves invaluable in situations like driving, cooking, or engaging in tasks where hands are occupied. Such systems enhance productivity and save time, especially for tasks involving lengthy emails or repetitive responses.

*Author for Correspondence

Ragini Sharma
E-mail: ragini.sharma@it.sce.edu.in

¹⁻⁵Student, Department of Computer Science & Engineering (Data Science) Saraswati College of Engineering, Kharghar, Navi Mumbai, Maharashtra, India

Received Date: July 16, 2024,
Accepted Date: July 29, 2024
Published Date: August 7, 2024

Citation: Ragini Sharma, Raj Pawar, Omkar Phadatare, Sahil Yadav, Rishikumar Yadav. Visionary Companion: Revolutionizing Email Accessibility for the Visually Impaired. Trends in Opto-electro & Optical Communication. 2024; 14(2): 21–28p.

As per the World Health Organization (WHO), around 2.2 billion people worldwide are affected by vision impairment or blindness, indicating a substantial potential user base for inclusive communication technologies. The National Blindness and Visual Impairment Survey (2015–19) conducted by the Ministry of Health and Family Welfare, Government of India, reveals approximately 8.8 million blind individuals and 47.7 million visually impaired persons in India alone. Given this significant portion of the

population facing visual challenges, there arises a pressing need for accessible technologies to facilitate communication and digital accessibility. Mandated by the Rights of Persons with Disabilities Act, 2016, the provision of accessible information and communication technologies (ICT) for individuals with disabilities in India is imperative.

Integrating voice-based email systems reflects the government's commitment to advancing digital accessibility and fostering equal opportunities for all citizens, including those with disabilities. As highlighted by a survey conducted by Pew Research Center in 2021, approximately 40% of adults in the United States utilize voice commands at least once a month. The global trend towards voice assistant usage is evident, with millions worldwide engaging with this technology. In 2020, the global voice recognition market reached a value of around \$8.3 billion and is projected to exceed \$27 billion by 2026, boasting a remarkable compound annual growth rate (CAGR) of over 20%. Concurrently, the market for voice-enabled devices, such as smart speakers and virtual assistants, is experiencing rapid expansion. While speech recognition systems typically achieve accuracy rates surpassing 90% under ideal circumstances, variability may occur due to factors like background noise, speaker accents, and pronunciation.

LITERATURE REVIEW

Madake and Pandey [1] introduces a novel voice-based emailing system tailored to assist individuals with physical impairments in accessing their emails. Unlike the existing system, which lacks user-friendliness for the visually impaired, this innovative approach integrates Google Speech Recognition technology. Furthermore, it incorporates advanced features for text-to-speech and speech-to-text conversion. Additionally, the system introduces a unique mouse pointing technique, enabling users to interact seamlessly with the interface by simply clicking anywhere on the screen. The initial phase focuses on gathering comprehensive user information through speech recognition, facilitating a streamlined user login process.

In the study [2], the discussion revolves around the various types of screen readers available and the myriad challenges associated with them. Screen readers serve the fundamental purpose of vocalizing content displayed on the internet, often necessitating the assistance of keyboards and mice for task execution. However, a significant drawback arises from the reliance on these peripherals, particularly for users with visual impairments who may not have direct access to them. Consequently, users must undergo extensive training to familiarize themselves with keyboard commands, posing a barrier to entry for those lacking prior computer literacy. Conversely, our proposed system eliminates the need for such prerequisites, offering an intuitive interface where users can effortlessly navigate by clicking anywhere on the screen, thus streamlining accessibility and usability.

In the study [3], the system introduces a pioneering approach employing voice commands for email functionalities. It seamlessly integrates voice recognition technology into an efficient emailing system. Central to its functionality is the conversion of numerical inputs into text, facilitating smooth interaction for users. The system is designed to respond accurately to user commands, ensuring reliable service delivery. Leveraging TCP/IP protocol, emails are transmitted securely and efficiently. Additionally, the user interface allows for intuitive operation, where users can initiate commands by tapping anywhere on the screen. This simplified interaction is facilitated by a user-friendly interface featuring a full-sized button accessible from any point on the screen.

