ABSTRACT

Communication is a fundamental aspect of human interaction, enabling the exchange of ideas, emotions, and information. However, individuals with sensory disabilities, such as deafness, muteness, and blindness, often face significant challenges in expressing themselves and connecting with others effectively. In recent years, advancements in technology have opened up new possibilities for improving communication and enhancing the quality of life for these individuals.

This project aims to develop a smart communication system that enables interaction between deaf, dumb, and blind individuals and the wider community. For the dumb, speech-to-text module is developed through which the deaf can sense the words through the text on the screen.

For the dumb, a speech recognition module is developed to convert spoken language into written or visual form, enabling effective communication with non-dumb individuals. Additionally, a text-to-speech synthesis system assists in conveying messages or information verbally.

For the blind, a combination of computer vision, natural language processing, and tactile interfaces is utilized to facilitate communication. The system enables blind individuals to read and comprehend written content. Furthermore, voice assistants provide audio responses to enhance the blind individual's understanding and engagement.

The smart communication system incorporates user-friendly interfaces, such as speech-to-text devices, and image-to-speech and text-to-speech which seamlessly integrate into the daily lives of individuals with disabilities. Moreover, the system can be extended to mobile applications, enabling remote communication and accessibility.

Through this project, the barriers faced by deaf, dumb, and blind individuals in communication are significantly reduced, and empowering them to participate actively in social, educational, and professional environments. The development of this smart communication system has the potential to transform the lives of individuals with disabilities, facilitating their integration into society and promoting equality and understanding among all individuals.

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LIST OF FIGURES

Chapter 1

INTRODUCTION

In this technological epoch with the advancement in information and communication technology. The hardest form for the communication between deaf dumb people and the extraneous world to provide the improved and easy lifestyle of dumb, deaf and blind people the proposed system is designed and developed. Approximately 290 million people are visually impaired in the world. Out of 290 million people, 60millions are blind and 255millions have low vision. Blind people can only read Braille script. To improve the learning process of blind people this innovative device is developed in such a way that it takes an input image and convert the image not only into text but also into speech form. By using this device, a blind person can easily be able to read the text. In this digital era about approximately 9.1 billion peoples are deaf and dumb. These deaf, dumb and blind peoples face plenty of problems in communication with normal people in daily life. These peoples are not involved with this digital world because of their disabilities.

Therefore, a large number of communication gap still exists between the deaf, dumb, blind and world. In spite of the huge number of deaf and dumb people very little research is done to overcome the communication obstructions. The proposed system helps ordinary and deaf dumb people to communicate with each other effectively and smoothly. To resolve these barriers with visually and vocally impaired people, the proposed system is designed

1.1 Text-To-Speech

Text-to-Speech conversion technique is helpful for the vocally disabled people who do not have the ability to speak like other people normally. The dumb people convey their message or information in text format which is converted into voice signals. The converted voice signal is given as output. The output is read out through the earphone or speaker, shown in Fig 1.1.

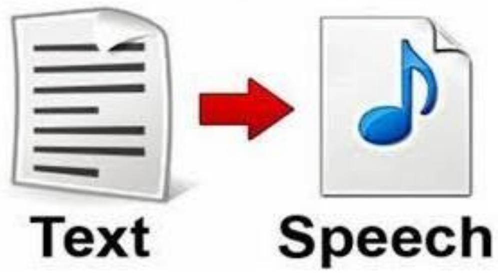


Fig 1.1 Text to Speech.

1.2 Speech-to-Text

This conversion technique is to help people with inability to hear or cannot identify the voice. To help them, the proposed model is equipped with a speech to text converter. It translates the voice of normal people into text. The microphone is used to take voice as input and conversion to text format as shown in the Fig 1.2.

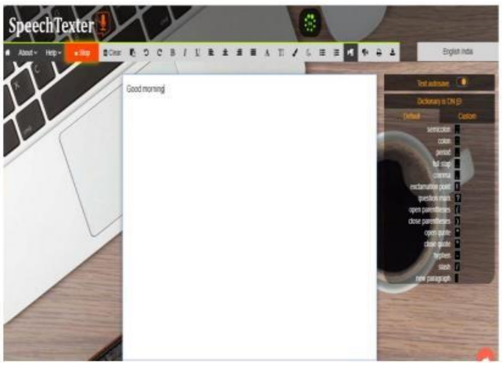


Fig 1.2 Speech to Text.

1.3 Image to speech

The image to speech conversion is developed for people who are not able to see and cannot analyze text. To aid blind persons, we have associated the Logitech digicam to record the image using OpenCV software. The recorded image as shown in Fig 1.3 is transformed to text with help of Tesseract OCR.

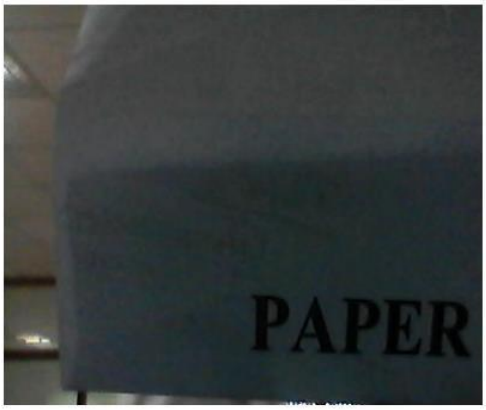


Fig 1.3 Image to Speech.

Chapter 2

LITERATURE SURVEY

K.NaveenKumar, P.Surendranath & K.Shekar [1] : This paper work focuses on finding a technique that aids the visually impaired by letting them hear what is represented as text, This paper also provides a way for the people with Hearing impairment to read which is in audio form by speech to text and we also provides a way for the vocally impaired to represent their voice by the aid of text to voice. All these solutions were modulated in single system using prevailed 2005, 3 boys UN agency have passed the examination wasn't appointment as IAS officers simply because they're deaf. This should not continue. They face several issues in their day-to-day life like transportation, Communication, level of dependency, social stigma and lots of things. The terribly initial drawback is suppression of Deaf individuals raising voice for his or raspberry-pi. The keywords used in this project are Raspberry-pi, Assistive device, Tesseract Optical Character Recognition OCR speak, Open CV, Google API. The advantage is that the device can be taken away easily and is of loss weight.

