

Voice based E-Mail with Attachment for Blind

Kavi Prakash N
Computer Science and Engineering
Lovely Professional University
Phagwara, India
kavi.prakash.3154@gmail.com

Tenzin Monlam
Computer Science and Engineering
Lovely Professional University
Phagwara, India
tmonlam99@gmail.com

Rohan Singh
Computer Science and Engineering
Lovely Professional University
Phagwara, India
rohansinghcool2016@gmail.com

Aravindhan RP
Computer Science and Engineering
Lovely Professional University
Phagwara, India
avdn16@gmail.com

Pentapuri Vishnuvardhan Reddy
Computer Science and Engineering
Lovely Professional University
Phagwara, India
vvardhan.144@gmail.com

Richa Jain
Computer Science and Engineering
Lovely Professional University
Phagwara, India
richa.17688@lpw.co.in

Abstract—The internet is one of the revolutionary outcomes of the last decade of the twentieth century. Communication and data access became much easier with the introduction of the internet. As the world's economies shift to a digital environment, it is becoming increasingly important for all living things to keep up with the times. It is easy for normal people to adopt the digital climate, but in the lives of visually impaired persons technological advancements played a minor influence. Despite the fact that technologies such as screen readers and braille keyboards have made it easier for them to access numerous applications, they still lack access to many crucial things and must rely on third parties for assistance. E-mail is one of them. In the last decade, some researchers have developed solutions that allow blind and visually impaired persons to use specific features of email, such as sending and reading messages, using a voice-based assistant.

Email is one of the most significant forms of official communication, however capabilities like attaching files to emails are unavailable to persons who are blind or visually impaired. One of the most important aspects of corporate communication and transactions is the exchange of attachments. The proposed research study established a paradigm, which uses speech to text and text to speech model to allow visually impaired population to use E-mail and attach files with mail conveniently and efficiently. The proposed system will function entirely without using a keyboard, mouse, and third-party assistance. Face recognition was used to simplify the security of the proposed model. The proposed system can also be used by normal users and illiterates.

Keywords—*Speech-to-text (STT), Text-to-speech (TTS)*

I. INTRODUCTION

The internet has become backbone of modern lifestyle. Information, data and knowledge in internet is used by every human [15]. Around 285 million [9] visually impaired persons reside in the world, with India accounting for 60 percent of the total blind population [12]. This large number underlines the necessity for technological improvement. Strong business and personal relationships are built on effective communication. According to Statista, in 2020 there are 4.03 billion email users worldwide, with that figure predicted to rise to 4.6 billion by 2025. This information shows that e-mail is an important form of official communication. Despite the development of technologies such as speech to text, artificial intelligence, machine learning and text to speech,

the visually challenged and blind people are still unable to use all features of email. If a technology exists to access all email features without the involvement of a third party, it may be possible for blind and visually impaired people to catch up to normal users in formal communication. There were few developments related to voice-based email in last decades which had major drawbacks like no attachment option, no use of regional languages, low accuracy in voice recognition and etc. In this paper we proposed completely voice-based system which is based on Speech to text and text to speech. This will assist blind people in increasing their productivity without relying on third parties. We have also added face recognition feature for easy and improved security.

II. LITERATURE SURVEY

We have analyzed and reviewed some research works related to “Voice based Email for Blind”.

S Tripathi et.al [1], this paper proposed the development of voice-based email system that mainly concentrates on accessibility and security. System was made accessible with the use of voice commands instead of mouse click operations. Security of system was improved and made simple by the use of face recognition, incase face is not recognized, then user has to speak username and password. Normal users are given the privilege to use keyboards. Python was used as a medium of development, OpenCV library was used for developing face recognition part, Speech recognition was done with the help of Google speech API and Text-to-speech made with help of Pyttsx3 library. This paper mentioned that the system starts with a registration process which requires the user to speak username, gender, address and face samples are taken. After successful registration, face recognition is done for authentication. If login with face recognition fails then the user is asked to speak username and password. Users with valid credentials are directed to the home page, where they can access their inbox, compose mail, send mail, and logout. If the user wants to go to inbox, he has to say the command “inbox”. He/she can hear all of the mail's that user has received till that instance in the inbox. The user is asked to speak the receiver's mail id, subject and message under Compose mail option. The sent mail option allows the user to hear

all of the emails he or she has sent to others. The user can say logout to return to the welcome page.

