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Bridging Voices and Dots: Real-Time Braille Output from Speech

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Abstract— Reading and writing is an issue for people who are visually impaired. A Braille translator is a software program that allows a document to be translated in to Braille and send to a Braille embosser, which produces a hard copy (Braille version) of the original document. This software will accept spoken English as an input and translate that into English text. Thus speech will be converted to text. The English text will then converted into Braille by extracting the appropriate Braille code for each letter. The final Braille output can then processed using special Braille printer, which will help blind people in interpreting the same. It also helps to convert the Braille document into the spoken English words. So that anyone (Blind people as well as normal people) can interpret the Braille document by listening it through Braille Translator. Our project will cater to blind and partially blind people and help them in creating Braille documents efficiently. Although Braille codes can be generated using several languages like Spanish, French, Music, Mathematics, Computers etc. The English text will the processed using algorithm and converted into Braille. The final Braille output can then be printed using special Braille printer, which will help blind people in interpreting the same.

Keywords— **Braille Translator, Braille code, Speech, Braille printer**

I. INTRODUCTION

Braille translator is software is mainly designed for blind people. Typing in English very difficult for blind people, Braille translator can convert the document into Braille which user can speech. This software can take audio input also. It has been observed that blind people find it difficult to type the contents using Braille. Braille Translator software will accept spoken English as an input and translate that into English text. Thus speech will be converted to text and vice-versa. The main cause for bridge failure and collapse. Many of these bridges are subject to decline due to external and internal factors.

Currently there is no standalone application available, which can facilitate creating Braille documents efficiently. Our project will cater to blind and partially blind people and help them in creating Braille documents efficiently. Although Braille codes can be generated using several languages like Spanish, French, Music, Mathematics, Computers etc.

Our project will generate Braille code using spoken English. Thus the scope of the project is to help blind people in generating Braille codes for efficient communication. In this application we are also going to implement vice-versa means Braille code to English text and then English text to speech. The benefit of this application is the blind people also listen there document which correct or not.
The English text will the processed using algorithm and converted into Braille. The final Braille output can then be printed using special Braille printer, which will help blind people in interpreting the same.

II. LITERATURE REVIEW

Writing and reading is an issue for visually impaired people. So the conversion of human speech to text format is very essential. There are mainly two techniques to do this: a. Hidden Markov Model (HMM); b. Fast Fourier Transform Algorithm (FTT) [1]. HMM is a finite state machine with n states whereby each state, besides the first and last, has specific output probabilities and each arc between states is associated with a transition probability. Fast Fourier Transform Algorithm is the extension of Finite DFT which constrains itself to limited value [1]. This FFT algorithm is used because of its accuracy even though in regard with infinite i.e. unstructured wave format, so that the, unnecessary noise is removed.

The Braille system comprises of a Braille cell per character consist of six embossed or raised dots arranged as shown in the figure. The way the dots are raised gives meaning and each cell has the meaning of only separate letter, digit or simple punctuation mark. Braille codes are systems elegant, concise and very human systems for transcribing printed material using a Braille Alphabet. The Braille is a script used by visually impaired person to read and write; the parameter name "dot-id" is used to define a braille cell [2]. A Braille cell is six dots arranged in 2 columns of 3 dots each. Each Braille cell as symbol represents a letter or a word or a combination of letters, symbols, numeral or punctuation mark [2].

Speech Recognition is an application of Digital Signal Processing which has many real time world applications. In this paper an experiment was setup in which CMUSphinx framework was used to test and train Speech Recognition System [3]. This framework supports other languages along with English and is dynamic in nature, hence it was possible for the authors to train the system for Kannada Language. The components of the above described system were a Language Model, Acoustic Model, and Dictionary. The Language model contains a large set of words

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with their chances of occurrence. The Phoneme set contains phonemes which in linguistics are the smallest sound unit in a language which can convey message. Dictionary is essentially a tool used to map vocabulary words [3].

