Text Image to Braille Code Converter

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Abstract- **The estimated number of people visually impaired in the world is 285 million, 39 million blind and 246 million having low vision. These people face many issues in accessing the text which is not in Braille script. Here we are proposing a prototype to help those blind people which convert text in the image to braille code. A camera is used to capture the image, the captured image will be processed by image processing techniques and the same will be converted to text using Matlab. The detected text will be transferred to Arduino through serial communication. The Arduino will be programmed in such a way that, it recognizes each and every character and converts it to braille code using the servo motor. The motors will be placed in 3 x 2 array of the matrix representing braille code. The servo arms will protrude out for its corresponding letter by rotating it in 90 degrees which depicts the particular alphabet. Hence it provides the tactile sensation of braille dot and visually impaired people will be able to read.**

Index Terms— Matlab, Arduino, Serial communication, Braille code, Servo motor.

I.INTRODUCTION

According to world health organization out of 6737.5 million people (world population),39.365 million people are blind, 246.024 million people are suffering from low vision, 285.389 million people are visually impaired. The distribution of people visually impaired in the six WHO Regions is shown in fig 1.1. These people are facing many issues to lead their life normally. Based on current technologies an effective measure can be taken to provide them a normal life in the current world irrespective of their impairment.

Recent development trends in computer vision, digital cameras, and portable computers make it feasible to assist these individuals by developing camera-based products that combine computer vision technology with other existing commercial products such as OCR systems.
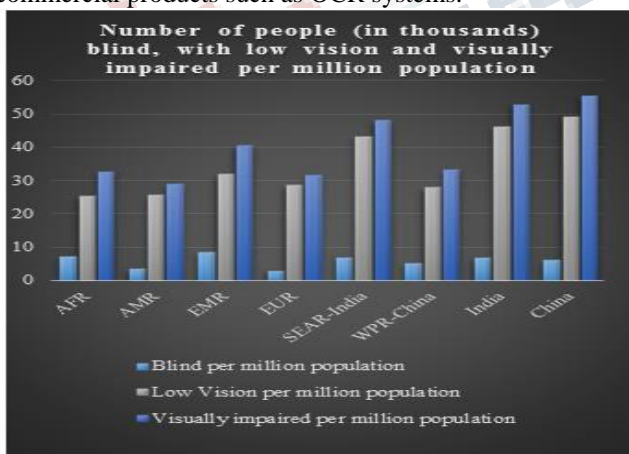

Fig. 1.1 Bar chart to represent number of visually impaired people in the world

Accessing text documents is troublesome for visually impaired people in many situations, such as reading text on the go and accessing text in less than ideal conditions. There are many devices which help them to access the text such as text to speech converters or screen readers. By using them visually impaired people only listen to the screen reader but they won't be able to know the correct spellings of certain words which are not common example few medical terms, this can be avoided by using screen reader for character by character but its time consuming and also these screen readers uses computer sounding voice which may be inconvenient. Hence to avoid these disadvantages braille display can be used.

A Braille Display is a tactile device that takes a text or pdf file from a computer which is converted from image that has been captured and protrudes braille dots for the visually challenged person to read. There are various types of braille display devices, these devices employ several types of actuators. The solenoid type device prints out braille using the movement of a plunger in the coil. The device based on piezoelectric materials exploits the characteristics that the length changes depending on the applied voltage. Some braille displays use electroactive polymers that change their shape and size in response to the applied voltage. The shape memory alloy (SMA) is also used in the braille display because the deformed shape tends to restore to the original state when heated [1].

However, the above devices have some problems. In case of the solenoid actuators, it is difficult to miniaturize the device because the magnetic field induced in the coil affects others. Since the piezoelectric materials and the electroactive polymers need high voltages for their operation, the size of a device controller becomes relatively large. On the other hand, the SMA-based device has higher power loss due to

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heat generation and slower response time which makes it difficult to offer real-time operation [1].

Above all these problems are avoided using servo motor arms to get the tactile feedback. These servo motor arms are protruded for its corresponding letters. These are protruded by rotating them by 90 degrees.

