2023 7th International Conference On Computing, Communication, Control And Automation (ICCUBEA)
Pimpri Chinchwad College of Engineering (PCCOE), Pune, India. Aug 18-19, 2023

Voice Based E-Mail System for Visually Impaired Peoples using Computer Vision Techniques: An Overview

Madhuri Rajole
Student Department of Information Technology
Pimpri Chinchwad College Of Engineering
Akurdi, Pune-411044, India
Savitribai Phule Pune University, Pune
madhuri.rajole21@pccoepune.org

Dr. Rajesh Phursule
Professor, Department of Information Technology
Pimpri Chinchwad College Of Engineering,
Akurdi, Pune-411044, India

2023 7th International Conference On Computing, Communication, Control And Automation (ICCUBEA) | 979-8-3503-0426-8/23/$31.00 ©2023 IEEE | DOI: 10.1109/ICCUBEA58933.2023.10391988

***Abstract*—Generations born in the modern period have an obligation to fully use the potential of the Internet. One of the most widely used aspects of the internet is email. The most essential need is the availability of standard Internet features. Even though there are many screen readers available, those who are blind or visually impaired still have trouble using the internet. Therefore, this article's goal is to provide them with a voice to rely on. Voice help is not limited to only email; many commonplaces but essential apps, such as calculators and music players, also provide this feature. This paper describes a systematic literature review of automatic email system for blind peoples using voice commands. The face recognition is the techniques involves for authentication and then voice to text API works for transformation of data. Finally, we demonstrate the challenges of various existing system and scope for future direction with innovative computer vision techniques.**

Keywords— text to voice converter, visually impaired peoples, Natural language processing, face recognition, automatic email system

I. INTRODUCTION

Everyone these days has access to a computer and the internet. It can't be separated from our daily lives. All the details of people's lives and regular events are recorded there. The internet has become the primary means of communication and social contact. When it comes to professional and academic settings, email has surpassed all other forms of electronic communication. Despite this, not everyone has access to the internet. This is because there is insufficient funding, resources, and expertise. Users' eyesight will be tested to ensure they can see the screen well. Nets are an alien and ineffective concept for those who lack the sense of touch and sight. The system uses TTS (Text-to-Speech) technology to provide voice navigation for the visually impaired. The programme takes into account an instant messaging system to help visually impaired people communicate with other people on the network. That's why we're using voice email to facilitate communication in this project. Even the most inexperienced users can read and send email to anybody else. The vocal answer is the only input used. You don't need any expertise to utilize this. Everything is prodding you automatically; all you have to do is respond to the voices.

The construction of Voice Email may take several forms. However, writers have employed a wide variety of methods to avoid detection, necessitating the development of new, improved methods capable of yielding more reliable findings. We presented a programme that takes voice commands as input and uses a voice-to-text converter to turn the user's natural speech into an actionable command. In response to the given instruction, the specified procedure will be carried out. Through the use of a text-to-speech converter, the output may be heard as natural speech. The three sections of this programme are the Inbox, Sent Items, and the Outbox. All incoming messages are stored in the inbox. To send an email is to write an email using a service that translates spoken words into text. A sent email may be tracked in the outbox. Voicemail software, which may be used to communicate through voicemail. The voice is processed with an API, converted to text, processed with an API, converted back to voice, and finally connected to the server with the help of the Gmail API. This software takes use of Google's APIs to convert text to voice and vice versa. The IVR facilitates communication between the user and the system. This technique communicates with the user's Email host system to answer their questions. The interactive voice response (IVR) technology uses a pre-recorded audio voice to guide users through the application's next steps. The voice assistant on this system may be used to send and receive emails. There are four stages to this process. The use of voice input to control a computer are all examples of speech recognition. Speech recognition software uses a database of phrases and words to decipher human speech.

Visually impaired users will find success with an E-mail system design centred on voice communication. This study's contribution has allowed people to use computers to exchange voice-based e-Mails in their original languages.

