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Braille Typographer with Code Initiator and Conversationist for People with Visual Impairment

Asst. Prof. Rajkumar. T, Durka. S, Jagadeesh. P, Priya. M, Vivek. V
Department of Electronics and Communication Engineering,
Nandha College of Technology,
Perundurai - 638052, Tamil Nadu, India.

Abstract-There are many Typographers are available to print the common language for common people. But these are character printer and not suitable for visually impaired. These problems are eradicated by the evaluation of some braille typographer. Although this type of typographer have some complication and snag. Then typist must know the braille language to access it. So we are brought some changes in the actual braille typographer to contribute the visually challenged persons. Like as text detection and communicator tool. Speech-to-Text Conversion (STT) systems have a lot of benefits for thevisually impaired people and find their applications in our daily lives. In the same way, the aim of the system is to convert the input speech signals into the text output for the visual impaired in the educational fields.an approach to extract features by using Mel Frequency Cepstral Coefficients (MFCC) from the speech signals of isolated spoken words. Hidden Markov Model (HMM) method is applied to train and test the audio files to get the recognized spoken word. We are converting the characters into braille codes by mean of voice recognizer process. So typist no need to know the braille codes and also time conception is very less. Another Purpose of this method is to teach the braille code and to create some e-books through this process. At last we are overcome this tactile application to reduce time complexity.

Keywords:- Visually Impaired person, Braille printer, voice recognizance, text to voice, self-learning support media, STT, MFCC, HMM.

I. INTRODUCTION

Major problem faced by the visual impairment is leaning, gathering information. Hence we introduce the voice recognizance and text to voice conversion technique in our project. We implement the project using three basic blocks. [1] Code generation from braille to normal text and normal text to braille via mobile application. [2] Controller unit, it responsible for instruction to mechanical part and mobile application. [3]

Mechanical part, it responsible for print braille codes on the A4 cardboard sheet. The block 1 contains speech recognize, code conversion, communication with microcontroller.

The block 2 contains servo and stepper motor for moving the printer pencil, and communication device, micro controller. The block 3 contains mechanical part. The application unit communicate to the printer by Bluetooth (version 5.2) on the mobile. Braille is a system that comprises touch reading and writing that is used by people who are visually impaired.

The braille script has a series of embossed dots that are arranged in a specific manner to represent a particular letter, number, or symbol and has different semantics and enunciation. The script is read from left to right but written in the opposite manner.. Unified English Braille (UEB) is based on Standard English Braille (SEB), with some significant changes.

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These changes are designed to take away ambiguity and provide a braille code for the entire English-speaking world. There are 3 main types of braille under the main script. [1] Grade 1 Braille is also called Uncontracted Braille which comprises 26 letters of the Roman alphabet. Each cell has dots embossed to represent one letter only. [2]

Grade 2 This type of braille is more concise and can represent many words but shortened forms and combinations of different cells. It is the most popular type and also consists of numerals, punctuation, and abbreviations for efficient use. Words are abbreviated in a single cell, single letter, or can even be represented by a specific symbol. There are various rules that have been drafted for the standardized and systematic use of grade 2 Braille Script. [3]

Grade 3 this type of Braille is used for personal purposes and cannot be used publicly.We using grade 1 type on this project. Voice convert into normal text and normal text is convert into braille. The Bluetooth conveying braille code in order of 6 digit information. Like c1=0, c2=1, c3=0, c4=1, c5=0, c6=0. This is the single letter information. This information is catch by Bluetooth in microcontroller. In which information used for instruction for braille printer operation or data for print it. It based on the word of visual impaired. HC-05 Bluetooth Module is a simple Wireless Communication device based on the Bluetooth Protocol.

This module is based on BC417 Single Chip Bluetooth IC that is compliant with Bluetooth v2.0 standard and with support for both UART and USB interfaces. Bluetooth Communication is a 2.4GHz frequency based RF Communication with a range of approximately 10 meters.

