VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama", Belagavi-560 014, Karnataka

A Mini Project Report On

"VOICE BASED EMAIL FOR BLIND PEOPLE"

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MINI PROJECT [21CSMP67]

BACHELOR OF ENGINEERING

IN

Department of Computer Science and Engineering

Submitted By

1. KISHOR N [1SV21CS038]
2. DHEERAJ S [1SV21CS027]

Under the Guidance of

Dr. Basavesha D M.Tech., Ph. D., MISTE

Associate Professor and HOD, Dept of CSE, SIET, Tumkur

Department of Computer Science and Engineering

SHRIDEVI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Affiliated to Visvesvaraya Technological University)

Sira Road, Tumakuru–572 106, Karnataka.

2023-2024

Sri Shridevi Charitable Trust (R.)
SHRIDEVI INSTITUTE OF ENGINEERING AND TECHNOLOGY
Sira Road, Tumkur - 572 106, Karnataka, India.
Phone: 0816 - 2212629 | Principal: 0816 - 2212627, 9686114899 | Telefax: 0816 - 2212628
Email: info@shrideviengineering.org, principal@shrideviengineering.org | Website: www.shrideviengineering.org
(Approved by AICTE, New Delhi, Recognised by Govt. of Karnataka and Affiliated to Visvesvaraya Technological University, Belagavi)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the mini-project [21CSM67] entitled "**VOICE BASED EMAIL FOR BLIND PEOPLE**" has been successfully carried out by 1.KISHOR N[1SV21CS038], 2. DHEERAJ S[1SV21CS027] in partial fulfillment for the Mini Project of **Bachelor of Engineering in** the **Department of Computer Science** of the **Visvesvaraya Technological University, Belagavi** during the Academic year **2023-24.** It is certified that all the corrections/suggestions indicated for internal assessments have been incorporated into the report. The Mini Project Report has been approved as it satisfies the academic requirements in respect of the Subject of the Bachelor of Engineering Degree.

Signature of the Guide

Dr. Basavesha D B.E., M.Tech., Ph. D., MISTE

Associate Professor and HOD, Dept of CSE, SIET, Tumakuru

Signature of the H.O.D

Dr. Basavesha D B.E., M.Tech., Ph. D., MISTE.

Associate Professor and HOD, Dept of CSE, SIET, Tumakuru.

Sri Shridevi Charitable Trust (R.)
SHRIDEVI INSTITUTE OF ENGINEERING AND TECHNOLOGY
Sira Road, Tumkur - 572 106, Karnataka, India.
Phone: 0816 - 2212629 | Principal: 0816 - 2212627, 9686114899 | Telefax: 0816 - 2212628
Email: info@shrideviengineering.org, principal@shrideviengineering.org | Website: www.shrideviengineering.org
(Approved by AICTE, New Delhi, Recognised by Govt. of Karnataka and Affiliated to Visvesvaraya Technological University, Belagavi)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DECLARATION

We, **KISHOR N [1SV21CS038], DHEERAJ S [1SV21CS027]** students of VI semester **B.E** in Computer Science & Engineering , at Shridevi Institute of Engineering & Technology, Tumakuru, hereby declare that, the Mini Project work entitled **"VOICE BASED EMAIL FOR BLIND PEOPLE"**, embodies the report of our Mini-Project work carried out under the guidance of **Dr.Basavesha D, Associate Professor, Department of CSE**, **SIET**, **Tumkur** as partial fulfillment of requirements for the **Mini Project [21CSMP67]** in **Bachelor of Engineering in Computer Science& Engineering of Visvesvaraya Technological University, Belagavi**, during the academic year **2023-24**. The Mini Project has been approved as it satisfies the academic requirements in respect to the Mini Project work.

Place: Tumakuru
Date:

Student Name and Signature
KISHOR N [1SV21CS038]
DHEERAJ S [1SV21CS027]

ACKNOWLEDGEMENT

This Mini Project would be incomplete without thanking the personalities responsible for this venture, which otherwise would not have become a reality.

