AUTOMATIC READER FOR THE VISUALLY IMPAIRED PEOPLE

A PROJECT REPORT

(Project Work II)

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BONAFIDE CERTIFICATE

This is to certify that the project work II report entitled **"Automatic Reader for the Visually Impaired People"** is the bonafide record of project work done by **AMIRTASURYA S(19ECR008), BHARATH VIYAS N (19ECL223), HARIHARAN A (19ECR050)** in partial fulfillment of the requirements for the award of Degree of Bachelor of Engineering in Electronics and Communication Engineering of Anna University, Chennai during the year 2022-2023.

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DECLARATION

We affirm that the project work II report entitled **"Automatic Reader for the Visually Impaired People"** being submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering is the original work carried out by us. It has not formed the part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

There are roughly 285 million blind and visually impaired people in the world. Visually impaired people are individuals who have partial or total loss of vision. Reading is one of the biggest challenges for visually impaired people. For this project an Automatic Reader for the Visually Impaired People is designed which converts text to audio signal. Here the input document is captured by a 1080-pixel webcam. Then it is converted into a digital format using Optical Character Recognition (OCR). Then the digital text is converted into audio signal by open-source E-speak module Text-To-Speech (TTS) engine. This can be hearable by the visually impaired people. To automatically detect the text areas from the entity, a text location, and Tesseract algorithm is accomplished by learning gradient properties of stroke direction and distribution of edge pixels in an Ada boost model. This project converts text to audio signal in English language only. This can be extended to other Indian regional languages in future.

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LIST OF ABBREVIATION

ARM	ADVANCED RISC MACHINE
ASCII	AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE
BARD	BRAILLE AND AUDIO READING DOWNLOAD
DVI	DIGITAL VISUAL INTERFACE
EAST	EFFICIENT AND ACCURATE SCENE TEXT
GPIO	GENERAL PURPOSE INPUT OUTPUT
HDMI	HDMI HIGH-DEFINITION MULTIMEDIA INTERFACE
IOT	INTERNET OF THINGS
MICR	MAGNETIC INK CHARACTER RECOGNITION
NLP	NATURAL LANGUAGE PROCESSING
OCR	OPTICAL CHARACTER RECOGNITION
OS	OPERATING SYSTEM
RCA	RADIO CORPORATION OF AMERICA
ROI	REGION OF INTEREST
TTS	TEXT-TO-SPEECH
USB	UNIVERSAL SERIAL BUS
VNC	VIRTUAL NETWORKING COMPUTING

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

There are roughly 285 million blind and visually impaired people in the world. Visually impaired people are individuals who have partial or total loss of vision. This can range from mild impairment where they can see some shapes and colors, to complete blindness where they cannot see anything at all. Visual impairment can be caused by various factors such as genetics, diseases, injuries, or aging.

Visually impaired individuals face various challenges in their daily lives, including difficulties with mobility, communication, and accessing information. They often rely on specialized tools and technologies, such as white canes, guide dogs, screen readers, and braille devices to help them navigate the world.

Despite these challenges, visually impaired people can lead fulfilling lives and engage in various activities, including education, employment, and social activities. Many organizations and resources exist to support visually impaired individuals, such as advocacy groups, training programs, and assistive technology.

It's essential to be respectful and understanding of visually impaired individuals and to be willing to accommodate their needs. This includes providing appropriate accommodations in public spaces and workplaces, such as braille signage, audio descriptions, and accessible technology.

Visually impaired people often face significant challenges when it comes to reading. Reading is an essential skill that enables individuals to access information, communicate effectively, and participate fully in society. However, for visually impaired individuals, reading can be a difficult and frustrating process.

One of the biggest challenges that visually impaired people face when it comes to reading is accessing printed materials. Most printed materials, such as books, newspapers, and magazines, are not accessible to individuals with visual impairments. This is because the text is often too small, and the contrast between the text and the background is not sufficient for visually impaired individuals to read comfortably.

To overcome this challenge, visually impaired individuals often use assistive technologies such as screen readers, which convert text into audio, or braille devices, which convert text into braille. However, not all printed materials are available in accessible formats, making it challenging for visually impaired individuals to access information.

Another challenge that visually impaired individuals face when it comes to reading is learning to read. Children with visual impairments often face difficulties in learning to read, as they may not have the same access to visual cues as their sighted peers. This can impact their literacy skills, which can affect their education and employment opportunities in the long run.

To address these challenges, various initiatives and organizations exist to promote literacy among visually impaired individuals. These initiatives include the development of accessible reading materials, the provision of assistive technologies, and specialized training programs to teach visually impaired individuals how to read and write in braille.

An Automatic Reader for the Visually Impaired Person is a device that has been designed to help individuals who are visually impaired read printed text. This device works by capturing images of the text and converting them into an audio output that the user can listen to. The process involves using a camera to take a picture of the text, which is then processed by optical character recognition (OCR) software to convert it into a digital format. The digital text is then read aloud by a text-to-speech (TTS) engine, allowing the user to listen to the text.

Automatic readers for the visually impaired are also portable and lightweight, making them easy to carry around. They can be used at home, in the office, or even while traveling. Additionally, some models are designed to be user-friendly, with intuitive interfaces and

voice-guided menus. This makes them accessible to people with varying levels of technological expertise.

In conclusion, automatic readers for the visually impaired are an innovative and useful device that can help improve the lives of individuals with visual impairments. They allow for greater independence and freedom, enabling people to read printed material without assistance from another person. This, in turn, improves their access to education and employment opportunities, as well as their ability to participate in everyday activities. With the advances in technology, automatic readers for the visually impaired are becoming more affordable and widely available, making them an accessible solution for people with visual impairments.

1.2 OBJECTIVE

The use of an automatic reader enables persons who are blind or visually impaired to read printed text on documents that are not available to them online or in braille more quickly. People who are blind or visually handicapped can use an automatic reader to read some of the web content that is missed. A computerised reader can read new books that aren't accessible online to persons who are blind.

1.3 PROJECT SCOPE

Our product's OCR has a very broad range. It has a lot of potential because it might become a common, affordable, and improved software tool that users can use for a variety of tasks. The process of reading and identifying characters in a document, instructional tasks, and tasks for businesses and government agencies that have access to databases of written documents and/or scanned images are just a few examples. No matter how big or little a document is, or what kind of character it contains, the product can recognise them. This can be achieved by attempting to locate and analyse the accumulated data in accordance with the user's preferences.

CHAPTER 2
LITERATURE SURVEY

[1]Rawaa Farhan, Baraa Farhan, and Mustafa Raheem Neamah have proposed designing and implementing a clever solution for assisting individuals with visual impairments involves utilizing a Raspberry Pi connected to a camera interface that captures an image of text. Through the implementation of OCR technology, the image is converted into text by optically recognizing characters and extracting the relevant textual data before being transformed into audio. The audio output is then transmitted through speakers and an amplifier. The Raspberry Pi is equipped with both OCR and a text-to-speech conversion unit, with the former responsible for optical character recognition and the extraction of text from images, and the latter for converting the extracted text into speech and delivering it via headphones or speakers.

[2]Nabendu , Dusayanta , Avishek , and Pratyay presented a paper titled the development of an automated reader for the visually impaired using Raspberry Pi has demonstrated significant progress compared to prior similar efforts. The system comprises various elements, such as capturing images using a Raspberry Pi camera, recognizing text through the Tesseract OCR framework, and converting text into speech using eSpeak TTS. The effectiveness of the model largely relies on the optimization and processing of these components to produce satisfactory output. However, issues with inaccurate text output from OCR due to processing problems necessitate the inclusion of preprocessing as a critical aspect of the entire system. The model's performance is affected by factors such as small or unclear characters, light issues, or the presence of graphics within the text. Our proposed solution overcomes these challenges through binarization, producing superior results in English, Bengali, and Hindi languages without internet dependency.

[3]Mohammed Ali , Karim Q. Hussein, and Dhiaa Al-Hassani presented an Audio Reading System that employs a camera as an input device and a speaker as an output device to assist blind persons in reading text. The Audible Reading System consists of three primary steps: input, processing, and output. The first step is to use a camera to take an image of the text that you wish to read, and then send it through the processing stage. Second, image processing will be utilized to filter and extract the text using the OCR technique, and finally, the TTS algorithm will be used to pronounce the text using a speaker device. The main features of our system are as follows: it simulates the system's real-time, uses cloud computing to avoid client hardware limitations and collect data (data centralization), page localization to assist the blind person in capturing the complete view of the text, and modifies the Efficient and Accurate Scene Text (EAST) algorithm for identifying text sequentially. In addition, there is a text correction process and index table technology.