II. LITERATURE SURVEY

A. Review of Literature

The conventional computer vision software's and traditional emailing system having limited features like voice recognition and text-to-speech. Existing search engines typically accept text queries from users, fetch relevant documents from a server, and then show the results as text, which is inaccessible to those with visual impairments.

T. Dasgupta et. al. [1] proposed an computer-based accessible systems, which is helpful for people who are blind or visually impaired in many parts of the world now have more opportunities than ever before. Blind persons have benefited greatly from screen readers since they provide a virtual world with audio feedback that allows them to use online programmes. However, these technologies are out of reach for a sizable population of visually challenged persons

in several nations, including the Indian subcontinent. This was mainly because Indian languages have different technical requirements from those of other widely spoken languages. In this article, we lay out the technical details of how a visually impaired user may retrieve their voice mail quickly and effortlessly. Because of this study's findings, visually impaired persons may now use computers and mobile devices to exchange e-mails using speech recognition software and their own languages. The user interface of our proposed system has been compared to that of a conventional email server. Our benchmarks show that the proposed design outperforms the state-of-the-art GUIs.

P. A. Tiwari et. al. [2] proposed internet based modern forms of communication. Numerous internet-based apps have been created in recent years to improve the dependability and efficiency of communication. E-mail, among all these programmes, is the most popular and dependable means of contact between people nowadays. While most people find using email to be intuitive and simple, those with visual impairments still face significant barriers to entry. Because the existing systems rely on visual perceptions, those with visual impairments cannot benefit from them. The technological landscape has changed significantly in recent years, with significant benefits accruing to the blind and visually impaired. The present email system has not been modified to accommodate the needs of those with vision impairments. As a result, there is a pressing need to improve the current setup so that the visually handicapped can make better use of it. Therefore, in this research, we provide a voice-controlled email system that may be used by individuals with visual impairments to have quick and easy access to their inboxes.

Using a revolutionary dual-finger haptic interface and enhanced by audio output and voice instructions proposed by R. Iglesias et al. [3]. The authors of this research present a Haptic Audio Virtual Environment that gives the visually handicapped access to the three-dimensional graphic computer environment. The European "GRAB" initiative is responsible for the development of such a system. The new system offers a unified platform for the creation of audio-haptic applications across disciplines (including construction, the visual arts, aerospace, and medical). Three applications—an adventure game, a city map explorer, and a chart explorer—were developed for visually impaired persons as part of the research to prove the viability of the concept. Visually impaired persons of varying profiles (congenitally blind, advantageously blind, partly sighted) assessed the new environment and the apps to assess their utility and potential.

S. Noel [4] proposed a concept advance in communication are causing a revolution. Email is becoming the standard for all but the most informal of correspondence. As digital technology has advanced, it has opened up many doors for those with visual impairments. This programme was made to make sending and receiving emails easier for everyone, not just those with visual impairments. Human speech may now be used as input alongside keyboard input. As a result, you won't need to know how to type anymore. The user's voice is detected and compared to a database of previously recorded voices before the programme carries out the user's instruction. The command language is made up of everyday terms. It's main goal is to make using one's memory easier. The goal of this proposed effort is to create a system that can both transcribe spoken words into written text for use in email writing and recite written words back to the user in spoken form. This software uses the Google web kit API (Application Programming Interface) for voice recognition.

According to J. Wang, P. et. al. [5] the CTI and VoIP continue to advance rapidly; more and more focus is being given to voice mailboxes that operate via VoIP technology. In this work, we propose a solution for the voice mailbox system that makes use of digital voice cards and Voice over Internet Protocol to cut down on development costs and speed up the process. This article provides an overview of the VoIP-based voice mailbox system's architecture, explains how the system works, and covers the practical implementations of scheduled message delivery and human service. The outcome is positive once the system is up and operating. For related projects using digital voice card technology, it serves as a useful point of reference.