We would like to thank our guide **Dr.Basavesha D**, **Associate Professor, Department of CSE,** Computer Science & Engineering, SIET for her support, sharing her technical expertise and timely advice.

We also wish to express our sincere thanks to our mini-project coordinators, **Dr. Rajeshwari.R** , **Professor** and **Dr.Bhargav H K., Associate Professor** for their invaluable guidance and assistance throughout this mini-project.

We would like to thank the Head of the Department **Dr. Basavesha D, Associate Professor and Head, Department of Computer Science and Engineering, SIET** for providing all the support and facility.

We express our profound gratitude to **Dr. Narendra Viswanath, Principal**, **SIET**, for his moral support towards completing our mini-project work.

We would like to express our sincere gratitude to all teaching and non-teaching faculty of the Department of CSE for guiding us in this mini-project by giving valuable suggestions and encouragement.

KISHOR N [1SV21CS038]

DHEERAJ S [1SV21CS027]

Abstract

Email communication is an essential aspect of modern life, facilitating both personal and professional interactions. However, traditional email interfaces present significant challenges for visually impaired users, limiting their ability to communicate effectively.The "Voice-Based Email for the Blind" project aims to bridge this accessibility gap by developing an innovative email system that leverages voice recognition and text-to-speech technologies.This system enables blind users to interact with their email accounts using spoken commands, allowing them to send, receive, read, and manage emails independently.The project involves the design and implementation of a voice-controlled email interface that is intuitive and user-friendly.The system's core functionalities include voice recognition to interpret user commands, text-to-speech to read emails aloud, and a robust email management module to handle various email operations.By integrating natural language processing, the system can understand and respond to a wide range of user commands, providing a seamless and efficient communication experience.This project underscores the importance of inclusivity in technology design and highlights the potential of voice-based interfaces in creating accessible digital environments.

Table of Contents

List of Figures

Chapter 1

Introduction

1.1 Background

In today's digital age, email remains a cornerstone of communication, playing a vital role in both personal and professional spheres. Despite the availability of advanced technologies, visually impaired individuals often find it challenging to access and manage email systems. Traditional email clients, with their graphical user interfaces, are not designed with the needs of blind users in mind. Screen readers and magnifiers offer some assistance but fall short in providing a seamless and efficient user experience. Recognizing this gap, the "Voice-Based Email for the Blind" project aims to harness the power of voice recognition and text-to-speech technologies to create an accessible and user-friendly email system for visually impaired users.

1.2 Objective

The primary objective of this project is to develop a voice-controlled email system that empowers visually impaired users to send, receive, read, and manage emails through spoken commands. By integrating voice recognition and text-to-speech capabilities, the system will facilitate a more natural and intuitive interaction, enhancing the independence and quality of life for blind users

.

1.3 Scope of the Project

The project encompasses the design, implementation, and testing of a voice-based email system. Key components include the development of voice recognition and text-to-speech modules, a user-friendly interface, and robust email management capabilities. The project also involves comprehensive testing and validation to ensure the system's effectiveness and reliability, as well as consideration of user feedback to refine and enhance the system

Chapter 2

Literature Review

2.1 Existing Solutions

Several existing solutions aim to make email accessible to visually impaired users, including screen readers like JAWS (Job Access With Speech) and NVDA (NonVisual Desktop Access). These tools convert text into speech or braille, allowing users to navigate and interact with email clients. However, these solutions often require significant training and can be cumbersome to use, especially for complex tasks.

Voice assistants like Google Assistant, Siri, and Alexa also offer some level of email management through voice commands. These assistants can read out emails and compose new ones based on spoken instructions. Despite their capabilities, these solutions are not specifically tailored for email management and often lack the comprehensive functionality needed for efficient email handling.

2.2 Challenges in Current Systems

Current systems face several challenges, including:

- **Accuracy of Voice Recognition:** Voice recognition systems often struggle with accents, speech impediments, and background noise, leading to errors in command interpretation.
- **Ease of Use:** Many existing solutions require extensive training and are not intuitive for new users.
- **Limited Functionality:** General-purpose voice assistants do not offer the full range of email management features needed by users.
- **Accessibility Issues:** Screen readers can be slow and challenging to navigate, particularly for users unfamiliar with the technology.