In the study [4], the system architecture relies on three core technologies: numerical-to-text conversion, voice response, and user registration through voice commands upon initial site visitation. Upon registration, users' voices are recorded and securely stored in the database. The primary emphasis lies on fostering a user-centric approach to enhance system efficiency and effectiveness.

He and Schomaker [5] presents an email system specifically designed for individuals affected by visual impairments or blindness. The system harnesses the power of Google Speech Recognition and

conversion technology, alongside the implementation of the Viterbi algorithm. This innovative approach aims to accurately interpret spoken words, reducing errors and optimizing word recognition. Additionally, the Viterbi algorithm enhances efficiency by minimizing the occurrence of extraneous spaces within the transcribed text.

In the investigation [6], a strong emphasis is placed on ensuring accessibility and ease of use for individuals who are blind or illiterate. The system prioritizes interaction efficiency through innovative techniques, notably eschewing the traditional interactive voice response (IVR) method in favor of a screen reader approach. Moreover, it eliminates reliance on hardware devices such as keyboards, streamlining the user experience. The system's design integrates text recognition and voice commands seamlessly, enabling straightforward registration and authentication processes. While the system operates smoothly with Gmail services, it is limited in its compatibility with other email providers like Yahoo or Hotmail, representing a notable drawback.

In the study [7], the system introduces a range of voting techniques designed for both computer and mobile phone platforms, representing a significant aspect of the research. Additionally, the paper discusses the integration of Google Mail notifications, RSS feeds, music playback functionality, and e-book reading capabilities, highlighting the diverse features offered by the system.

In the investigation [8], the software system is specifically tailored for individuals affected by various forms of visual impairment, offering seamless integration of email and MMS (multimedia messaging service) functionalities into the operating system. The graphical user interface (GUI) is designed with accessibility in mind, catering to both partially and completely blind users through intuitive voice command features. Additionally, the system incorporates RSS feeds to provide timely updates and announcements, enhancing user engagement. Moreover, the system allows for the integration of other applications that can be controlled using voice-based commands, further extending its functionality and usability.

In the findings [9], the authors introduce a novel concept termed Tetra-Entry, aiming to address the accessibility needs of both sighted individuals and those with visual impairments seeking to access email services. This innovative approach presents a new paradigm of email activities specifically tailored to meet the unique requirements of visually impaired users.

Kulkarni et al. [10] presents a novel voice-based email system tailored specifically for the visually impaired community, facilitating seamless access to email services. The primary goal is to empower visually impaired individuals to effortlessly send and receive emails using voice commands, thereby eliminating the reliance on traditional typing devices. Central to this work is the development of innovative techniques for converting voice input to text and vice versa, enabling efficient interaction with email content. Leveraging Python libraries and IVR technology, this system offers a user-friendly interface for navigating and managing emails. By providing audio feedback within a virtual environment akin to screen readers, this solution significantly enhances internet accessibility for the blind. The architecture of the voicemail system is outlined, demonstrating its effectiveness in enabling visually impaired users to engage with email communication in their native language. This research contributes to bridging the accessibility gap for the visually impaired, facilitating their participation in digital communication with ease and efficiency.

PROBLEM STATEMENT

Individuals with visual impairments face significant challenges in accessing information and interacting with computers. They are unable to read text or visually locate the mouse cursor to navigate and issue commands effectively. Consequently, accessing emails and performing essential tasks on the computer proves daunting for them. This renders computers impractical for blind individuals, turning information retrieval into a cumbersome endeavor. Moreover, for someone with visual challenges, the

initial experience of using a computer is notably less convenient compared to sighted users, despite efforts to make interfaces user-friendly.

The visually impaired community encounters considerable obstacles when attempting to navigate and utilize email, an essential tool for communication in today's digital era. Traditional email systems predominantly rely on visual elements, rendering them inaccessible to individuals who are blind. There exists a pressing demand for the development of a voice-centric email platform tailored specifically to the needs of the visually impaired. Such a system should empower blind individuals to independently and effectively manage their emails through spoken commands. Key features should include a seamless and user-friendly interface, support for natural language interactions, and robust privacy and security measures. By prioritizing accessibility and minimizing reliance on sighted assistance, this voice-based email solution aims to ensure full inclusion and participation of blind individuals in the digital communication landscape.

