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Towards many to many communications among blind, deaf and dumb users

Umme Athiya
athiya.naseem@gmail.com
Don Bosco Institute of Technology, Bangalore, Karnataka

Chaithra A. S.
aschaithra@gmail.com
Don Bosco Institute of Technology, Bangalore, Karnataka

Aishwarya R.
r.aishwaryyaa@gmail.com
Don Bosco Institute of Technology, Bangalore, Karnataka

Aswathi Rajesh
aswathirajesh2604@gmail.com
Don Bosco Institute of Technology, Bangalore, Karnataka

ABSTRACT

Humans are social creatures. We learn by connecting with those and around us, through communication. While people with hearing or visual impairments alone can find a way to share their thoughts with others and understand them, deaf blind people face a much more difficult communication task. Thus, project presents and implements the design, prototype and testing of a portable software and speaker device with a display for the communication between two people or also between visually impaired people.

Keywords— *gTTS, OCR (Optical Character Recognition), Pytesseract, pyttsx3, Google Trans, Contour Extraction, Thresholding, Background Elimination, Feature Extraction, LSTM*

1. INTRODUCTION

We live in a digital era with advancement in information and communication technology where everything is available in a fraction of seconds. Humans are social creatures. While people with hearing or visual impairments alone can find a way to share their thoughts with others and understand them, deaf blind people face a much more difficult communication task. Thus, solving the problems of people with Visual, Hearing and Vocal Impairment through a single supporting system is a tedious venture.

2. PROBLEM STATEMENT

2.1 Existing System

In the earlier days, blind people can only read Braille script. Braille is a type of scripting language where blind people read through the 6 raised dots sensed by their fingers. It is traditionally written with embossed paper. Now a days Braille user can read computer screens and other electronics support using refreshable Braille displays.

Traditionally, gesture recognition method was divided into two categories namely vision based and sensor-based method. In vision-based method, the input aided for this is capturing the image from the computer camera to analyze the position of the fingers. In sensor-based systems, it involves wearing an assistive device which help in obtaining the accurate finger positions and angles between them. Lots of studies have been done on sensor-based approaches like gloves, helmets etc. But wearing it continuously is not possible.

2.2 Proposed System

The work focusses on developing “intelligent sign language recognition using image processing” which deals with the computer system in which sign language is captured and processed and translated to speech. The work focusses on providing a way for the people with deaf and dumb person to visualize / read which is in audio form by speech to text conversion process and we also provides a way for the dim-sighted person to represent their input/ conversation by the aid of text to voice process. The proposed system influences its full concentration on finding a unique technique that aids the visually impaired by letting them hear what is represented as text and it is obtained by following the procedure that captures the image through a camera or you can upload an image from stored directories as well and converts the text available into corresponding correctly identified speech.

3. SYSTEM DESIGN

The idea for implementing this system design is to bridge the gap between the visually impaired person & a normal person for ease of communication between them. The project is catered with the source code of Python. The system is provided with 4 unique and individual modules.

3.1 Text to Speech (TTS)

Text-to-speech technology reads aloud digital text. It can take words on computers, smartphones and convert them into audio. gTTS is the commonly used API and accurate results are obtained. It is a tool which converts the text entered or provided as an input by user into audio which can be saved as an mp3 file

and reads it aloud for them. The gTTS supports several languages. The speech can be delivered in the requirements for the users either slow or fast.

3.2 Text to speech using camera (OCR)

Text to Speech using Camera is performed by a source called Optical Character Recognition. OCR is used to scan the image and extract the available text from the image and perform background color and disturbances causing in the image. After the successful recognition of the text from image it is produced as speech using the gTTS module. The libraries used are Pytesseract, pyttsx3, Python Imaging Library (PIL) and Googletrans.

3.3 Speech to Text (STT)

Speech Recognition is based on the algorithm of acoustic and language modeling. Acoustic modeling represents the relationship between speech and audio signals. Language modeling matches sounds with word sequences.