2.3 Technological Advancements

Recent advancements in artificial intelligence (AI) and natural language processing (NLP) have significantly improved the accuracy and usability of voice recognition and text-to-speech systems. These technologies can now handle a wider range of accents and speech patterns, providing more

2.4 Voice Assistants & Accessibility:

Research shows that voice assistants like Google Assistant, Amazon Alexa, and Apple Siri significantly enhance accessibility for blind and visually impaired users by allowing them to perform tasks through voice commands (Source: "Voice-Activated Assistants: Accessibility and Usability for Blind Users").Enhances accessibility through voice commands (e.g., Google Assistant, Amazon Alexa).

2.5 Speech Recognition Technologies:

Studies highlight the advancements in speech recognition technologies, such as Google's Speech-to-Text and IBM Watson, which have improved accuracy and reliability for converting spoken language into text, making them viable for email composition.Advances in accuracy for converting speech to text (e.g., Google Speech-to-Text)

2.6 Text-to-Speech Systems:

The development of high-quality text-to-speech (TTS) systems, like Amazon Polly and Google's Text-to-Speech API, has enhanced the readability of digital content for blind users by providing natural and intelligible speech synthesis (Source: "Evaluating Text-to-Speech Systems for Accessibility"). High-quality TTS systems improve readability (e.g., Google Text-to-Speech).

2.7 Email Accessibility Challenges:

Research identifies key challenges in email accessibility, including navigation complexity and screen reader limitations, which can be mitigated by voice-based systems that simplify email interactions.Simplifies email navigation and interaction for blind users.

2.8 User Experience in Voice Interfaces:

Literature indicates that designing intuitive voice interfaces is crucial for usability, as blind users rely heavily on audio feedback. Intuitive voice design essential for usability and clear audio feedback.

Chapter 3

System Design

3.1 Architecture Overview

The system architecture comprises three main components: the Voice Recognition Module, the Text-to-Speech Module, and the Email Management Module. These components interact seamlessly to provide a comprehensive voice-based email solution.

1. **Voice Recognition Module:** Captures and interprets user commands using advanced speech recognition algorithms.
2. **Text-to-Speech Module:** Converts email text into spoken words, allowing users to listen to their emails.
3. **Email Management Module:** Handles email operations such as sending, receiving, reading, and deleting emails.

The system architecture is designed to be scalable and modular, enabling easy integration of additional features and improvements.

3.2 Functional Requirements

The system must fulfill the following functional requirements:

- **Voice Command Recognition:** Accurately recognize and interpret user commands.
- **Email Reading:** Read emails aloud to the user.
- **Email Composition:** Allow users to compose and send emails through voice commands.
- **Email Management:** Enable users to manage their inbox, including deleting, archiving, and marking emails as read/unread.
- **User Authentication:** Ensure secure access to email accounts through voice-based authentication.

3.3 Non-functional Requirements

Non-functional requirements include:

- **Usability:** The system should be intuitive and easy to use, requiring minimal training.
- **Accessibility:** The system must be fully accessible to visually impaired users.
- **Performance:** The system should respond to user commands promptly and accurately.
- **Security:** Ensure the confidentiality and integrity of user data.
- **Scalability:** The system should be able to handle an increasing number of users and emails without degradation in performance.

