Implementation of a Tactile Device for the Visually Impaired People to Read Documents

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Abstract: The main origin of our project research is that Blind people usually face many difficulties while reading even if Braille language is available to them. The Braille books available can age and become imprecise. There are many books converted into Braille language but not every book is converted. It is a very tedious job to convert every book in Braille language, and even after conversion their life is limited. Due to this reason all the books are not converted in Braille language and this creates a huge gap between the normal reader and the visually impaired reader. Tactile Device for Blind People is an important device which will reduce the gap between them. The main objective of our project is to let the visually impaired reader to read the same book which normal person can read. Also, this will help the blind person to read newspapers, magazine, etc. This device also focuses on their educational growth. This device can help them acquire equal knowledge like the normal reader.

Index Terms - Tactile Device, blind people, Braille, difficulties while reading, age with time, innovative device, conversion, newspapers, magazines, books, acquire knowledge, educational growth

I. INTRODUCTION

In the domain of natural language processing, the Text to Braille language converter upholds a major research work. During the past years, there has been a substantial improvement in the information technology contributing to the development of technologies facilities for the visually impaired people.
Braille consists of raised dots in cells arrangement where a cell consists of six dots arranged in two columns of three dots each. The position of different dots represents different characters. This enables the visually impaired people to read using the sense of touch instead of vision.

[1] [10] This project focuses on the real time text to Braille language conversion using serial order pattern. This distinctive method of conversion reduces the gap between the normal reader and the visually impaired reader. It overcomes several shortcomings of existing Braille converters and results in better performance. This system facilitates an easy learning environment to the user and self-directs the user to the language translation function.

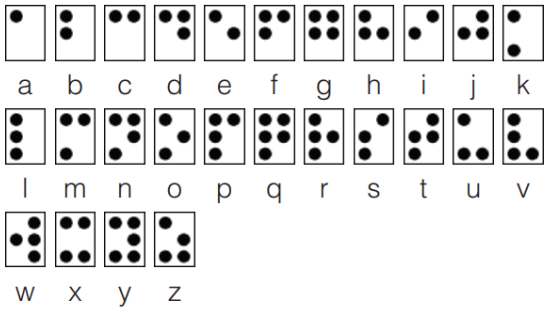

Fig1: Braille Script

II. Scope Of Project

We propose to tackle the problem of reading for a visually impaired person by constructing a Braille hardware which enables real time conversion of text. Every stage in the conversion process is examined and an attempt is made to improve each stage. This substantial method of conversion in which text is read serially or extracted from an e-book is converted to Braille characters, can be easily felt by the visually impaired**.**

This feature extraction method helps in taking input as any font, size, character and then, comparing it with the features stored already in the database. If the feature matches, then the corresponding object in database is the required output of the system. All these functions are performed by Pi Tesseract, an optical Character Recognizer. Coming to the future scope of this project work, it will be possible to integrate this device for the regional languages of India as well and also other languages of the world; to enhance its reach to as many as possible. The speed of the reading is further increased. This device also targets the beginner learners of the Braille code.

III. Research Methodology

After detailed comparison with previous works many of projects, we learned that Braille language books are bulky, expensive and oversized as compared to printed books. Conversion of all books, drafts and documents to Braille language is not feasible as the people using Braille are very few in number and this conversion takes a significant amount of time. This becomes a useful model which provides solution to this problem and helps the visually impaired person to convert text to Braille so that they can read any books, magazines, newspapers as normal person does.

Various methods are adopted to convert this Braille language into other forms of perception. Related studies were conducted by [1] Kaustubh Bawdekar et al.,; [2]Hima Pradeep V et al.,; [4]E. L. Glaser et al.,; [8] Mukund Bandodkar et al.,; [9]Gonzels R.C et al. It uses an algorithm which enables the user to convert the text which is available in English language into Braille Script and thus gives impetus for the visually impaired to read that text. These paper represents very simple models which can blind people easily handle.

Character Recognition/Pattern Recognition has become main aspect of Computer vision. Optical Character Recognition is a method where characters are recognized from images digitally. Many algorithms are available for this purpose but I-Novel algorithm implements this in a faster and efficient way based on unique segmentation technique. This algorithm has been implemented in Matlab R2010a with a set of test images and an accuracy of 98% has been obtained. Text to Speech conversion is an artificial tool that converts text to speech into sounds. The study conducted by [5]Blenkhorn et al.,; [6]J. K. Dupress et al., on Selective Speech Synthesis has provided naturalness in speech sounds based on phonemes, diaphones and syllabus.

A competition, held at the Braille Institute's San Diego office is the only one designed to test the academic skill of visually impaired or blind youths. This contest, put on by the Los Angeles based-Braille Institute, included four events that measure Braille reading speed and accuracy, proofreading, chart and graph reading, and reading comprehension as per [3]Ebnet et al.

