ACCESSIBLE LEARNING

Speech to **Braille** Translator and **Sign** Language Recognition System

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CONTENT

CHAPTER 1

1.1 Problem Statement

The problem statement for this project is to create a system that can provide an accessible way for the deaf and blind to access audio-video content, by providing a Speech to Braille translator and Sign Language Recognition System. This system should be able to convert speech to braille, detect signs in order to teach sign language, and output letters corresponding to the signs shown. This system will help bridge the gap between the differently-abled and modern society, by providing a two-way approach, allowing normally-abled people to learn braille script and sign language as well.

1.2 Methodology

1.2.1 Speech to Braille

The Speech to Braille project has a two step process.

The first step is to convert speech to text using a speech recognition library like SpeechRecognition. The second step is to convert the text to braille.

In order to convert speech to text, the speech recognition library will listen to the user's voice and convert it to a text string or will take input audio file and convert it into a text string.

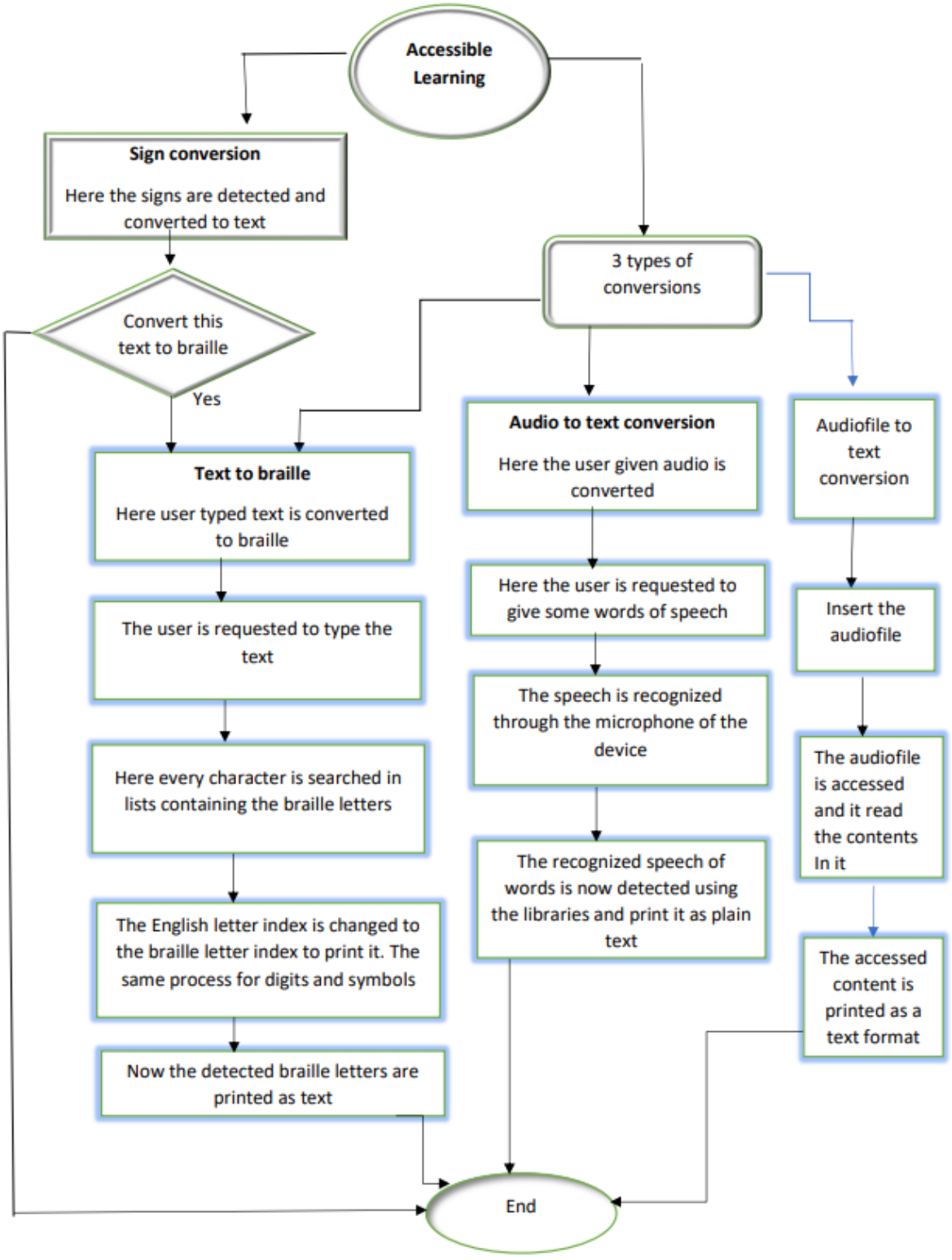
The text string can then be parsed using a natural language processing library to extract meaningful information from the text string. The second step is to convert the text string to braille. The text obtained is then converted to Braille using a predefined mapping of English alphabets and numbers to their corresponding Braille characters.The braille string can then be displayed on a braille display grid.