It is one of the most popular and most frequently used low range communication for data transfer, audio systems, hands free, computer peripherals etc. Microcontroller is arduino uno used. Printing pencil is heat caring tool. The image of braille code is converting into text by using of python based application and then text is converting into speech.

II. VOICE TO TEXT CONRESION

An approach to extract features by using Mel Frequency Cepstral Coefficients (MFCC) from the speech signals of isolated spoken words. Classification of speech into voiced or unvoiced sounds provides a useful basis for subsequent processing.

A three way classification into silence/unvoiced/voiced extends the possible range of further processing to tasks such as stop consonant identification and endpoint detection for isolated utterances. In noisy environment, speech samples containing unwanted signals and background noise are removed by end point detection method. End point detection method is based on the short-term log energy and short-term zero crossing rate.Whereas (n) is the speech signal, Elog is the logarithmic short-term energy and ZCR is the short-term zero crossing rate.

- Elog = Nn =1 log (s (n) 2)
- Elog is the logarithmic short-term energy

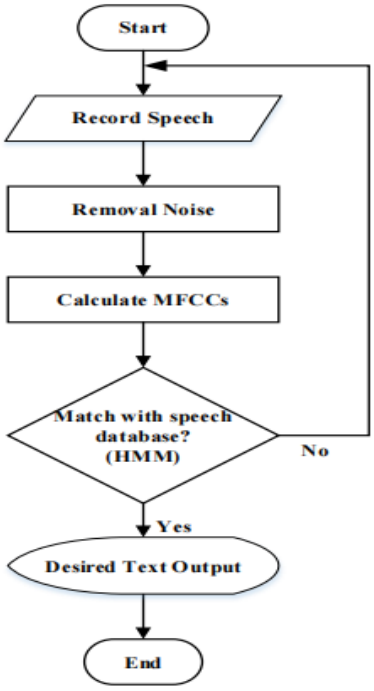

Fig 1. Flow chart of voice to text conversion

III. CODE GENERATION

Code generation is the part of this project. In this part we converting the normal text to braille code. Hence we should know about braille code and how to convert it. This approach is made by using of python programming. First we take the equivalent value for each 26 character in braille and then how to modify it. For example for braille code:

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Table 1. Example for Braille Code.

Character	Braille	Braille Dots
a	⠁	1
b	⠃	12
c	⠉	14
d	⠙	145
e	⠑	15
1	⠼⠁	3456 1
2	⠼⠃	3456 12
3	⠼⠉	3456 14

Conversion of braille is done by the python programming part. That take the input as a normal text. All the letters in the word is separate and generate corresponding braille code like as above tabulation. Some of the example is given following.

- Take input as "ECE":
- The corresponding braille dots: E-135 C-14 E-135.

1. Algorithm:

- **Step 1:** Start the program
- **Step 2:** Assign the values for characters (a=1, b=12, c=14, d=145, e=15 and so on).
- **Step 3:** Get the input from user.

Ex: ECE

- E is checked to pre-assigned character, and get equivalent braille dot code
- C is checked to pre-assigned character, and get equivalent braille dot code
- E is checked to pre-assigned character, and get equivalent braille dot code

For E:

1	0	0	0	5	1

For C:

1	0	0	1	0	0

For E:

1	0	0	0	1	0

- **Step 4:** Assign the value in [1X6] dimension array value
- **Step 5:** This output given to the Bluetooth.
- **Step 6:** Stop the program

IV. PRINTING UNIT

The printing unit contains the Raspberry pi, camera, arduino mega, Nano, bug controller, SD Card module, stepper motor. The system is controlled by arduino mega and Nano. The braille embosser get the instruction and code from Raspberry pi.