Mullapudi Harshasri et.al [2], in this paper the authors proposed a chatbot which makes interaction easier with user and also it answers questions asked by user. The model described is Python based desktop application which uses four technologies namely Speech-to-text (STT) for converting speech into text, Text-to-speech (TTS) for converting text into speech, Chatbot for making the conversation more real and human like interaction and finally mail communication module for sending and receiving emails. Firstly, the system opens with a manual registration process which requires name, email, password and a four-digit keyword. Then the user has to say one of three provided commands namely "send an email", "gnidaeR" "unseen mails", and "Read all mail". After the command the user has to say the 4-digit keyword said during the registration process to ensure login and mail sending or reading functions. Some of futurescope stated by the authors are adding attachments and controlling indentation and fonts with voice commands.

Pallavi Tyagi et.al [3], this particular paper explained a python based application which used Text-to-speech (TTS), Speech-to-text (STT) and Interactive voice response (IVR) technology. User can use his g-mail account to send and receive mail with the help of this proposed system.

Bhardwaj Parkhi et.al [4], this paper described an application that uses Text-to-speech (TTS), Speech-to-text (STT) technologies, IVR (Interactive Voice Response) and Speech recognition technology. System consists of three modules namely TTS, STT and mail programming module. Paper explained that one's system starts it will ask a new user to register and login, if the user is an existing user, then the system will ask for username and password. It then leads to an inbox where users can either compose mail using Speech to text (STT) or check mail using Text to speech (TTS). User interface here is designed using CSS3 and HTML.

Latha L et.al [5], this paper proposed a system that uses an android speech to text which can recognize 10 languages and android text to speech which can speak multiple languages. This proposed system is an android application for composing, reading, sending and receiving emails. Uses android speech recognizer is used for Speech to text conversion, android TTS engine is used for Text to speech conversion, API's and keys, and Human presence detection system (detects motion around mobile within 6 meters and if detected give buzzer and LED blinks) to ensure user's privacy. This paper stated that when this application starts, the first step is the manual registration process which asks for information like name, address, birth date and contact number. After successful registration, the user is given options like send mail, set alarm, location finding, etc. The keyword "mail" should be said to enter the mail module then keyword "help" should be said to know all modules available. In this case options given are compose mail (option which takes voice input of mail id of receiver and message content), search

mail (option to find mail of user's interest) and get mail (this option reads first three mails in inbox and read it for user). Some of the drawbacks is that human detection sensors can't be fit into phones (It can be fit into phones after its size is reduced using nanotechnology).

Aishwarya Belakar et.al [6], this paper proposed a desktop application developed with speech to text converter build using .Net framework and C#, which is capable of analyzing input sound and convert it into digital format. Text to speech uses speech synthesis techniques to convert a text into speech. Simple Mail Transfer Protocol (SMTP) was used to send email from one user to other, POP3 (Post Office Protocol) protocol for receiving emails. Microsoft SQL server is used to build web applications and Relational Database Management System (RDBMS) for storing the new user registration and other details in the database. This paper stated that when the application opens it takes the user to the registration module where it takes username and password. Successful registration takes the user to the login module, where the system takes username and password. After successful login, the user is given check and compose mail options. There is an option to attach an audio file, the audio in audio file is converted to text and sent. The speech to text used for converting audio file to txt couldn't recognize voice exactly. This proposed research also tries to assist users for some basic applications like my computer, notepad, word, etc.