Speech Recognition of Computer Speech Recognition is a task whose motive is to get to know the voice which is produced by the computer and then do the required task. In day to day life while we speak in English we tend to use words from our native languages. To solve this problem the author has proposed a system in this paper for Multilingual Speech-To-Text conversion. The operation of the system is divided into two areas, training and testing. In the training phase utterances of each word is recorded. For each word acoustic features are extracted using MFCC method. In this way features of each word are stored in feature vector for reference. Database is an important part of any speech to text recognition system. The proposed system uses a self-generated database. [4]

In the system mentioned in the paper written by Ahmad M. Abushariah speech waveforms are translated into a set of feature vectors using Mel Frequency Cepstral Coefficients (MFCC) [11]. The system is MATLAB (GUI) based. The paper mainly focuses on digits (zero to nine) which have isolated word structure [11]. Two modules were developed namely, isolated word speech recognition and continuous speech recognition. The features from the waveforms taken as input are extracted using the MFCC algorithm and then all the features are stored accordingly in the feature vector. Later the feature vectors are classified using the phonetic based categories at each frame using HMM algorithm. Then an optimal sequence of states is computed as HMM cannot capture the sequence of state and that sequence is used for observing outputs [1][11].

The task of converting audio input into text format is being pursued by scientists and engineers for a long time. The main hurdle in this is the diction or the accent of the particular person in question. Having a system that can recognize various accents is quite difficult so this paper is only related to recognizing the British English [8]. The described uses a table referencing system for the conversion process of the speech to text and later text to braille. The referencing table for text to braille conversion have the classification of the Braille codes as Grade 1 and Grade 2 codes. The entries in the table are made according to the syllables and not according to the phonemes [8]. The system uses a state matching system which operates on a finite number of states which can hold the current context in the text document.

III. PROPOSED SYSTEM

The proposed system is the development of Real time speech to braille converter. The system takes speech input from user. Converts the speech input to corresponding text and the converted text is further converted into corresponding braille language. For text to braille conversion the system make use of the Braille database to find the equivalent braille code for each alphabet as well as numbers. The system saves the converted braille code in a separate file .The system also provides braille to text verification. The saved Braille coded file can again be opened and the contents of the file are read to the user through speaker or any headset.

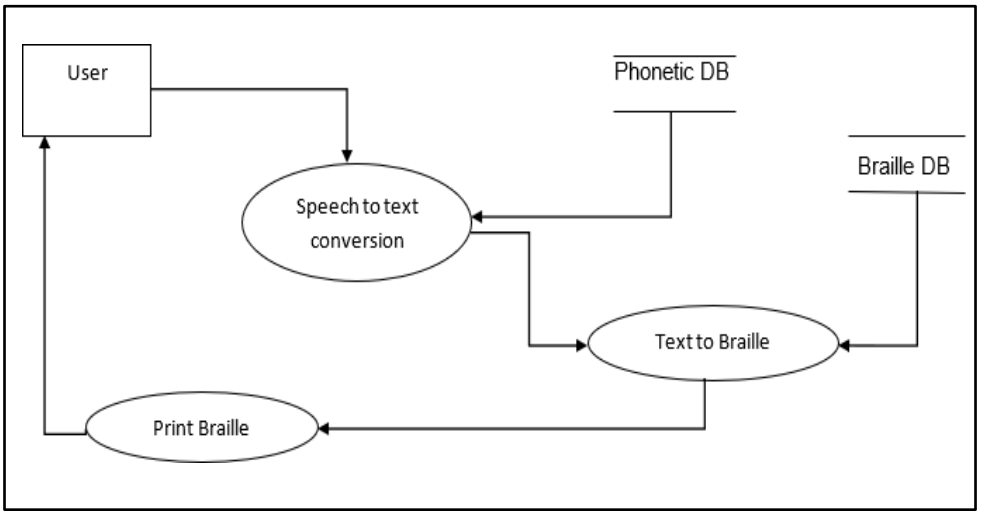

Fig. 1 System Architecture of proposed system.

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Components of the system:

User:
User gives the speech input to the system for processing. The speech input is given to the system using a microphone. The speech input maybe in different languages like Spanish, English, German, et cetera, but this system gives focus to the conversion of English speech into the text format which will later be converted in Braille.

Speech to Text conversion:
The speech input taken from the user is converted into equivalent text using the Fast Fourier Transform Algorithm. The FFT algorithm is used to classify the sound waves according to their frequency levels. It does captures wavelengths from an infinite frequency range. It then removes the unnecessary noise from the given input. The processed soundwaves are used to convert the speech input into a text format. This is done with the help of a phonetic database.