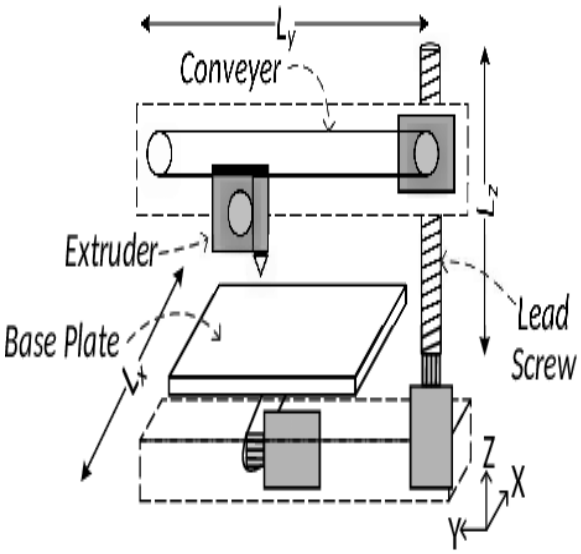

Fig 2. Overall 3D printer structure.

Inside the printer, an electronic module encompasses a microcontroller, which processes the Braille vectors generating a buffer to control the printer head's hammers. Communication between the printer head and the microcontroller is bidirectional because it is necessary to know with accuracy the shaft's position to actuate the cam- follower mechanisms.

In addition to receiving the Braille vectors from the software, the microcontroller manages the position data coming from the printer head's encoders and the embosser's sensors.

This communication is made by Bluetooth. Bluetooth works by the simple principle of sending and receiving data in the form of radio waves. Every Bluetooth enabled device has a card-like attachment known as the Bluetooth adapter. It is this Bluetooth adapter that sends and receives data. A Bluetooth adapter has a particular range of connection.

The microcontroller controls the servomotor and the two step-motors that actuate the guide rollers and the printer head moving structure. Braille standard complying dots can be effectively embossed on paper. Our current work seeks to have visually

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impaired readers assess the printed pages to confirm that Braille characters are actually discern able and comfortable to the fingertips.

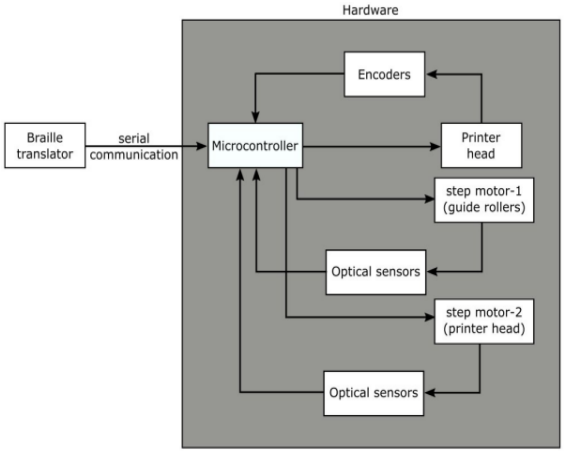

Fig 3. Block diagram of printer unit.

Normally, one A4 page can contain around 1,000 characters (25 lines of 40 cells). With our system, printing a regular text page containing most of the letters in the alphabet and spaces between words roughly takes 10 min, which amounts to six A4 pages per hour. Note that this printing speed is suitable for home purposes only.

We are currently working on debugging the micro-controller's code to handle efficiently all input and output data and the daily situations traditional printers face such as paper run out, jams, diverse alerts, etc.

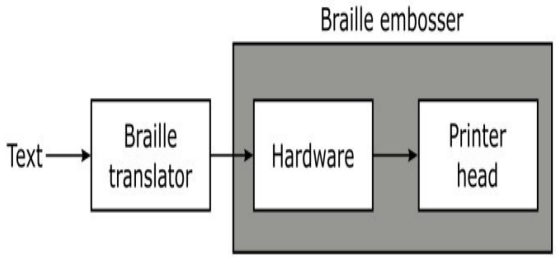

Fig 4. Braille embosse.

