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RASPBERRY PI BASED READER FOR VISUALLY IMPAIRED PERSON

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ABSTRACT
The creation and deployment of an intelligent reader system intended to help people with visual impairments access printed materials is presented in this research. Utilizing a push-button interface and Raspberry Pi technology, the system combines a text-to-speech engine for voice output, an optical character recognition (OCR) program for text extraction, and a high-resolution camera module for picture capture. Evaluations of the system's performance and functionality revealed dependable speech synthesis and image processing capabilities. The system's intuitive design and potential to improve autonomy and engagement in a variety of circumstances were emphasized in user feedback. Future advancements seek to increase voice synthesis quality, add sophisticated capabilities like real-time translation, and further improve text extraction speed and accuracy. Throughout the project, ethical issues pertaining to data security, privacy, and inclusive design were carefully taken into account. All things considered, the intelligent reader technology is a positive step in making the world more welcoming and accessible for people with visual impairments.
KEYWORD-*Raspberry Pi, Optical Character Reader,Text To Speech*

I.INTRODUCTION

People with visual impairments have a difficult time reading printed material, which limits their freedom and ability to participate in many facets of life. Many visually impaired people still face difficulties reading printed things like books, paperwork, and product labels, even with technological developments. Although they have offered useful alternatives, traditional methods like audio books and Braille frequently have drawbacks in terms of usability, cost, and availability. We provide a novel solution to these problems: an intelligent reader system created especially to meet the requirements of those who are blind or visually impaired. Our system uses a Raspberry Pi and a push-button interface to provide a portable, easy-to-use tool for taking pictures of printed text, extracting the text using optical character recognition (OCR), and using text-to-speech (TTS) technology to turn it into spoken words.

We describe in detail the planning, execution, and assessment of our intelligent reader system in this paper. We go over the methods for taking and processing pictures, the hardware and software elements used, and the user interface design for simple interaction. In addition, we showcase the outcomes of user testing and feedback, emphasizing the system's performance, usability, and possible influence on the lives of people with visual impairments. In the future, we see our intelligent reader system being a useful tool in everyday life, the workplace, and educational settings, allowing visually impaired people to more easily and independently access written information.

Mainul Hossain, Mahmudur Rashid, Pias Paul, Muiz Ahmed Khan, and Md. Atiqur Rahman Ahad "A Completely Blind Visual Aid Powered by AI with Integrated Reading Assistant" [1] Research on AI-based visual assistance for the totally blind is advancing quickly and might greatly enhance the quality of life for those who are visually impaired. These gadgets usually combine cameras, sensors, and artificial intelligence to help with reading, navigation, and other tasks while giving users real-time information about their environment. The creation of AI-based visual assistance that can be included into eyeglasses is one of the most exciting research topics in this industry. This would eliminate the need for users to carry around a separate device in order to get visual information. In recent years, several prototypes have been created, and some of them are currently undergoing clinical testing. Khan et al.'s (2020) device is an example of an AI-based visual aid that also functions as a reading assistant. [1] This gadget helps with reading and gives users information about their surroundings by utilizing a Raspberry Pi 3B+ microprocessor, a camera, and ultrasonic sensors.

The gadget is lightweight and portable because it can be attached to a standard pair of eyeglasses. For object detection, the gadget makes use of a pretrained TensorFlow Lite-Mobile Net model. People, faces, and indoor objects are just a few of the many objects that this model can identify. A built-in reading aid on the device can read material from books, documents, and other sources aloud.

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In their 2019 paper, "Virtual-blind-road following based wearable navigation device for blind people," J. Bai, S. Lian, Z. Liu, K. Wang, and D. Liu [2] suggest a brand-new wearable navigation tool that enables blind individuals to safely and effectively navigate roadways. The apparatus includes an ultrasonic rangefinder, a depth camera, a fisheye camera, and a set of optical seethrough glasses. A virtual blind road is constructed using the depth and fisheye cameras, and a visual SLAM technique is employed to pinpoint the user's location. The ultrasonic rangefinder is used to make up for the depth camera's shortcomings, which include its inability to penetrate clear objects and its absorption by some unique materials.