Text to Braille conversion:
The main purpose of this system is to provide an easier way for blind people to communicate with able people and vice versa. In this module the text file that has been converted from the speech input that is taken from the user as input will be converted into a braille format. This is done using a braille database which contains the braille codes for each corresponding alphabet and number.

Phonetic Database:
Phonetic database contains list of words coded phonetically which helps in speech to text conversion. Phoneme of a letter is a basic unit of pronunciation used for that letter. A combination of these phonemes is used to pronounce a word. This database will hold the phonemes of all the letters and according to the phonemes the speech input will be converted into the text format.

Braille Database:
Braille database contains the corresponding braille code for each alphabet and numbers. Braille language has two dub types namely 6 dot code and 8 dot code. This database will contain the 6 dot code for each and every alphabet and basic number which will be used in the conversion process of the text file to a braille format.

Print Braille:
After the successful conversion of text to braille the final result is displayed to the user. This file can be saved in the local storage. To print this image we may use a braille embosser, but using a braille embosser is out of the scope of this project.

Braille Codes:

6 dots Braille can only produce 63 different Braille cells. In 6 dots Braille an unused Braille cell or a blank Braille cell is used as a space. Some 6 dot Braille cells have numerous meanings. Numbers, capital letters, and many symbols require more than one cell to produce 6 dots Braille data. 8 dots Braille can produce 255 different Braille cells.

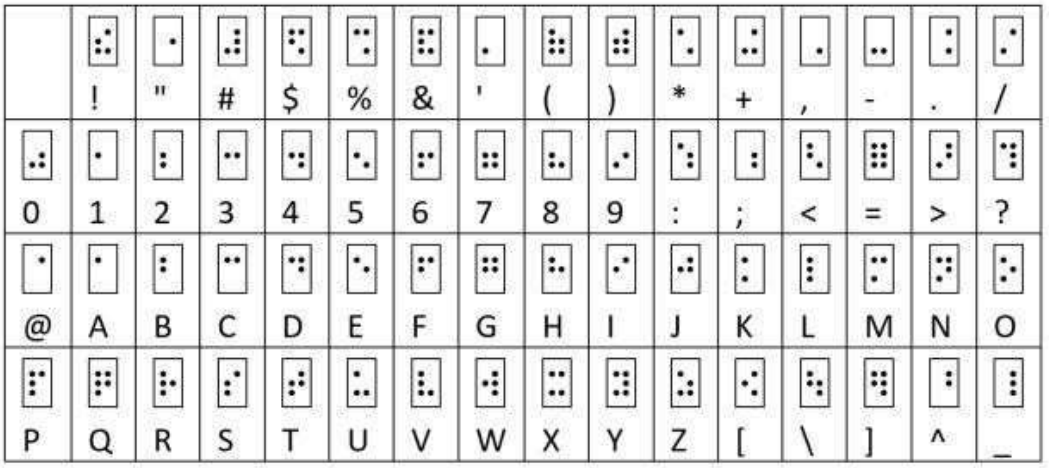

Fig. 2 Six dot Braille codes.

Speech to text conversion:

Hidden Markov Model is a statistical model. It is used to identify the hidden states in the frequency waves. The sequence of the emission can be observed in the HMM model but the sequence of the states is not known. The speech is first taken as input from the user. Then all the excess noise is removed from the given waves. The filtered waves are then compared with the speech database (HMM), according to which the output is derived.

Hidden Markov model has a very specific drawback. It cannot capture the sequence of the states in the given speech input. This is overcome in the Fast Fourier Transform algorithm which is used in this system. FFT is the extension of Finite Discrete Fourier Transform algorithm. Finite DFT constrains itself to a limited value. It entails that Finite DFT only captures wavelengths of a specific frequency. FFT is used in spite it captures infinite frequency wavelengths. As the wavelengths may have infinite frequency the wave format is unstructured. The unnecessary noise is later removed. Then the processed waves are converted to text.

IV. CONCLUSIONS

This system helps to the blind peoples to interact with the other normal peoples very efficiently. As well as normal peoples who want to interact with blind peoples this software helps them also. Peoples interacting with this system can create the Braille documents who ever not having knowledge about the Braille code.
Keeping in mind requirement of the system the project has completed on time with following advantages: a) Easy to use interface. b) Better load handling capacity.

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