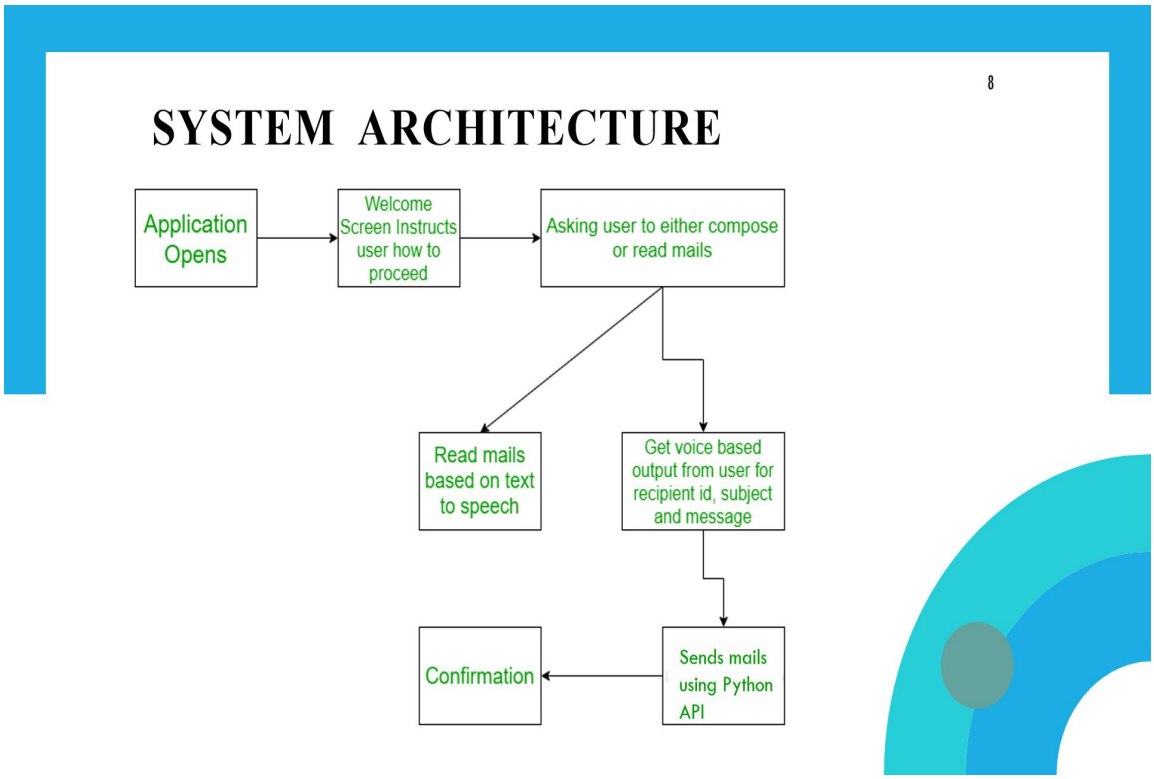

Fig 3.1 System Architecture

Chapter 4

Implementation

4.1 Development Environment

The development environment includes a combination of software and hardware tools:

- **Programming Languages:** Python and JavaScript for backend and frontend development.
- **Frameworks:** Django for the backend and React for the frontend.
- **APIs:** Google Cloud Speech-to-Text and Text-to-Speech APIs for voice recognition and text-to-speech functionalities.
- **Databases:** PostgreSQL for storing user data and email information.
- **Development Tools:** Visual Studio Code, Git for version control, and Docker for containerization.

4.2 Tools and Technologies Used

The project leverages several advanced tools and technologies:

- **Google Cloud Speech-to-Text API:** Provides robust and accurate speech recognition capabilities.
- **Google Cloud Text-to-Speech API:** Converts text into natural-sounding speech.
- **Django Framework:** Facilitates rapid development and clean, pragmatic design for the backend.
- **React:** Offers a dynamic and responsive user interface for the frontend.
- **PostgreSQL:** Ensures reliable and scalable data storage.

4.3 Voice Recognition Module

The Voice Recognition Module is responsible for capturing and interpreting user commands. It utilizes the Google Cloud Speech-to-Text API to convert spoken words into text. The module includes error-handling mechanisms to manage inaccuracies and provide feedback to users for unclear commands.

4.4 Text-to-Speech Module

The Text-to-Speech Module uses the Google Cloud Text-to-Speech API to convert email content into spoken words. It supports multiple languages and accents, providing a natural and clear listening experience for users. The module also includes customization options for voice pitch, speed, and volume to cater to individual preferences.