Milan Badigar et.al [7], this paper used a dialog manager to recognize input commands and decides what operation to perform next. The proposed system is an android application made using Java, SQLite and Java Mail application programming interface (API) that used technologies like text to speech and speech to text. Simple Mail Transfer Protocol (SMTP) was used to send email from one user to other, Post Office Protocol (POP) to retrieve and download email from mail server. The first module is registration module, username and password are saved in the database. Credentials of user like Username and password should be entered in login module. Authorized users with valid credentials will be taken to the next GUI interface where he will be given options like "Compose", "Sent mail" and "Received mail". This paper described that the users have to say a few terms like Compose (to send mail), Received Mails (to check inbox), Sent Mails (to listen mails which have been sent) and Go Back (to recede previous menu). The paper also suggests some drawbacks like adding features of attachment (like image, video or document) with mail, using encryption and decryption algorithm to protect password and username, adding comments like search, mark important, forward and archive. The advantages of the system are: it is simple, voice based, fingerprint is used for security and supports large size messages. Some of the disadvantages of the system are lacks attachment option, only one language supported and lack of some mail features (like searching, archive and forwarding mail).

Sunny Kumar et.al [8], this proposed system concentrated on users accessibility and simplifying the system. Interactive voice response (IVR) was used to interact with the users in natural way. The paper went on to state that system will produce voice response when user interacts with the proposed model. Speech recognition, Python audio, Python Text To Speech and Simple Mail Transfer Protocol (SMTP) Server are some tools and technology used. Firstly, users have to register, the user has to speak for this task. Login module follows the registration module, user has to speak username and password at this stage. Successful login takes the user to the homepage where he will be given options like compose, sent mail, inbox and trash. The proposed system is completely voice based and require one mouse click operation at the start of system. The paper also lists future scope like reading deleted and spam mails and adding more regional languages.

S Biruntha et.al [9], this proposed system is based on the prompts of system and mouse hovering. Interactive voice response (IVR) is the main technology, which is used with mouse click operations. When the system opens, the user is given signup (for new user) or login (existing user) options. If a user wants to sign up, he/she is taken to the registration page, where the user is asked to enter name, password and re-enter password. If two passwords don't match then an error flags, else the user is taken to the login page where the user has to enter credentials like username and then password for validating users' identity. After validating credentials, the user is given options like inbox, sent mail and compose. User has to hover the mouse and the system will prompt the options, When the user hears the intended option, the user should click the mouse. In the compose option the user is given three options like record message, listen to recorded message and send the message. In the sent mail option, the user can hear all messages he sent. In the inbox option, the user has to hover the mouse (system will tell the user on which mail the cursor is present) and click to read a particular message. On clicking the logout user is sent to the login page. In this system user is required to hover the mouse left to right and top to bottom, depends on his/her mouse location system prompts voice and user has to click mouse when he/she come across the prompt of intended option. This mouse hovering makes the process very uncomfortable for blind people.

Pranjal Ingle et.al [10], this paper proposed a system that is a web-based voice oriented system, mainly uses Speech To Text (STT) for converting raw speech into text format, Text To Speech (TTS) for converting text into system voice, and Interactive Voice Response (IVR) system that allows users to engage with an email host system using a system keyboard and assists users by listening to IVR discourse on how to proceed. Pre-recorded audio stored in a database which will be used for guidance, user validation and storing mails of the user. Adobe Dreamweaver CS3 was used to create the user interface. Paper states that the first module is registration module, where users have to speak to fill in all details. Next is the login module where users have to speak password. Once

spoken credentials are valid, the user is taken to the mail app page. User is given options like inbox and compose, where he can listen to mail using TTS and compose mail using STT. Mouse click operation are used and it causes inconvenience for the user.

A.Mamatha et.al [11], this paper proposed a pc program which uses Speech to text (STT) for converting users input into text for mailing, Text to speech (TTS) for converting mail in inbox into speech, Interactive Voice Response (IVR) and adobe dream weaver cs3 for user interface. Users have to enroll at first before login. During voice-based login user is asked for username and mystery key. Users are diverted to the home page once login is done. In home page users are given options like inbox, create, sent mail and junk. Junk or trash option can be used to access mails deleted from inbox and sent mail. Mouse clicks are used and use of key for login are drawbacks of the system.