[4]Norharyati Harum, Nurul Zakaria, Nurul Eimran, Zakiah , Anawar have published this project that makes use of IoT technology, including an IoT device, IoT infrastructure, and a service. The Raspberry Pi IoT device is utilized, which is incredibly energy efficient since it merely requires 5V of power to function. It is also a very portable gadget that is only the size of a credit card and can be taken anywhere. The book reader will photograph the book pages using a camera and then process the photos with Optical Character Recognition software. When a book reader recognizes a picture, he or she will read it aloud. As a result, folks who are blind or have impaired eyesight will be able to hear it without having to touch it with their fingertips. The user may experience both soft copies and hardcopy books by employing an online text-to-audio converter and IoT networking protocols such as Wi-fi connectivity and 4G services. A camera is inserted in hardcopy books to photograph the page. The inspiration for creating this product was to inspire all blind individuals to read regular books. This will allow them to get specific information from reading without having to learn Braille.

[5]Ying Li, Junxin Cheng, and Xin Wang have described The optophone is a device designed to help people with visual impairments to read written materials just like those without such impairments. The system is composed of a Raspberry Pi, a camera, and an Android app. The

camera is connected to the Raspberry Pi interface to capture images of reading materials. The audio output device is also connected to the Raspberry Pi audio interface to provide audio playback for the users. The Android app is used to control the operations of the Raspberry Pi, including identifying images to convert to text, selecting reading materials, and controlling playback. Compared to previous versions of similar devices, this optophone is much more user-friendly since it can be controlled directly from the user's phone. This article provides a technical overview of each subsystem of the optophone and explains how they work together to provide an improved reading experience for people with visual impairments.

[6]Neha , Akanksha Raut, Saloni Sonawane, and Raza Shaikh have published a paper titled Presentation of a smart reader system for the blind that depicts an interactive system using text readers and flipping pages with the capability of pages being translated using a dictionary. It is based on Raspberry Pi and Python programming by employing a camera to snap pictures and convert them into text and then into sound to help the blind overcome the problems of previous methods, the introduced a prescription reading aid system for people with visual impairments based on an Android app, the program takes a snapshot of the prescription, identifies the region of interest (ROI), and separates it from the backdrop. The taken image is transformed into text using the OCR algorithm, which recognizes letters, and then translated into voice and read to people using NLP.

[7]Supriya Kurlekar, Onkar A. Deshpande, and Akash V. Kamble have presented this project is based on the Raspberry Pi processing board. It is in charge of peripherals like the camera and speaker, which serve as a connection between both the system and the user. In this project, optical character recognition (OCR) is used to recognize characters, which are then read out loud by the system via a speaker. The camera is positioned on a stand in such a way that when a piece of paper is presented in front of it, it catches clear sight of the paper and stores it in the system. Furthermore, when the lens takes a picture of the papers, it ensures that there are acceptable lighting circumstances. The paper's content must be written in English and in legible font size. When all of these circumstances are satisfied, the system is taking the snapshot, analyses it, and

determines if the material printed on the paper is recognized. Following that, it speaks to the material that was converted to a textual form in the system when analyzing the image of the paper. As a result, a Reading Device for Blind Persons enables a blind person to comprehend written material without the assistance of a human reader.

[8]Niveditha , Kavya , Nivedha , Pooja , and Lakshmikantha have proposed a recent research paper discusses the development of a smart stick assistive navigation system designed to aid individuals who are blind or visually impaired with both outdoor and indoor travel. Blindness is a significant challenge for individuals in society, and it can be challenging for them to navigate the world and locate desired objects or locations. Blind individuals often rely on assistance from others to perform daily tasks. To address this problem, the proposed solution provides blind individuals with a virtual eye in the form of a smart stick, allowing them to live independently. The Smart Stick is equipped with a camera and a Raspberry Pi, which can detect and identify obstacles that may impede the movement of blind individuals. This information is relayed to the user through earbuds connected to the Smart Stick. Additionally, a sensor is located at the bottom of the stick to detect and avoid puddles. The system utilizes advanced algorithms such as Yolo and Dark Flow to enable the identification of objects and obstacles. The primary objective of this solution is to provide visually impaired individuals with a reliable system that guides them to their desired locations and enables them to live independently.

[9]Isha S. Dubey, Jyotsna S. Verma, and Arundhati Mehendale have published A recent study has proposed an innovative solution that combines a reading machine (OCR), virtual assistant, and Domotics system using a Raspberry Pi. This technological tool has immense potential for aiding individuals with visual impairments and disabilities. The OCR technology enables the identification of text, which is then converted into audio speech using gTTS (Google Text to Speech) with pre and post-processing techniques. The platform of choice for virtual assistants in this system is Google, which can be utilized for various everyday tasks such as checking emails, weather updates, and news. Through the implementation of voice-based home automation using Google Assistant and Python programming language, this initiative aims to provide comprehensive technological support to visually impaired individuals. The voice command feature enables activities like document reading, home automation, and customization, among

others. Overall, this technology has the potential to provide significant assistance to individuals with disabilities.

[10]Akila , Akshaya, Deepthi , and Sivadharshini have provided a system that enables individuals who are visually impaired to access text in English or Tamil by capturing images of the text and translating them into audio output. The system was created using a Raspberry Pi 3 model B, a webcam, the Tesseract OCR engine, and the Google Voice API text-to-speech engine. However, the system is not without limitations, as it may produce unclear output with inaccurate regional accents and may experience difficulties with Tamil speech.

CHAPTER 3
EXISTING METHOD

3.1 BRAILLE SYSTEM:

Braille is a tactile writing system invented by Louis Braille in the 19th century, primarily for people with visual impairments. It uses a combination of raised dots on a surface, arranged in a specific pattern, to represent letters, numbers, and punctuation marks.

There are several existing methods of Braille System, including:

Grade 1 Braille: This method uses a one-to-one correspondence between letters of the alphabet and individual Braille cells. It is the most basic form of Braille and is typically used by beginners.

Grade 2 Braille: This method uses contractions, abbreviations, and other symbols to represent common words and phrases, making it more efficient and faster to read. It is the most commonly used form of Braille.

Computer Braille Code: This method is used to represent text on a computer screen or other digital devices. It uses the same six-dot cell pattern as standard Braille, but includes additional symbols and characters for formatting and punctuation.

Nemeth Braille Code: This method is used for mathematical and scientific notation, using a specialized set of symbols and abbreviations to represent mathematical equations, scientific formulas, and other technical content.

Music Braille Code: This method is used to represent musical notation, including notes, rhythms, and other musical symbols.

Unified English Braille: This method combines Grade 1 and Grade 2 Braille, using a single set of rules for representing English text in Braille. It includes a number of new symbols and contractions, making it easier and more efficient to read and write in Braille.

3.2 ELECTRONIC BOOK READER:

There are various e-book readers available that are specifically designed for visually impaired or blind individuals. Here are some options:

Amazon Kindle: The Kindle has a feature called VoiceView that allows users to navigate and read books using text-to-speech technology. Users can also adjust the font size and contrast to suit their needs.NLS BARD Mobile: The National Library Service's Braille and Audio Reading Download (BARD) Mobile app is available for iOS and Android devices. It provides access to a large collection of books and magazines in audio and braille formats.

Bookshare: Bookshare is an online library of over 900,000 books, including textbooks, literature, and popular fiction. Members can read books using a variety of accessible formats, including audio, braille, and large print.

Voice Dream Reader: Voice Dream Reader is an app that supports a wide range of formats, including EPUB, PDF, and Word documents. It offers features such as text-to-speech, adjustable reading speed, and customized highlighting.

Capti Voice: Capti Voice is a web-based application that offers text-to-speech capabilities for e-books, webpages, and documents. It supports a range of formats, including PDF, EPUB, and Word documents, and offers features such as vocabulary building and translation.

These are just a few examples of e-book readers that are accessible to blind or visually impaired individuals. It's important to note that some readers may work better for certain individuals based on their specific needs and preferences.

Reading Assistance for Blind is a great application of technology that can help improve the quality of life for individuals with visual impairments. In this project, we will be using an ATmega328 microcontroller and Matlab to create a device that can read text aloud for the user.

3.3 READING ASSISTANCE FOR THE BLIND USING ATMEGA328 AND MATLAB:

Hardware Setup: First, we need to set up the hardware. We will be using an ATmega328 microcontroller to control the device. We need to connect a camera module to the microcontroller, which will capture the image of the text. We also need to connect a speaker to the microcontroller, which will play the audio of the text.

Image Processing: Once we have captured the image of the text, we need to process it using Matlab. We will use the Image Processing Toolbox in Matlab to perform OCR (Optical Character Recognition) on the image, which will convert the text in the image into digital text.