According to [6] "Voice Based System in Desktop and Mobile Devices for Blind People" is the title of this article. Access to e-mail and other multimedia features of the operating system (songs, text) is facilitated by voice mail architecture for the visually impaired. The technology can also read SMS messages via a mobile app. These days, the world's visually impaired community has access to more resources than ever before because to developments in computing. Nearly sixty percent of the world's blind live in India, according to recent estimates. In this article, we outline the voicemail infrastructure that allows the visually impaired to utilize the operating system's e-mail and multimedia features with ease and proficiency. In addition, the blind won't have to exert as much mental effort trying to memories and write individual letters because to its design. The advancement of technology for the visually handicapped is well documented. Among these technologies are screen readers, magnifiers, and text-to-Braille systems. In recent years, efforts have been undertaken to provide accessible internet technology for the visually impaired. Voice input and surfing input were among the first methods of access employed by the visually impaired. IBM's homepage is a web page that transforms text to audio using distinct gender voices for reading texts and links, and it has an easy-to-use interface. In order for the screen reader to understand and navigate the complex graphical web pages, the developer must create a whole new interface. Easy-to-use browser extension that splits a webpage in half horizontally. The structure of a website is substantially simplified and the user experience is greatly enhanced by this. Another web browser parsed the HTML content and created a tree structure by following the links inside it. Unfortunately, it did not improve the browsing experience despite its best efforts to organize the interconnected sites. After then, it stopped caring about the requirements of the current page's usability and navigation.

Create a search engine that allows for voice-only human-computer interaction, as suggested by [7]. A new speech-based search engine and web page reader is shown, which can be controlled by the user's voice. Existing search engines take textual queries from users and provide results in textual form after getting the necessary documents from a server. Although current web browsers support playing music and video, users must first make a request by entering some text into a search bar before being presented with graphical user interfaces (GUIs) that allow them to play the desired audio or

video. The goal of the proposed Voice based Search Engine is to aid users, particularly the visually impaired, in doing Internet searches. The user may interact with the computer through vocal interaction; both the user and the computer can hear each other's voices. The computer may also provide reading assistance. The "Social Robot Maggie" may be turned into a reading aloud device by means of a voice-enabled interface, which also provides support for gesture-based input and output methods. A lot of factors, like the voice's pitch, pace, loudness, etc., may influence how well voice recognition and synthesis work. Loquendo ETTS (Emotional Text-To-Speech) served as the foundation for this. The robot uses gestural language to convey its emotions as well. Reducing background noise helps with speech recognition. In In an iterative speech enhancement process, the speech and noise components are separated using a Bayesian approach in a wavelet domain. To take use of the chosen characteristics in the time-frequency space representation, the suggested approach is created in the wavelet domain. There are two phases: estimating the noise level and extracting the signal. The HMM for the visual modality of audio-visual recordings is based on Principal Component Analysis (PCA). Both principal component analysis (PCA) and probability density function (PDF) are used. Using fuzzy modelling and decision making, the authors provide a method for voice identification that does not focus on removing background noise. Instead of using hard and fast acoustic characteristics, the speech spectrogram is translated into a fuzzy linguistic representation. In Virtual artists with upper-limb limitations may use a voice-recognition technology in conjunction with facial-feature interaction to help them produce visual cuts in a digital medium, helping to maintain the originality and authenticity of their work. Structural analysis methods are used to recover features including sentence boundaries, filler words, and disfluencies. Speech recognition output may be improved with the use of metadata, which describes the method that automatically appends information about the position of sentence borders and speech disfluencies. The ISS is equipped with a voice-enabled procedure browser called Clarissa. The Clarissa system is comprised mostly of the following modules: a voice recognition module, a classifier to carry out the open microphone accepts/rejects decision, a semantic analysis, and a dialogue manager. Expressions are the main emphasis. An end pitch and a delta pitch for each syllable are predicted using a collection of textual cues to construct a prosody model for each expressive state. Units containing expression tags are combined with untagged data, Paralinguistic events in a TTS system effectively give clues as to the status of a transaction, and developers may easily produce these sorts of events in the audio output from the TTS engine by using Markup to describe these events. Key benefits include the ability to synthesize speech that sounds natural and smooth, as well as the flexibility to alter the voice's own characteristics. High quality vocoder and hidden semi-Markov model based acoustic modelling have helped overcome the fundamental system's limitations, which include the "buzz" character of the synthesized speech. Concatenation synthesis, articulation synthesis, and formant synthesis are the three subfields of speech synthesis. Mainly concerned with formant synthesis, the input is an array of phonemes of syllables with formants frequency, and the output is audio through soundcard. The input frequency is processed, and then, in collaboration with the Thai-Tonal Accent Rules, the formants frequency format is converted to wave format.