Omkar Kulkarni et.al [12], This paper proposed a system, in which Adobe Dreamweaver CS3 was used to create the user interface., they have used Speech-to-Text converter, Text-to-speech converter and automatic speech recognition (ASR). Mail module provides options like compose or check inbox. The model proposed by the paper suggests, future scope of their work as nick naming the recipients of mail id's for convenient mail sending.

Rijwan Khan et.al [13], this proposed research uses artificial intelligence for speech to text and text to speech synthesizer for converting text into speech. This research uses hashing algorithms like Message digest algorithm (MD5) and Secure hashing algorithm (SHA) are used for storing encrypted password in database. System proposed uses Speech to text module for composing a mail, Text to speech module for reading the received mail, and mail programming module which uses standard protocols like Simple mail transfer protocol (SMTP) for sending mail from one user to other and Post office protocol (POP) was to download and retrieve email from mail server. Internet message access protocol can be also used instead of POP. HTML5 and CSS3 was used to create the user interface. First step is voice assisted registration where users have to speak all required fields. In order to login, the user has to speak the Username and Password. Successful login will lead the user to a page where he will be given options like compose, inbox and sent mail. No attachment feature is considered as drawback.

Akshita Bhandari et.al [14], in this paper authors have combined Interactive Voice Response with mouse click operation to yield required result. Mouse can be clicked anywhere in the screen, what matters is number of clicks. They have developed an android application using Python coding Language. Interactive voice response (IVR), Text-to-speech (TTS), Front End was made using HTML CSS, Database was made using MySQL and Speech-to-text (STT) were used. After logging in successfully, the user will be taken to the main page where he can perform actions based on mouse clicks. For example, he has to double click the mouse left to go to inbox view or they

have to single left click to compose mail. Mouse click events become an ultimate drawback of this system.

Dr. S Brindha et.al [15], in this paper the Desktop application was developed using Visual studio. They mainly used combination of Text-to-speech (TTS), Speech-to-text (STT) and Interactive voice response (IVR) technology to send either a text message using speech to text or user can send voice attachments. The architecture of the system consists of two modules namely Interface selection Module and Mailing Options. Interface selection module provides an option to select blind user or sighted user. Blind users will get completely voice-based feedback and sighted will get text-based feedback. The mailing option module contains two options namely Compose Mail and Inbox Check. In compose mail, the user can record the voice by saying "begin recording" and the user can stop the recording by saying "stop recording". This system didn't provide any option for sending attachments.

A. Disadvantages of existing systems

- All the reviewed systems does not contain add attachment (word, pdf, text and so on) with mail option.
- Some proposed models had manual registration process option.
- Mouse click operations are performed.
- One language is used as medium of mailing.
- Either systems lack security feature or do not contain simple and efficient security feature.
- Poor speech recognition accuracy.

