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Text To Braille Conversion For Real-Time Teaching (For Grade III Braille)

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Abstract

In the recent times , the universe is going to be completely electronic. Everything is accessible in a digital and virtual world and everyone is taking the benefit of that but the problem is what about the physically handicapped people . Can they also take the same benefit of the existing information ?.Most of the available information for the visually impaired people is in the e-books, magazines, and digital documents format. But when talked about implementing such a system in schools and colleges. No such provision has been made for it. Hence Real-time teaching becomes a big issue when it is addressed. The majority of the text to Braille conversion focuses only on the reproduction of the already available books and then their conversion into the Braille. Using the current project will be able to address the issue and help to teach the students in Real-time like the other normal students are taught in the school. For the implementation of this method, will be using a webcam, the language which this is using is Python, in Python this is using TESERRACT and Arduino board and for the output, solenoids would act as a feeling mechanism for the blind students. The main reason for using Python language is that Python has extensive libraries which can be called and used. The productivity and the speed of Python are also very high and also the data structures used in Python are user-friendly and the most important thing is they can be easily learned..

Keywords: Tesseract, OCR, Python, Arduino, Physically disabled, real-time teaching

Introduction

With the new campaigns of making the world a more digitally accessible place, where digital media is easy to use , there arises too many hurdles when we talk about people with visual disability .

In India alone 2,00,000 children are estimated to have visual disformity or they have severe visual defect or blindness to which there are only half the amount of Special schools which take care of the needs of the special children.What about these kids? How will they learn online?[1]

Although the number is less as compared to five million blind people in India but still quite significant .

A couple of   Schools liks American Printing House for the Blind (reception with APH Resources), California School for the Blind (Parent Resources for Virtual and At-Home Learning Curriculum and Professional Development:) are offering courses for the blind students[3]. But such schools are limited. Our blind children cannot attend these schools or these   facilities.

Also one among the foremost faced problems is that visually impaired children have a really limited source of data (books and voice books)[4]. These students are never taught the way normal students are taught. Using our project model this issue are going to be solved. The Visually impaired students are going to be taught in real-time like other normal students then they will also dream of becoming the Pride of our

Nation and fulfill their hunger for knowledge and become subsequent Engineers and Doctors of our country.

For this application, OCR is employed . Optical Character Recognition (OCR) may be a technology that will convert image data into text form which may be edited using a computer software. In the field of literature OCR has some interesting application. For Natural language processing Optical charatcer recognisation is applied.

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Literature Survey

Dejan Stefanović and his team had a preprocessing application for enhancing the images with colourful backgrounds using Tesseract Optical Character Recognition. The intended preprocessing application improves Tesseract OCR performance by approximately 20%. Image clustering and Segmentation for the two methods used for the fulfillment of the project. the most important benefit of a clustering method is that the recovery from failure can happen without the user intervention ie also called as the automatic recovery from failure . It is that a degraded image are often recovered but its disadvantages are that it increases the complexity and its inability to get over database corruption[1].

Muhammed Tawfiq Chowdhury and his team during this paper had developed a Bengali OCR which is extremely precise.OCR's library is made from 18110 characters and 2617 words. During this research, the accuracy of OCR is tested using the 'Solaimanlipi' font and 200 input files. 97.56% is the accuracy achieved for the software for the clean image files. Rather than paying someone to enter large amounts of text this method is much cheaper. It is very fast and therefore therefore tables and the original layout can be recreated by the latest software. The accuracy isn't 100%. The system is precise, not accurate. After manual correction all the documents have to be checked over carefully. This method isn't suitable for little amounts of text [2].

Teddy Mantoro and his team within the paper "Optical Character Recognition (OCR) Performance in Server-based Mobile Environment" has suggested a method for Optical Character Recognition (OCR) on a mobile device using server-based processing. 5% higher character recognition accuracy than the standalone OCR is there in the server based mobile OCR and 99.8% is its format recognisation accuracy. Very useful are the format amd the character accuracy for example the book reprints uses it. When talked about the cost, more efficiently OCR can be used with good accuracy. Using the suggested process, the digitization of the 100-page book cam be finished in only 90 mins . Though a standalone OCR application requires more time, this process gives us better results for text format and the character [3]

Jamshed memon and his team within the paper had used ANN (Artificial Neural Networks) for the implementation. ANN is employed in machine learning and may be a fairly new technology. The ANN methods are very effective for the noise of the training data. The final output is not affected by the noise present in the training examples. It is implemented where the fast evaluation of the learned target function is required and may bear long training times counting on factors like the amount of weights within the network, the amount of coaching examples considered, and therefore the settings of varied learning algorithm parameters. Before being introduced to ANN the problems need to be translated into numerical values [4].