PROPOSED SYSTEM

The program development includes a voice prompt feature to guide users through various tasks. Users will verbally provide input, which will be processed by the Google speech application interface in Python, converting speech to text for task execution. Tasks encompass logging into Gmail accounts and sending emails through the Gmail platform. During phase 2 of the program, users will interact with the system via speech input, managed by the speech recognition module. This Python library interprets spoken requests, converting them into text format. Upon receiving user input, the speech-to-text converter records responses within script variables. Subsequently, based on these values, the program proceeds to the relevant modules for task completion. This integration of speech recognition technology enables accurate transcription of spoken words into text, empowering blind users to compose emails using their voice. Process flow of the proposed system is shown in Figure 1.

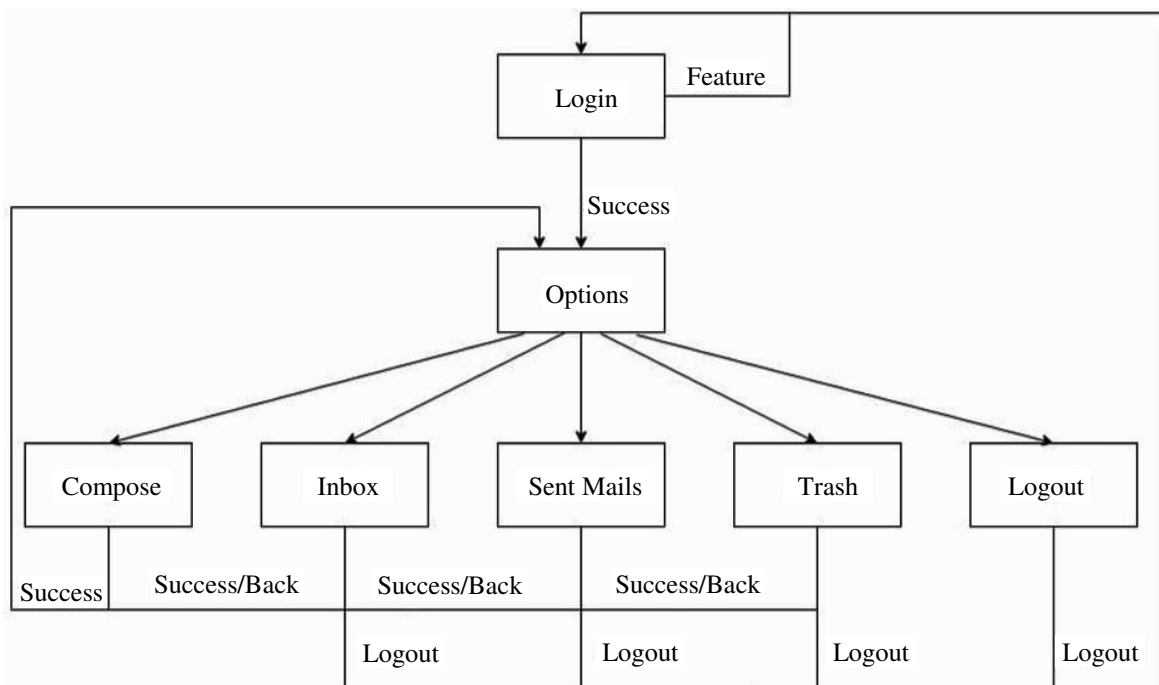


Figure 1. Process flow of the proposed system.

Incorporate advanced natural language processing algorithms to accurately decipher the context and intent behind voice commands, ensuring precise interpretation of user instructions. Employ cutting-edge text-to-speech technology to seamlessly convert text-based content, such as email messages, into spoken audio, enhancing accessibility for blind users. Offer comprehensive audio feedback and prompts

to navigate users through the email interface, providing guidance on available options and actions. Introduce voice-controlled shortcuts and commands for common tasks, including composing new emails, reading messages, and managing email settings, enhancing efficiency and ease of use. Implement IMAP (internet message access protocol) functionality to enable blind users to access their inbox and retrieve email messages through voice commands, utilizing IMAP commands to fetch email content, including message bodies and attachments. Facilitate vocal interaction with email messages, empowering users to read, reply to, forward, or delete messages using voice commands. Integrate SMTP (simple mail transfer protocol) functionality to allow blind users to compose and send emails seamlessly using voice commands. Develop a robust speech-to-text feature to transcribe spoken messages accurately into text format, facilitating the composition of emails through voice input.