SunitaV.Matiwade, Dr.M.R.Dixit [2] : This paper aimed to growing an digital support device which could translate sign language into text and speech so that it will make the communiqué take place among the mute groups with the overall public. The hidden Markov model toolkit (HTK) hidden Markov model toolkit (HTK) keywords used in this challenge are Hand Gloves, signal language, flex Sensor, ARM7TDMI, LM386, voice section. This undertaking have recognized hand gesture of sign language for alphabet A to Z with logic levels as per price of flex sensor. This machine is used for verbal exchange between deaf and dumb people with regular person.

Piyush Patil, Jayesh Prajapat [3] : This paper is to make bigger an advanced technique of verbal exchange for deaf human beings with the assist of IOT .This gadget using CNN could make right use of recent technology that is based totally on Embedded Linux board named Raspberry Pi with an brought advanced function of changing speech to text in Real Time. Normal character will speak into raspberry pi device and it will stumble upon the sound using speech reputation module. After that the Speech will be transformed into textual content and sent to the deaf character's Mobile Application by the usage of Wi-Fi, Bluetooth or Cloud Server according to the situation.

Anish Kumar, Rakesh Raushan, Saurabh Aditya, Vishal Kumar Jaiswal, Mrs. Divyashree Y.V. [4]: This paper provides a method for a blind man or woman to study a text and it can be carried out through shooting an photograph via a camera which converts a textual content to speech (TTS). It presents a way for the deaf human beings to read a text by using speech to textual content (STT) conversion technology. Also, it gives a method for dumb people using textual content to voice conversion. The gadget is provided with four switches and every switch has a specific function. The blind people can be capable of examine the words using by Tesseract OCR (Online Character Recognition), the dumb people can speak their message through textual content with the intention to be examine out by way of speak, the deaf human beings can be able to listen others speech from text. All these functions are implemented with the aid of the use of Raspberry Pi. The keywords used for this challenge are Raspberry Pi, Tesseract OCR (Online Character Recognition), speak, Speech to text (STT), Text to Speech (TTS).

Kanwal Yousaf, Zahid Mehmood, TanzilaSaba, AmjadRehman, Muhammad Rashid, Muhammad Altaf,and Zhang Shuguang [5] : The proposed software, named as vocalizer to mute (V2M), uses computerized speech recognition method The hidden Markov model toolkit (HTK) is used for the process of speech recognition. The software is likewise incorporated with a 3D avatar for imparting visualization support. To recognize the speech of Deaf-mute and convert it right into a recognizable shape of speech for a ordinary person. The quantitative and qualitative analysis of consequences also found out that face-to-face socialization of Deaf-mute is progressed by the intervention of mobile technology. The participants also suggested that the proposed mobile software can act as a voice for them and they can socialize with pals and family by way of using this app.

Amanpreet Singh Khajuria, Sonakshi Gupta [6]: This interacting device is a microcontroller-based machine which is largely outline for lessening the verbal exchange area between dumb and regular people. This machine using CNN can be therefore configured to paintings as a smart tool. In this paper, at mega 328 microcontroller, voice module, LCD show and flex sensors are utilize. The tool considered is essentially residing of a glove and a microcontroller-based system. Data gloves are used to come across the hand motion and microcontroller-based system will interpret the ones few man oeuvre into human region voice. The statistics glove is supplied with 4 flex sensors located on the glove. This machine is beneficial for dumb people and their hand man oeuvre will be transformed into speech signal due to the date glove worn on the hands. The Key words used right here are Gesture Remembrance; Data forearm band; Flex Sensor; Adriano UNO; At mega 328; Voice module.

Prof. Prashant G. Ahire, Kshitija B. Tilekar, Tejaswini A. Jawake, PramodB. Warale [7]: International Conference on Computing Communication control and automation.The system is mainly consists of two modules, first module is drawing out Indian Sign Language(ISL) gestures from real-time video and mapping it with human-understandable speech. Accordingly, second module will take natural language as input and map it with equivalent Indian Sign Language animated gestures. Processing from video to speech will include frame formation from videos, finding region of interest (ROI) and mapping of images with language knowledge base using Correlational based approach then relevant audio generation using Google Text-to-Speech (TTS) API di.The other way round, natural language is mapped with Equivalent Indian Sign Language gestures by conversion of speech to text using Google Speech-to-Text (STT)API, further rmapping the text to relevant animated. The keywords are Correlationa lbased approach, Region of Interest, Region growing, STT, TTS, ISL.

Suganya R, Dr.T.Meeradevi [8] :The proposed add this paper is to implement a system without handheld gloves and sensors and by capturing the gestures continuously and converting them to voice and the other way around , thus making the communication simpler for deaf and dumb people by a handheld embedded device in conjunction with the hardware setup. The effectiveness of the work is verified under MATLAB environment and further in future dedicated to vocalizer to mute (V2M) voice output are becoming to be produced a bit like the text and thus the gesture images captured. The keywords used here are communication aid, signing , MATLAB.

Nikita P. Nagori, Mrs.Vandana Malode [9]: Kinect sensor is that the first of its kind; it's used on a large-scale, depth camera. it's device which may view in 3Dimensions.Microsoft made the device mainly as a game controller and is operated by the businesses own software for analyzing its 3Ddata, including proprietary computation for, scene analysis, feature tracking, motion tracking, gesture recognition and skeletal tracking. The effectiveness of labor is completed in matlab and verified using SVM. Kinect using Matlab could even be an honest solution for converting signing to speech and this is often the thought of this paper which is described here in details. The keywords used here are signing, Gesture Recognition, MATLAB, Microsoft Kinect.