4.5 Email Management Module

The Email Management Module handles all email-related operations, including sending, receiving, reading, and managing emails. It integrates with popular email services like Gmail and Outlook through their respective APIs, ensuring compatibility and seamless operation. The module also includes features for sorting and filtering emails, making it easier for users to manage their inboxes.

Chapter 5

User Interface

5.1Voice Command Interface

The voice command interface is designed to be intuitive and easy to use. Users interact with the system through simple and natural voice commands. The interface includes prompts and suggestions to guide users through various tasks, ensuring a smooth user experience.

The voice command interface operates on a series of defined voice commands. For example, a user might say, "Read my new emails," and the system will fetch and read the latest emails aloud. Commands like "Delete this email," "Reply to this email,"

5.2 Design Principles

1. **Accessibility:** The interface must be fully accessible to visually impaired users. This includes supporting screen readers, providing clear auditory feedback, and ensuring that all functionalities are operable through voice commands.
2. **Usability:** The system should be easy to use, with a minimal learning curve. Voice commands should be intuitive and natural, and the system should provide guidance and assistance where needed.
3. **Simplicity:** The interface should be uncluttered and straightforward, avoiding unnecessary complexity. Users should be able to perform tasks quickly and efficiently.

5.3 Core Components

1. **Voice Command Interface:** This is the primary mode of interaction. Users issue voice commands to perform various email-related tasks. The interface must be able to accurately recognize and interpret these commands.
2. **Auditory Feedback System:** Provides real-time feedback to users based on their commands and actions. This ensures users are aware of the system's status and any actions that have been performed.

Chapter 6

Testing and Validation

6.1 Test Plan

A comprehensive test plan is essential to ensure the system's functionality, reliability, and user satisfaction. The testing phase includes the following steps:

- **Unit Testing:** Each module (Voice Recognition, Text-to-Speech, Email Management) is tested individually to ensure they function correctly in isolation.
- **Integration Testing:** The modules are then tested together to verify that they interact seamlessly and as expected.
- **System Testing:** The entire system is tested in real-world scenarios to ensure it meets all functional and non-functional requirements.

6.2 Test Cases

Specific test cases are designed to cover a wide range of scenarios, including:

- **Voice Command Accuracy:** Testing the system's ability to accurately recognize and interpret a variety of voice commands.
- **Email Operations:** Verifying the system's ability to send, receive, read, and manage emails through voice commands.
- **Error Handling:** Ensuring the system handles errors gracefully and provides appropriate feedback to the user.
- **Performance:** Measuring the system's response time and accuracy under different conditions, such as background noise and varying accents.

6.3 User Testing

User testing involves real visually impaired individuals interacting with the system. This phase is crucial for gathering feedback and identifying any usability issues. Test participants are selected to represent a diverse range of backgrounds, including different ages, genders, and levels of technical proficiency. The user testing phase includes:

- **Task-Based Testing:** Participants are asked to complete specific tasks, such as composing an email or managing their inbox, using the voice-based system.
- **Feedback Sessions:** Participants provide feedback on their experience, including any difficulties they encountered and suggestions for improvement.
- **Observation:** Observers note any non-verbal cues, such as hesitation or frustration, that indicate potential issues with the system's usability.

6.4 Results and Analysis

The results of the testing phase are analyzed to identify any patterns or common issues. Key metrics include:

- **Command Recognition Accuracy:** The percentage of correctly interpreted commands.
- **Task Completion Rate:** The percentage of tasks successfully completed by users.
- **User Satisfaction:** Feedback from participants on their overall experience and satisfaction with the system.

The analysis helps identify areas for improvement and informs the next iteration of development. Any critical issues are addressed immediately, while less urgent enhancements are prioritized for future updates.