1.2.2 Sign Language detection

Sign language detection is a process of recognizing the sign language gestures and converting them into text. This process is achieved by using Computer Vision, Machine Learning, and Neural Networks.

First, the image of the sign language gesture is captured using a camera. Then, the image is processed in order to extract the features of the sign language gesture. This is done by applying filters, such as Gaussian blur, adaptive thresholding, and Otsu thresholding. Once the features of the sign language gesture are extracted, they are fed into a machine learning model. The machine learning model then uses these features to predict the sign language gesture. The predictions are made by comparing the extracted features with the trained parameters of the model. Once the prediction is made, the sign language gesture is then converted into text. This is done by mapping each sign language gesture to a corresponding alphabet. Finally, the generated text is then used to construct sentences or phrases. This is done by using natural language processing.

1.3 FLOWCHART



CHAPTER 2

2. Braille and Sign Language

Braille :

2.1 Introduction:

Braille is a system of raised dots that can be read with the fingers by people who are blind or who have low vision. Teachers, parents, and others who are not visually impaired ordinarily read braille with their eyes. Braille is not a language. Rather, it is a code by which many languages—such as English, Spanish, Arabic, Chinese, and dozens of others—may be written and read. Braille is used by thousands of people all over the world in their native languages, and provides a means of literacy for all.
The specific code used in the United States has been English Braille, American Edition but as of 2016 the main code for reading material is Unified English Braille, a code used in seven other English-speaking countries.