Text-to-Speech Conversion: Once we have the digital text, we need to convert it into speech. We can use the Text-to-Speech Toolbox in Matlab to convert digital text into speech. We can customize the voice and language of the speech to make it more natural and easier for the user to understand.

Audio Output: Finally, we need to output the audio to the speaker connected to the microcontroller. We can use the PWM (Pulse Width Modulation) output of the microcontroller to control the volume of the audio.

With these steps, we can create a Reading Assistance for Blind device using ATmega328 and Matlab. This device can help individuals with visual impairments to read and understand text, improving their quality of life.

CHAPTER 4
PROPOSED METHOD

4.1 PROPOSED SYSTEM

A proposed OCR system utilizes a grid infrastructure for character recognition across multiple languages, given prior input. The grid infrastructure streamlines recognition of diverse characters and supports a range of document functionalities, including editing capabilities like the current system. However, the new system expands upon this by enabling document search capabilities not currently available.

4.2 BENEFIT OF PROPOSED SYSTEM

It is low in cost as compared to the existing system. It is an automatic system, which could not only be used to convert large printed texts into digital texts, but could also be used to read them out as an audio file. The proposed system employs an efficient algorithm which effectively ignores all the background speckles and other undesired marks. The system extracts text information not only from the hand-held objects, but also from nearby signage.

4.3 ARCHITECTURE OF THE PROPOSED SYSTEM

The three main components of the OCR system architecture in a grid infrastructure are illustrated in "Figure 4.1." These components include:

4.3.1 SCANNER

The main role of the scanner is to scan the document thoroughly and convert the paper document into the scanned document. The illuminator which is attached with the scanner

provides better lighting for better performance and increased efficiency. Thus the scanned document is kept under the detector for detection of the characters in the document.

4.3.2 OCR HARDWARE AND SOFTWARE

The image of the scanned document then goes through a number of processes. Document analysis is one of the process where the whole document is examined word by word or line by line. Once a document is analysed then OCR starts its process by detecting each word through a process called character recognition where each word is recognised letter by letter. Contextual processing is a method which is used to develop new word meanings as they are found in the context of a story.

4.3.3 OUTPUT INTERFACE

It is the interface between the user and the software that being processed. The output of the OCR after going through the different phases of detection is finally processed as each word is recognised and understood by it. Thus the final output of the scanned document is converted into text format and is presented to Users are provided with the assistance of an interface that allows them to use this new technology.

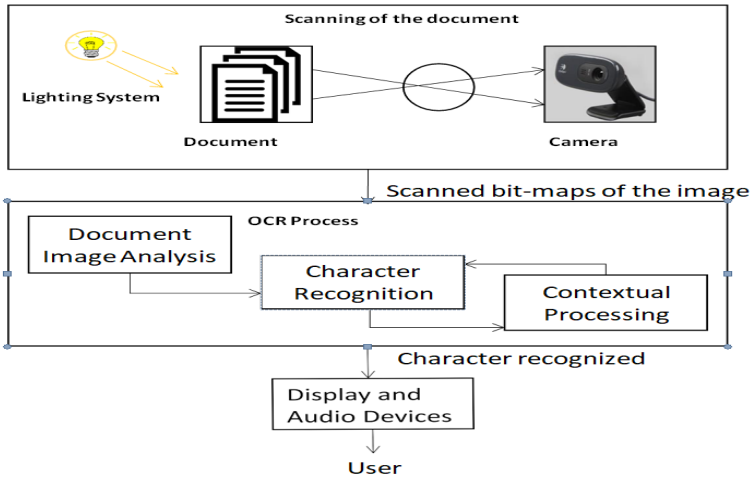

Figure 1

Figure 4.1: OCR ARCHITECTURE

4.3 INTENDED AUDIENCE AND READING SUGGESTIONS

To implement the OCR system effectively, it is crucial to identify the target audience who have a direct or indirect interest in the product. Based on the analysis, it can be inferred that the primary beneficiaries of this technology are visually impaired individuals, as well as research and development teams in scientific organizations, government institutes, and large corporations. Therefore, the following groups can be considered as potential stakeholders for the implementation of the OCR system:

- Telecommunications researchers, scholars, and fellows are keen on utilizing OCR systems to process word documents that contain foundational papers for their studies.
- The visually impaired persons who are fond of reading and for those who wants to read and understand documents and articles around them.
- A professional must use an OCR system to manage the information contained in older books when creating a virtual digital library.

Reading suggestion for the people who are interested in the OCR system can make use of the following instructions:-

- In order to read the document of the reader's wish. The document should be kept under the camera range at a proper distance so that the camera captures the maximum portion of the document.
- Once the document is placed properly the user has to press the capture key which captures the image of the document and analyses the complete document. Then each word is recognised letter by letter by the OCR through character recognition and contextual processing.
- The final output of the OCR after analysing and recognising the complete document is given through an interface through which the user can interact i.e as text on the display screen or as an audio output through an audio output device, depending on the application of the user.

CHAPTER 5
WORKING PRINCIPLE

5.1 COMPUTER VISION

The intelligence of humans is one of god's greatest gifts to humans and it is such a potential based on which we can make everyday decisions. Due to this god's gift, human beings are among all living things on the planet, the most superior.

For making these day-to-day decisions, human beings have got five senses and out of these five, the listening and visionary sense is the most important of all. The sense that tells us that a person is a friend by recognizing the voice is the auditory sense, it helps in spotting sounds, categorizing them, etc. A person with a regular sense of listening can easily distinguish between many different types of sounds, voices, animal sounds, wind-gushing sounds, and footsteps of a family member and position them in differing specific slots they belong to.

The potential to identify an individual from a pool of unknown people simply by casting a casual look, this ability is permitted by the visionary sense which is the strongest sense of all. The visionary sense allows us to differentiate our objects from objects that belong to others, and also to correct a misspelt word in a sentence and unconsciously correct it. The potential of

figuring out a picture just simply based on its capabilities that have been spontaneously decided and not pre-defined or predetermined, the human mind has this power.

One of the enormous fields of laptop technology that contemplate differing disciplines and form the core of its study is Artificial Intelligence. Artificial Intelligence has been popularly defined as “the things which people can do higher right now, thinking of creating computer systems do the same things’’. As given in “Figure 5.1”, the few sub-branches of computer imaginative and prescient are given, and it is the most important branch of Artificial intelligence.

It has become the core of all picture acquisition, processing, file comprehension, and popularity and also gives the location of research, which helps in pursuing that in turn helps in emulating the human imagination and prescient. A field of study that is firmly based on the understanding of different physical processes is known as Computer vision and to get an image formed that is the conclusion, it is obtained from the values of discrete pixels such as the shape of the object, and using probabilistic techniques or geometric information in recognition of the object.

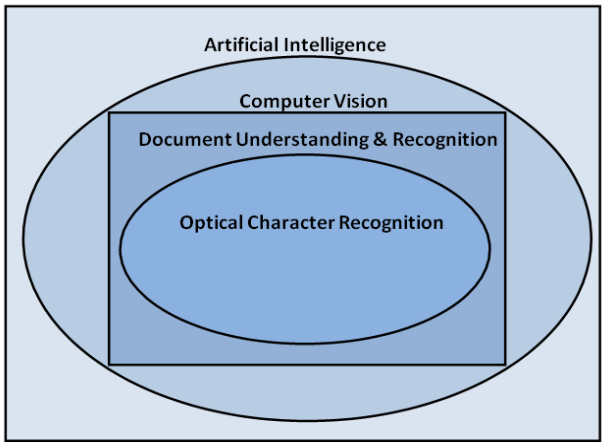

Figure 2

Figure 5.1: SUB-FIELDS OF ARTIFICIAL INTELLIGENCE

5.2 CHARACTER RECOGNITION

In this area of research of sample recognition, Character recognition, from a text photograph the character of images are taken, and due to this being stated, the textual content inside the photo is displayed due to the reputation respective codes being remitted and rendered.

Character recognition is a common challenge in computer vision, especially when it comes to raster images that depict symbols like letters or digits. To address this challenge, the recognition process is typically categorized into two types, with careful consideration given to how input is presented to the recognition engine. Figure 5.2 illustrates this categorization in a hierarchical manner.