Aruljothy.S, Arunkumar.S, Ajitraj.G, Yayad Damodran.D, Jeevanantham.J, Dr.M.Subba [10] :In this project, a method from NLP is proposed that makes the use of hand gestures for recognition of Indian sign language. A sign language consists of various gestures formed by physical movement of body parts i.e., hands, arms and countenance. Hand gesture recognition system provides us an innovative, natural, user friendly way of interaction with the pc which is more familiar to the citizenry. The communication between the dumb and visually impaired person are made only by their expressions and their hand gestures. This project presents various methods of hand gesture and signing recognition for blind and dumb person. The keywords used here are Gesture recognition, sign language, Image processing technique

Chapter 3

SYSTEM ANALYSIS

3.1 Existing System

In the earlier days, blind people can only read **Braille script**. Braille is a tactile writing system used bypeople who are blind. It is traditionally written with embossed paper. Now-a-days Braille user can read computer screens and other electronics support using refreshable Braille displays.

Fig 3.1 Braille System.

In Braille system as shown in Fig 3.1, the language will go from left to right across the page, just like printed words. The symbols which represent each letter are prepared up of between one and six dots based on the figure ofsix dots which we would pick up on a dice or a domino [1]. Later in the evolution there exists screen readersystem which is a computer program that enables the blind masses to interpret what is shown on the screen through speech.

The next technology which is beneficial to the BVI is **Finger Reader** shown in Fig 3.2, is a wearable device in finger.It helps the BVI to access the plain printed text. People who ware this device, scan a text line with theirfinger and in a result, they get audio feedback of the words and also a haptic sense of the layout. Thesesenses may be the start or end of the line, new line and so on. It also alerts the reader if he moves awayfrom the baseline thus it helps him maintain straight scanning.

Fig 3.2 Finger Reader

As shown in Fig 3.3, Deaf and dumb people used **sign language** to communicate with outside world in masses. Sign languageis a linguistic process which is employed for communication among the normal people and differently abled people using gestures. Traditionally, gesture recognition method was divided into two categories namely vision-based and sensor-based method [5]. In vision-based method, the computer camera is an inputdevice for various gestures of hands and figures. In sensor-based systems, gloves are used which can achieve the accurate positions of hand gesture.

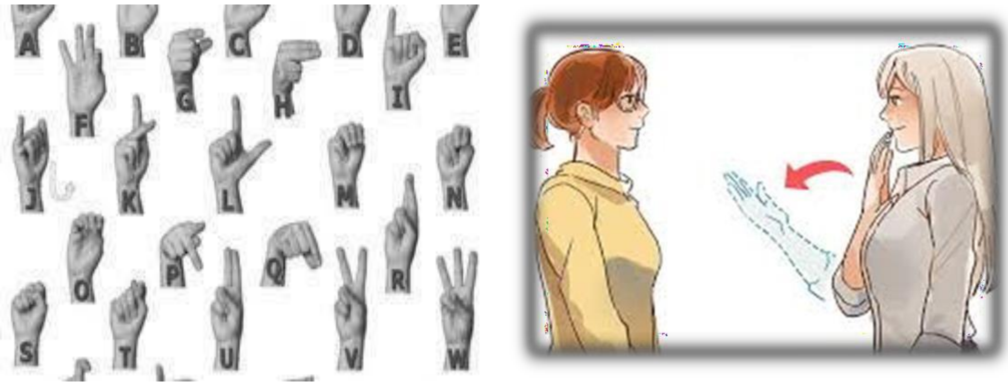


Fig 3.3 Sign Language

Lots of studies have been done on sensor-based approaches like gloves, helmets etc. But wearing it continuously is not possible [3]. Therefore, further work is concentrated on image-based approaches.

3.2 Disadvantages of Existing System

- Blind people want the assistance of neighbors to use **braille script** which is time consuming and **fingerreader** is not a language independent system and limited for English language only.
- It is not possible for all the masses to learn the **sign language** to understand whatever is said through gestures. Therefore, the communication gap still exists between deaf and dumb people
- Dumb people can simply tilt the message by **sign language** which could not be understandable by other people.
- System consisting solution for all the three disabilities does not exist.

3.3 Problem Statement

To develop a common wearable communicating device for blind, deaf and dumb person using text to speech , image to speech and speech to text conversion using Tesseract OCR.

Chapter 4

SYSTEM ARCHITECTURE

4.1 Module Description

A module description provides detailed information about the module and its supported components, which is accessible in different manners as shown in Fig 4.1. The included description is available by reading directly, by generating a short html-description, or by making an environment check for supported components to check if all needed types and services are available in the environment where they will be used.