This system proposal aims to introduce an email platform tailored for individuals with visual impairments, addressing the challenges faced by those with poor eyesight in accessing the standard Gmail interface as shown in Figure 2. Users are guided through the login process solely via voice prompts, where they enter their Gmail credentials verbally. The system then employs speech recognition to convert the spoken input into text, subsequently utilizing the text to initiate the IMAP protocol for account access. In the event of incorrect credentials, the user is notified of a login failure. Upon successful login, users are directed to a menu section offering various Gmail functionalities, including composing emails, fetching inbox messages, viewing sent and trashed emails, and logging out. This fully voice-activated program facilitates efficient email communication for visually impaired individuals, seamlessly converting spoken commands into text and vice versa to enable email sending and receiving.

RESULTS

By developing a voice-based emailing website with an accessibility-focused interface design, the project seeks to ensure inclusivity and seamless engagement with technology for this demographic. Leveraging resources such as the Google speech converter, users will be able to navigate the system solely through voice commands, eliminating the barriers posed by typing or pointing devices.

In Figure 2, the process begins with users logging into their Gmail accounts by inputting their username and password. Upon successful authentication, users are directed to a Menu page presenting various available options. Using voice commands, users select their desired option, which is recognized by the speech recognition system. The Menu page offers choices, including Compose, Inbox, Sent, Trash, and Logout, enabling users to navigate the email system efficiently.

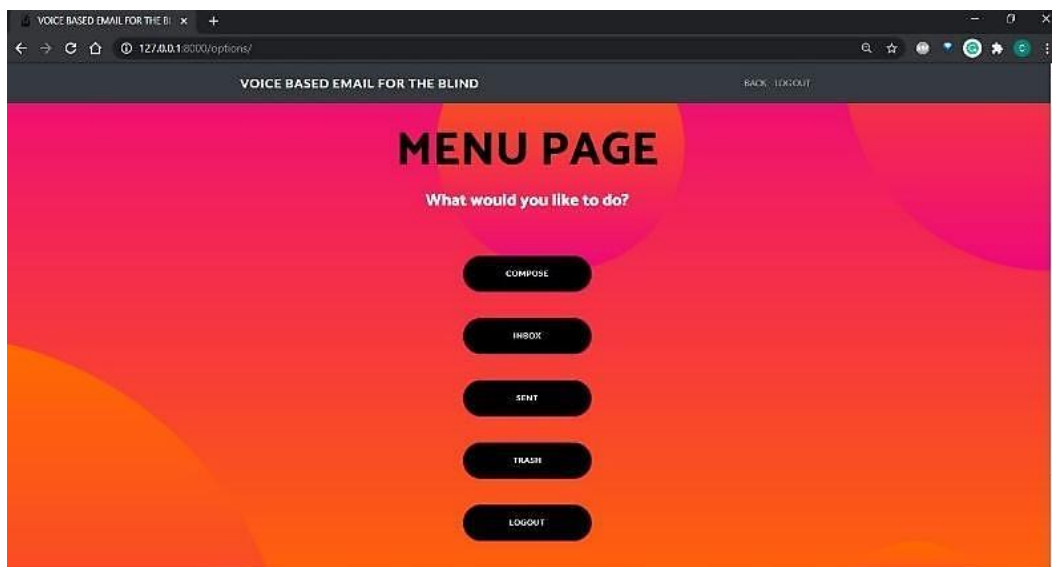


Figure 2. Menu page.

In Figure 3, upon selecting the Inbox option from the Menu, users are directed to the Inbox page, presenting them with further choices: Unread, Search, Back, and Logout. Users can provide their desired input through voice commands corresponding to these keywords. The Unread option checks for any unread emails and reads them aloud to the user if found. The Search option allows users to search for emails from a specific Gmail ID by providing the desired Gmail ID as input. The Back option returns users to the Menu page for further navigation. Lastly, the Logout option redirects users to the Login screen, requiring them to log in again to perform additional actions.