III. COMPARATIVE ANALYSIS

TABLE I. TABLE TO COMPARE VARIOUS RESEARCHES

AUTHOR	TECHNOLOGY	TECHNIQUES PROPOSED	MERITS	LIMITATIONS
S T ripathi et.al [1] (2019)	Face recognition, Text to speech and Google web speech API.	Security improved with the use of face recognition. Accessibility improved with voice commands instead of mouse and keyboard operations.	No keyboard and mouse are required. Normal user can use keyboard as well.	Lack attachments sending option, only English language is used.
Mullapudi Harshasri et.al [2] (2021)	Speech to text, Text to speech and Chatbot.	Chatbot is used to make interaction with system simple.	Questions asked by users are answered by chatbot and no mouse click operations are used.	No attachment feature and Registration process is manual.
Latha L et.al [5] (2019)	Android speech recognizer, android TTS and Human presence detection system.	Speech to text in android can recognize inputs in 10 languages and Text to speech in android can speak the text in many languages.	Can take input in 10 languages, Human detection sensor is additional novelty to this research	Manual registration and lack attachment in mail feature.
Aishwarya Belakar et.al [6] (2020)	Text to speech converter, Speech to text converter made using .Net framework and C#.	Speech to text converter filters what users says and converts into digital format that the system can read. Speech synthesis is used to read text using text to speech.	Access emails easily and efficiently by linking application with the Gmail Client. Audio attaching feature with mail seems a convenient and efficient option.	Speech recognition accuracy is low and documents cannot be attached.
Milan Badigar et.al [7] (2018)	Speech to text and text to speech synthesizer	Dialog manager is used which recognizes input commands and decide what actions to perform next.	Increased accessibility with introduction of voice commands, audio feedback, Fingerprints is used for security and large message size.	One language is supported, lack features like search, archive, forward options and files attachment (video, document, image).
Sunny Kumar et.al [8] (2021)	Interactive Voice Response (IVR)	Interactive voice response (IVR) makes it keyword free and efficient.	Completely voice based, user need not remember keywords.	Supports one language, lacks attachment feature and one mouse click operation is performed.
S Biruntha et.al [9] (2021)	Interactive Voice Response (IVR)	When user hovers the mouse, the system prompts	Keyboard is not used, Password protected	Mouse click events are used which

		the operation at that location of mouse. If user wants to perform that operation users need to click mouse.	and well-structured interface.	minimise the user friendliness.
Pranjal Ingle et.al [10] (2016)	Speech to text (STT), Text to speech (TTS), IVR (Interactive Voice Response)	Interactive voice response was used in combination with speech to text and text to speech.	Keyboard is not used.	No file attachments feature, mouse clicks are used and lack security authentication feature.
Rijwan Khan et.al [13] (2020)	Speech to text, Text to speech, and Interactive voice response (IVR)	Message digest (MD5) algorithm and Secure hashing algorithm (SHA) are used to store encrypted password in database.	High Security provided with hashing algorithms, simple and easy user interface	No attachments feature and one language is supported.

IV. PROPOSED WORK

Our study is entirely based on a novel concept that addresses some of shortcomings of past studies. We designed our system keep in mind that it should address the one of the important missing feature (attachment feature) for blind people and design a simple and efficient system to use. Python and its inbuilt libraries are used to design our proposed system.

A. Face Recognition

We have designed login page with openCV which recognises authorized user and permits entry. Here we have tried to make the process easy for blind user to login. The face samples of user are feeded into the system by designer during designing phase.

B. Home page

After successful login, user is taken to home page where user is given two options namely 1). Compose a mail and 2). Check inbox as shown in figure 1. User has to say either command one to compose mail or command two to check inbox.

C. Compose a mail

In this module user is given two options as shown in figure 1 namely 1). Simple mail module and 2). Attachment mail module. User have to say command mail to access simple mail module and command attachment to access attachment mail module.

D. Simple mail module

As given in figure 1, this module asks for subject of mail, message of the mail and send the mail after asking the user to select a person from his contacts. User can say either logout command to logout or he will be taken to home page.

E. Attachment mail module

As given in figure 1, in this module user is asked for subject of the mail of the mail, message, user has to select the contact of receiver and finally user will be asked location and name of the file. User can say either logout command to logout or he will be taken to home page.

F. Check Inbox

As in figure 1, when user says command two in home page he/she is directed to this module where system will tell the count of number of messages in the inbox, count of number of unread messages and read the unread messages for the user with the mail id of sender, subject and body. User can say either logout command to logout or he will be taken to home page.

G. Tools and libraries used

Python and its inbuilt libraries was used to build the proposed system. Text to speech was implemented using google text to speech library (gTTS), Speech to text was implemented using Python audio (Pyaudio) and Speech_recognition as sr library, mail is sent using Simple mail transfer protocol (SMTP) in smtplib library, mail is read using Internet message access protocol (IMAP) in imaplib library and MIME (Multipurpose Internet Mail Extension) module is used to sent the attachment.