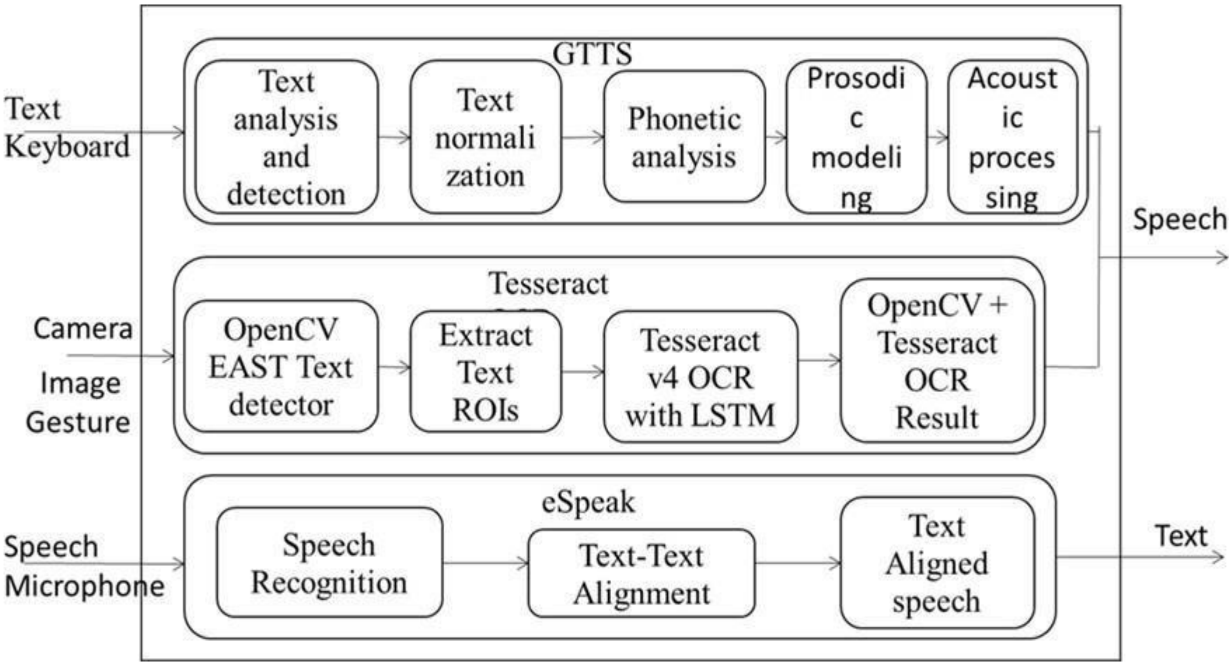


Fig 4.1 System Architecture

4.1.1 GTTS

GTTS (Google Text-to-Speech) is a Python library and CLI tool to interface with Google Translate text-to-speech API. We will import the GTTS library from the gtts module which can be used for speech translation. The text variable is a string used to store the user's input.

4.1.2 Tesseract OCR

Python Tesseract is defined as an optical character recognition (OCR) engine for a variety of operating systems. It is the process of electronically extracting text from images and reusing them in a various no of applications, including document editing and text searches.

4.1.3 eSpeak

The program 'espeak' is a simple speech synthesizer which convert written text into spoken voice Install espeak and the python-espeak package in Ubuntu with apt-get. Next, download the Russian dictionary pack from http://espeak.sourceforge.net/data/. Download the version that matches your installed version. If you need to check what version you have installed use apt-cache.

Chapter 5

IMPLEMENTATION

5.1 Flowchart of the proposed methodology

5.1.1 Text-to-Speech

Text-to-Speech conversion technique is helpful for the vocally disabled people who do not have the ability to speak like other people normally. The dumb people convey their message or information in text format which is converted into voice signals. The converted voice signal is given as output. The output is read out using earphone or speaker as shown in Fig 5.1.

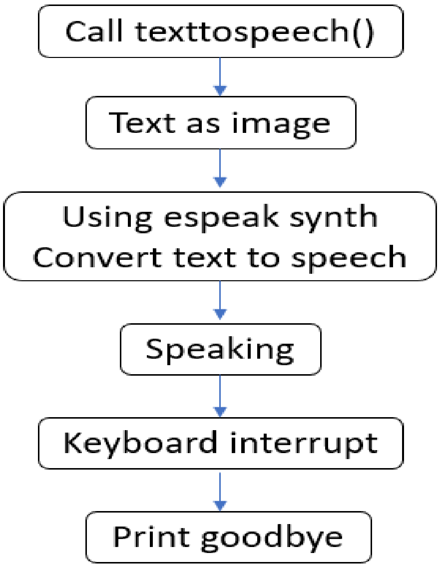


Fig 5.1: Data flow diagram of Text-To-Speech

5.1.2 Speech-to-Text

This conversion technique is to help people with inability to hear or cannot identify the voice. To help them,(from the Fig 5.2) the proposed model is equipped with a speech to text converter. It translates the voice of normal people into text. The microphone is used to take voice as input and conversion to text format is made using API.

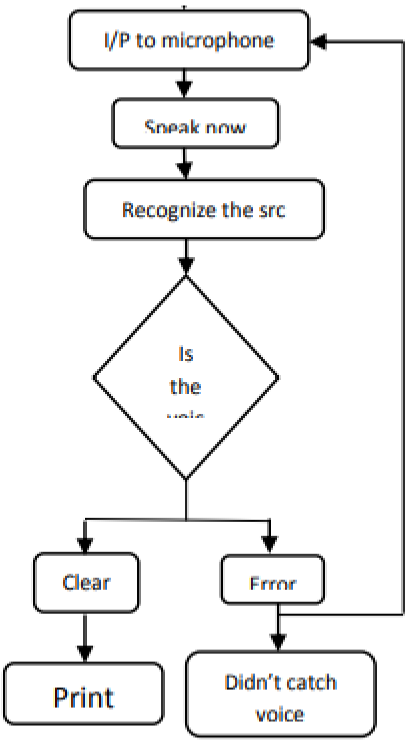


Fig 5.2 : Data flow diagram of Speech-to-Text

5.1.3 Image-to-Speech

This conversion technique is used to help people who cannot read normal text. In order to help blind people we have collected the images using OPENCV tool. The image is converted to text using Tesseract OCR .The text is read out using the speaker and it is also displayed on the screen as shown in Fig 5.3 .

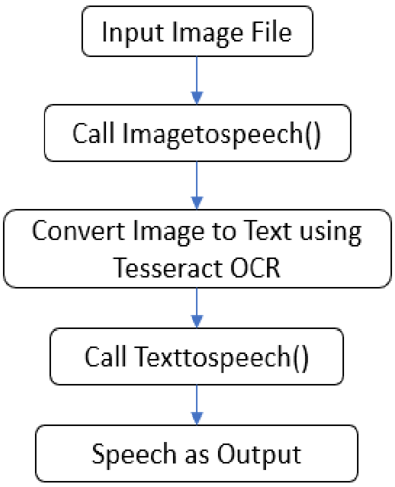


Fig 5.3 : Data flow diagram of Image-to-Speech

5.2 Steps involved in proposed methodology

Proposed methodology consist of the following steps.