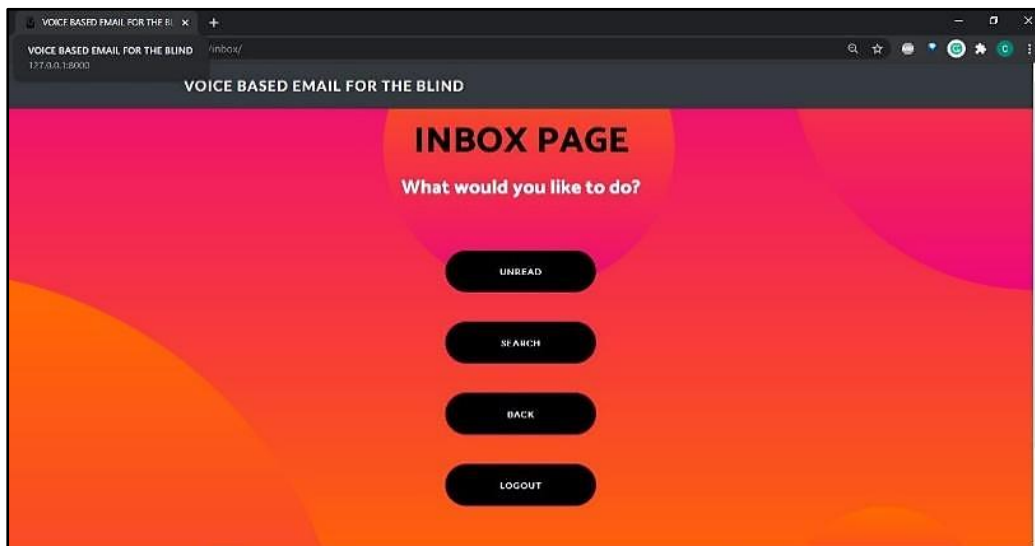


Figure 3. Inbox module.

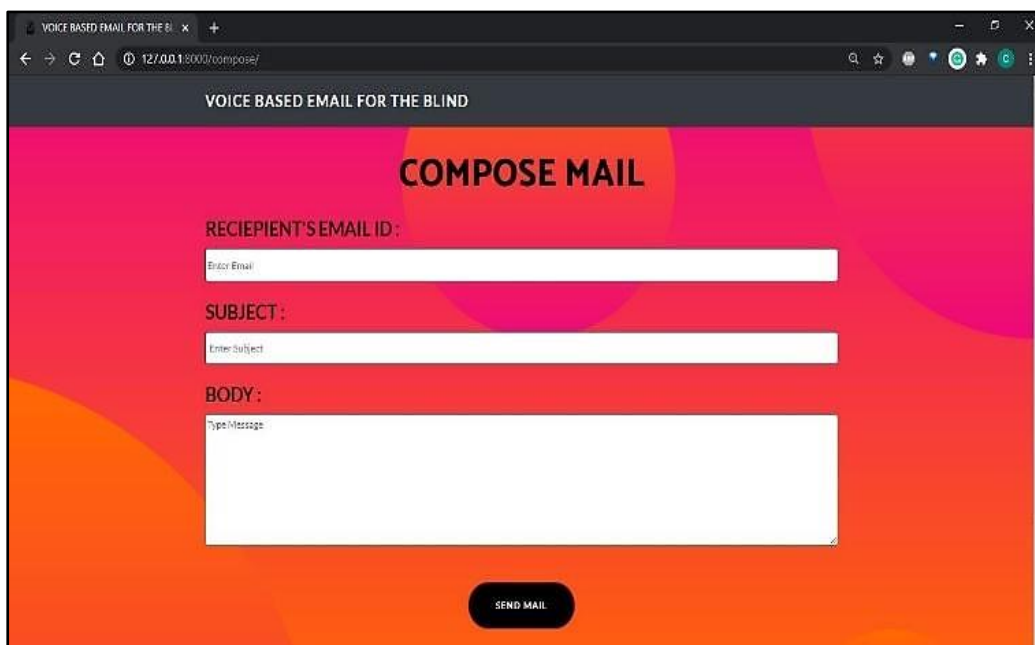


Figure 4. Compose mail module.