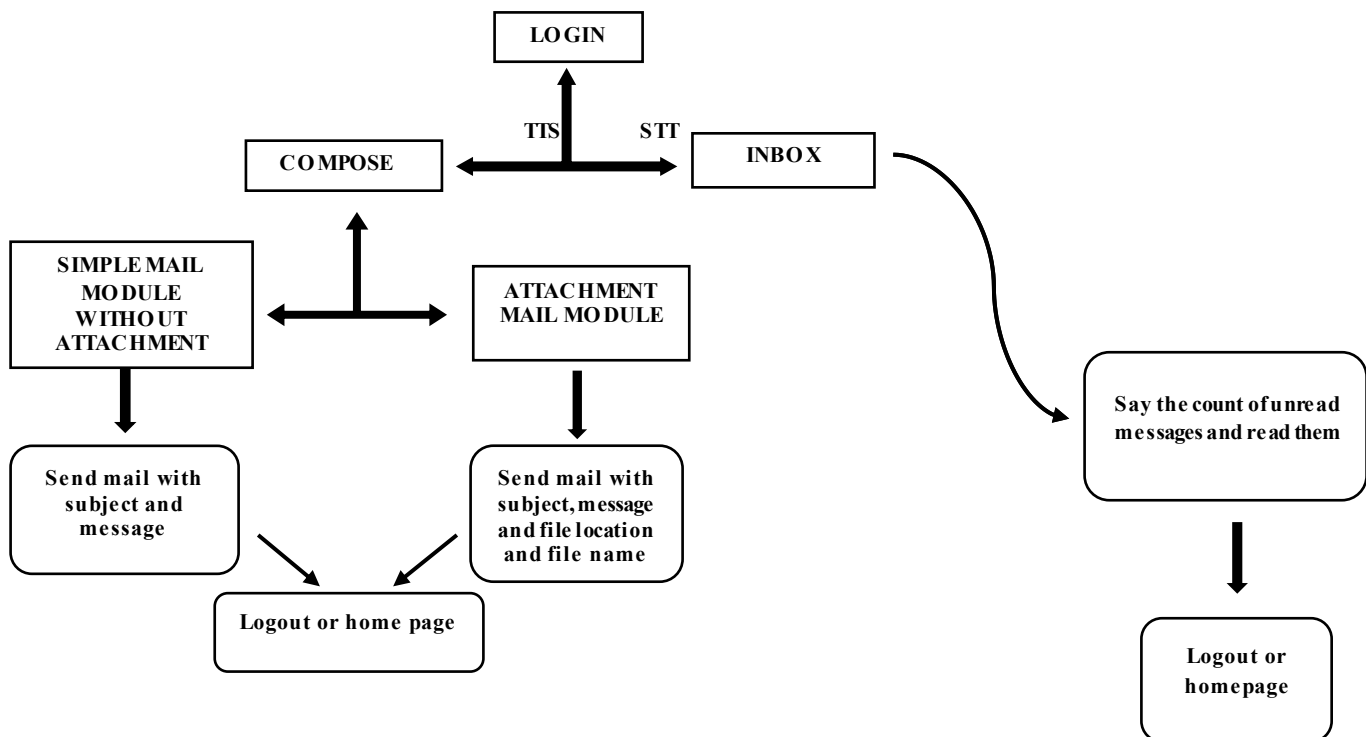


Fig. 1. Figure to represent working of our system

V. RESULT DISCUSSION

```

=====
Project: Voice based Email with attachment for blind
=====
You are logged in from : KAVI
1. Composed a mail.
2. Check your inbox
Your choice :
Copied that!!
You said : 1
Dear user, If you want to send a Email without attachment Say command 'mail' else say command 'Attachment'
Your choice :
Copied that!!
You said : mail
Dear user, What is your Subject ??
Your choice :
Copied that!!
Your subject is : show the working of project
Dear user, What is your message ??
Your choice :
Copied that!!
Your message is : the project is in mail module without attachment
Dear user, Whom you want to send mail ??
Your contacts are Dhoni,Jadeja, Rohan ,Khohli, Vishnu and Arvind
Your choice :
Copied that!!
Your receiver is : Dhoni
Are you sure, you want to send to Dhoni
Your choice :
Copied that!!
You said : yes
Congrates! Your mail has been send.
    
```