3.4 Hand Gesture Recognition

Real time finger tracking and contour detection for gesture recognition using OpenCV. Gestures are important for communicating information among the human. Hand gesture recognition implement sufficient enough with the help of Machine learning methods such as neural networks, support vector machine, and Adaptive Boosting (AdaBoost).

4. HIGH LEVEL DESIGN SYSTEM

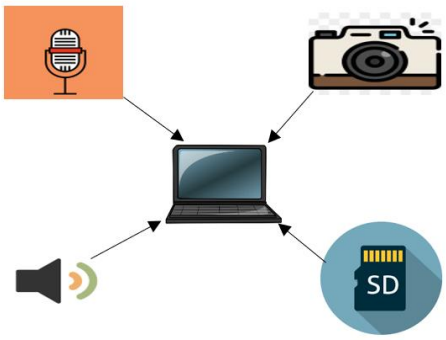

Fig. 1: Block Diagram of the Project

5. REQUIREMENTS

5.1 Hardware Requirements

Most software executing x86 architecture define processing power as the model and the clock speed of the CPU. Various features of a CPU that influence its speed power like bus speed, cache and MIPS are often ignored. The processor used is Intel core i5, speed is 1.1 GHz, and RAM is 8GB.

5.2 Software Requirements

Software requirements give a brief description of the software amenities that are required for the successful execution of the software with minimal errors. The software used for implementation are Jupyter notebook, Visual Studio Code for UI front end design.