In this part, we provide a comprehensive literature assessment of the most up-to-date methods in the field. In article [8], the authors suggest a voice-based email architecture to help visually impaired people use email. Due to the lack of auditory input during text reading, existing technology is inaccessible to the visually impaired. The suggested system makes use of three distinct technologies: speech recognition, IVR, and mouse click events. As an extra layer of security, speech recognition is also employed for user verification. The initial part of this system is the registration process. The user's information will be gathered by this module, which will prompt them to provide their information. In the second section of the programme, the user will be prompted to provide their login credentials. This is done via the use of voice instructions. Accessible email for the visually impaired was given in paper [9]. The system is divided into three distinct parts: the Mail Programming Module (which includes the functions Compose, Mailbox, and Sent Mail), Text-to-Speech (TTS), and Speech-to-Text (STT). In this system, developers may use a speech-to-text API powered by neural network models provided by Cloud-based speech-to-text. Stronger security is achieved than in conventional systems because to the employment of several Hashing Algorithms (MD5, SHA) to transform passwords and other credentials into hash functions. They propose an accessible electronic mail system for the visually impaired in their publications [10]. The Viterbi Method, a text-to-speech converter, and a speech-to-text converter are all discussed. Algorithmically, the best word is selected as soon as the user types it in, and the spoken word is matched with the anticipated one. A user must first create an account before they can begin exploring the site. Some of the problems with the old system have been fixed in this new one. The system's efficacy decreases as the number of errors increases, and the Viterbi algorithm requires more space. Voice-Based Systems for the Visually Impaired on Desktop and Mobile Devices was presented by Payal Dudhbale and colleagues [11]. The main parts of the system proposed in this paper are detailed below. First, the recipient's inbox is scanned by the Gmail system. Simple Real-Time Synchronisation (RSS) 3. Take in some tunes The Red Book Reading Programme, Version 4 Using the device's browser, you may search for files and directories. The authors of the [12] article proposed Tri Mail, an accessible and usable blind-friendly mail client, to tackle the difficulties of doing email-related tasks on a smartphone. The make-up of Tetra Mail users: Tetra Mail, an email client tailored to the needs of the visually impaired, was developed utilizing principles from the HCI framework. Even if you've never used a touchscreen before, Tri Mail's intuitive layout will make you feel right at home. In their research [13], Saurabh Sawant and colleagues propose a method for making email more accessible to those with disabilities or little literacy. This technique has supplanted the use of screen readers and Braille keyboards in IVR systems. We did some text-to-speech and voice-to-text conversions there. Voice inputs are utilized for a number of purposes as well. To sign up, I entered my email address and password. Make use of PHP's built-in support for sending email, known as PHP mailers. It's an email-sending software suite. The user's inbox must be retrieved from the IMAP server. Knuth-Morris-Pratt Algorithm is used to search through email inboxes. In conclusion, the whole system environment is controlled by

voice commands, and all user input needs are met by the system. We can't use other email providers, like Yahoo, since this solution requires utilizing Gmail as a host server.