Fig. 2. Simple mail module

```

You said : 2
Dear user, If you want to send a Email without attachment Say command 'mail' else say command 'Attachment'
Your choice :
Copied that!!
You said : attachment
You are in attachment mail module
Dear user, What is your subject ??
Your choice :
Copied that!!
Your subject is : show the working of project
Dear user, What is your message ??
Your choice :
Copied that!!
Your message is : attachments can be sent from this module
Dear user, Whom you want to send mail ??
Your contacts are Dhoni,Jadeja, Rohan ,Khohli, Vishnu and Arvind
Your choice :
Copied that!!
Your receiver is : Dhoni
Are you sure, you want to send to Dhoni
Your choice :
Copied that!!
You said : yes
Dear user, tell the path of your document one by one :
Your choice :
Copied that!!
You said : downloads
C:/Users/KAVI/downloads
Next location after downloads
Your choice :
Copied that!!
You said : file
C:/Users/KAVI/downloads/file
Dear user, What is your file extension ??
Your choice :
Copied that!!
You said : document
Following is the list of names of all the files present in the location:
document.docx
file.docx
Your choice :
Copied that!!
You said : document
Congrates! Your mail with attachment has been send.
    
```

Fig. 3. Attachment mail module

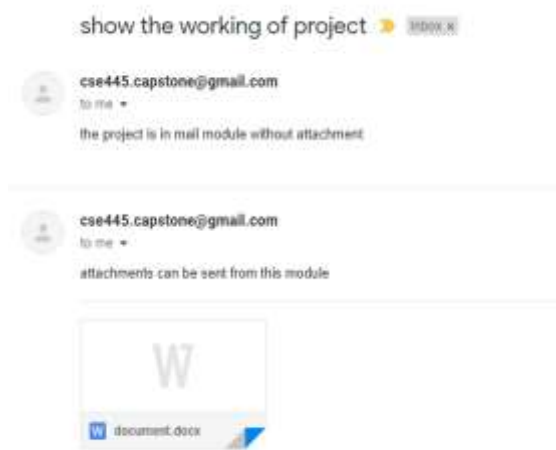


Fig. 4. Received mail send by the system

The system was successfully able to achieve sending attachment with mail. Fig.2 shows the simple mail module, Fig. 3. Shows the attachment mail module and Fig. 4. shows the mail received by receiver from the system. The sending of attachment with email is seen by us as novelty of our research. The system completely dumped the use of keyboard and mouse using completely voice-based commands, user need not remember these commands as system will guide user during the process. We used google text to speech library which increased the voice recognition accuracy of the system. Face recognition is simple login procedure followed by us and this makes blind people get rid of remembering username or password.

VI. FUTURE SCOPE

Technological development like voice based email with attachment will boost the confidence of visually impaired and blind people. Future scope of our research is that more regional languages can be added, other feature of mail (spam, archive, sent mail and etc) can be added, controlling fonts and indentation with voice and adding cc (carbon copy) field and bcc (blind carbon copy) field in mail with voice.

VII. CONCLUSION

In this study, we propose a voice-based email system that will aid the visually impaired by making it easier for them to access, send, and receive emails with attachments. Our system is purely voice-based and the use of a mouse or keyboard is completely eliminated. Users are spared of the strain of remembering important keyboard phrases and actions because the system handles voice commands. Face recognition is merely another icing on the cake. Face recognition will provide security to users, preventing data exploitation.

Despite the fact that the primary objective of this research is to assist the visually impaired, it is also valuable to non-visually impaired users due to its simplicity, security, and effectiveness (including illiterates). This proposed technology can assist regular people in sending and receiving attachment-laden emails by using voice instructions. Our research successfully overcame some of drawbacks of previous researches such as including attachment with mail, making the system completely voice based, simple login with face recognition and increased accuracy in voice recognition.