There have been several more studies on creating wearable navigation systems for blind persons in addition to the work done by Bai et al. (2019). For instance, Chen et al. (2018)'s study "A Wearable Navigation System for Blind People Using Augmented Reality"[21] suggests a wearable navigation system that guides blind individuals via augmented reality. According to the 2019 article "Vision-based mobile indoor assistive navigation aid for blind people," [3] a novel vision-based mobile indoor assistive navigation system for blind individuals is suggested. A smartphone with an integrated camera and a semantic map of the inside space make up the system.

A unique method for using social media to assist the blind with navigation is put out by S. L. Joseph et al. in their 2015 [19] paper, "Being aware of the world: Toward using social media to support the blind with navigation." The system gives the user situational awareness in real time by combining social media messages with wearable sensors. While social media communications are used to identify and report happenings in the user's immediate proximity, wearable sensors are utilized to estimate the user's location and orientation.

"Assistive clothing pattern recognition for visually impaired people," by X. Yang, S. Yuan, and Y. Tian [16] Research on assistive clothing pattern recognition for the blind and low vision is expanding in order to create technology that will enable these individuals to recognize and select clothing on their own. Because it calls for the capacity to discriminate between various patterns, colors, and textures, this can be a difficult undertaking. For the recognition of helpful clothing patterns, several methods have been put forth. In their article "Representing and retrieving video shots in human-centric brain imaging space," published in 2021, J. Han et al. [20] suggest a revolutionary method for doing just that.

III.PROPOSED METHODOLOGY

A person who is blind is unable to learn about their surroundings. A strong and methodical approach is needed to create an intelligent reader for those with visual impairments. The intelligent reader is designed, developed, and tested to guarantee its efficacy, usefulness, and accessibility. The objective of this research is to develop an accurate, dependable, and user-friendly system that could improve the reading experience for people with visual impairments. This work proposes a new visual aid system that is affordable, small, and has an integrated reading assistant that can translate images to text and provide audio feedback. The Raspberry Pi is used in this prototype to provide its functionality. Tesseract and TTs (Text to Speech Technology) are the two primary elements of the suggested prototype.

The main goal of this proposed effort is to develop a smart and flexible intelligent reader that can comprehend context, recognize and read text accurately, make navigation simple, and provide a customized reading experience. This system aims to give visually impaired people a more efficient and natural way to freely access a variety of printed and digital content by combining cutting-edge technologies with careful design. Around 2.2 billion individuals worldwide suffer from mild to severe visual impairment, according to the World Health Organization (WHO). Although Braille and audio books, two traditional ways of accessing textual information, have been very helpful, recent developments in technology present opportunities for a more dynamic and inclusive approach.

A.Raspberry pi 4 model

A 1.5 GHz 64-bit quad core ARM Cortex-A72 processor, on-board 802.11ac Wi-Fi, Bluetooth 5, full gigabit Ethernet (throughput not limited), two USB 2.0 ports, two USB 3.0 ports, 1, 2, 4, or 8 GB of RAM, and dual-monitor support via a pair of micro-HDMI (HDMI Type D) ports for up to 4K resolution were all features of the Raspberry Pi 4 Model B, which was released in June 2019. The price of the 2 GB RAM version has decreased, and the 1 GB RAM variant is no longer available. The 8 GB model's circuit board has been upgraded. The Raspberry Pi 4's USB-C port enables more power to be delivered to devices downstream when paired with the appropriate PSU.