B. Objectives

The purpose of voice-based email is to enable the visually impaired to send and receive emails just as efficiently as sighted people do, using all the same tools at their disposal. Users will be prompted to execute various things by saying certain keywords into the system. To wit: peruse; transmit; create; etc. A voice mail system allows a blind person to quickly access their email. The application's foundation lies in the employment of speech-to-text and text-to-speech translators, making it possible for users to manage their email accounts entirely hands-free. The user will be asked by the system to do various tasks via voice commands, to which the user will respond in kind. With the use of Speech to Text, commonly known as Automatic Speech Recognition, writing emails becomes a breeze. The Text to Speech feature reads aloud the sender's name, the subject line, and the message content of receiving emails. The computer system will read the data to you. As a result, those who are visually impaired might rely less heavily on email-related tasks.

C. Scope of work

A voice email system is a computerized method of exchanging and receiving communications without the need of written text. The main beneficiaries of this technology are the visually impaired, since all government paperwork and information are now sent electronically. The most notable advantage of this technology is that the user may dispense entirely with the keyboard and respond only by voice. The goal of this method is to make life easier for the visually impaired while also contributing to the growth of digital India.

D. Problem Definition

It used to be difficult for blind people to use the system to send emails. Many individuals, especially the blind, found it hard to send and receive emails because of accessibility issues. Due to the plethora of email formats and storage options, they were able to make regular use of email. Visually impaired people prefer to communicate using audio emails. A voice email system allows those who are visually impaired to access their inbox quickly and easily. Keyboard and mouse shortcuts are not required to be learned. They can easily follow along with audio instructions. People who are visually impaired, such as the handicapped or the blind, may benefit from this. It's easy enough for regular folks to utilize.

E. Existing system

Most of the current infrastructure is dedicated to developing a voice-based email system that will allow persons who are blind or have low vision to utilize email services without having to learn how to use a computer. IVR, or interactive voice response, is the foundation of the whole system. However, it relies on mouse click events and requires the user to memories certain keyboard shortcuts in order to do some tasks. The system's primary shortcoming is that messages are sent through recording, however this is not an issue when communicating with persons with similar sensory impairments. However, a recorded message is unnecessary if the content can be read by the intended audience. In a workplace or public setting where others may readily see the content, individuals may feel uneasy about using a recording device. Due to its lack of audible feedback and limited functionality, this technology is not accessible to those with visual impairments.

III. Research Methodology

The approach of the system will make it extremely easy for persons with visual impairments to use email. The authors of the system suggested it with the goal of making it available to as many people as possible. In this setup, the computer will prompt the user to take action. The user will then be guided through the registration process using voice commands after completing the required registration form. After registering, a person may log in by saying their password aloud when requested. After the username and password have been transformed from voice to text, the user will be verified by checking the information against a database.

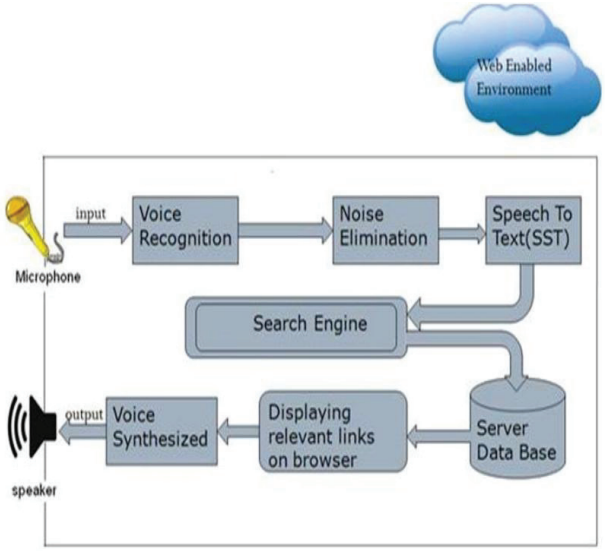

Fig. 1. block diagram for proposed model

In figure. 1, you can see the five individual parts that make up the email creator. The user's voice is being processed, a comparison is being made with a previously recorded sample, text is being written, the output text is being verified, and an email is being sent. The user provides instructions by talking to the device. The programme processes the voice after receiving the input from the hardware. The received voice input is compared to the sample voice in the database during processing. Google's WebKit API can transcribe spoken words into text. The voice command is converted into text, which is then entered into the appropriate text field. The user may check the text that was generated by speaking into the attached headphones and make any required changes. After you approve, the programme will send the email straight from the outbox.