5.2.1 Text-to-Speech

- Step 1: Start
- Step 2: Call the function Text-to-Speech ().
- Step 3: Enter the text/file.
- Step 4: Convert text to speech using pyttsx3.
- Step 5: Voice is generated
- Step 6: Stop

5.2.2 Speech-to-Text

- Step 1: Start.
- Step 2: Call the function Speech-to-Text ().
- Step 3: Audio input is given.
- Step 4: Recognize the speech.
- Step 5: Check, if the voice is perfect.
  - The text is displayed.
- Step 6: Recognize it as error and resend the voice, go to step 1.
- Step 7: Execute the above steps recursively, until correct output is obtained.
- Step 8: Stop.

5.2.3 Image-to-Speech

- Step 1: Start
- Step 2: Call the function Image-to-Speech().
- Step 3:Provide the path for the image.
- Step 4: Convert image to text using Tesseract OCR.
- Step 5: Text is displayed on the screen.
- Step 6: Convert text to speech using gtts.
- Step 7: Voice is generated.
- Step 8: Stop

Chapter 6

METHODOLOGY

6.1 Collection of File Dataset

This dataset is a collection of text file samples for text-to-speech (TTS) conversion tasks. It is designed to facilitate the development and evaluation of TTS systems. The dataset covers various domains and includes a wide range of texts, such as news articles, book excerpts, and conversational speech. It is limited to English language.

Dataset Details:

- Size: 5000 samples (text file)
- Text Format: Plain text
- Speech Format: WAV or MP3 audio files
- Language: English
- Duration: Each speech sample is approximately 5-10 seconds long and above

6.2 Collection of Image Dataset

This dataset comprises a collection of paired images for image-to-speech conversion tasks. The dataset aims to facilitate the development and evaluation of models that convert visual information into spoken descriptions. It covers a diverse range of visual content for converting given image file to speech.

Dataset Details:

- Size: 5000 samples (image file)
- Image Format: JPEG or PNG
- Speech Format: WAV or MP3 audio files
- Language: English
- Image Resolution: Varied, ranging from 640x480 to 1920x1080 pixels
- Speech Duration: Each speech utterance is approximately 5-15 seconds long

6.3 Algorithms Used

6.3.1 Tesseract OCR engine

Tesseract OCR is a free software for optical character recognition (OCR) that can be used for various operating systems. It uses a process to electronically extract text from pictures and then, the converted text can be reused in multiple ways for document editing, text-to-speech conversion. OCR technique can be used for converting documents such as scanned papers, PDF files and captured images into editable data. Tesseract can be used on operating systems like Windows, Linux and Mac OS. The programmers are able to extract texts that are typed or printed from the images by making use of an API.

6.3.2 Text-to-Speech Synthesis

Text-to-speech (TTS) synthesis, also known as speech synthesis or speech generation, is the process of converting written text into spoken words. TTS systems use advanced algorithms and linguistic models to generate natural and human-like speech from textual input. Here is a brief overview of the text-to-speech synthesis process:

1. **Text Pre-processing:** The input text is first pre-processed to handle punctuation, capitalization, abbreviations, and other linguistic elements. It may involve tokenization, part-of-speech tagging, and other language-specific processing steps.

2. **Linguistic Analysis:** The pre-processed text is analysed to determine the linguistic structure and semantic meaning of the sentences. This step involves parsing the text to understand sentence boundaries, grammatical structures, and syntactic elements.

3. **Text-to-Phoneme Conversion:** The text is converted into a phonetic representation, which is a sequence of phonemes. Phonemes are the basic units of sound in a language. This conversion allows the system to determine the pronunciation of each word accurately.

4. **Prosody Modeling:** Prosody refers to the rhythm, intonation, and stress patterns in spoken language. TTS systems model prosody to add naturalness and expressiveness to the synthesized speech. Prosodic elements such as pitch, duration, and emphasis are generated based on the linguistic and contextual information in the text.

5. **Acoustic Modeling:** Acoustic models map the linguistic and prosodic features to acoustic parameters. These models are trained using large datasets of recorded speech to learn the relationships between the text and corresponding speech features.

6. **Waveform Synthesis:** The final step involves generating the waveform that represents the synthesized speech. There are different methods for waveform synthesis, including concatenative synthesis, where pre-recorded speech segments are combined, and parametric synthesis, where acoustic parameters are used to generate the waveform.

7. **Post-processing:** The synthesized speech may undergo post-processing techniques such as smoothing, noise reduction, and signal normalization to improve the overall quality and intelligibility of the output.

Chapter 7

RESULTS AND DISCUSSION

7.1 Dataset

The dataset consists of the files and the images which are used in the implementation of the project for result analysis. The results are based on the accuracy produced in the text-to-speech module and image-to-speech module.

In text-to-speech module input can be given in two ways :

(a) External Text file
(b) Text as input

In image-to-speech module the image files are used as the dataset. The output will be based on the text contained in the image file.

