The Machine Learning based Smart Assistant for Library Management and Book Reader for Blind People using Raspberry Pi

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Abstract: *For people who love books and want to read books, they need good library management that organizes the library collection in such a way that it is easy to find and locate books. However, it is common for someone to spend time in the library looking for books and library management will provide support in finding the required material. For the blind and visually impaired, providing an audio format of a book or text can be a beneficial way of producing reading material. The whole process will be done by using Raspberry Pi and Optical Character Recognition (OCR), the Tesseract algorithm that captures the image, then text is extracted and the resulting text can be converted into speech using eSpeak module.*

Keywords: Optical Character Recognition, Raspberry Pi,Image to text, Text to speech.

I. INTRODUCTION

Libraries play a crucial role in society and have many important uses. Libraries provide access to educational resources, including books, journals ,and other materials. They also offer study places, research support, historical records and other important documents. To locate a book in the library this system is introduced. The system is developed in a way that the user he/she can be able to search the book with help of smart assistant through voice commands and it can be viewed in a web page and through speech technology this makes it easier and quicker for people to get information they need.

Blind people face several challenges with Braille script. Learning Braille can be challenging and time consuming, it requires significant dedication and practice. It can be also be limiting in terms of availability, cost, portability. Therefore, developing and improving text-to-speech technology can be incredibly beneficial for blind individuals to access information in a more efficient and portable way.

II. PROBLEM STATEMENT

Education a fundamental right that should be accessible for everyone, regardless of their socioeconomic status or disabilities they may have. Searching a book in Library is major challenge the smart assistant library management navigates the location book. Older People with visual impairment facing a problem in accessing good education and expanding their knowledge. There is need in technology to enhance the independence and quality of life by allowing them to access to read aloud printed materials.

III. LITERATURE SURVEY

Optical Character Recognition is a technology that recognizes the handwritten and printed text in a machine-readable format. OCR has been around for several decades and continues to evolve. This improves its accuracy and speed. Researchers use a Convolutional Neural Networks (CNN) to the recognize handwritten and machine-printed characters [1].

Another technology that helps the visually impaired is a fingerprint reader. The user wears the device to his finger, Its cans the text and convert it to audio. If the user deviates from a straight line while scanning, it detects and alerts the user, helping them maintain a straight line scan [2].

Images plays plays a major role in the human perception of surrounding environment. In this it undergoes Digital Image Processing. It produce a digital image by using digital computer. [3].

Another technology that covers Smart surveillance systems using Raspberry Pi and PIR sensors for mobile devices. In the House, security collects information through camera. motion detector and video camera for remote sensing can be controlled by using Raspberry Pi [4].

This paper describes the implementation of EM tourism assistance for blind people. The project is the implementation of a microwave short-range radar system to be mounted on a white cane[5].

Another paper that describes the Smart surveillance monitoring system using PIR sensors for Raspberry Pi. The proposed home security system collects information such as motion detectors and video cameras for remote sensing[6].

This proposes that People with visual impairments has many problems in accessing printed text materials using conventional technology, The system is developed the camera must be in a focus, accuracy and portability. Introducing a fingertip device that helps blind people read text materials efficiently and effectively[7].

Face recognition is a common part of a security systems and is useful for determining whether a face is human. The image process is fundamental to all security systems in this paper face detection system for security purposes is based on open-source computer vision (Open-CV) using Python programming.

IV. PROPOSED METHODOLOGY

The library management methodology involves the creating a web page that connects to the Raspberry Pi by its IP address. There is a specific type of voice command that uses the smart assistant to search for books in the library, and the voice command is received using a mobile voice control that is connectedtotheRaspberryPiwiththehelpofHC05 Bluetooth module. If the book is available in the library, it uses the eSpeak module to respond with a voice for that location. The code for this feature is written in Python, HTML, and PHP. This makes it easier for users to find the right book.

A methodology to enable text-to-speech technology involves a camera is connected to the Raspberry Pi. Camera captures the image .Then the image is then processed using Python's Optical Character Recognition(OCR) and teaser act methods. This determines the position, orientation, and alignment of the text in the image. The eSpeak module generates a waveform signal that is sent to the Raspberry Pi's audio output and then plays back the speech.

Using text-to-speech technology for the visually impaired in library management is very efficient and effective. Utilizes the Raspberry Pi, an inexpensive and powerful microcontroller, and open-source, easy-to-use software modules such as OCR and eSpeak.