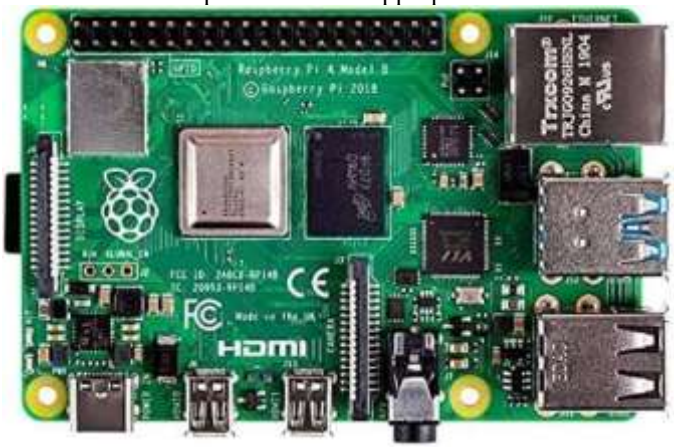


Fig.1.Raspberry Pi Model 4B

B.Pi camera Model: A small camera add-on made especially for Raspberry Pi single-board computers is the Raspberry Pi Camera Module Rev 1.3. In comparison to its predecessors, it offers more features and capabilities, marking an advancement in the

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Raspberry Pi camera lineup. Because of its compact and lightweight design, the Raspberry Pi Camera Module Rev 1.3 is simple to include into a variety of projects and applications. Its small physical factor makes space needs low and mounting options open. Up to 5 megapixels (2592 × 1944 pixels) of high-quality photographs can be captured with this camera module. It is appropriate for a variety of photography and imaging activities since it produces photos that are crisp and detailed. Applications for the Raspberry Pi Camera Module Rev 1.3 are numerous and include computer vision projects, photography, videography, and surveillance.

C.Speakers: Real-time image capture and text-to-speech conversion are accomplished via the Raspberry Pi Camera Module, and the user can get output feedback via a speaker or Raspberry Pi-connected earbuds. Make use of Python text-to-speech synthesis libraries like gTTS or pyttsx3.

D. User Interaction: Provide a user interface so that users may operate the system and start the speech synthesis and text recognition processes. Use a voice command recognition system or a push-button mechanism to start the system. Give the user auditory feedback to let them know how the system is doing, such as when text-to-speech conversion is underway or image capture is finished.

IV.SOFTWARE DETAILS

1.Image Processing: Optical Character Recognition (OCR), another name for text recognition, is a technology that turns text images into machine-readable text. Enabling computers to decipher and extract valuable information from handwritten or printed texts is the main objective of text recognition technology. Image processing is the process of modifying or examining digital photos in order to improve their visual quality or extract pertinent information. In the project's setting, image processing is essential for getting printed text pictures ready for optical character recognition (OCR).

2. *Image Enhancement:* By boosting sharpness, altering brightness and contrast, and lowering noise, image enhancement techniques seek to improve an image's visual quality. Noise reduction filters, contrast stretching, and histogram equalization are common techniques for improving images.

3. *Image Segmentation:* Based on pixel intensity, color, or texture, image segmentation divides an image into several areas or segments. Text can be extracted and recognized more easily when text portions are separated from the image's background using segmentation techniques.

4. *Thresholding:* Thresholding is a simple yet effective technique for image binarization, where pixels are classified as either foreground (text) or background based on a predefined threshold value. Thresholding converts a grayscale image into a binary image, simplifying subsequent processing steps such as text extraction.

5. Edge Detection: Algorithms for edge detection locate and identify boundaries or edges in an image. Text boundaries can be found and text areas can be distinguished from background clutter with the help of edge detection.

6. *Text to Speech Conversion:* Text-to-speech (TTS) synthesis is the process of converting written text into spoken speech. In the context of the project, text-to-speech conversion is used to transform the recognized text from the images of printed text into audible speech that can be heard by visually impaired individuals.
7. Input Text: Optical character recognition (OCR) techniques can be used to extract text from photographs, which is usually the input for text-to-speech systems.

8. *Text Analysis:* The input text may be subjected to linguistic analysis prior to synthesis in order to pinpoint linguistic elements like emphasis, punctuation, and sentence structure.
Fig.2. shows flowchart of the proposed code.