Character recognition can be of two types:

a. On-line character recognition

a. Off-line character recognition

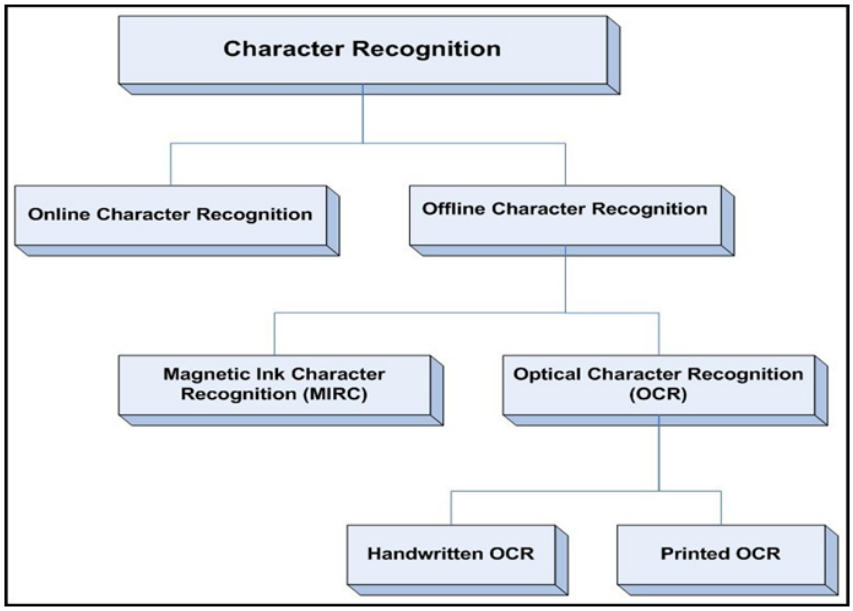

Figure 3

Figure 5.2: CLASSIFICATION OF CHARACTER RECOGNITION

5.2.1 ONLINE CHARACTER RECOGNITION

Online character recognition systems are utilized to recognize characters in real-time. This

involves a complex process, where a transducer captures input through a specialized sensor-based device, and the text is written on a stress-sensitive, electrostatic, electromagnetic digitizing tablet. The input text is then transformed into a sequence of digital signals using a set of rules in the form of letter codes, and stored for future processing. The recognition device operates based on the x and y coordinates generated by the pen tip movements. The digitizer produces recognizable patterns as the text is written side by side.

5.2.2 OFFLINE CHARACTER RECOGNITION

In Offline and online character recognition, there are substantial differences between them and they're specifically hired for the development of fashionability structures for both of them, and the design, armature, and methodologies are affected. The input data take the form of a factual time textbook or a temporal sequence in the online recognition and these are created on a sensitive machine and hence might be the reason that time series contextual data get displayed. As soon as the data is written down, the real recognition starts in the offline recognition device. This is because then, the real-time contextual data isn't needed.

Offline character recognition is further divided into two sub-types based on the input used for the system to recognise characters which are

i. Magnetic Ink Character Recognition (MICR)

ii. Optical Character Recognition (OCR)

5.2.3 MAGNETIC INK CHARACTER RECOGNITION (MICR)

MICR is a text recognition technology that utilizes unique fonts and magnetic ink, which contains iron oxide, to print characters on paper. When the code is scanned, the printed characters are magnetized automatically, with the North Pole located at the right-hand side of each MICR character. This creates recognizable waveforms and styles that can be captured and used for further processing. The reading device used in MICR technology functions similarly to a tape recorder head, detecting and interpreting the recorded sound on magnetic tape. For a

significant amount of time, this technology has been utilized efficiently in banks worldwide to produce checks due to its high accuracy rates and low error probabilities

5.2.4 OPTICAL CHARACTER RECOGNITION (OCR)

Optical Character Recognition (OCR) is a technology used for recognizing text from printed or written documents, which can then be converted into editable digital files. By optically scanning the text and converting it into a bitmap, the OCR machine is able to transform the text into a format that can be edited and manipulated digitally, using ASCII or Unicode character representation.

Often, we desire the ability to modify the contents of a hard copy text such as a book or magazine. To achieve this, a digital camera or scanner is utilized to capture the images, which are then processed by a recognition system resulting in the creation of an MS Word document.

Scanning a sheet of paper generates a digital version of a physical document, but the resulting image file does not allow for easy manipulation of the text contained within. However, Optical Character Recognition (OCR) technology can recognize the characters in the image and convert them into editable and searchable text, similar to a Word document. This enables the efficient storage and sharing of large amounts of information in a compact digital format. As OCR technology continues to advance, it is revolutionizing the way we store and share information in the modern era.

5.3 GENERAL

A new framework is being developed to assist visually impaired individuals in reading text labels and packaging on handheld objects using a camera. The framework isolates the item of interest from cluttered backgrounds or other objects in the camera's field of view by prompting the user to shake the object. A motion-based approach is used to identify a region of interest (ROI) within the video, which is then analyzed for text data using text localization and recognition techniques. To automatically locate text within the ROI, a unique rule based on gradient orientations and edge pixel distributions is proposed, which is learned using an Adaboost model. Text characters within the localized regions are then recognized using OCR software and converted into speech format for delivery to the user through devices like

earphones. A block diagram in "Figure 5.3" provides a visual representation of the framework's working principle

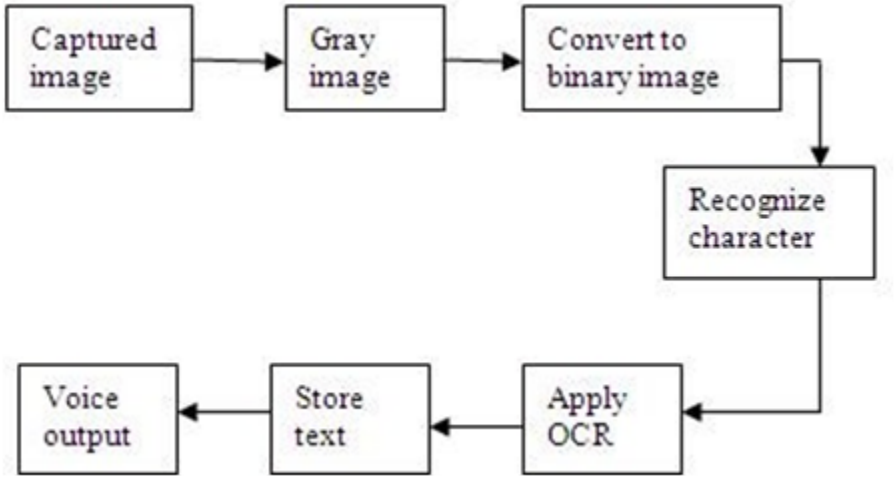

Figure 4

Figure 5.3: WORKING PRINCIPLE BLOCK DIAGRAM

5.4 IMAGE CAPTURING AND PRE-PROCESSING

Using a webcam, the video is captured and the video frames are then segregated and pre-processing is performed on them. First, the objects are captured from the camera in a continuous manner and are adapted for further processing. After extraction ofAfter removing the object of interest from the camera's image, a grey image is produced. To recognize the character from the object, the ‘haar’ cascade classifier is used. There are two major stages in the working of a cascade classifier: training and detection.

5.5 AUTOMATIC TEXT EXTRACTION

In order to handle complex backgrounds, two new feature maps are used to extract text characteristics based on, respectively, edge distributions and stroke orientations. Here, "Stroke" is characterised as a uniform area of constrained width and significant extent. These feature maps are merged to produce a text classifier based on the Adaboost model.

5.6 TEXT REGION LOCALIZATION

On the camera-based image itself, text localization is performed. Text information being present in an image patch is confirmed by Cascade 'Adaboost' classifier, but in the entire image it cannot do so, so henceforth for text classification-ready image patch extraction from candidates, heuristic layout analysis is performed. Usually, text information appears like horizontal text strings in the image containing only three-character members.

5.7 TEXT RECOGNITION AND AUDIO OUTPUT

Before releasing educational words from the localised text regions, off-the-shelf OCR first performs text recognition. The text region identifies the smallest rectangular space that can hold characters. As a result, the content region borders touch the edge boundary of the text character. However, this experiment has shown that the background text character segments are assigned binaries before proper margin areas are assigned to better-performing text regions generated by the OCR.

The recognised text codes are saved in script files. The Microsoft Speech Software Development Kit is used to load these files, display the audio output of the resulting text information, and play it back. Users who are blind can change their speaking tone, volume, and rate to suit their preferences. Basically, these are made and can be found in most computers using the same USB technology in order to interface with the dedicated computer systems easily. Static random access memory (SRAM) is a kind of semiconductor memory that uses bi-stable latching circuitry to store each bit individually.

The suggested system makes it possible to read printed text on portable objects to aid the blind. The common targeting issue for blind users is anticipated to be resolved by a motion-based method, which only requires the blind user to shake the object for a brief period of time. This

technique is useful for clearly separating the subject of interest from any surrounding objects or background in the camera view. An Adaboost learning model is used to find text in images taken with a camera. Off-the-shelf OCR is used in the localised text regions for blind users to perform word recognition; the results are then converted into audio output.