Here to convert the image which is captured by the camera into text, Character recognition or optical character recognition (OCR) is used. It is the process of converting scanned images of machine printed or handwritten text (numerals, letters, and symbols), into a computer format text. Each character is extracted from the text and extracted character will be recognized. After recognizing character its respective servo motor will be triggered. The triggered servo motor will rotate in such a way that its arm will be protruded above the surface. Hence it provides tactile which represents the character.
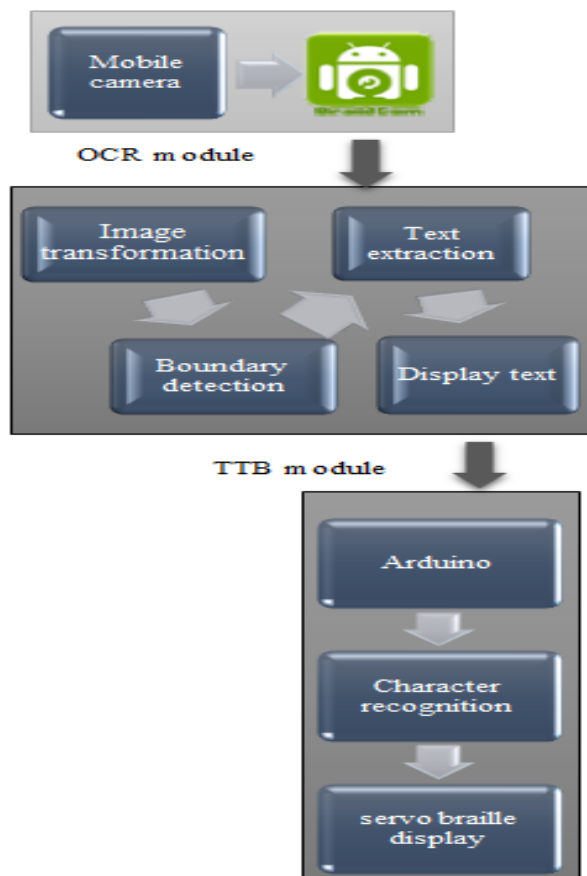
II. IMPLEMENTAION

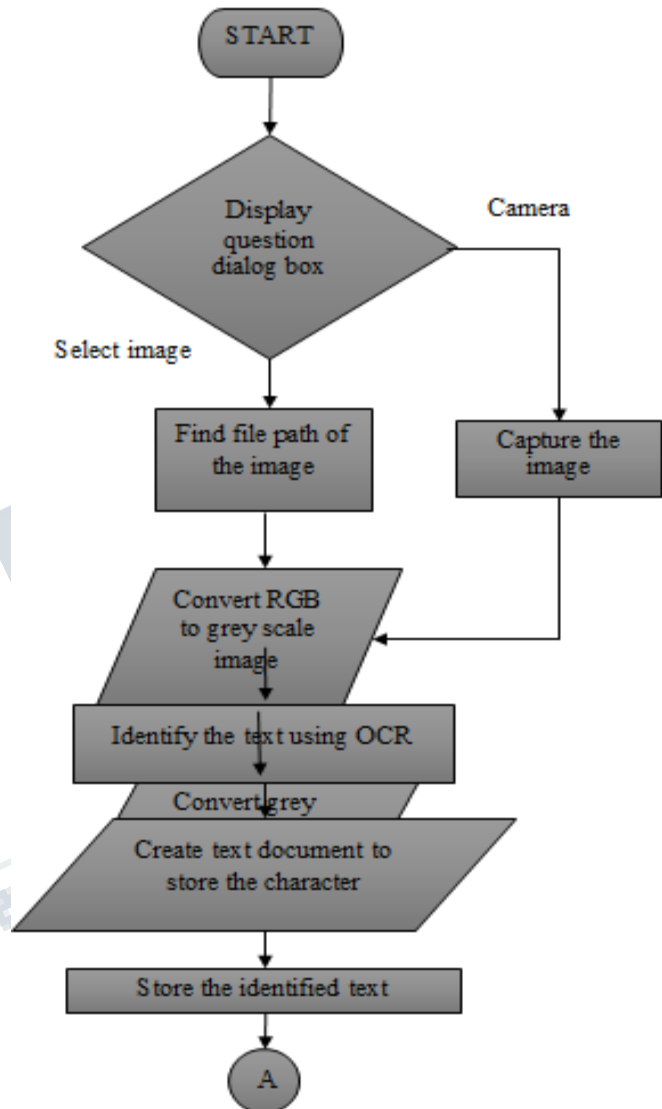**Fig. 2.1 Block diagram to convert text image to braille code**