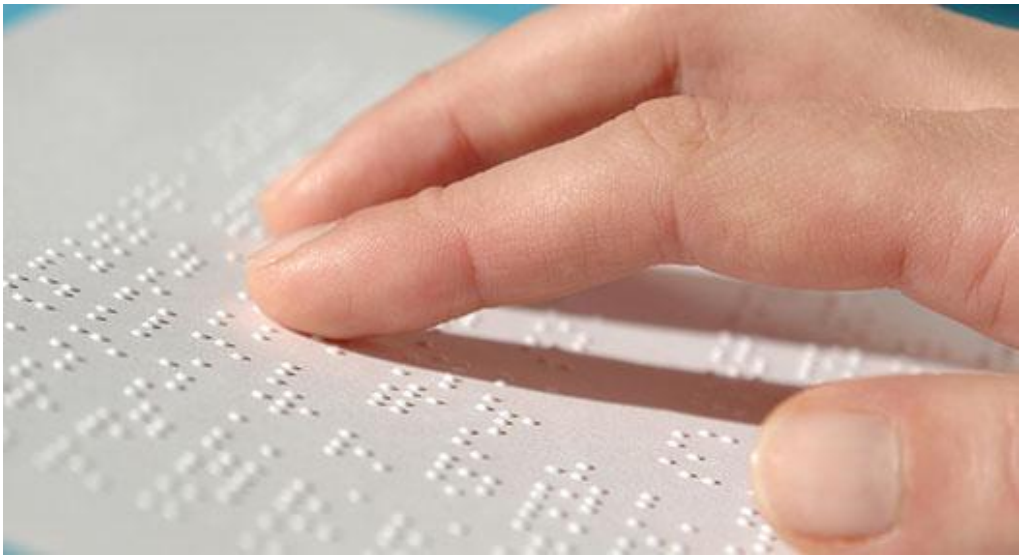


Figure 1

2.2 What Does Braille Look Like?

Braille symbols are formed within units of space known as braille cells. A full braille cell consists of six raised dots arranged in two parallel rows each having three dots. The dot positions are identified by numbers from one through six.

Sixty-four combinations are possible using one or more of these six dots. A single cell can be used to represent an alphabet letter, number, punctuation mark, or even a whole word. This braille alphabet and numbers page illustrates what a cell looks like and how each dot is numbered.

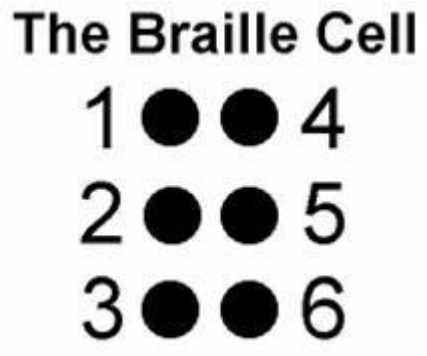


Figure 2

2.3 How Was Braille Invented?

Louis Braille was born in Coupvray, France, on January 4, 1809. He attended the National Institute for Blind Youth in Paris, France, as a student. At that time, books were created using raised print which was laborious to produce, hard to read, and difficult for individuals to write. While attending the Institute, Braille yearned for more books to read. He experimented with ways to create an alphabet that was easy to read with the fingertips. The writing system he invented, at age fifteen, evolved from the tactile "Ecriture Nocturne" (night writing) code invented by Charles Barbier for sending military messages that could be read on the battlefield at night, without light. Learn more about the creation of the braille code by exploring AFB's Louis Braille Online Museum.

Figure 3

Sign language

2.4 Introduction:

Sign language, any means of communication through bodily movements, especially of the hands and arms, used when spoken communication is impossible or not desirable. Practice is probably older than speech. Sign language may be as coarsely expressed as mere grimaces, shrugs, or pointings; or it may employ delicately nuanced combination of coded manual signals reinforced by facial expression and perhaps augmented by words spelled out in a manual alphabet. Wherever vocal communication is impossible, as between speakers of mutually unintelligible languages or when one or more would-be communicators is deaf, sign language can be used to bridge the gap.

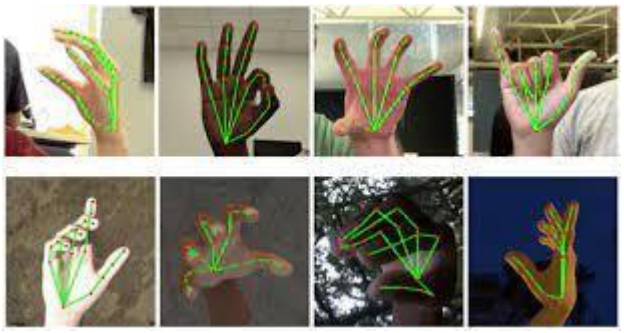


Figure 4

2.5 Language barrier:

Chinese and Japanese, whose languages use the same body of characters but pronounce them entirely differently, can communicate by means of a sign language in which one watches while the other traces mutually understood characters in his or her palm. Evidence of long use of sign language to communicate around mutually unintelligible languages exists for Africa, Australia, and North America. The most generally known model is that of the Plains Indians of 19th-century North America. Although their languages were dissimilar, the mode of life and environment of all groups had many shared elements, and, consequently, finding common symbols was easy. Thus, a cupped hand leaping and bobbing away from the “speaker” was familiar to all as the rump of a bounding deer; a circle drawn against the sky meant the moon—or something as pale as the moon. Two fingers astride the other index finger represented a person on horseback; two fingers spread and darting from the mouth like the forked tongue of a snake meant lies or treachery; and the gesture of brushing

long hair down over the neck and shoulder signified a woman. This sign language became so familiar that long and complex narratives—in monologue or dialogue—could be signed and understood within large groups of Indians otherwise unable to communicate.