Visually impaired people face difficulties in interacting and gaining full advantage of computers. Recently, and with the fast evolution in technology, researchers proposed to give the blinds the ability to take advantage of these advancements. Accordingly, designers and engineers started working on projects that relate input and output devices to the computers in order for the blind individual to have full control of the hi-tech machines. However, investments in these kinds of hardware presented complexity in the design, in addition to the high cost imposed by the devices used. The projects objective is to design and develop a Braille System Output Device for the visually impaired individuals that enable them to interact and communicate. In this project, the conversion of image to character takes place through feature extraction method. The image is compared with the predetermined algorithm of different characters and it recognizes the particular character which is very close to the character indication features. After character recognition, this character will be converted to Braille Language (Raised dot pattern) accordingly.

III. Proposed Design

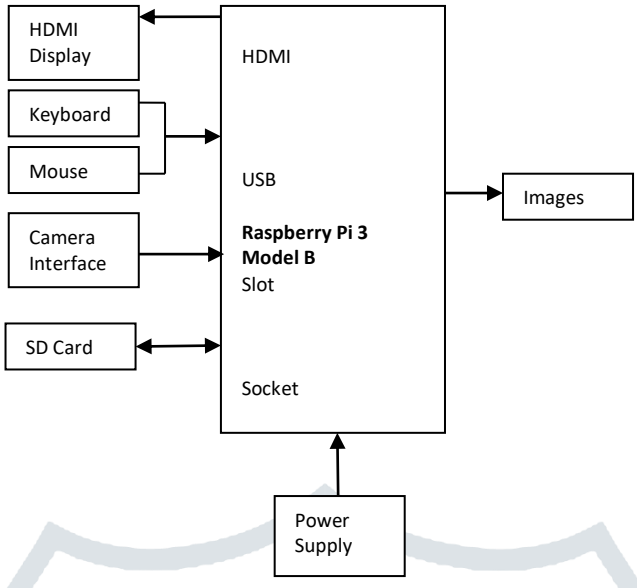

Fig. 2: Interfacing Block Diagram of the Tactile Device

Raspberry Pi 3 (Model B):

Fig.3: Raspberry Pi 3 Model B

Raspberry pi board is the central module of the whole embedded image capturing and processing system. The Raspberry Pi is a single board computer and it is a small credit card size processor board also cost effective compared with other versions of pi. It operates on 5v power rate, current rating at 700mA and its weight is around 50g.The Raspberry Pi 3 model B is the second generation raspberry pi. It has 900MHz quad- core ARM cortex A7 CPU and 1GB RAM. It also has 4 USB ports, full HDMI port, camera and display interface, and micro SD card slot. Raspberry pi is the main processing module of the project which controls and monitors all functions of the camera module which is used to capture the image, output module which contains servo motors and motor driver IC which actually represents the recognized character.

Pi Camera:

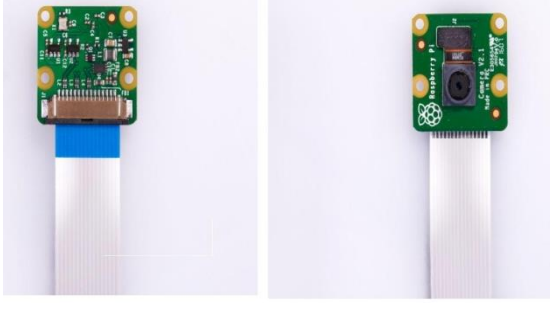

Fig. 4: Pi Camera

The camera module used in our project is Raspberry pi camera module. The camera module plugs to the CSI connector on Raspberry pi. It is able to deliver clear 5MP resolution image. The camera module attaches to the Raspberry pi 15 pin Ribbon cable, to dedicated 15 pin MIPI Camera Serial Interface, which was designed especially for interfacing to cameras. The CSI bus capable of extremely high data rates and it exclusively carries pixels data to the BCM235 processor.

Motor Driver IC (LM293D):

Fig. 5: Motor Driver IC

There are two reasons why LM293D chip is used in this project is as follows: 1.The first is that the output of the Raspberry Pi is nowhere strong enough to drive motor directly and to try this may damage Raspberry Pi. 2. Secondly in our project we want to control the direction of the motor according to the logic provided by the Raspberry pi. This is only possible by reversing the direction of the current through the motor, so that L293D is designed with the help of two control pins.

DC BO Motors:

Fig. 6: DC BO Motor

The DC BO motor can run at approximately 300 rpm when driven by a 9V Li-Ion cell. This motor has a rotation detector (encoder) mounted on the back shaft side of the motor to detect the position and speed of the rotor. This enables high resolution, high response positioning operation. This motor can usually only turn 90° in either direction for a total of 180° movement. Ability to operate with minimum or no lubrication, due to inherent lubricates.