V. TEXT TO VOICE CONVERSION

The image files can be in PNG or JPEG formats. To convert image to text, first choose the language for the text to be extracted from the language drop down list. Then click the browse button to choose the file you want to extract text from. When the text extraction is complete, the result will be added to the text box above. They are following steps involved in text to voice conversion.

- **Step 1:** As you will access this, the first thing to do is upload the text you wish to convert. You can either type the text in the box provided or upload the file saved on your device.
- **Step 2:** After entering the text, you've to select the language in which you want to listen to the text. Just click on the drop-down list and select any language.
- **Step 3:** Now, you have to choose the speed variation for the spoken words. You can choose between normal, fast, and slow speeds.
- **Step 4:** The next step is to select the voice type in which you need the output. Our tool provides you two options, which are male and female. Both of the voices seem natural and aren't robotic.

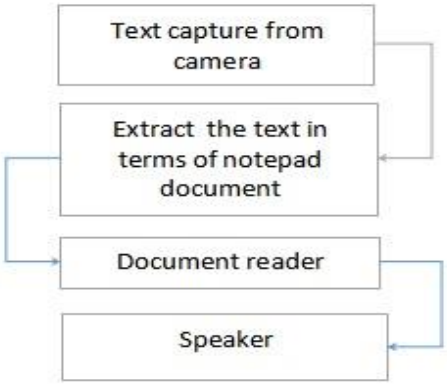

Fig 5. Flow Chart of Image to Text.

- **Step 5:** Lastly, you have to tap the "Convert to Speech" button. Before hitting it, you can click the "Play" button to listen to the speech.

VI. RESULTS AND DISCUSSIONS

1. Voice Recognition Conversion:
Speech Input Using a Microphone and Translation of Speech to Text

1.1 Allow Adjusting for Ambient Noise: Since the surrounding noise varies, we must allow the program a second or too to adjust the energy threshold of recording so it is adjusted according to the external noise level.

1.2 Speech to Text Translation: This is done with the help of Google Speech Recognition. This requires an active internet connection to work. However, there are certain offline Recognition systems such as Pocket Sphinx, but have a very

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rigorous installation process that requires several dependencies. Google Speech Recognition is one of the easiest to use.

2. Code Conversion:

These changes are designed to take away ambiguity and provide a braille code for the entire English-speaking world. There are 3 main types of braille under the main script.

Grade 1 Braille is also called Uncontracted Braille which comprises 26 letters of the Roman alphabet. Each cell has dots embossed to represent one letter only. This conversion is done by programming language of C. The Bluetooth conveying braille code in order of 6 digit information. Like c1=0, c2=1, c3=0, c4=1, c5=0, c6=0. This is the single letter information. This information is catch by Bluetooth in microcontroller.

3. Printing of Braille Code on Paper:

It can be observed that the second (and final design) enables the print head to be more compact overall as it allows all three servomotors to be placed longitudinally. In particular it details how, by using the Word Object Model, the translation system can map the layout information (format) in the print document into an appropriate Braille equivalent

Fig 6. Print thank you the paper.

Table 2. Font and accuracy.

Font	Percentage Accuracy
Arial	80.95
Harlow solid italic	42.42
Wide Latin	100
Courier new	84.61
Bernard mt condensed	96.29
Bradley hand itc	30
comic suns ms	100
Imprint shadow	86.20

VII. CONCLUSION

This system consists of three main parts,

- Image processing and mapping the image to the characters.
- Voice recognize
- Converting string of characters and actuate them by hardware.

Therefore, a complete Braille printing solution must keep this in consideration. However, the research was successful insofar as it serves to prove that a viable, inexpensive, and complete solution to Braille printing is 2132possible, and several limitations of commercial Braille printers can be done away with, such as paper requirements, flattening of embossments leading to illegibility of characters, large amounts of noise being generated through printing. This system is implemented by the some advanced technique. We hope with in this project it'll be perfect for visually impaired.

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