Table 7.1: Test cases for Result Analysis

TEST CASES	EXPECTED OUTCOME	ACTUAL OUTCOME	RESULT
Text to Speech	Audio for Blind	Audio for Blind	Passed
Image to Speech	Audio from image for blind & dumb	Audio from image for blind & dumb	Passed
Speech to text	Text for deaf	Text for deaf	Passed

Table 7.1: Test cases for Result Analysis

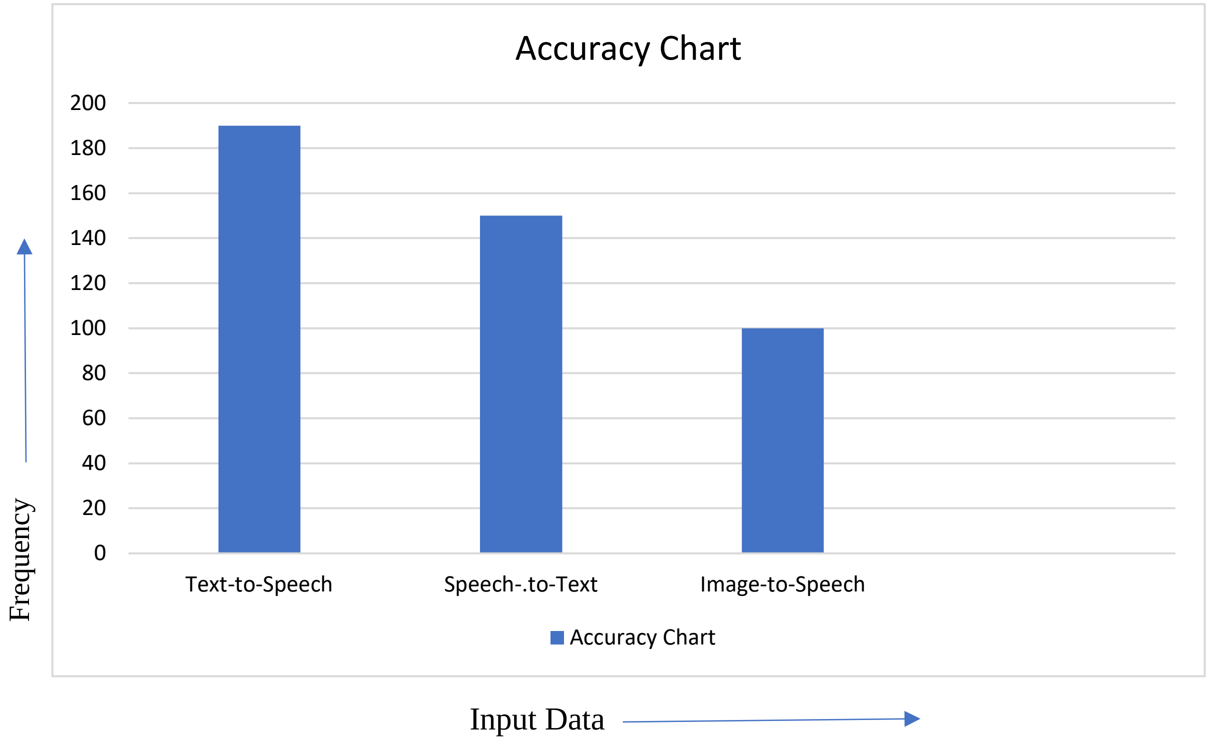


Fig 7.1: Visualization of accuracy chart

Chapter 8

CONCLUSION AND FUTURE WORK

8.1 Conclusion

"Smart Communication between Deaf, Dumb and Blind People" The system is an innovative and important initiative that seeks to bridge the communication gap between individuals with sensory disabilities and those without. The system harnesses modern technologies such as speech-to-text, text-to-speech, and sign language interpretation to facilitate real-time communication between people with sensory disabilities.

This system has significant potential applications in various domains such as education, healthcare, and everyday life. In education, the system can be used to provide real-time interpretation and translation of spoken language, making it easier for individuals with sensory disabilities to access educational materials. In healthcare, the project can help patients with sensory disabilities to communicate their healthcare needs and receive appropriate care.

Overall, this project has the potential to significantly enhance the lives of individuals with sensory disabilities, promote their inclusion and accessibility, social and economic empowerment. With further development and implementation, the project can make a significant contribution to advancing the cause of disability rights and social justice.

8.2 Future Work

- The system can be further followed with any other advanced devices by using simple coding language to get it less complicated.
- The system can be made handy by incorporating it into a mobile phone.
- System can be made more efficient for all languages.