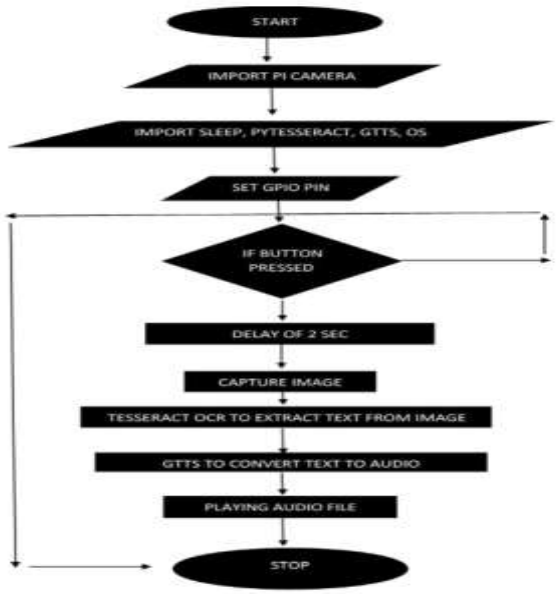


Fig.2.Python Code Flowchart

Fig.3 shows putty configuration

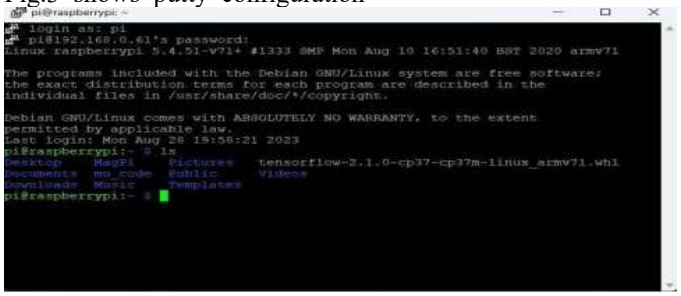


Fig.3.Putty Configuration

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IV.RESULT AND DISCUSSION

Several significant results were obtained after the intelligent reader project for blind people was put into practice utilizing a Raspberry Pi camera and a push-button interface. The system's performance and functionality were first and foremost carefully assessed. The system continuously showed that it could take pictures, use OCR to extract text, and turn that information into speech. Despite obstacles including changes in illumination and visual clarity, these problems were successfully resolved by hardware modifications and software enhancements. Focus was primarily placed on accessibility and user experience, with essential input from visually challenged users. The push-button interface was simple and intuitive for users, allowing them to retrieve printed information on their own. Their favorable response demonstrated how the approach may improve involvement and autonomy.

Fig4. Shows the prototype of the system.

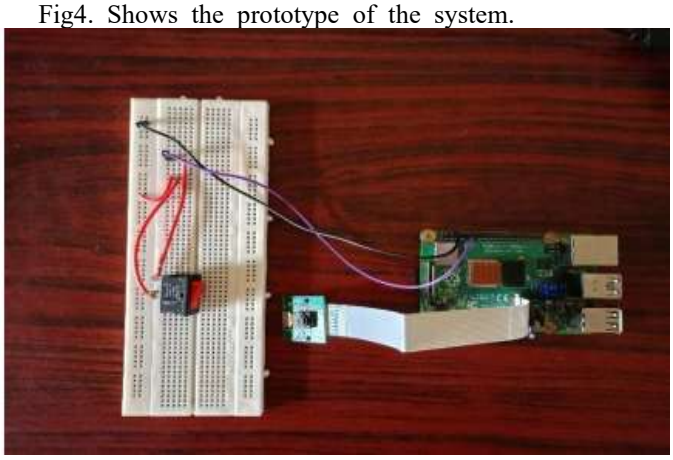


Fig.4.Prototype of the system

V.CONCLUSION

The project's primary goal is to present a temporary "Intelligent Reader for Visually Impaired Persons." The pictures can be turned into text by using a Raspberry Pi and the Python programming language. The Raspberry Pi is frequently utilized in this context for image processing and visualization. Installing the required software, taking or importing pictures, using Python to process the photographs, and then extracting text from the images are the steps involved in configuring the Raspberry Pi. It integrates the ideas of text-to-speech synthesizer (TTS) on the Raspberry Pi and optical character recognition (OCR). Through a voice interface, this type of device facilitates effective computer interaction for those who are blind or visually handicapped. People with visual impairments who struggle in their life due to their eyesight issue can benefit from an inventive solution called the Intelligent Reader for Physically Impaired Individuals (IRPI). When this technology is put into place, visually impaired people can easily listen to anything they desire. Additionally, the text can be translated into the required language with the aid of translation tools, and the modified text can then be turned into voice using Google's speech recognition engine. They can become independent in this way. In addition, it is less expensive than alternative solutions. A text-to-speech device can convert text images into sound with a high enough performance, a readability tolerance of less than 2%, and a processing time of less on average.