Fig. 2.2 flow chart to convert captured image to editable text form and store in the file

Visually impaired people can easily read the text which is in braille script. Braille script uses a set of raised dots that can be felt with a finger. The text which is not in braille has to be converted. In fig 2.1 camera module is used to capture the image of the text using Mobile camera through Droid Cam. The acquired image is then applied to the image pre-processing step. In image pre-processing the unwanted noise in the image is removed by applying appropriate threshold. Initially the captured image is rescaled to appropriate size and converted into grey scale image such that it will be

more useful for further processing. The greyscale image is then converted to binary image. After pre-processing the image, it will be converted to text form by using OCR command in Matlab. The conversion flow is as shown in fig

2.2. Converted text will be stored in the file

The stored text is sent to Arduino using serial communication. Serial communication is the process of sending data one bit at a time, sequentially, through USB (in Arduino UNO). Each character from the text is extracted and recognized. After recognition the respective servo motor will be triggered. To trigger the servo motors PCA9685 motor driver is used which triggers servo motors by passing pulses to rotate. The data from Arduino to driver will be sent through I2C serial communication protocol. The program flow will be as shown in fig 2.3. When the servo motor triggers its arm is protruded out from the surface such that it can provide tactile feedback to blind people. Hence they can recognize each character which is converted to braille script.
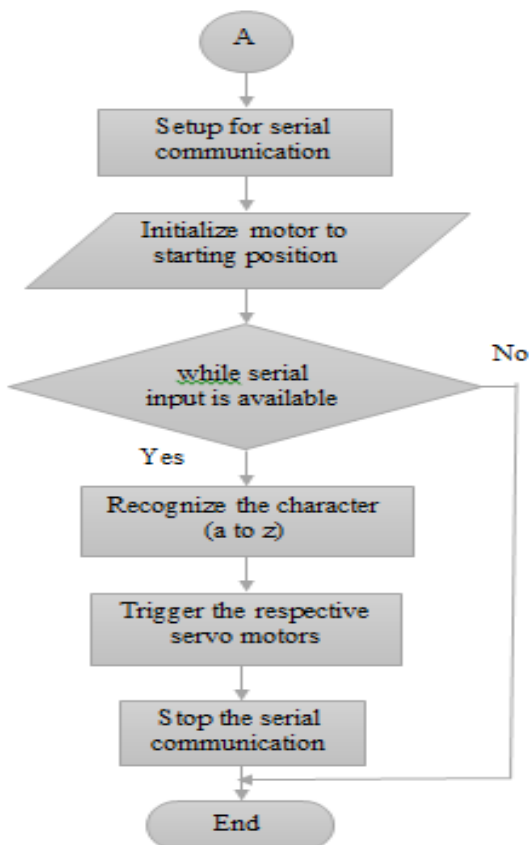

Fig. 2.3 Arduino program flow to convert text to braille code

III. CONCLUSION AND FUTURE SCOPE

Visually impaired people has to face many issues while accessing the text which are not in braille script. To help them there are many technologies, one among them is text to speech converter, which converts text to speech hence they can hear the words. But usually voice which is used will be inconvenient to listen and even the spellings will not be known to the user. This can be avoided by using character by character recognition but its time consuming. Hence the other technology that can be used to help them is braille displays. Here we are using servo motor braille display. This display over comes all the disadvantages of other types of displays used. Now days the cost of braille displays are increasing, but we used servo motors which are available at lower costs. Here we have used pre-manufactured servo motors which has the driver circuits build in it thus it occupies more space. But the size can be reduced by building own servo motors because the size of the gears that required to rotate are small. We have used matlab to convert text in the image to editable text form in which programming is easy compared to other softwares such as python, c# etc… Using matlab we have created desktop application. This helps to obtain the output in the systems which doesn't has matlab software. This can be improved by creating voice controlled desktop application.

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