The page of the application that displays real time email sending to provided mail id.

```
2. Check your inbox
Your choice
Listening done!
Google Speech Recognition could not understand audio.
Your choice
Listening done!
Google Speech Recognition could not understand audio.
Your choice
Listening done!
You said: one
Your message
Listening done!
You said: I am going to college tomorrow with Puneeth and Panindra you also come with me
Congrats! Your mail has been sent.
PS D:\voice-based-email-for-blind-master>
```

Fig 6.1 Real Time Message

Email received conformation in receiver mail :

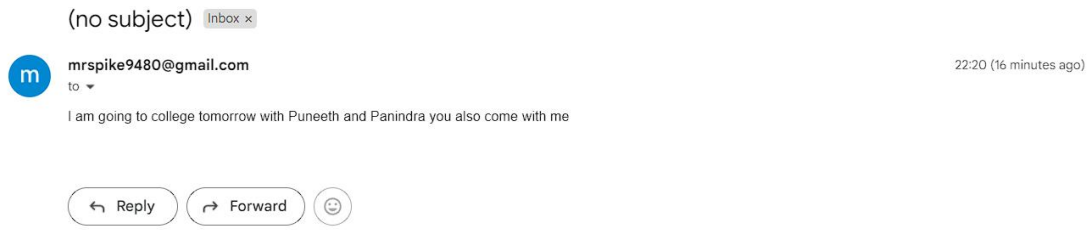

Fig 6.2 Conformation of Message in Mail

Check your inbox of the user mail for number of mails in the inbox and number of unseen mails:

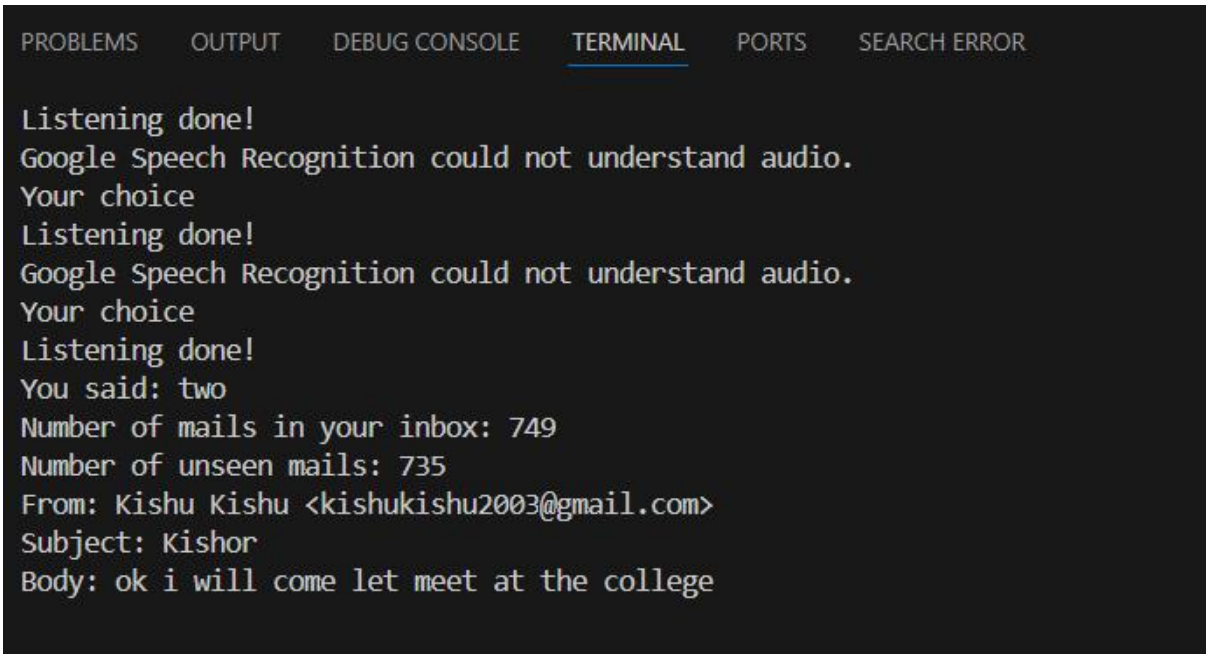

Fig 6.3 Read Message in inbox

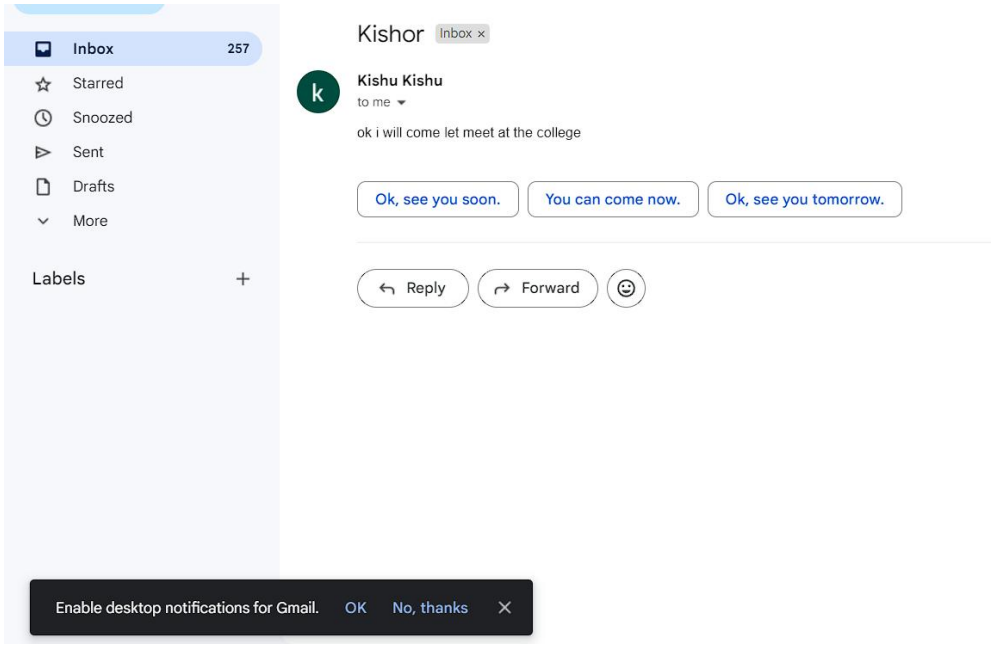

Fig 6.4 Conforming Mail in inbox

Chapter 7

Challenges and Limitations

7.1 Technical Challenges

Developing a voice-based email system for visually impaired users presents several technical challenges:

- **Voice Recognition Accuracy:** Ensuring the system accurately recognizes and interprets commands, especially in noisy environments or with varying accents, is a significant challenge. Continuous training and refinement of the speech recognition model are necessary to improve accuracy.
- **Natural Language Processing:** Understanding the context and intent behind user commands requires advanced NLP algorithms. This involves handling ambiguous commands and maintaining context in conversational interactions.
- **Integration with Email Services:** Seamlessly integrating with various email providers (such as Gmail and Outlook) and handling different email protocols (IMAP, SMTP) can be complex. Ensuring compatibility and security across these services is critical.

7.2 User Acceptance

User acceptance is crucial for the success of the system. Challenges include:

- **Learning Curve:** While the system is designed to be intuitive, users may still require some time to get accustomed to voice-based interactions. Providing comprehensive onboarding and support is essential.
- **Trust in Technology:** Visually impaired users need to trust that the system will perform reliably and securely. Any technical glitches or security concerns can significantly impact user trust and acceptance.

- **Privacy Concerns:** Users may have concerns about the privacy and security of their email data, especially when using voice commands. Ensuring robust data encryption and privacy policies is critical to address these concerns.

7.3 System Limitations

Despite its advantages, the voice-based email system has certain limitations:

- **Environmental Noise:** The system's performance can be affected by background noise, making it challenging to use in noisy environments. Noise-cancellation technologies can help mitigate this issue but may not eliminate it entirely.
- **Complex Commands:** While the system handles simple commands well, complex or nuanced commands may require further refinement. Continuous improvement of NLP capabilities is necessary to address this limitation.
- **Dependency on Internet Connectivity:** The system relies on internet connectivity to access email services and process voice commands. Users in areas with poor or unreliable internet access may experience difficulties.