Tan Chiang Wei and his team during this paper "Improved Optical Character Recognition with Deep Neural Network" . ADNN using Inception V3 has been used to train and perform OCR. 53,342 noisy character images have been used to train the Inception V3 network, which are collected from receipts and newspapers. Better recognition and accuracy on poor quality text images is achieved at a great rate using the proposed deep neural network and compared to existing OCRsan overall 21.5% reduction in error rateis resulted. The system resulted much better recognition accuracy at 78% for poor quality text images and resulted in an overall 21.5% reduction in error rate. The OCR also maintained a 90.6% accuracy on an honest quality image test dataset. The proposed OCR can perform well with noisy character images.Good quality training data but also poor quality training data should be included in the training process of a network to enhance the training of the network [5].
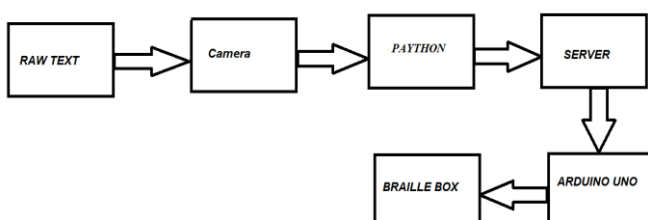
Kimaya Kulkarni presented a communicator and text detector for visually impaired people. To send the characters from the document to the microcontroller Bluetooth is used , And Arduino was the microcontroller which was used. Portability is ensured using bluetooth. The advantages of Bluetooth are that Bluetooth uses wireless communication to transmit voice and data at high speed using radio waves. Power consumption of the Bluetooth is also very less. Bluetooth is upgradeable. Bluetooth is way better than Infrared communication. The disadvantages are that connection in the Bluetooth is less in certain conditions. Bandwidth as compared to Wi-Fi the bandwidth is low . Only short-range communication between devices is allowed [6].

TJoshua L. Dela Cruz and his team within the paper had used Haptic technology for the processing of the OCR. The haptic system is definitely user-friendly and accessible. The precision and accuracy of the system is high. But complex designing is required as Haptic devices are required to be precise. The cost is high initially. In video gaming the Haptic system is used. Medical Applications make use of Haptic interfaces are also used for Medical Applications. It is utilized in Military Applications also involve Haptic systems. [7].
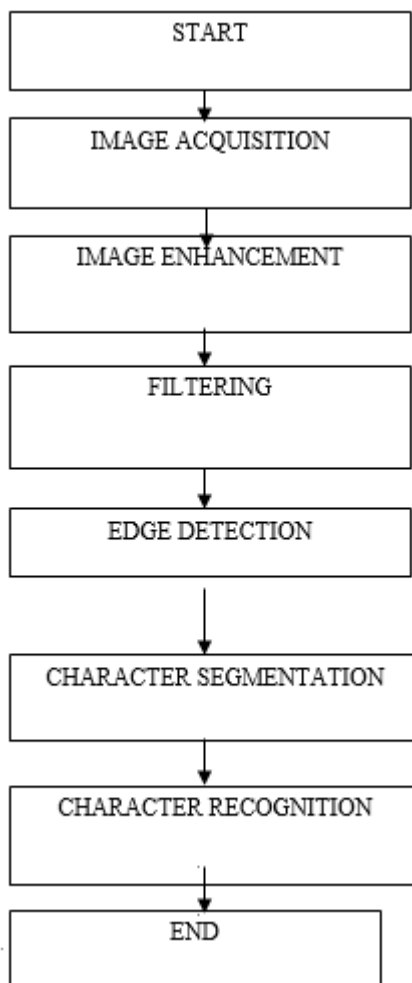
Mr. Vrushabh S. Dharme and his team within the paper are using the Thre sholding algorithm for the conversion system. The disadvantages for the algorithm are the computational time and resources needed to compute the new data set, and therefore the new data takes up space in your image . Also, the initial cost is high, and once the system is broken the image is lost. the benefits include removing noises. Correct image density and contrast. Helps to simply store and retrieve computers. Image are often made available in any desired format like black and white, negative image[8].