2.6 Inability to speak:

The Indian sign language was codified by use into an explicit vocabulary of gestures representing or depicting objects, actions, and ideas, but it made no attempt to "spell out" or otherwise represent words that could not be conveyed by gestures. Several forms of sign language were developed to enable signers to spell out words and sounds, however. Most of these are as complex and flexible as spoken languages.

It was long thought in many cultures that the deaf were ineducable, and the few teachers willing to try were available only to the wealthy. In the mid-18th century, however, the first educator of poor deaf children, Charles-Michel, abbé de l'Epée, developed a system for spelling out French words with a manual alphabet and expressing whole concepts with simple signs. From l'Epée's system developed French Sign Language (FSL), still in use in France today and the precursor of American Sign Language (ASL) and many other national sign languages.

FSL was brought to the United States in 1816 by Thomas Gallaudet, founder of the American School for the Deaf in Hartford, Connecticut. The new sign language was combined with the various systems already in use in the United States to form ASL, which today is used by more than 500,000 deaf people in the United States and Canada; it is the fourth most common language in the United States. National sign languages such as ASL have more in common with one another than with the spoken languages of their country of origin, since their signs represent concepts and not English or French or Japanese words. One system, Cued Speech, first developed by the American physicist R. Orin Cornett in 1966, does, however, successfully employ hand signs representing only sounds (not concepts), used in conjunction with lipreading. It has been adapted to more than 40 languages.

CHAPTER 3

3. ALGORITHM

3.1 Introduction:

There are many blind people, not only blind people there are many people who are Disabled like dead and mute so keeping in mind about the all 3 categories we developed an Interface where people can make the 3 conversions.

First we had done the work individually later we combined the 3 different segments to single section based on the user interest he can select a particular method which he requires

- Our speech to text
- Text to braille
- Audiofile to text

These conversions are helpful for the different categorical people .In each step we use different methods of coding .

3.2 Algorithm:

- **For the speech to text**

Here we get the access of the microphone and the user is requested to talk about what he wants to convert and then the collected speech is gathered and it is converted to the text.

steps are

1. Create a speech recognizer object (r)
2. Prompt the user to speak ("Speak SOMETHING")
3. Use the microphone (source) to listen for the user's input
4. Save the user's input as an audio file (audio)
5. Print a message to indicate the user is done speaking ("OVER, THANKS")
6. Attempt to recognize the user's input using the speech recognizer (r)
7. If successful, print the recognized input.

- **For text to braille**

First we use different variables of list data structures to store all letters of alphabets and their respective braille letters and also the numbers and the special symbols then we followed the below steps

1. Create a variable to store the input string
2. Create a variable to store the translated Braille output
3. For each character in the input string:
   a. Check if the character is in the alphabet list
      i. If it is, add the corresponding Braille character to the output string
   b. Check if the character is in the numbers list
      i. If it is, add the corresponding Braille character to the output string
   c. Check if the character is in the punctuation list
      i. If it is, add the corresponding Braille character to the output string
   d. Check if the character is in the character list
      i. If it is, add the corresponding Braille character to the output string
4. Print the output string
5. Return

- **The algorithm for the audiofile to text**

here we take the input form the user of audiofile
we consider the audiofile name

The steps are

1. Import the Speech Recognition library
2. Create a Recognizer object
3. Create an AudioFile object and load the audio file to be processed
4. Use the "with" keyword to open the audio file and record the audio in the Recognizer object
5. Print the type of the recorded audio
6. Use the Recognizer object to recognize the audio using a speech recognition service
7. Print the recognized audio text

These are the algorithms we followed for the constructing the conversions

3.3 Illustrative example:

- **Audio to text**

let's consider this section of conversion

It uses a microphone as the source of audio input and then uses the Google Speech Recognition API to recognize the spoken words.