VI.REFERRENCES

1. *Muiz Ahmed Khan , Pias Paul , Mahmudur Rashid , Student Member, IEEE, Mainul Hossain , Member, IEEE, and Md Atiqur Rahman Ahad , Senior Member, "An AI-Based Visual Aid With Integrated Reading Assistant for the Completely Blind" IEEE Trans on human machine system vol.50 issue .6*
2. *J. Bai, S. Lian, Z. Liu, K. Wang, and D. Liu, "Virtual-blind-road following based wearable navigation device for blind people," IEEE Trans. Consum. Electron., vol. 64, no. 1, pp. 136– 143, Feb. 2018.*
3. *B. Li et al., "Vision-based mobile indoor assistive navigation aid for blind people," IEEE Trans. Mobile Comput., vol. 18, no. 3, pp. 702–714, Mar. 2019.*
4. *J. Xiao, S. L. Joseph, X. Zhang, B. Li, X. Li, and J. Zhang, "An assistive navigation framework for the visually impaired," IEEE Trans. HumanMach. Syst., vol. 45, no. 5, pp. 635– 640, Oct. 2015.*
5. *A. Karmel, A. Sharma, M. Pandya, and D. Garg, "IoT based assistive device for deaf, dumb and blind people," Procedia Comput. Sci., vol. 165, pp. 259–269, Nov. 2019.*
6. *C. Ye and X. Qian, "3-D object recognition of a robotic navigation aid for the visually impaired," IEEE Trans. Neural Syst. Rehabil. Eng., vol. 26, no. 2, pp. 441–450, Feb. 2018.*
7. *Y. Liu, N. R. B. Stiles, and M. Meister, "Augmented reality powers a cognitive assistant for the blind," eLife, vol. 7, Nov. 2018, Art. no. e37841.*
8. *A. Adebiyi et al., "Assessment of feedback modalities for wearable visual aids in blind mobility," PLoS One, vol. 12, no. 2, Feb. 2017, Art. no. e0170531.*
9. *J. Bai, S. Lian, Z. Liu, K. Wang, and D. Liu, "Smart guiding glasses for visually impaired people in indoor environment," IEEE Trans. Consum. Electron., vol. 63, no. 3, pp. 258–266, Aug. 2017.*
10. *D. Dakopoulos and N. G. Bourbakis, "Wearable obstacle avoidance electronic travel aids for blind: A survey," IEEE Trans. Syst. Man, Cybern. Part C Appl. Rev., vol. 40, no. 1, pp. 25– 35, Jan. 2010.*
11. *E. E. Pissaloux, R. Velazquez, and F. Maingreaud, "A new framework for cognitive mobility of visually impaired users in using tactile device," IEEE Trans. Human-Mach. Syst., vol. 47, no. 6, pp. 1040–1051, Dec. 2017.*
12. *K. Patil, Q. Jawadwala, and F. C. Shu, "Design and construction of electronic aid for visually impaired people," IEEE Trans. Human-Mach. Syst., vol. 48, no. 2, pp. 172–182, Apr. 2018.*
13. *R. K. Katzschmann, B. Araki, and D. Rus, "Safe local navigation for visually impaired users with a time-of-flight and haptic feedback device," IEEE Trans. Neural Syst. Rehabil. Eng., vol. 26, no. 3, pp. 583–593, Mar. 2018.*

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14. *J. Villanueva and R. Farcy, "Optical device indicating a safe free path to blind people," IEEE Trans. Instrum. Meas., vol. 61, no. 1, pp. 170–177, Jan. 2012.*
15. *X. Yang, S. Yuan, and Y. Tian, "Assistive clothing pattern recognition for visually impaired people," IEEE Trans. Human-Mach. Syst., vol. 44, no. 2, pp. 234–243, Apr. 2014.*