CHAPTER 6
HARDWARE DESCRIPTION

6.1 SYSTEM MODELING

The overall block diagram of the hardware description is shown in the following “Figure 6.1.”

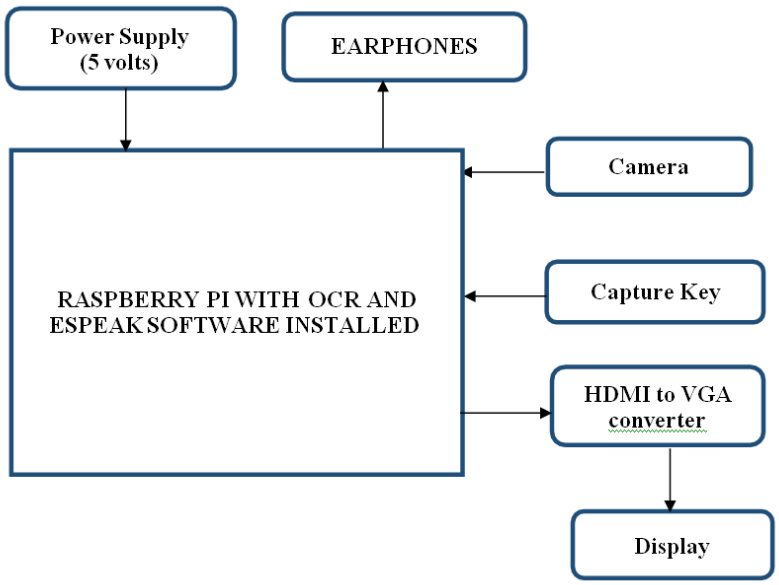

Figure 6.1: BLOCK DIAGRAM OF THE PROJECT

6.2 RASPBERRY PI

The Raspberry Pi is a processor that connects to a computer or a television. It is the size of a credit card. When it connects to the computer, it can be connected to a standard USB keyboard and mouse for input. It is a highly efficient system that is designed in such a way that makes it easier for users to grasp the knowledge on how to make the best use of it. It also allows users to learn and explore the computer language Python.

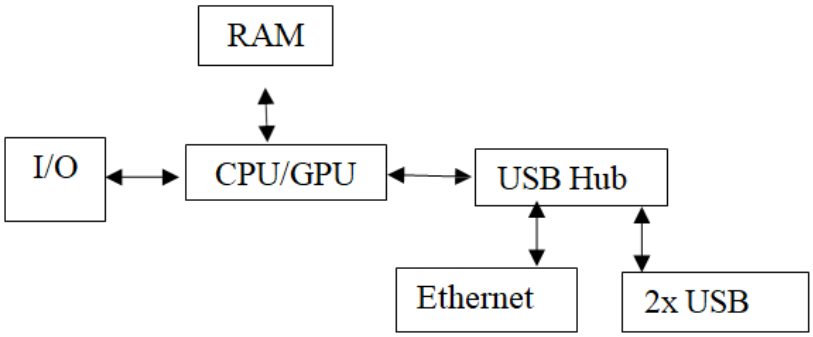

Figure 6.2: INTERNAL DIAGRAM OF RASPBERRY PI.

"Figure 6.2" represents the basic internal block diagrams of Models A, B, A+, and B+. The difference between the models is that models A, A+, and the Pi Zero do not include the Ethernet and USB hub elements. The Ethernet adapter in these models is internally connected to a USB port. In these models, the USB port is affixed directly to the system, on a chip (SoC). On the Model B+ and the models that came later, the USB/Ethernet chip consists of a more than sufficient, five-point USB hub, out of which four ports are available for use. However, Model B only provides two ports. On the Pi Zero, the USB port is also connected straight to the System on Chip, but it utilizes a micro USB On-The-Go (OTG) port. The Raspberry Pi processor B3 model was used. "Figure 6.3" depicts the descriptive block diagram of Raspberry pi.

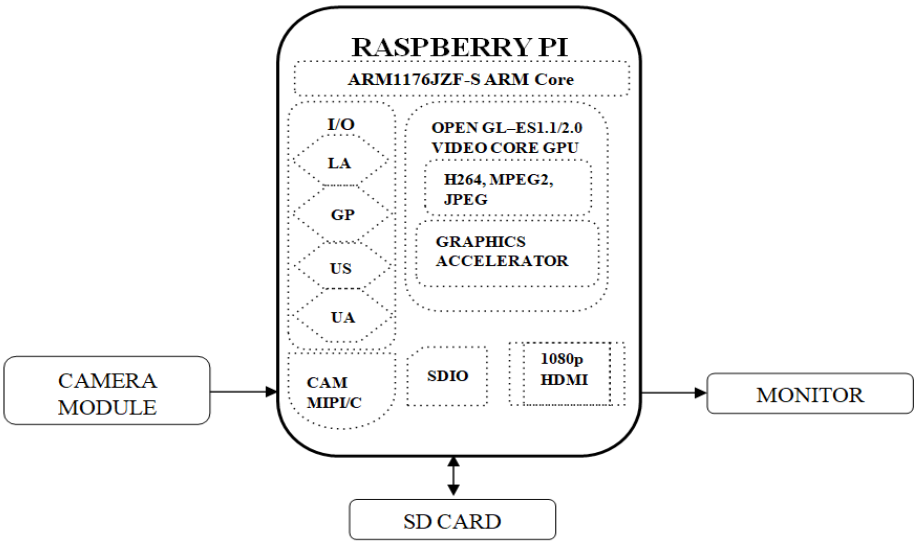

Figure 6.3: DESCRIPTIVE BLOCK DIAGRAM OF RASPBERRY PI

6.3 DETAILS OF THE RASPBERRY PI BOARD

In the market, two models of Raspberry Pi processors exist- Model A and B. Model B is similar to Model A, only being more technically advanced than the latter. Model B has 512MB Random Access Memory (RAM) and 2 USB ports. On the other hand, when compared to Model B, Model A has only 256MB of RAM, 256MB less than that in Model B—also, it only has1 a USB port. Moreover, Model B contains an onboard Ethernet port, whereas Model A has no such provision.

Different components of Raspberry Pi are briefly described below:

6.3.1 SD CARD SLOT

Since the Raspberry Pi lacks a physical hard drive like laptops and desktop computers, the SD card is utilised as a solid-state drive (SSD) to install the operating system, store all other applications, and save data. To use the Raspberry Pi, you must insert an SD card into the slot.

6.3.2 MICRO USB POWER

The power port is a 5V micro-USB input, and since there isn't a built-in power regulator, the supply must be precisely 5V. For practical reasons, the power supply should thus not be greater than 5V.

6.3.3 HDMI OUT

The Raspberry Pi can be connected to a monitor via HDMI (High-Definition Multimedia Interface) using this output connector. As a result, it may be linked to any screen or TV that has an HDMI connector.

6.3.4 ETHERNET AND USB PORT

The integrated LAN9512 chip on the Model B supplies power to both the Ethernet port and USB port. It is a 10/100 Ethernet controller-equipped high-speed USB 2.0 hub (Donat, 2014). Keyboards and mice are connected using USB connections. The Raspberry Pi can connect to almost anything that can connect to a computer through USB.6.3.5 RCA both audio and video output

6.3.5 RCA VIDEO OUT AND AUDIO OUT

There are RCA video and audio jacks for audio and video output on the board. The Raspberry Pi does allow audio through its HDMI output, however USM microphones may or may not function. There is a normal 3.5-mm audio socket for connecting headphones. Any connected RCA video device receives video from the RCA jack.6.3.6 GPIO HEADERS (PINS)

6.3.6 GPIO HEADERS (PINS)

The abbreviation GPIO stands for general-purpose input-output pins. These connectors are used to attach various physical expansions to the Raspberry Pi. Programming languages like C, C++, or Python can be used with the Raspberry Pi's libraries to connect to the pins.

6.3.7 CHIPS (BROADCOM)

The Broadcom chip, which is located in the middle of the board, is the most crucial part of a Raspberry Pi. The chip has a Videocore4 GPU and an ARM11 processor that can be overclocked to at least 800 MHz without experiencing any issues.

6.4 HARDWARE REQUIRED FOR RASPBERRY PI

The Raspberry Pi is not a stand-alone system; it needs several others peripherals along with it. A brief description of its hardware components is mentioned below.