V. BLOCK DIAGRAM DESCRIPTION

The block diagram block diagram description is divided into two parts.
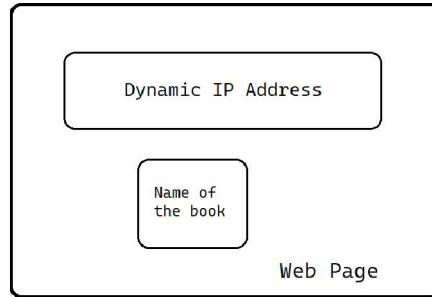
Smart Assistant Library Management.

Book Reader for Visually Impaired.

It is a system that uses the functions of a Raspberry Pi . It is the heart and Brain of all operations. We have used a Raspberry Pi 3 Model-B board. The Raspberry Pi has GPIO (general purpose input/output) pins .Useful for connecting external devices such as sensors, LEDS, buttons, etc. There is a USB Port that can be useful for connecting external devices such as keyboards and USB drives

.There is a HDMI port. This is useful for connecting a monitor or a TV and displaying the Raspberry Pi's output. An Ethernet port is used to connect a network. Headphones, Speakers, and camera is connected to the Raspberry Pi and a Micro SD card Slot to store the Raspberry Pi OS and the data.

The proposed library management system uses modern technology to improve efficiency and effectiveness. Each Raspberry Pi model has an IP address, and an IP address is associated with each book in the library. When a user requests a book from the library (using voice command), it checks the IP address and responds if the book is available. It responds in the form of speech .An efficient way to enter data using voice commands via a phone connected to the Raspberry Pi HCO5 Bluetooth module. This approach is more likely to improve the library management system in a convenient, hands- free way.

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Smart Assistant Library Management

Book Reader for visually Impaired .

This describes a process of capturing an image using a camera is connected to the Raspberry Pi and text is extracted from captured image using OCR techniques.

Raspberry Pi OS provides a necessary interface for capturing the image Once the image is captured , it writes the text from image to a Micro SD card in a text format. The Raspberry Pi uses Python to determine if a script is involved in capturing an image and to update the status. Once the image is captured, the image is exposed to the Open CV library and the teaser act method that works on the image. It detects and recognize the text in images. Then the captured text is converted into a speech using eSpeak module.

VI. SYSTEM OVERVIEW

A smart assistant library management is an innovative application. The system utilizes various technologies such as Raspberry Pi, Micro SD card, HC05 Bluetooth.

One of the key features of this system is to use of voice commands through a phone connected via Bluetooth to HC05 module of Raspberry Pi. This allows users to check the availability of books and receive information within the library.

It has a camera module that is connected to Raspberry Pi, that captures the image then it is stored in Micro SD card and processed using various algorithms such as Open CV and teaser act to extract text then the eSpeak module convert the text into speech.

Once the image is captured to extract the text into text document Open CV and teaser act algorithms are used. It helps in accurate detecting and recognizing text in images. It is image processing. It makes an approach in cropping, Grey scaling, thresholding etc to gain information. It has a lot of scope in face recognition, sample recognition, motion tracking etc.

Binarization is a process that converts color image into a grayscale image that is a two-tone black and white image. The system cannot detect then images and letters directly. The system can only understand numbers i.e. '1','0'.the image has noise that is represented in a RGB space. The pixels of image is converted into a binary image, then all pixels will be transformed into a uniform value.

Image smoothing is performed to remove unwanted noise in the image. This can also be done linear filters, Gaussian filters, etc. this can be done additionally photo blurring. Selecting a specific filter that leads to smoothed image . This approach of selecting the filters will result to get appropriate image. This is the mechanism that run behind system. Thus the device can be easily access printed materials enhance the user experience.

VII. RESULTS

HARDWARE SETUP:

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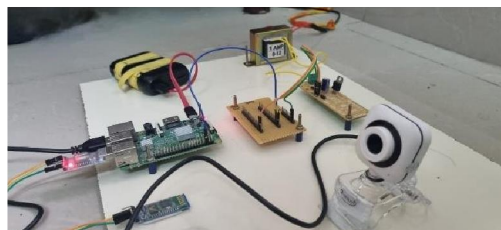
The Raspberry Pi is connected to a power transformer, which is supplying power to the board. TheRaspberryPihasaninputvoltageof5volts.The HC05 Bluetooth module is connected to take voice command using mobile. The Camera is connected to capture images then undergoes OCR, text is extracted from the captured image and then using eSpeak module speech is generated. By connecting the headset to Raspberry Pi we can hear the generated speech.