7.4 Technical Challenges

Voice Recognition Accuracy:

- **Variability in Speech Patterns:** Users have diverse accents, dialects, speech speeds, and intonations. Ensuring that the voice recognition system can accurately interpret commands across this variability is challenging.
- **Background Noise:** Real-world environments often have background noise that can interfere with voice recognition. Techniques like noise cancellation and signal processing are critical but not foolproof.
- **Continuous Learning:** The system must continuously learn and adapt to individual users' speech patterns, which requires sophisticated machine learning models and significant computational resources

Chapter 8

Future Work

8.1 Enhancements

Future enhancements to the system include:

- **Improved NLP Algorithms:** Enhancing the natural language processing capabilities to better understand and respond to complex commands and conversational interactions.
- **Multilingual Support:** Expanding the system to support multiple languages and dialects, making it accessible to a broader user base.
- **Personalization:** Introducing more advanced personalization options, such as learning user preferences over time and adapting responses accordingly.

8.2 Integration with Other Systems

The system can be integrated with other assistive technologies and smart devices to provide a more comprehensive solution for visually impaired users:

- **Smart Home Integration:** Integrating with smart home devices, such as lights and thermostats, allowing users to control their environment through voice commands.
- **Wearable Devices:** Extending functionality to wearable devices, such as smartwatches and glasses, providing users with more convenient access to their emails.
- **Accessibility Platforms:** Collaborating with existing accessibility platforms and organizations to ensure the system meets the highest standards of accessibility and usability.

8.3 Potential Improvements

Potential improvements to the system include:

- **Enhanced Security:** Implementing advanced security features, such as biometric authentication and end-to-end encryption, to enhance user trust and protect email data.

Chapter 9

Conclusion

9.1 Summary of Findings

The "Voice-Based Email for the Blind" project aims to create an accessible and user-friendly email system for visually impaired users. By leveraging voice recognition and text-to-speech technologies, the system allows users to send, receive, read, and manage emails through spoken commands. The project addresses key challenges in accessibility, usability, and performance, ensuring a seamless and efficient user experience.

9.2 Impact of the Project

The development of this voice-based email system has the potential to significantly improve the independence and quality of life for visually impaired users. By providing an intuitive and accessible means of email communication, the system empowers users to engage more fully in both personal and professional interactions. Additionally, the project contributes to the broader goal of making digital communication tools more inclusive and accessible to all users.

9.3 Final Thoughts

The "Voice-Based Email for the Blind" project underscores the importance of inclusivity in technology design. As advancements in AI and NLP continue to evolve, the potential for creating accessible digital environments expands. This project serves as a testament to the power of technology in breaking down barriers and enhancing the lives of individuals with disabilities. By continuing to innovate and prioritize accessibility, we can create a more inclusive and connected world for everyone.

Chapter 10

References

1. Gihub Link : https://github.com/hacky1997/voice-based-email-for-blind
2. Books and Articles on Accessibility and Assistive Technology:

   - Lazar, J., Feng, J. H., & Hochheiser, H. (2017). Research Methods in Human-Computer Interaction. Morgan Kaufmann.

   - Norman, D. A., & Nielsen, J. (2018). The Design of Everyday Things: Revised and Expanded Edition. Basic Books.
3. Standards and Guidelines:

   - World Wide Web Consortium (W3C). (2018). Web Content Accessibility Guidelines https://www.w3.org/TR/WCAG21/
4. Web Resources and Organizations:

   - National Federation of the Blind (NFB). https://www.nfb.org/

   - American Foundation for the Blind (AFB). https://www.afb.org/
5. GoogleAccessibility.

   https://www.google.com/accessibility/

- Voice Recognition and Assistive Technology Tools:

  - Google Voice Assistant: https://assistant.google.com/
  Microsoft Cortana:
  https://www.microsoft.com/en-us/cortana