In Figure 4, users can compose and send emails to their desired Gmail addresses. When users select the Compose option from the Menu page, they are directed to the Compose page. This page includes four fields: Recipient's email address, Subject field, Body field, and an optional Attachment field. Users provide input for all required fields using their voice. Additionally, users are prompted whether they wish to attach any optional files to the email.

In Figure 5, Users have the capability to search for emails that have been sent by a specific user, enhancing their ability to efficiently manage their correspondence. Furthermore, users can access information regarding the total number of emails they have sent, providing valuable insights into their email activity. Upon selecting the Back option, users are seamlessly redirected to the Menu page, facilitating smooth navigation within the email system. Additionally, opting to logout from the system redirects users to the login page, ensuring secure access to their email account and maintaining privacy.

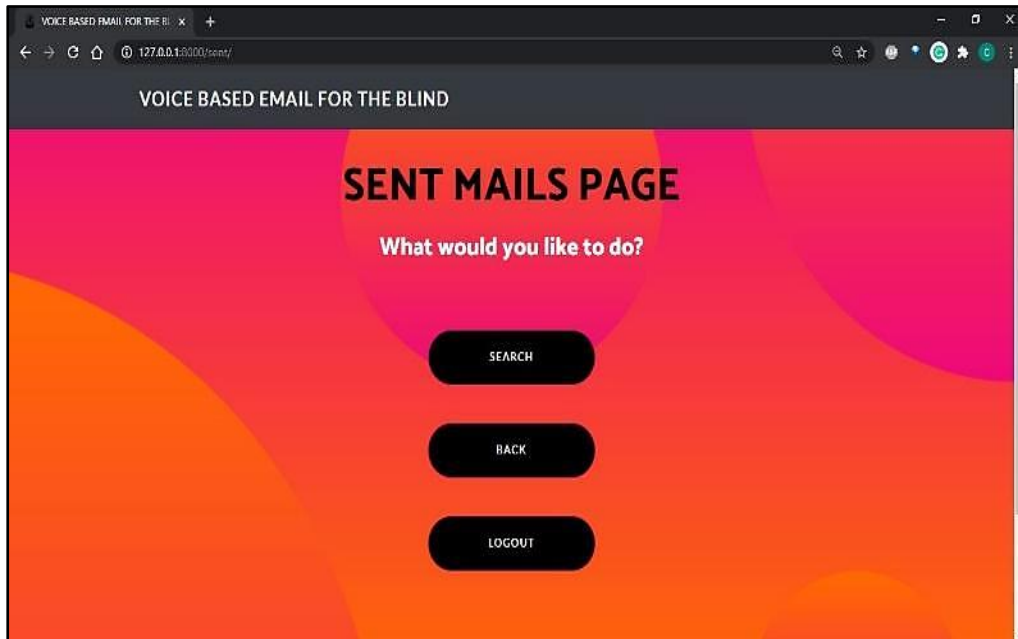


Figure 5. Sent mail page.

