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# AMBERT- VOICE CONTROLLED SMART READER FOR VISUALLY IMPAIRED

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**Abstract -** *This paper describes an innovative, beneficial, and cost-effective model AMBERT which is a voice-controlled smart reader for visually impaired people. Visual impairment is a major problem faced by humanity. People suffering from complete or partial blindness are unable to read written or printed content on their own. Optical Character Recognition (OCR) is a quite popular and widely used technique to extract and recognize characters from any image. This model AMBERT combines the benefits of OCR with a Voice command system which makes it efficient and effective for use by the visually impaired. The title AMBERT is a German name meaning bright, shining light depicting that it will bring light in the lives of the visually impaired. AMBERT is designed to assist visually impaired people by reading books, articles, newspapers, magazines, etc. for them. It is a Raspberry Pi version 2 based hardware model with 1.2 GHz processor, 1 GB RAM, and using OCR (Optical Character Recognition) software, OpenCV (Open Source Computer Vision) library, web camera, etc. to serve the purpose.*

***Key Words***: **Optical Character Recognition (OCR), Voice command system, Text to speech conversion, Speech to text conversion, Image to text conversion, OpenCV, Raspberry Pi.**

## 1. INTRODUCTION

This era of the internet revolution, information, and technology is marked by immense availability of resources to acquire comprehensive knowledge. Books, articles, magazines, journals, newspapers, etc. comprise a major portion of the sources to keep ourselves updated on the innovations, news, researches, and developments being carried out across the globe. Despite this remarkable enhancement in the availability of such resources, a considerable fraction of the human population cannot access this ocean of information due to visual impairment.

With the rapid increase in the human population, the number of people suffering from visual impairment increased quite largely. As per the statistics shared by the World Health Organization (WHO), over 285 million individuals are affected by this problem. They suffer from either complete or partial blindness. These people find it difficult to acquire knowledge from written or printed material. Books in braille format provide some relief to this ailment but they fail to address the problem in totality because all the books are unavailable in braille. This model AMBERT provides the feature of reading books for visually impaired people. The model uses Raspberry Pi version 2. Optical Character Recognition (OCR) technique is used in this model. This technique enables us to extract text from an image of printed or handwritten text into a machine format. OpenCV (Open Source Computer Vision) libraries provide real-time computer vision features. The various functions of image processing are used in this library.

## 2. LITERATURE REVIEW

Numerous researches have been carried out and models have been developed to address this problem by developing smart readers for visually impaired. These models used various techniques and methodologies to serve the purpose.

A paper by L Latha, V Geethani, M Divyadharshini, P Thangam titled "A Smart Reader for Blind People" describes a Raspberry Pi based smart reader for blind people. It uses Optical Character Recognition (OCR) to extract text out of images. The OpenCV library and TTS (Text to Speech) engine are also used in it. It helps visually impaired people to access information [1].

A paper by J. N. Balaramakrishna, Ms. J. Geetha, "Smart Text Reader from Image Using OCR and OpenCV with Raspberry PI 3" gives the details of a smart reader which uses Optical Character Recognition (OCR) and Text to Speech Synthesizer (TTS) in Raspberry Pi. The device has image and voice processing modules [2].

A paper by Ram Nivas Duraisamy, Sathya Manoharan titled "A Smart Reader for Visually Impaired People" is based on a comparative study. This reader operates in 3 modes namely acquisition, text conversion, and conversion of speech. It is an economical model and the accuracy of its results is compared with the MATLAB image processing model [3].

A paper by G. Ashwini, M. Nithish Reddy, R. Paramesh, P. Akhil on "AN INTELLIGENT VIRTUAL ASSISTANT USING RASPBERRY PI", describes a Voice Command System as an Intelligent Virtual Assistant (IVA). It can perform numerous services for an individual. It uses Query processing, Machine Learning, Raspberry Pi. It performs operations like retrieving information based on voice command [4].

## 2. INFERENCES FROM LITERATURE REVIEW

A. Optical Character Recognition (OCR) is an important technique used in the development of any Smart Reader for visually impaired.
B. Voice Command System can enhance the effectiveness of any device developed for visually impaired people.
C. If we combine the benefits of using OCR (Optical Character Recognition) and Voice Command System, then the developed model to assist visually impaired people would become more user-friendly.

## 3. HARDWARE REQUIREMENTS

1. Webcam: Webcam acts as an input source to the model. The plain text is placed underneath the webcam and its image is captured through the webcam.

2. Microphone: Microphone acts as a primary controlling device for giving voice commands to the smart reader. It provides the feature of voice control to this smart reader. The voice commands are further processed to perform the instructed operations.

3. SD Card: Secure Digital (SD) Card is a non-volatile memory card to provide storage features to the Raspberry Pi. A 32 GB SD card is used in the development of the model AMBERT.

4. Raspberry Pi: This model uses Raspberry Pi which is a low-cost computer that can be connected to keyboard, mouse, monitor, or TV. Here the Raspberry Pi is connected to the input and the output devices. The processing of voice commands and image to text conversion, text to speech conversion, etc. is done in Raspberry Pi. The version 2 of Raspberry Pi with 1 GB RAM and 1.2 GHz processor is used in this model.

5. Speaker: In this smart reader, the speaker serves as an output device. It is aimed at giving the output of the read text in speech form. The visually impaired people can listen to this output which enables them to understand the content of the written text in a comprehensive manner.