6.4.1 POWER SUPPLY

The Raspberry Pi system requires a 5V power supply to function. In case the supply exceeds the 5V limit, then its proper functioning cannot be guaranteed. The supply should also carry at least 500mA, preferably 1A. If the supply is less than 500mA, it may malfunction. Therefore, it is not recommended to power the system with a laptop's USB port, since it might not supply enough current. Hence, the Raspberry Pi requires a Micro- USB connection from a PC. It should be able to provide a current that is at least 700 mA (or 0.7 A) at 5V

6.4.2 STORAGE

For Raspberry Pi to store all of its information, including ROM and RAM, an additional storage card is required. For this purpose, an SD card could be used. An SD card may have 4, 8, 16GB, or larger in size. This card stores the operating system, codes, and calculation results.

6.4.3 INPUT

Externally, a computer keyboard and/or a mouse can be connected to the Raspberry Pi system via a USB port. Additionally, no other software is required to operate them.

6.4.4 MONITOR

A monitor or a TV with an HDMI port or a DVI input can be used, as the screen for the Raspberry Pi. An HDMI-to-DVI converter is needed if DVI input is used. Monitor is required for the system to actually be able to work on Raspberry Pi, be it coding work or otherwise.

6.5 WEBCAM

Using either USB connection, Ethernet or a Wi-Fi, a Webcam, or in other words, a video camera, continuously feeds live image to a computer system. By making use of this system, computers can be linked to each other for video calling purposes, like conference calls. Since conference calls are done over the web, this video capturing system so got its name- Web-Cam.The “figure 6.4” represents the web camera.

6.5.1 FEATURES (LOGITECH WEBCAM C100)

- It's a plug-and-play system.
- Video capture in 640 x 480 pixels.
- Photos clicked can be upto 1.3 mega pixels.
- Frame rate is maximum 30 fps.
- Enhanced camera version with a fixed focal arrangement
- Its clip can be easily attached to any kind of computer or television system.

Figure 6.4: WEBCAM

6.5.2 FEATURES

- “Figure 6.5” shows the headphone to hear the out from the automatic reader.
- Compatibility: Wired headphones are compatible with a wide range of audio devices, including smartphones, laptops, desktop computers, and other devices with a standard headphone jack.
- High-quality sound: Wired headphones can deliver high-quality sound, especially if they are designed with high-quality drivers and materials.
- Affordable: Wired headphones are generally more affordable than wireless headphones, which can be a factor to consider when shopping for headphones.
- No battery required: Wired headphones do not require a battery or charging, which means that they can be used for extended periods of time without worrying about battery life.
- Minimal latency: Wired headphones have minimal latency, which means that there is no noticeable delay between the audio being played and the sound being heard through the headphones.

Figure 6.5: HEADPHONE

CHAPTER 7

SOFTWARE DESCRIPTION

7.1 PYTHON

The project has been built by usage of Python programming language. It's a very simple, powerful artificial language. It gives an efficient, straightforward approach to object- oriented programming and consists of a very economic high-level information structure. With new

functions and information varieties enforced in C or C++ (or different languages owed from C), the Python interpreter is obviously extended. It is also suitable for customizable applications as an extension language. Hence for all major platforms in the supply or binary type, the Python interpreter and hence the customary library area unit is freely accessible.

7.2 RASPBIAN JESSIE OS

Raspbian is a Debian-based PC that runs on the Raspberry Pi's system. The Raspberry Pi Foundation is currently formally providing the primary software package for the Raspberry Pi family of single-board computers. For the low-performance ARM CPUs of the Raspberry Pi line, the Raspbian is highly optimized. As its main desktop setting, it uses IXEL, Pi Improved X windows setting, light weight as of the most recent update. The Raspbian Jessie OS has a changed LXDE desktop setting and henceforth there are a few alternative changes and the Open box stacking window manager has a replacement theme.

7.3 START UP WITH RASPBERRY PI

7.3.1 INSTALLATION OF OPERATING SYSTEM ON RASPBERRY PI

It is necessary to install the operating system (OS) as the Raspberry Pi is a little computer. The operating system is installed in the external memory as the Raspberry Pi has no hard drive. For this purpose only, for the operating system installation, a memory card (SD card) is used and in the same SD card all the necessary software and supporting files are stored. NOOBS (New Out of the Box Software) is mostly preferred as it is more suited for the beginners though there are many types of operating system. A preinstalled SD card or empty SD card can be bought. The NOOBS is already copied and is ready to be booted in a pre-installed SD card. In the Appendix B, how an operating system should be installed in a blank SD card is given in details.

7.3.2 USE OF LAPTOP SCREEN, KEYBOARD FOR RASPBERRY PI

The monitor of a laptop can be used for this purpose if a suitable screen isn’t available for the Raspberry Pi. A keyboard and mouse of a laptop can also be used for this purpose. As to

which screen is going to be used for Raspberry Pi, two software need to be installed in the laptop. In the following sections, the software installation and configuration are discussed. 'Xming'- This software can be downloaded from the link, DownloadXming and is the first software that needs to be installed in the laptop. The 'XLaunch' application is run after successful completion of installation.

7.4 OCR

The conversion of typed, handwritten or printed text into digitally editable data files is known as Optical character recognition. Many OCRs are in productive use and have been developed for quite a lot of languages around the world.

7.5 OCR PROCESSES

Firstly, scanning and then digital reproduction of the text in the given image this is how the OCR process begins. As shown in "figure 7.1", the following discrete sub-processes occur in the OCR process.

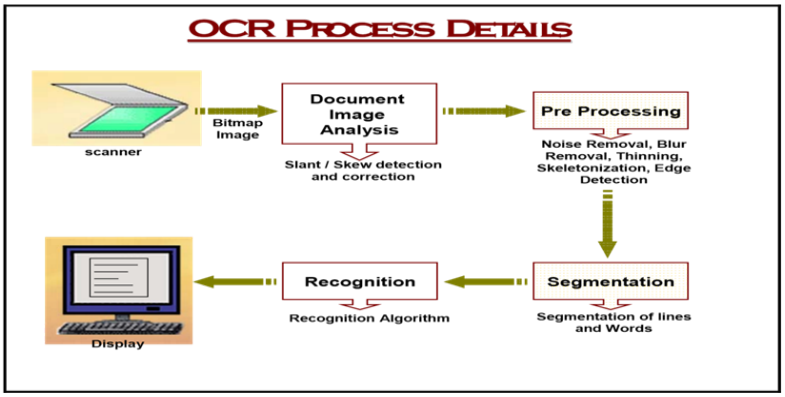

Figure 7.1: OCR PROCESSES

7.5.1 SCANNING

Through the use of a flat-bed scanner that operates at 300DPI, the printed material on the page is transformed into a bitmap image.

7.5.2 DOCUMENT IMAGE ANALYSIS

The bitmap picture of the text is therefore examined, and any skew or slant that may be present is then eliminated. The printed material contains a substantial amount of text in addition to tables, graphs, and other visuals. Therefore, it is necessary to perform localization and extraction as well as discrete text area identification from the other images that are there.

7.5.3 PRE-PROCESSING

Many morphological procedures, such as edge identification, thinning, banalization, and noise and blur reduction, take place in the text picture in order to provide an OCR-ready image of the text region that is free of noise and blur.

7.5.4 SEGMENTATION

If the entire image is made up entirely of text, the image is first divided into separate lines of text. These lines finally split into words and then letters to give us individual letters. After all the letters have been identified, localization has been carried out, and segmentation has been completed, the recognition algorithm can decide whether it wants to put the text in the image into a text processor.

7.5.5 RECOGNITION

The most crucial stage is applying the recognition algorithm to the images available in the text image, where segmentation has already been applied at the character level. Due to the recognition character code being given by the system that matches to the image, it is sent to a word processor where it can be edited, modified, and stored in a new file format. The word processor then displays it on the screen.

CHAPTER 8
RESULTS

The various components employed in the OCR project are shown in detail in “Figure 8.1” below. The OCR's brain is a Raspberry Pi 3B. Images are taken using a Logitech webcam. The output device for OCR is a Headphone/Speaker that is connected to the Raspberry Pi through a 3.5mm connector. Additionally attached are a keyboard and mouse, and the processor is powered by the CPU. USB port is used to connect the webcam. A stand is used to support the webcam to read the book that help to keep it stable, the clear image is taken by webcam.

so that the image to text conversion by tesseract is done faster and it keeps helping the espeek module to convert the text to speech and the accuracy is more when the clear image is captured. The stand is help to take the clear picture.