6. IMPLEMENTATION

6.1 Text to Speech Algorithm

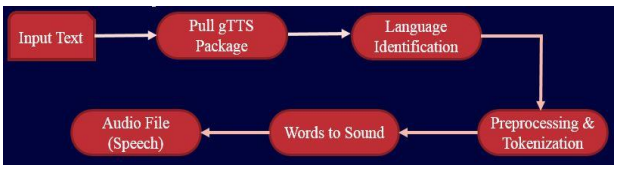

Fig. 2: Algorithm steps for Text to Speech using gTTS

6.2 Image to Speech via Camera (OCR)

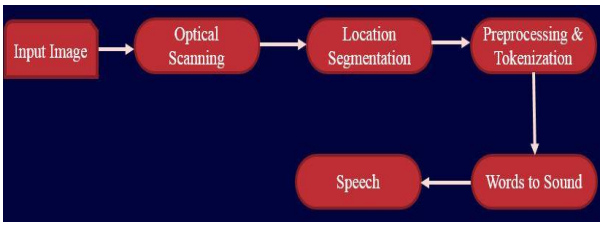

Fig. 3: Algorithm steps for Image to Speech

6.3 Speech to Text

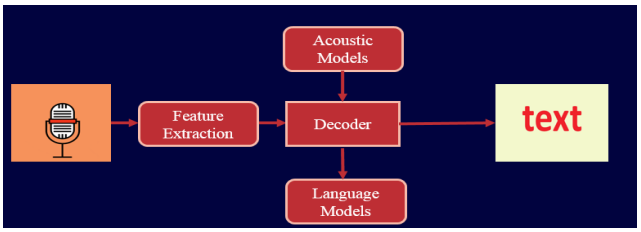

Fig. 4: Algorithm Steps for Speech to Text

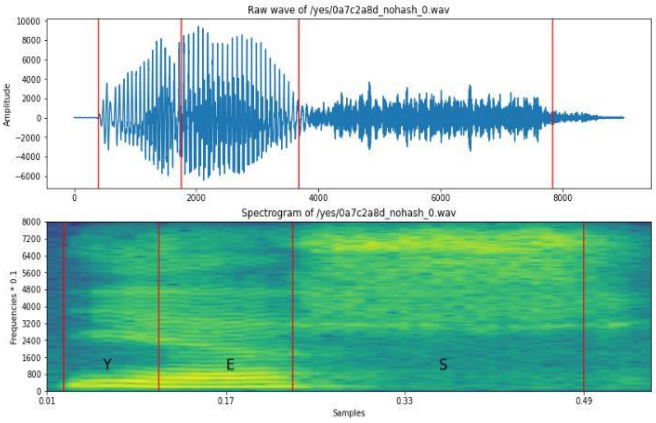

Fig. 5: Spectrogram for speech signal

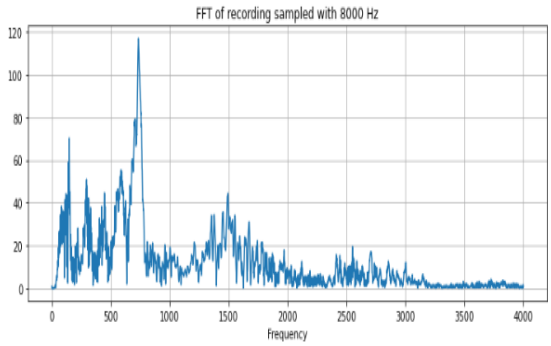

Fig. 6: FTT graph for resampled speech signal

6.4 Hand Gesture Recognition

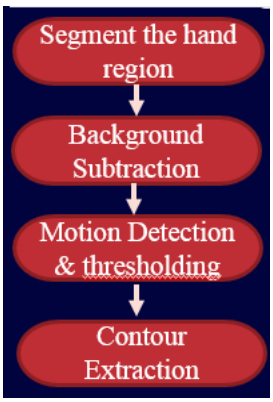

Fig. 7: Part 1 procedure for Hand Gesture Recognition

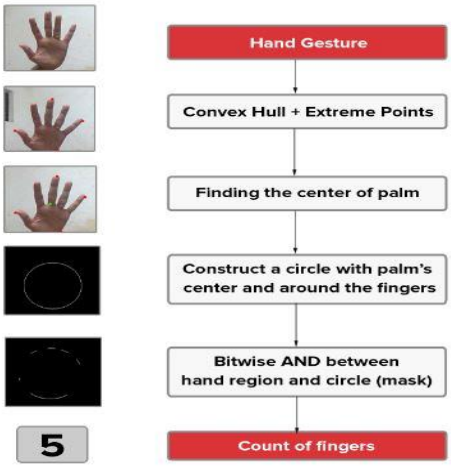

Fig. 8: Part 2 procedure for Hand Gesture Recognition

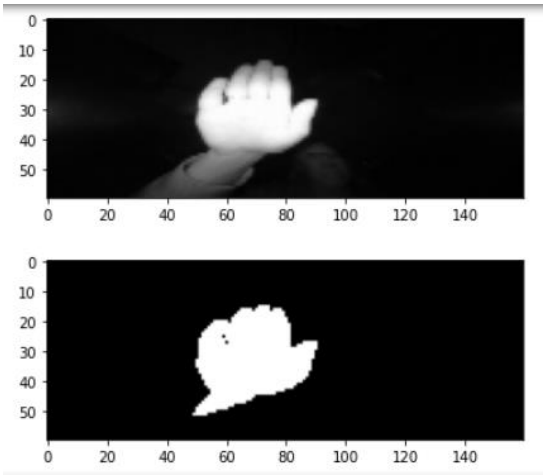

Fig. 9: Contour Extraction & Background Elimination

7. RESULTS

The proposed system provides the functionality of conversion of Text to Speech and Image to Speech via camera for blind users, Speech to Text for hearing impairment users, and Hand Gesture Recognition for Deaf and Dumb Person. All these modules are available for single system general purpose as well as for complete visually impaired person. Below are the comparison of algorithms results and their accuracy applied for Hand Gesture Recognition model.

Algorithms	Train Results	Test Results
1. Decision Tree	95.43%	93.03%
2. Random Forest	100%	99.892%
3. SGD Classifier	72.00%	73.14%
4. Long Short Term Memory	99.887%	98.208%

Fig. 10: Comparison of Algorithms

8. CONCLUSION

This project aims to lower the communication gap between blind, deaf or mute community and normal world, help them to lead a standard lifestyle. The design prototype is used to convert text/ image to voice for blind, speech to text conversion for deaf and conversion of hand gestures to text for dumb people. We have designed the prototype model for blind, deaf & dumb people (or integrated even as for visually impaired). The advantage of this is that it can be easily carried due to less weight. The functionality developed can be used as a smart assistant for differently abled people to communicate with others and it is a language independent system.

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