IV. Flow Chart

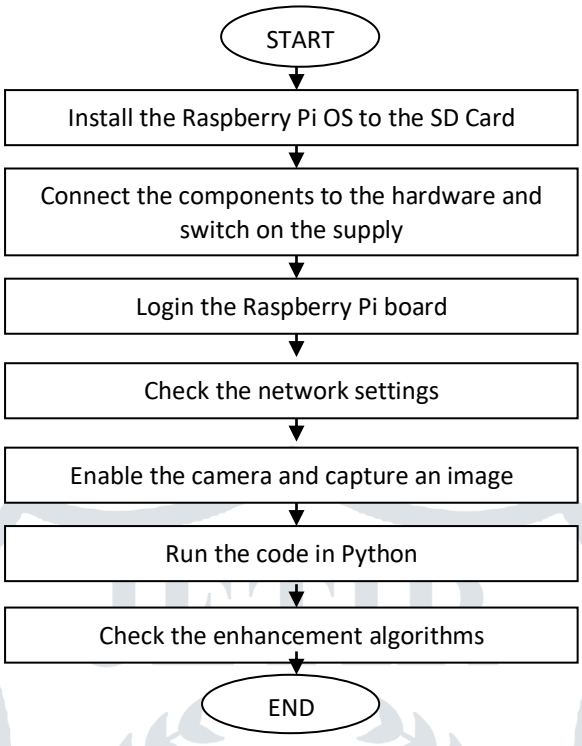

Fig. 7: Flowchart for developing Tactile Device

4.1 Developing algorithm for software:
To get the complete working of the project, development of algorithm is done for two stages. Firstly for the image processing and then to drive the Braille keypad motors.
Algorithm:

1. Study of alphabets keyboard in Braille.
2. Capturing of image alphabet from book or newspaper and stored it.
3. Using Image processing algorithm the alphabet converted into ASCII value.
4. Using Raspberry pie ASCII value converted into binary value.
5. The binary data is then converted to Braille language accordingly.
6. The data is feed to Braille keypad motors.

V. Objectives

This project facilitates the real time conversion of Text to Braille language using feature recognition and extraction method. This application enables the blind people to read any texts which are available in English language and not in Braille. It provides the best solution to the visually impaired people for their educational growth by converting the English text into Braille language which is the base of their reading and writing skills.

VI. Expected Outcome

The camera captures and stores the image of particular character suppose 'A' .This is converted into character by image extraction method i.e. character ‘A’ is compared with the predetermined algorithm which determines the particular character. Then after recognition of alphabet ‘A’, it is given as input to motors. Motors which is connected or mounted on the relay mechanism acts as output. A means the first motor out of 6 motors starts rotating. Braille keypad is 2*3 matrix with six motors in each block. Combination of these six blocks give all the alphabets, numbers and other characters by setting the first motor out of 6 in astable state. Thus, the visually impaired reader will sense the vibration of the motor and understand that the alphabet is 'A'. After few seconds, all motors are brought back to stable state.

VII. Conclusion

We expect that the visually impaired reader does not require any special book which is in Braille language as he can use the Braille converter. So reading any book will be possible for them as the normal one. Speed of reading can be increased further. Also, the variation in handwriting and various size of the text can be detected and converted into Braille language in future. For further improvement, a multi language Braille translator will be considered. Look-up tables for different languages could be stored in FLASH memory so that when translation of text in a particular language is required, the corresponding look-up table is loaded. We hope this 'Tactile Device For Blind People' will be helpful for the betterment of the visually impaired people and enlighten their life.

IX. References

[1]Kaustubh Bawdekar, Ankit Kumar and Raj Krishna Das Text To Braille Converter International Journal of Electronics And Communication Engineering And Technology, 7(4),pp.54-61, 2016.

[2]Hima Pradeep V, Jeevan K M and Miji Jacob, Device For Text To Speech Production and To Braille Script, International Journal of Electronics and Communication Engineering and Technology,5(12),pp.174-17,2014.

[3]Ebnet, Matthew (2001), "Braille Challenge Gives Young Blind Students a Chance to Shine", Los Angeles Times, PP.169, 2009.

[4]E. L. Glaser, "Small computers and grade 2 Braille," 1966 Proc. Braille Res. Develop. Conf. (sponsored by the Sensory Aids Evaluation and Development Center, Massachusetts Institute of Technology, Cambridge, pp.66, 1966.

[5]Blenkhorn, Paul [ble 1997], A System for converting print into Braille IEEE Transaction on Rehabilitation Engineering, Vol. 3, No .2, pp.215-221, 1997.

[6]J. K. Dupress and D. M. B. Baumann, "Towards making Braille as accessible as print," Dept. of Mech. Engg., Massachusetts Institute of Technology, Rept. DSR 70249-1, June 19, 1968.

[7]Yoshimi T, Islamu G, Braille Printer, U.S Patent 5193921, March 16, 1993.

[8]Mukund Bandodkar, Virat Chourasia, Low Cost Real-Time Communication Braille.

[9]Gonzelez R.C and Woods R.E, Digital Image Processing, Third Edition.

[10] www.brailleauthority.org/learn/braillebasic.pdf

[11]https://en.wikipedia.org/wiki/English_Braille