The user is required to provide voice samples during registration. The voice clips are structured as directives. The user's voiceprint will be utilized for further verification. The user gives voice commands to the device through the built-in microphone or an externally connected microphone. When a voice command is received, the microphone feeds that information into the composer's in-built HTML. Simple voice commands control all of the system's functionalities. Therefore, the user doesn't have to worry about using the keyboard or learning any special shortcuts.

Google's WebKit API was utilized in the development of the app to facilitate speech detection and processing. The API receives microphone input and basically does two sequential tasks. The first step is the transcription of spoken words into written text, and the second is verifying the identity of the speaker. The suggested system employs a voice synthesizer built on top of the Web speech API. This speech synthesizer can transcribe spoken words or phrases back into text. Voice processing is carried out by use of interfaces such as speech recognition interface and speech synthesis interface. The processing of the voice includes identifying its location, velocity, consistency, and language. The final output of the speech processing is then entered into the database as a string.

The interface verifies the validity of a voice command by comparing it to a library of previously recorded voices. Speech recognition software: When instructed, the speech synthesizer will respond to the following voice instructions. Properties such as pause, pending, speaking, resume, cancel, getVoice, etc. are included into the speech synthesis interface.

Saying "send email" out loud will transmit the message you have written. The user may preview the email before sending it. As the sender address, the programme uses the user's registered domain (such as @abc.com/org). Inbox scan: Saying "read email" to your smart speaker will have it read aloud to you. The email will play over the device's speakers or headphones.

The process of using the app begins with logging in. After confirming the user's login details, the next step is user recognition. The software compares the user's voice to a database of previously recorded voices to ensure accuracy. When an application's internal processes reveal an unauthorized user, the app immediately prompts the user to log in. Whether the user wants to "compose email" or "read email," the apps are ready to respond to their voice commands. If the user inputs "compose email," the programme will validate the input and launch the user's default email client so they may begin composing an email. In addition to "edit to," "edit subject," and "edit body," you'll need to use your voice to finish writing the email. The STT interface converts spoken word to digital form for use in other applications. When finished writing an email, the user may go back and read it by selecting the "read email" option. A text-to-speech interface then reads aloud the user's prepared email. When finished, a "send email" voice command sends the message to the specified recipient. The interface uses text-to-speech technology to read the user's inbox in response to the "read email" command. The user has the option to log out of the programme.

IV. Discussion

A. Evaluation

The goal of this survey is to improve the usability of email for the visually impaired by developing an autonomous mailing system. Some of the challenges that blind individuals have had in the past in accessing email will be mitigated by this approach. We describes an way with the idea of utilizing keyboard shortcuts altogether, and screen readers may assist reduce the mental burden of knowing them. In addition, the requirement for a keyboard is removed, so even a person who is not very savvy may use it without issue. Follow the IVR's instructions to access the appropriate service. In other cases, though, the user will be asked to provide information through voice inputs. It has been noted that India is home to over 70% of the world's blind population. In this work, we present the voice mail infrastructure that allows the visually impaired to utilize the OS's email and multimedia features with ease. In addition, the blind won't have to exert as much mental effort trying to memories and write individual letters because to its design. In addition, it aids the disabled and the uneducated.

B. Applications

This proposal is being made for the greater good of society. The goal of this initiative is to make it easier for the visually impaired to use the internet and participate in India's expanding digital economy. People who are blind or illiterate, who also deserve a fair shake in society, will benefit from the success of this effort as well.