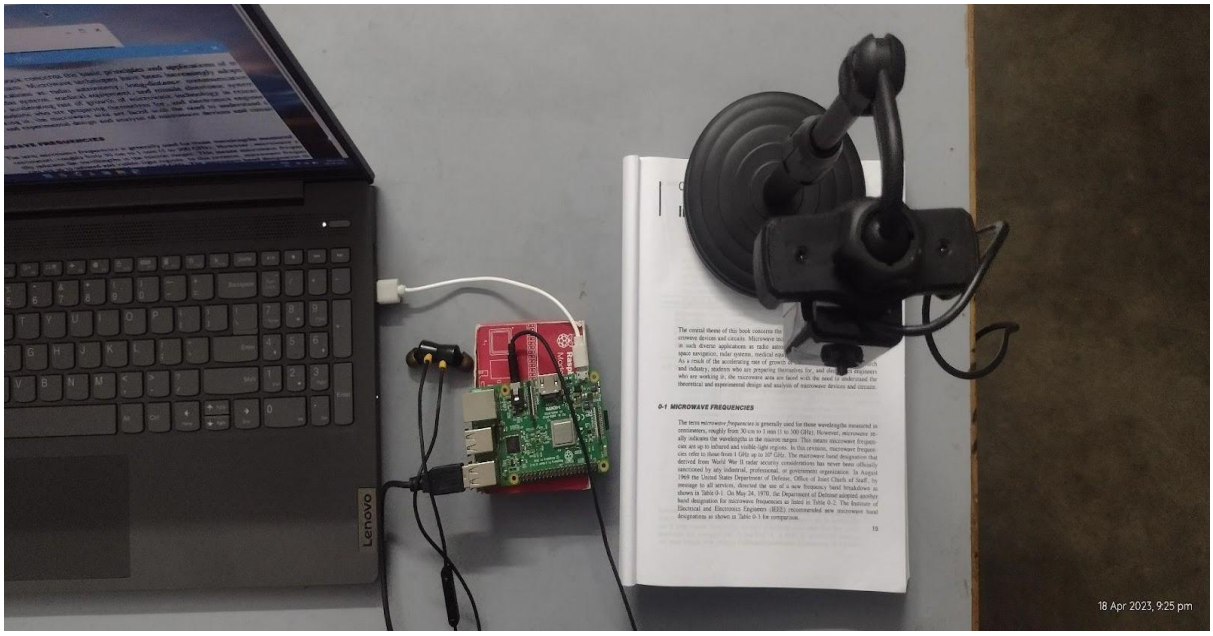

Figure 8.1: OCR COMPONENTS

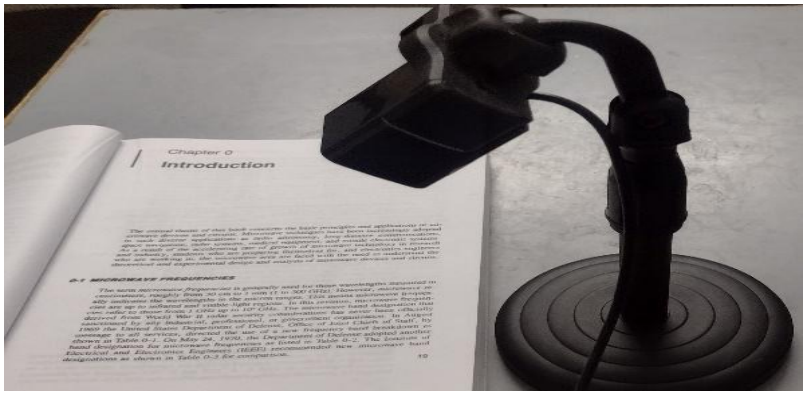

Figure 8.2: WEBCAM IN THE STAND

"Figure 8.2" shows the webcam on the stand to capture the image clear without shake during the capturing quality image is taken by webcam and give it to the tesseract module and convert the image to text accurately by python program which search in the library and gives the correct output audio by espeek module.

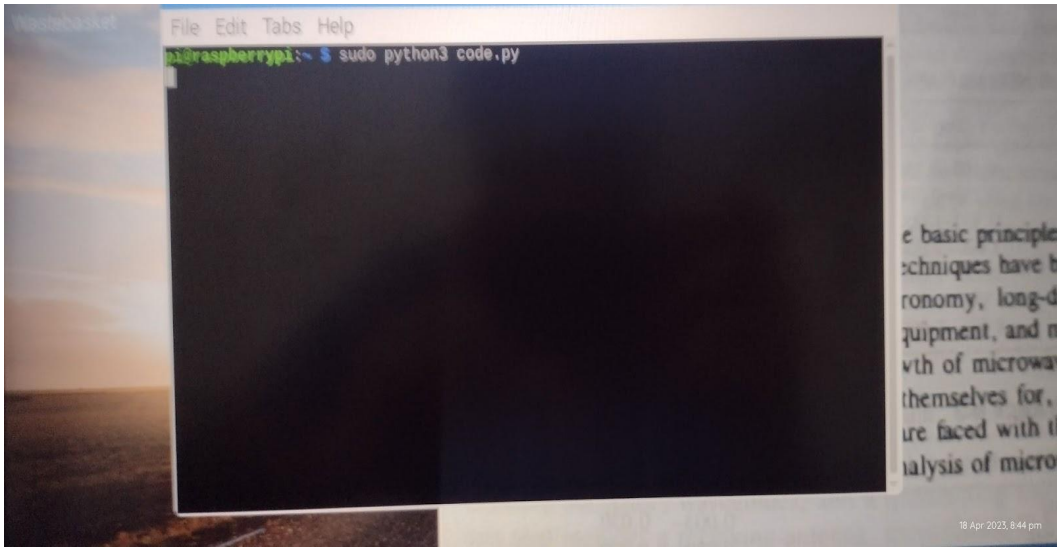

Figure 8.3 :VNC VIEWER

In "figure 8.3" the input window is ready to take the command to start the webcam by writing the program in the input window. The program line is sudio python3 code.py to start the program. This is the first step in the processes giving the starting command in the VNC viewer to start the program.

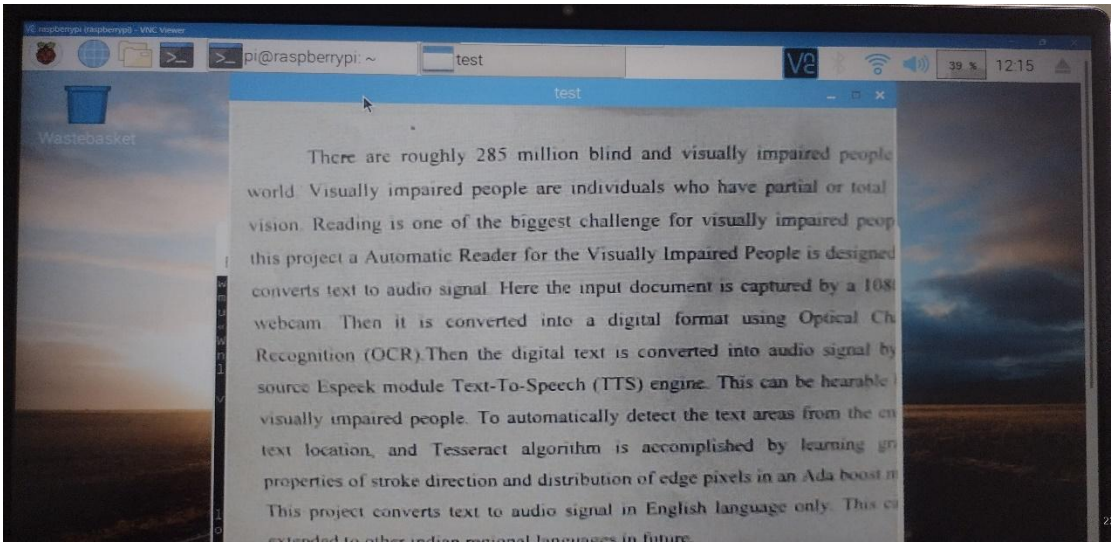

Figure 8.4 :WEBCAM CAPTURED IMAGE.

"Figure 8.4" displaying the live feed from the webcam capturing the image to convert it into audio. After the command code is given in the window the raspberry pi gives the signal to capture the image by turning on the webcam by pressing the space bar in the keyboard. The image is captured and sent it to the tesseract module by open cv method.