APPENDIX – A

A.1 SNAPSHOTS

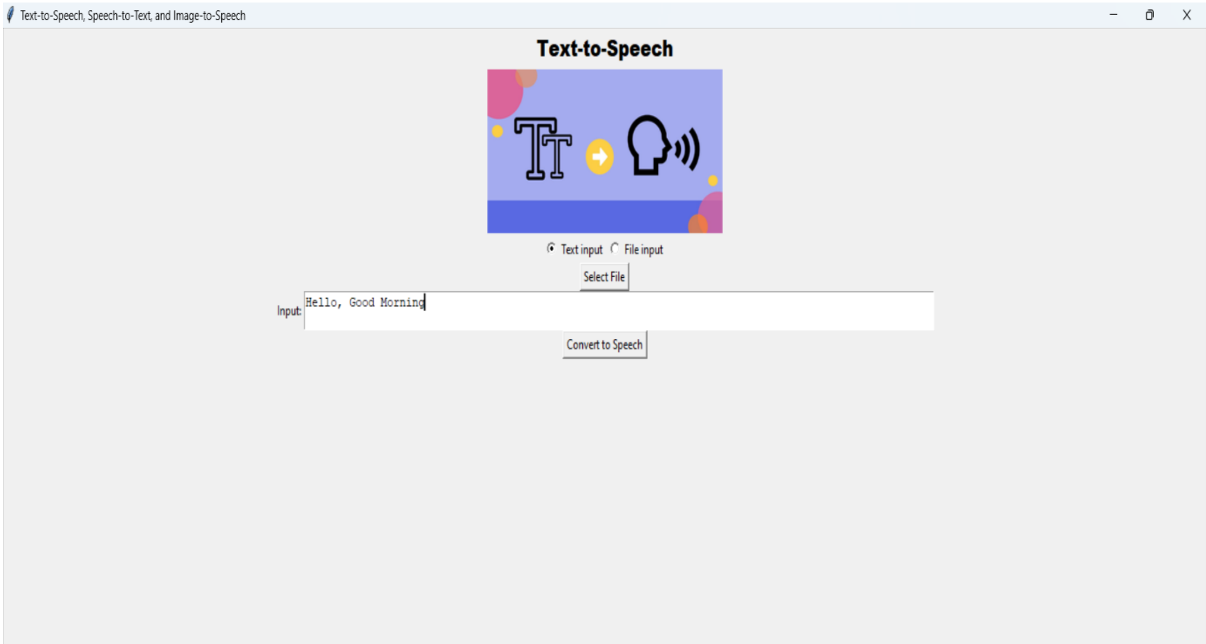


Fig A.1: Text-to-Speech Conversion

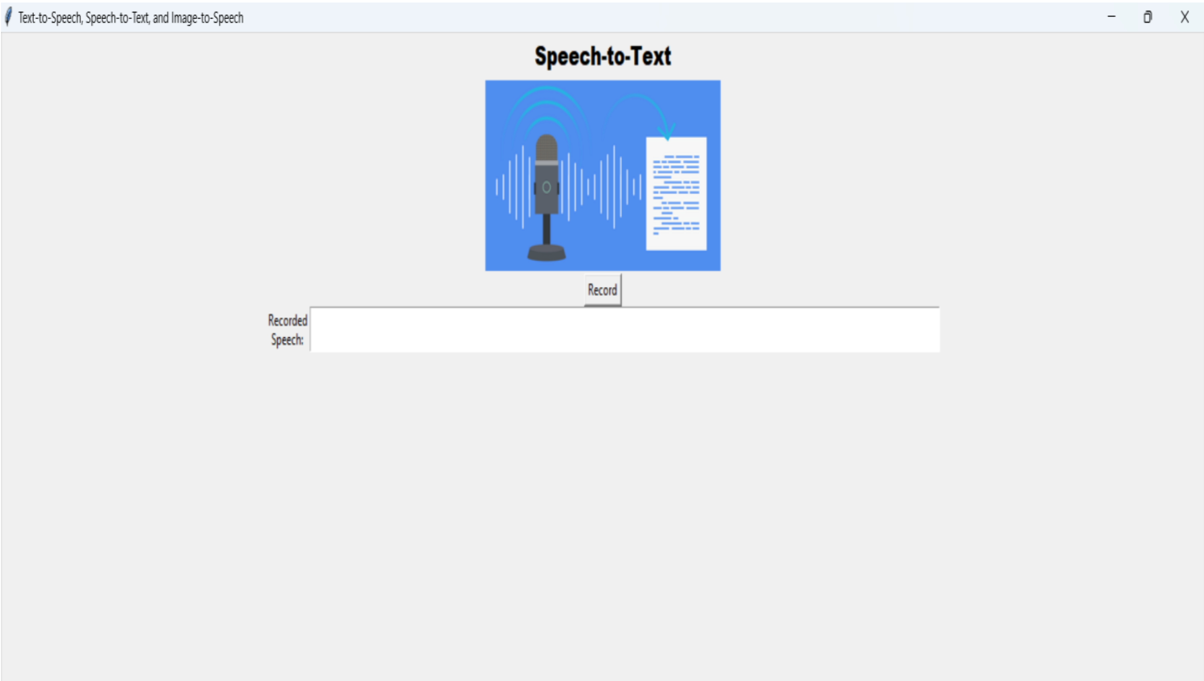


Fig A.2: Speech-to-Text Conversion

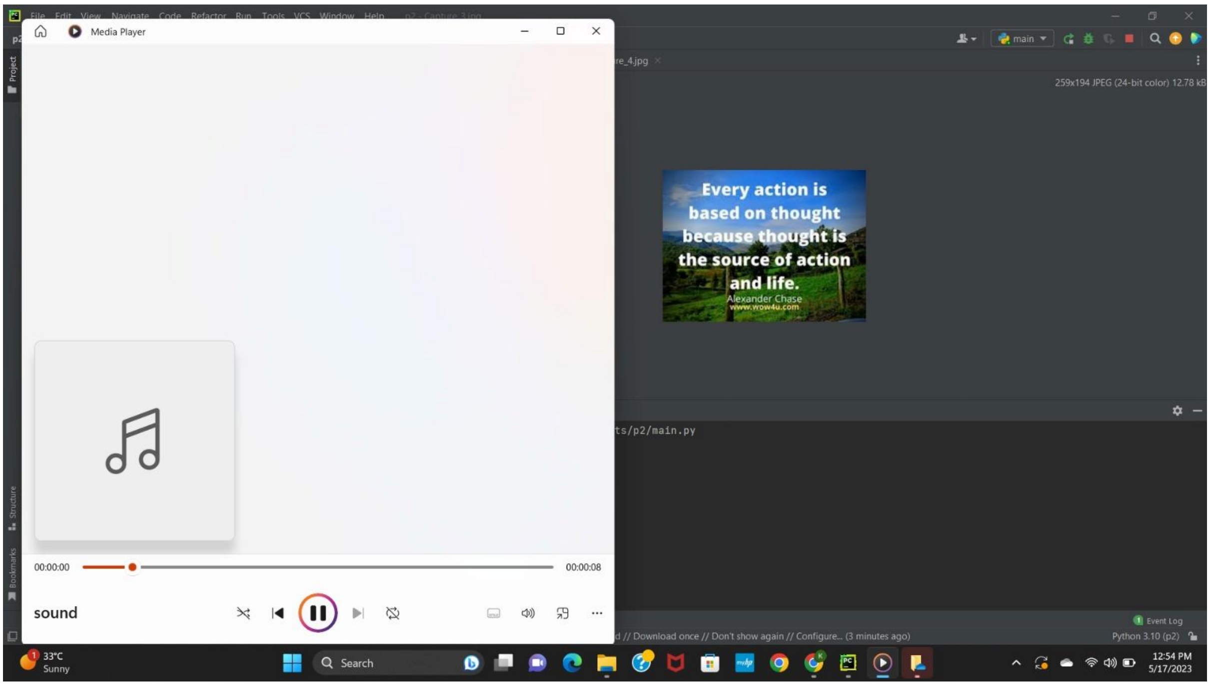
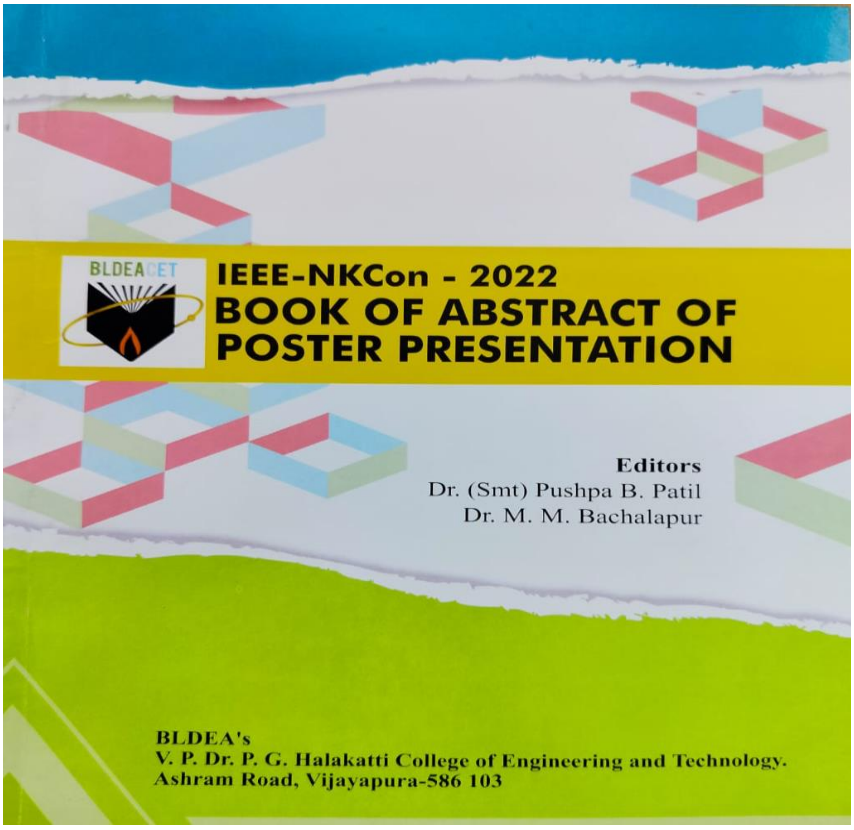
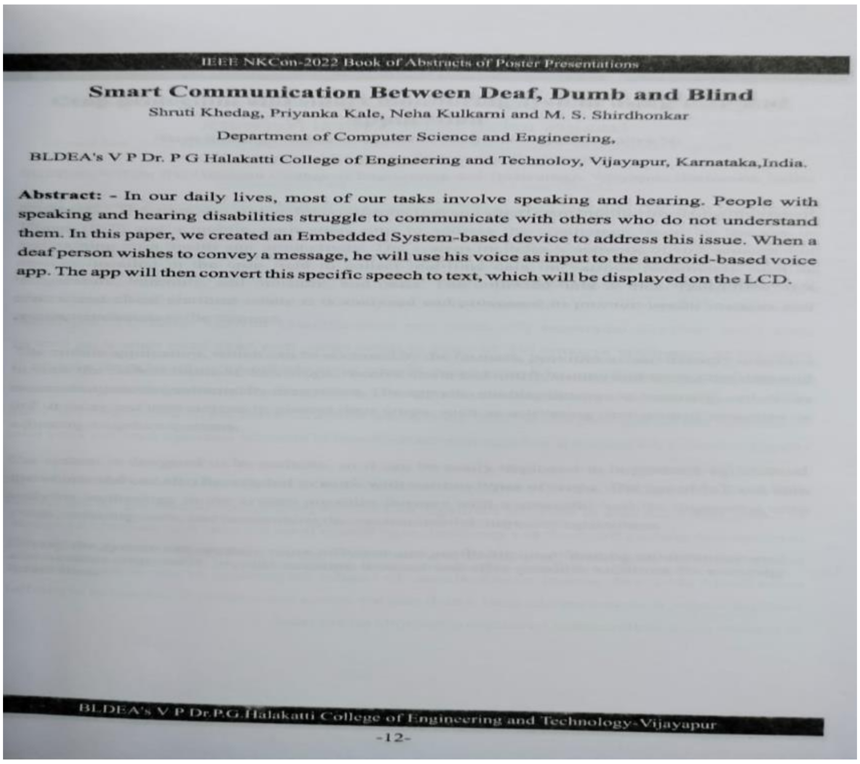


Fig A.3: Image-to-Speech Conversion

A.2 IEEE NKCon-2022 poster presentation and ISBN abstract published





IEEE NKCon-2022 Book of Abstracts of Poster Presentations

Smart Communication Between Deaf, Dumb and Blind

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BLDEA's V P Dr. P G Halakatti College of Engineering and Technoloy, Vijayapur, Karnataka,India.

Abstract: - In our daily lives, most of our tasks involve speaking and hearing. People with speaking and hearing disabilities struggle to communicate with others who do not understand them. In this paper, we created an Embedded System-based device to address this issue. When a deaf person wishes to convey a message, he will use his voice as input to the android-based voice app. The app will then convert this specific speech to text, which will be displayed on the LCD.

BLDEA's V P Dr.P.G.Halakatti College of Engineering and Technology-Vijayapur

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