From the subsequent papers, this is often concluded that the Teserract method used for the OCR gives us less accuracy as compared to ANN or DNN. The clustering method are often used for poor image quality and downgraded images for his or her recovery. Next, this concludes that server-based OCR provides more accuracy than Standalone OCR. ANN and DNN are used for machine learning and are new technologies. they're effective but their initial cost is extremely high. Hence for the event of our project, this may be using Python language because it's easy to read or write it contains inbuilt libraries also it's free and open source.

Figure 2 .Blocks used in for the text conversion.

Methodology

```
                    ┌──────────────────────┐
                    │        START         │
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │  IMAGE ACQUISITION   │
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │  IMAGE ENHANCEMENT   │
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │      FILTERING       │
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │    EDGE DETECTION    │
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │ CHARACTER SEGMENTATION│
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │ CHARACTER RECOGNITION│
                    └──────────┬───────────┘
                               │
                    ┌──────────▼───────────┐
                    │         END          │
                    └──────────────────────┘
```

• The camera captures the raw text. The camera then sends the raw Captured Image which is captured by the camera is then sent to the python for the conversion into Braille Text.

•The Braille script is poped up using a solenoid that this is often getting to output. 6 solenoids are used for the output.

• The blocks perform Image Acquisition, Edge detection ,image enhancement, filtering, character segmentation, and then the image is compared with the database and then the character is recognised optically.

• Image acquisition - Image acquisition means that acquiring the images.

• Image Enhancement - digital image quality is an improvement in the image enhancement. Histogram acquisition helps in the contrast adjustment. The visibility of the Image is also increased.

• Filtering -Within the filtering section the teehnique of median filtering is used. A median filter works by selecting the median intensity within the window during which it is allowed to operate. The median filter is an example of Non-linear filtering is a median filter . To remove noise it is used.

• Edge Detection - edge detection methods are used to side within the image ,for finding the boundaries.

No	Hardware and Software 3942 Requirements

Table 1 ; Hardware and Software requirements

2	Operating System	Windows
3	Camera	USB 2.0
4	Languages	python

System Implementation

A. Block Diagram

This has used the OCR algorithm for the extraction and recognition of text in our application OCR algorithm is used In the world of pattern recognition OCR algorithm has made great advances. It is used in security, image processing, and scanning documents applications providing a 99% accuracy rate for printed characters and quite 90% for handwritten characters.

OCR algorithm is meant to convert scanned images into editable digital documents. OCR includes the subsequent phases

1) Pre-processing

Pre-processing may be a vital introduction which changes effective processing. Pre-processing phase using normalization the reduction is decreased after capturing the information and the variations are reduced that would have caused the low recognition rate.The input image is converted into binary format using the grayscale techniques. This method is called as the binarization of the digitization of image.

2) Extraction

From the image the relevant information is extracted in the extraction. Within the input image each character of the text is extracted which was embedded. The input of the preprocessed image is given to the extraction.

3)Recognition

Because of the letter each character within the extracted image is converted into the code labeled . A meaningful object is created from each text

4) Post-Processing

The method of post-processing is that it provides, aiming for the unrecognized text or character and to eliminate the abnormal object. Any unrecognized and distorted object is called as an abnormal object. Only meaningful labeled letters are used in this pahse.

Testing and Results

- The performance of the proposed solution was checked on the following device:

Laptop: windows

Version: windows 7 ultimate 64 bit

Processor: Octa-core

RAM: 4 GB

Note: The speed and connection status of the internet decides the conversion response time.

Table 2; Per Module Operations

No	Per-Module Operations	
1	Delay between letters	Ave. Time
2	Online text translation response time	0.5sec
3	Delay between words	3000ms

Conclusion

• The image is captured and converted into Braille language with the assistance of Arduino Uno. The system implemented helps blind students and assists inReal-Time Teaching.
•The implemented project can perform the subsequent task:
1. The captured image are often converted to textwith help of an open cvAll the alphabet can be recognized by the system.

1. The Arduino-based receivers the info serially and converter the info in braille code.
2. The braille code is employed to activate the solenoid valve.
3. O.5 sec and 3000ms the delay between the letters and words give is taken into account with regard to the typical student. This delay might be increased or decreased on the extent of intelligence of the scholars

Acknowledgment

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