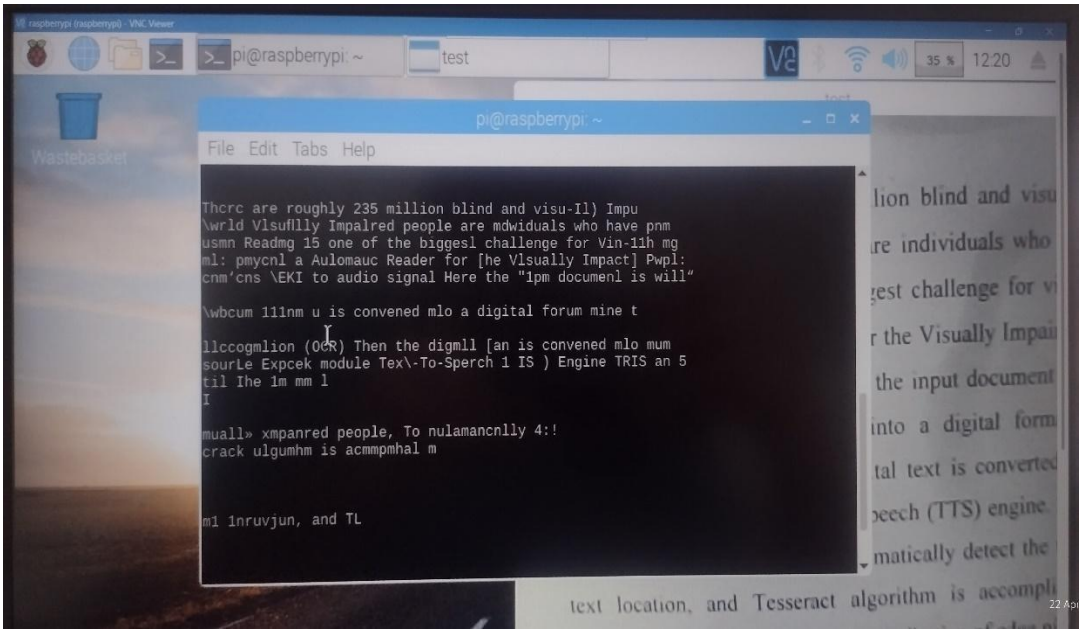

Figure 8.5: OUTPUT IMAGE.

"Figure 8.5" convey the output from the tesseract module after converting the image to

text. The output from the tesseract is displaying in the above image after this step the espeek module converts the text to audio and the output can be hearted by connecting headphone in 3.5mm jack in the raspberry pi.

CHAPTER 9

APPLICATIONS

- In surveillance cameras, motion detection is frequently used. Motion detection is done by constantly monitoring each pixel and refreshing this data at constant intervals of time. Any change in any pixel, that is any change in data, could be linked with a change in motion of that particular object.
- Localization of an object draws attention to a specific area of interest in an image. reduction of data. Only interest points that are later used to solve the correspondence problem are frequently discovered.
- Motion segmentation: This is usually employed in highway monitoring cameras, where vehicles on one side of the road moves in one direction and vehicles on the other side of the road moves in opposite direction.
- Three-dimensional shape from motion: It is also called structure development from motion of an object. Used in stereo-vision. Other large scale application is movement of the celestial objects where its plane or sphere of movement could be generated to predict its future position.
- Object tracking: To focus on one object, detect its centre, and constantly track it within the range of the camera.
- Space body detection and tracking: This is one of the biggest applications of this concept. Object tracking can be employed in outer space to track asteroids, exo- planets and other celestial objects' movements, and predict their future position and speed.
- Traffic Density detection: This can be used to detect number of objects per frame (object density) at a traffic signal to manage traffic effectively and efficiently.
- OCR: This involves detecting the letters and alphabets on a sheet of paper (handwritten or printed) and giving out an audio or digital text output. The basic block diagram for the same is shown below in "Figure 9.1."

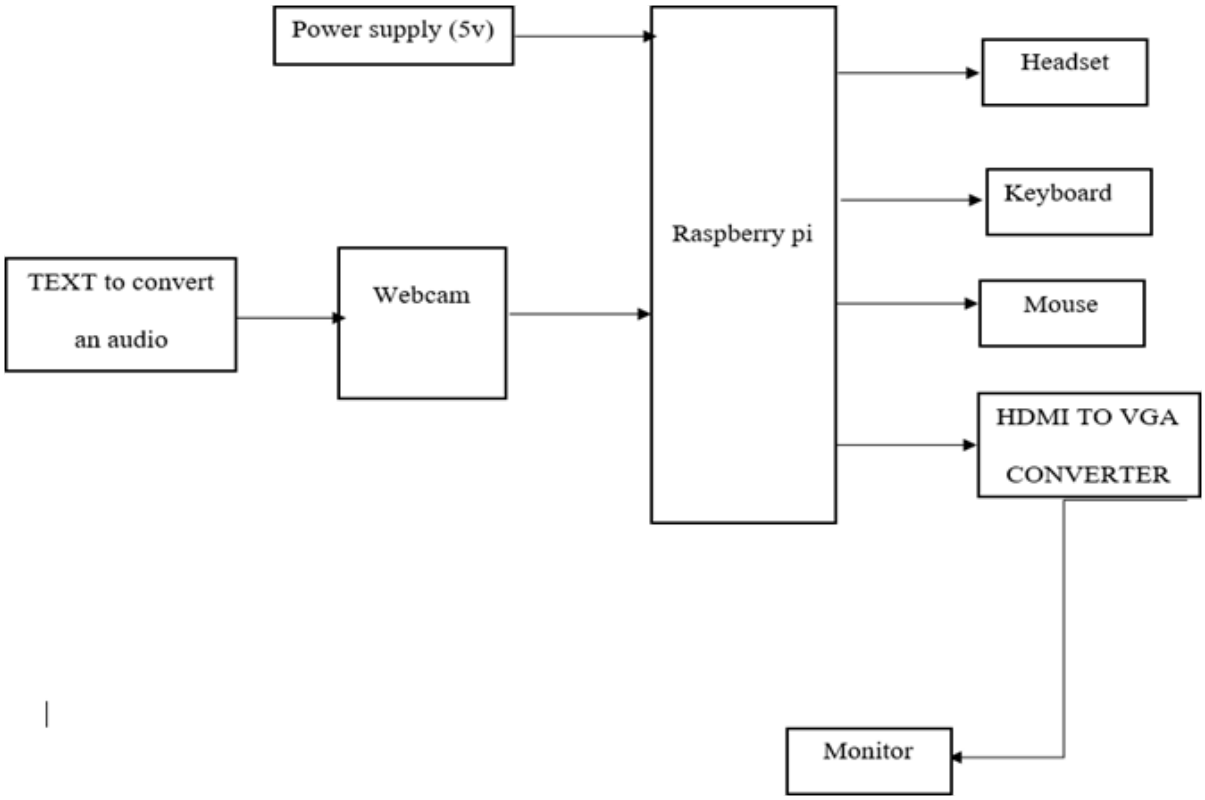

Figure 9.1: BLOCK DIAGRAM OF OPTICAL CHARACTER RECOGNITION (OCR)

CHAPTER 10

CONCLUSIONS

In conclusion, the use of Raspberry Pi, OCR (Optical Character Recognition), and Espeak to develop an automatic reader for visually impaired individuals has immense potential to enhance their reading experience. The device can effectively scan and read printed materials aloud, making it an invaluable tool for individuals with visual impairments to access information independently and efficiently.The combination of Raspberry Pi, OCR, and Espeak provides a low-cost and user-friendly solution for visually impaired individuals to read books. It can recognize various languages and fonts, and its customization options make it an ideal choice for people with different needs.Moreover, the use of this technology for reading books can improve the educational and leisure opportunities for visually impaired individuals. It provides an effective way for them to access a vast range of printed materials, including textbooks, novels, magazines, and newspapers. This, in turn, can promote their overall literacy and learning, leading to better communication and integration into society.Although there are still challenges to overcome, such as improving the accuracy of OCR and Espeak technology and ensuring the device is user-friendly, the automatic reader for visually impaired individuals using Raspberry Pi, OCR, and Espeak has tremendous potential to improve their quality of life.In summary, the development of an automatic reader using Raspberry Pi, OCR, and Espeak is a significant advancement in assistive technology for visually impaired individuals, providing them with greater access to information and educational resources. This device has immense potential to promote social inclusion, enhance literacy, and empower individuals with visual impairments to live more independent lives.

CHAPTER 11

FUTURE SCOPE

The proposed system can certainly be developed by using better, but cheaper cameras and its cost could be further cut down by using suitable processor or simply by manufacturing one, as needs be.

- The market potential for the proposed system is enormous. For marketing purposes, the body of the OCR system could be made of aluminium or plastic. Carbon fibre bodies are also a good option.
- Cameras with improved depth sensing, focusing and adjusting capability could be employed to shorten the height of the system.
- A switch to turn ON/OFF the system and another switch to capture the image could be mounted on the body of the system itself, for making it easily accessible by the visually impaired user.
- By making use of neural networks, database could be improved for the system to be able to detect other languages other than English.

CHAPTER 12
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