First, the code initializes the Recognizer() object from the SpeechRecognition library. Then it starts listening to the microphone audio input with the "listen" function. Once the audio input is complete, it uses the "recognize_google" function to pass the audio to the Google Speech Recognition API. If the API is able to recognize the words, it will print them out. Otherwise, it will pass without doing anything.

Example:

User: Hello world (spoken words)
Output: Hello world

Text to braille conversion example :

This code is a program that translates text written in English to Braille. It takes an input from the user of the text they want to translate and then it goes through each character in the input, checks if the character is a letter, number, punctuation mark, or special character, and then adds the corresponding Braille symbol to a string. Then it prints out the string with the Braille symbols.

For example, if the user enters the phrase "Hello World" as the input, the code will output the braille translation " ⠠⠓⠑⠇⠇⠕ ⠠⠺⠕⠗⠇⠙".

- **Audio file to text**

This code uses the speech_recognition library to convert an audio file into text. It uses the Recognizer() class to create a recognizer object, and then it uses the record() method to read the audio file and store the audio data in the audio_text variable. Finally, it uses the recognize_google() method to recognize the audio data and convert it into text.
let us consider a audio file of containing "hello world" then the code read the content from it and paste it as a plain text to do this we used the special libraries like speech_recognition

CHAPTER 4

4. RESULTS:

```
This the space where the audio given to the microphone is converted to Text:
Please make sure that there is no continous background noise
please speak SOMETHING
OVER, THANKS
result2:
{   'alternative': [   {'confidence': 0.68683481, 'transcript': 'hello world'},
                       {'transcript': 'hello word'},
                       {'transcript': 'helloworld'},
                       {'transcript': 'hello ward'},
                       {'transcript': 'Hello bird'}],
    'final': True}
hello world
```

```
Here the given Text  is converted to Braille
enter the string which you want to convert to Braille:this is project to participate shebuilds of team 26767
⠠⠓⠑⠗⠑ ⠞⠓⠑ ⠛⠊⠧⠑⠝ ⠞⠑⠭⠞ ⠊⠎ ⠉⠕⠝⠧⠑⠗⠞⠑⠙ ⠞⠕ ⠃⠗⠁⠊⠇⠇⠑ ⠞⠓⠊⠎ ⠊⠎ ⠏⠗⠕⠚⠑⠉⠞ ⠞⠕ ⠏⠁⠗⠞⠊⠉⠊⠏⠁⠞⠑ ⠎⠓⠑⠃⠥⠊⠇⠙⠎ ⠕⠋ ⠞⠑⠁⠍ ⠼⠃⠅⠋⠛⠛

!!!! Hope you satisfied with the results!!!
```

```
enter name of the audio file including extension
Enter the file name:1VC.wav
<class 'speech_recognition.AudioData'>
result2:
{   'alternative': [   {'confidence': 0.92995489, 'transcript': 'hello world'},
                       {'transcript': 'hallo world'},
                       {'transcript': 'Helo world'}],
    'final': True}
hello world
```

4.1 CONCLUSION:

In conclusion, this project aimed to provide an accessible way for the deaf and blind to access audio-video content. The Speech Recognition System and Hand Sign

Recognition System were developed to convert speech to Braille and detect signs in order to teach Sign Language respectively. This project has the potential to bridge the gap between normally-abled people and the deaf and blind, allowing both to learn and benefit from each other. This project is a great asset to those who are deaf and blind, as well as to Sign Language Coaches, NGOs, and Braille Publishing Companies. We hope that this project will be of use to many in the near future.