REFERENCES

- [1] S Tripathi, Nidhi Kushwaha, and Puneet Shukla, "Voice based email system for visually impaired and differently abled," International Journal of Engineering Research & Technology (IJERT), Volume 8, Issue 07, July 2019.
- [2] Mullapudi Harshasri, Manvam Durga Bhavani, and Misra Ravikanth, "Voice Based Email for Blind," International Journal of Innovative Research in Computer Science & Technology (IJIRCS), Volume 9, Issue 04, pp.10-13, July 2021.
- [3] Pallavi Tyagi, Tanishka Sharma, Mayank Mittal, Ankit Kumar. "Voice based Email for Physically Challenged," International Research Journal of Engineering and Technology (IRJET), Volume 7, Issue 05, May 2020.
- [4] Bhardwaj Parkhi and Gunjan Sethi, "Voice Based E-mail System for Visually Impaired: A Review," International Research Journal of Engineering and Technology (IRJET), Volume7, Issue 12, December 2020.
- [5] Latha L, Babu B, and Sowndharya S, "Voice based email with security for visually challenged," International Journal of Engineering and Advanced Technology (IJEAT), Volume 8, Issue 6S3, September 2019.
- [6] Aishwarya Belekar, Shivani Sunka, Neha Bhawar, Sudhir Bagade, "Voice based E-mail for the Visually Impaired," International Journal of Computer Applications, Volume 175, September 2020.
- [7] Milan Badigar, Nikita Dias, Jemima Dias and Mario Pinto. "Voice Based Email Application for Visually Impaired," International Journal of Science Technology & Engineering (IJSTE), Volume 4, Issue 12, June 2018.
- [8] Sunny Kumar, R. Yogitha, and R. Aishwarya, "Voice Email Based on SMTP For Physically Handicapped," 5th International Conference on Intelligent Computing and Control Systems (ICICCS), IEEE, pp. 1323-1326, May 2021.
- [9] S. Biruntha, M. Gaja Priya, R. Kiruthika, N. Indupriya and Mrs. R. Ashwini, "Voice Based Email for Blind People Using Speech Recognition through Artificial Intelligence" International Journal of All Research Education and Scientific Methods (IJARESM), Volume 9, Issue 04, April 2021.
- [10] Pranjal Ingle, Harshada Kanade, and Arti Lanke, "Voice based e-mail System for Blinds," International Journal of Research Studies in Computer Science and Engineering (IJRSCSE), Volume 3, Issue 01, pp. 25-30, 2016.
- [11] A. Mamatha, Veerabhadr Jade, J. Saravana, A. Purshotham and A.V. Suhas, "Voice Based E-mail System for Visually Impaired," International Journal of Research in Engineering, Science and Management, Volume 3, Issue 08, 2020.
- [12] Omkar Kulkarni, Akshay Alhat, Namdeo Tejankar and Madhuri Patil, "Voice based e-mail system for blind people," Open access international journal of science and engineering, Volume 4, Issue 01, 2019.
- [13] Rijwan Khan, Pawan Kumar Sharma, Sumit Raj, Sushil Kr. Verma and Sparsh Katiyar, "Voice Based E-Mail System using Artificial Intelligence," International Journal of Engineering and Advanced Technology (IJEAT), Volume 9, Issue 3, February 2020.
- [14] Akshita Bhandari, Aayushi Shukla, Darshita Khanna, Garima Verma, Poorva Shinde and Prof. Asif Ali, "Voice based email system using python," EPRA International Journal of Research and Development (IJRD), Volume 6, Issue 07, July 2021.
- [15] Dr. S. Brindha, Ms. D. Priya, Mr. S. Mukesh, Mr. C. Dinesh Kumar and Mr. R. K. Naveen, "Voice based email for visually challenged people," International Research Journal of Engineering and Technology (IRJET), Volume 7, Issue 03, March 2020.