## 4. SOFTWARE REQUIREMENTS

1. Python 3.7: Python version 3.7 is needed to be installed in the Raspberry Pi.

2. TTS Synthesizer: A Text-to-Speech (TTS) Synthesizer is used for the conversion of text captured from an image.

3. Optical Character Recognition (OCR): OCR is used for the conversion of printed text into a machine-encoded format. The two main processes involved in it are feature extraction and classification. Feature extraction deals with the extraction of characters from the image. Classification is concerned with the matching of characters extracted with letters.

4. Raspbian OS: It is the Operating System used in Raspberry Pi to support other functionalities in it.

5. OpenCV: Open source Computer Vision (OpenCV) is a library to provide real-time computer vision. It is used in image capture of text.

6. IDLE: Python Integrated Development and Learning Environment.

## 5. PROPOSED ARCHITECTURE

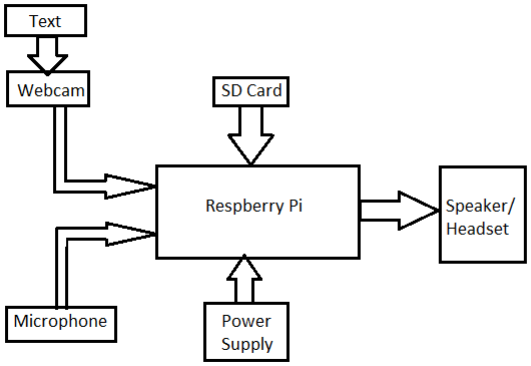


**Fig -1**: Block Diagram

Figure 1 shows the block diagram for the voice-controlled smart reader. The various components along with their interconnections are shown. The Raspberry Pi forms the central unit of this model to which all the input and output devices are connected. The Raspberry Pi is connected to a power supply and an SD Card is inserted into the Raspberry Pi for storage purpose. The microphone shown is used for taking voice commands from the operator. The processing of the instruction given by the operator is done in the Raspberry Pi. Then the image is captured through the camera and it further processed. The final output in the form of audio is given by the speaker/headset connected to the Raspberry Pi at the center.

Initially, the written or printed material needs to be brought in front of the camera. The voice command to read the text would initiate the image capturing process. This will be followed by image to text conversion. The text file will then be provided as an audio output through the speaker/headset.

## 6. FLOW OF PROCESS

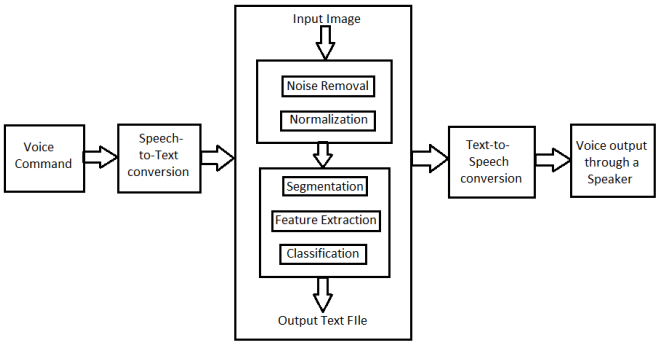


**Fig -2**: Process Flow

Figure 2 shows the process flow of the voice-controlled smart reader. This model consists of three modules:

1. Speech to Text conversion: This module deals with the conversion of speech taken as an input from the microphone. The STT engine converts the speech into text by canceling the noise and distortion and then uses NLP (Natural Language Processing) to produce text string.

2. Image to Text conversion: This module deals with the conversion of an image captured by the camera into text form. OpenCV (Open source Computer Vision) library is used for this purpose. The noise from the image is removed and the image is converted into black and white. The image is further processed to extract text out of it.

3. Text to Speech conversion: TTS (Text to Speech) Engine is used for the conversion of text into speech. This speech output makes this model more user-friendly. The model can interact with visually impaired through the speech output.

## 5. APPLICATIONS

Some real-world applications of this voice-controlled smart reader are:

1. Learning opportunity**:** This smart reader will open doors for enhanced learning and access to prominent online resources for visually impaired which is a great source of information for all.
2. Assistant: The model will act as an assistant for visually impaired people working on their voice commands. It will process speech into text format and function accordingly.
3. Competition spirit**:** Visually impaired candidates will be able to compete with other students. They could learn new things and explore the information available online.

## 6. ADVANTAGES

1. The benefits of ever dynamic technological advancements would be made available to visually impaired people.

2. The visually impaired students would be in a better position to compete with other students.

3. Encouragement of learning attitude and usage of the internet, which is a wide ocean of knowledge.

4. Promotion of awareness and knowledge.

## 7. CONCLUSION

A simple architecture to design a voice-controlled smart reader for visually impaired people is present in this paper. This model AMBERT will be efficient and effective in solving the challenges faced by visually impaired people in accessing the vast amount of information. This can well operate in real-time to read printed or written material for its operator. It is cost-effective and combines the benefits of Optical Character Recognition (OCR) with that of Voice-controlled systems.

## 8. FUTURE SCOPE

Voice-controlled systems are becoming more popular day by day. The algorithms used in this model can be enhanced to produce more accurate results. Furthermore, the design of this model can be more simplified with better technology such that it becomes handier for the visually impaired people. Additionally, this model can be used in schools, colleges, and universities to teach visually impaired students. The main aim of this model AMBERT to benefit society and bring about light in the lives of visually impaired people would be better served with advancements. A simple architecture to design a voice-controlled smart reader for impaired people is present in this paper. This model AMBERT will be efficient and effective in solving the challenges faced by visually impaired people in accessing the vast amount of information. This can well operate in real-time to read printed or written material for its operator. It is cost-effective and combines the benefits of Optical Character Recognition (OCR) with that of Voice-controlled systems.

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