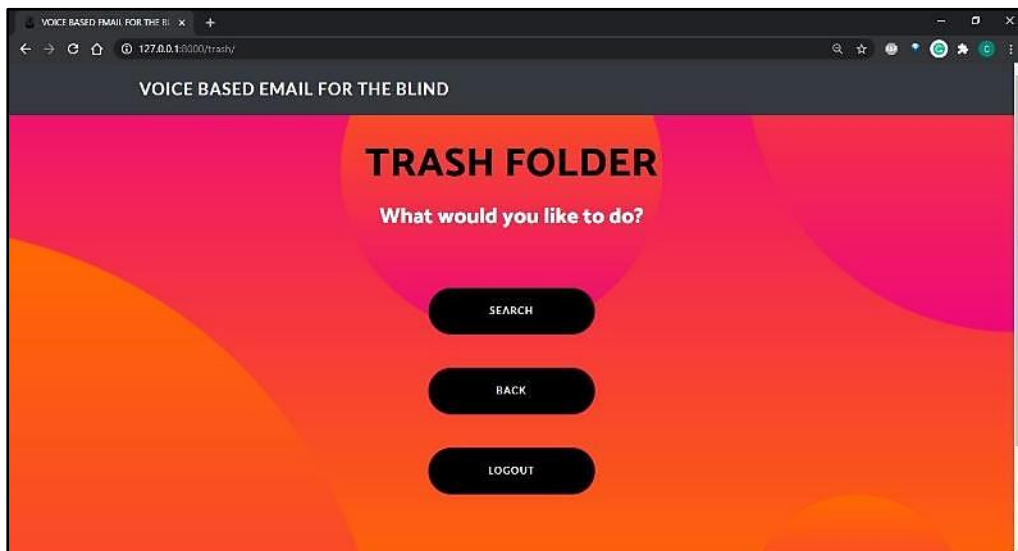


Figure 6. Trash page.

In Figure 6, within the Trash option, users can discard unwanted emails from their inbox, facilitating the management of their email content. However, it is important to note that these discarded emails are not permanently removed from the email system, allowing users the opportunity to retrieve them if needed. Upon selecting the Back option, users are seamlessly redirected to the Menu page, simplifying their navigation experience within the email interface. Additionally, opting to logout redirects users to the login page, ensuring the security of their email account and safeguarding their privacy.

CONCLUSION

This research paper presents a voice-based emailing system specifically designed to cater to individuals affected by color blindness and visual impairment. However, the system is intended for use by a broader audience, encompassing both visually impaired and sighted individuals. This innovative solution facilitates email sending and receiving through simple microphone commands, eliminating the need for keyboard input and minimizing mouse interaction. Future iterations aim to further enhance accessibility by reducing reliance on mouse usage. Accessible via desktop, the system prioritizes user privacy and authentication, ensuring a secure experience. By providing an intuitive interface based on speech commands, this system empowers individuals with disabilities to independently manage their email tasks without relying on external assistance. Users can easily compose emails by dictating the recipient's email address and message content. Additionally, to bolster security, biometric authentication can be implemented, enhancing reliability. By leveraging this system, visually impaired individuals gain autonomy in their email interactions, freeing them from dependence on others and allowing them to navigate and utilize the platform independently. Furthermore, the system's user-friendly design ensures that users can seamlessly navigate and utilize its features without requiring external guidance, thereby offering significant assistance to individuals with disabilities.

REFERENCES

1. Tapia GAH, Reyes-Herrera AL. E-mail management system for blind people in Spanish language. In: *Interacción'17:XVIII International Conference on Human Computer Interaction*, Cancun, Mexico, September 25–27, 2017. Article 50.
2. Suresh A, Paulose B, Jagan R, George J. Voice based email for blind. *Int J Sci Res Sci Eng Technol*. 2016; 2 (3): 93–97.
3. Badigar M, Dias N, Dias J, Pinto M. Voice based email application for visually impaired. *Int J Sci Technol Eng*. 2018; 4 (12): 166–170.
4. Ingle P, Kanade H, Lanke A. Voice based email system for blinds. *Int J Res Stud Computer Sci Eng*. 2016; 3 (1): 25–30.
5. Kalita B, Mahto SK. Voice based email for blind people. *Int J Eng Sci Comput*. 2019; 9 (10): 23789–23799.
6. Sawant S, Wani AK, Sagar S, Vanjari R, Dhage MR. Speech based email system for blind and illiterate people. *Int Res J Eng Technol*. 2018; 5 (4): 2398–2400.
7. Dudhwala P, Wankhede JS, Ghyar CJ, Narawade PS. Voice based system in desktop and mobile devices for blind people. *Int J Sci Res Sci Technol*. 2018; 4: 188–193.
8. Gagana M, Brundha K, Meshram N. Voice based email for visually impaired. *Int J Sci Res Sci Technol*. 2023; 5 (1): pg 108-112.
9. Mamatha A, Jade V, Saravana J, Purshotham A, Suhas AV. Voice-based email system for visually impaired. *Int J Res Eng Sci Manag*. 2020;3:51-4.
10. Chowdhary A, Kakde P, Dhoke S, Ingle S, Rushiya R, Gawande D. Timetable generation system. *Int J Computer Sci Mobile Comput*. 2020; 3 (2): 410–414.