The voice command is taken from the user i.e. searching the book in the IP address. If it is available the location of the book is generated in a web page and instructs us in voice too. The availability of the book in the library can be also checked.
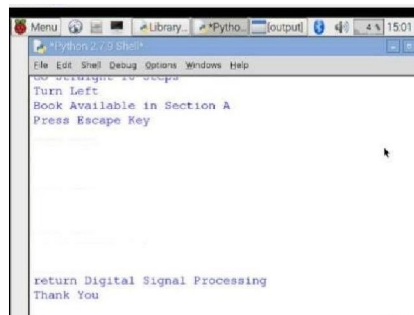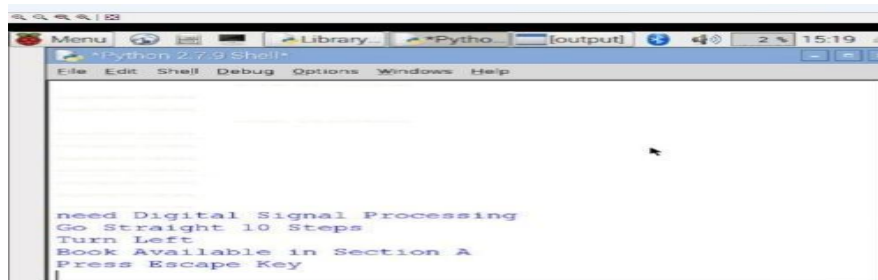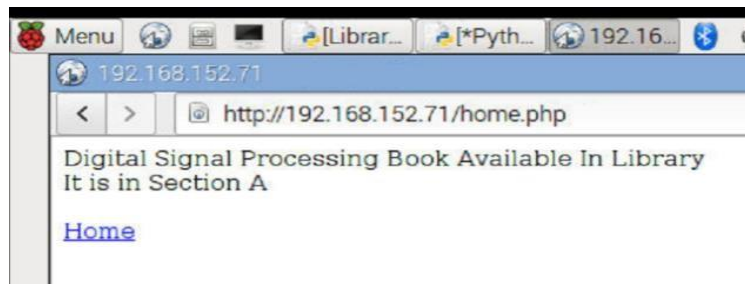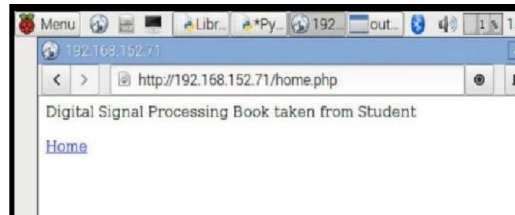
Thus this the way how library management is done. It is easily accessible makes easy for a person to search a book. For Blind people and those who are having a problem in reading the book. The image is captured. The image captured that is shown below.
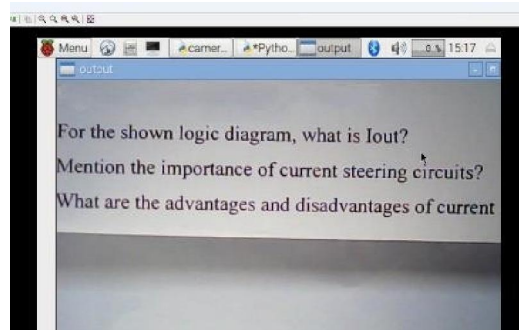
Text that is captured using OCR teaser act engine from the image is shown below in a window. Using the eSpeak module Text to speech is generated.

VII. CONCLUSION

The Machine Learning based Smart Assistant Library Management and Book Reader for the Blind is an innovative and efficient solution that improves the library management experience. Features like voice control, text-to-speech technology, and more make the librarian's job easier. Using of Raspberry Pi microcontroller as the system's central hub provides a powerful and flexible platform that can be customized to meet the specific need of library.

The book reader for the blind is a highly useful application. It is now possible for visually impaired people and those are having a problem in reading. They can easily the text through this system. Overall this system is used to improve library services and promote accessibility.

IX. FUTURE SCOPE

The future work of the system includes connecting the Raspberry Pi with the Cloud-based service. can handle larger volumes of data and provides a faster processing time and improving OCR techniques.

If the system meets the expectations of the customers by conducting some feedback and provides real value and benefits to them.

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