V. Conclusion

This email service is designed to be user-friendly for people of all ages. This method allows the visually impaired to do things like send and receive emails without the usual difficulties. If this effort is successful, it may encourage other developers to create tools for the visually impaired and the blind. The applications of this technology are far-reaching. The system has a lot of room for improvement, including the addition of other languages and the ability to retrieve old messages that were marked as spam or trashed. The system may be made more flexible and reliable by including a sign language system. This approach may also be used to android programmes.

A. Future Scope

Images, documents, and media may be added as attachments to the programme to enhance its usefulness. Credentials supplied over a link may be guaranteed using encryption and decryption methods. Many other actions, including as archiving, reporting, replying, forwarding, etc., may be accomplished using a variety of commands. Integration with an automated email response system is also possible.

References

[1] T. Dasgupta, A. Anuj, M. Sinha, R. Ghose and A. Basu, "VoiceMail architecture in desktop and mobile devices for the Blind people," 2012 4th International Conference on Intelligent Human Computer Interaction (IHCI), 2012, pp. 1-6, doi: 10.1109/IHCI.2012.6481791.

[2] P. A. Tiwari, P. Zodawan, H. P. Nimkar, T. Rotke, P. G. Wanjari and U. Samarth, "A Review on Voice based E-Mail System for Blind," 2020 International Conference on Inventive Computation Technologies (ICICT), 2020, pp. 435-438,doi: 10.1109/ICICT48043.2020.9112539.

[3] R. Iglesias et al., "Computer graphics access forblind people through a haptic and audio virtual environment," The 3rd IEEE International Workshop on Haptic, Audio and Visual Environments and Their Applications, 2004, pp. 13-18, doi: 10.1109/HAVE.2004.1391874.

[4] S. Noel, "Human computer interaction(HCI) based Smart Voice Email (Vmail) Application -Assistant for Visually Impaired Users (VIU),"2020 Third International Conference on Smart Systems and Inventive Technology (ICSSIT), 2020,pp.895-900,doi: 10.1109/ICSSIT48917.2020.9214139.

[5] J. Wang, P. Ren, M. Huang and L. Guo, "The design and implementation of voice mailbox system based on VoIP," 2015 6th IEEE International Conference on Software Engineering and Service Science (ICSESS), 2015, pp. 611-614, doi: 10.1109/ICSESS.2015.7339132.

[6] “Voice Based System in Desktop and Mobile Devices for Blind People”. In International Journal of Emerging Technology and Advanced Engineering (IJETAE), 2014

[7] Voice Based Search Engine and Web page Reader”. In International Journal of Computational Engineering Research (IJCER)

[8] Sharma, J. and Sharma, J., 2016. Voice Based Mail System. [online] Scribd. Available at: based-mail-system> [Accessed 29 June 2020].

[9] Amritha Suresh, Binny Paulose, Reshma Jagan and Joby George, "Voice Based Email for Blind". International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET) - Volume 2, Issue 3, 2016, pp. 93-97.

[10] 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, pp. 166-170.

[11] Pranjal Ingle, Harshada Kanade and Arti Lanke, "Voice Based email System for Blinds". International Journal of Research Studies in Computer Science and Engineering (IJRSCSE)- Volume 3, Issue 1, 2016, pp. 25-30.

[12] Bishal Kalita and Santosh Kumar Mahto, "Voice Based Email for Blind People". International Journal of Engineering Science and Computing (IJESC) - Volume 9, Issue 10, October-2019, pp. 23789-23799.

[13] Saurabh Sawant, Amankumar Wani, Sangharsh Sagar, Rucha Vanjari and M R Dhage, "Speech Based E-mail System for Blind and Illiterate People". International Research Journal of Engineering and Technology (IRJET) - Volume 05, Issue 04, April-2018, pp. 2398-2400