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The Smart Assistant for Library Management and Book Reader for Blind People Using Raspberry Pi

Dr. M. V. Karthikeyan, K. Abirami and K. Abinaya
Department of Electronics and Communication Engineering
St. Joesph's Institute of Technology, Chennai, India

Abstract: *This system proposes a camera-based assistive text reading framework to help blind persons ad text labels and product packaging from hand-held objects in their daily lives. To isolate the object from cluttered backgrounds or other surrounding objects in the camera view, we rest propose an ancient and active motion-based method to dine a Region Of Interest (ROI) in the video by asking the user to shake the object. In the extracted ROI, text localization and recognition are conducted to acquire text information. To automatically localize the text regions from the object ROI, we propose a novel text localization algorithm by learning gradient features of stroke orientations and distributions of edge pixels in an Ad boost model. Text characters in the localized text regions are then binaries and recognized by the shelf Optical Character Recognition (OCR) software.*

Keywords: Text to speech, Image to Text, Optical Character Recognition, Raspberry Pi, and Speech output, Python Programming.

I. INTRODUCTION

The World Health Organization (WHO) survey says that over 285 million people are estimated to be visually challenged worldwide and blind individuals around fifty million worldwide. Although there are many solutions to help individuals who are blind to read the content, but still it requires a lot of enhancement for better reading. The camera-based assistive text reading framework to help Visually Challenged People and text labels. To isolate the object from cluster backgrounds or other surrounding objects in the camera view, the rest propose an ancient and active motion-based method to dine a region of interest in the video by asking the People to shake the object. The method extracts moving object region by a mixture-of Gaussians based background subtraction method. In the extracted Region of Interest, text localization and text recognition are conducted to acquire text information. To automatically localize the text regions from the object Region of Interest, we propose a text localization algorithm by learning incline features of stroke orientations and distributions of edge pixels in an Ad boost model. Text characters in the localized text regions are then binaries and recognized by optical character recognition (OCR) software.

For the first time, visually impaired people, will soon have access to web-based and Android mobile apps of digital audio versions of books available in all public libraries, in the first phase, books from Anna Centenary Library will be converted into digital audio versions by using special software. At present, the library holds five lakh books covering a wide range of subjects. It also has several sections including a Braille Section and Student's Section, besides Periodicals and Newspapers unit. A senior School Education Department official told DT Next that the new high-tech software, which will be developed by a multinational IT company, will be in compliance with the Digital Accessible Information System (DAISY) audio format.

Accordingly, visually impaired people can register with administrator assistance to access the Tamil or English Books and resources, search books by category, author, publication and also access selected books by chapter. "The application will have the feature of admin access to load books chapter wise, list and search members, search books, update or reload information, edit information," he said, adding, that administrators can also activate, authorize, deactivate any user. Stating that the user-friendly audio book will be compiled by language experts and recorded by native speakers who will guide the learners in capturing information, the official said the proposed application will

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have user-friendly interface designs such as fast access to database, less error, more storage capacity and quick transaction.

"The application will also have literature review option, which will help to improve the library services for visually challenged people to access Tamil and English efficiently", he said. Pointing out that the new system will also help librarians manage information in an organized way, the official said it will also aid them in reporting various operations related to visually impaired people's resource accessibility. "In addition, the application will help monitor and control overall day to-day transactions."

The newly-inaugurated Anna Centenary Library in Kotturpuram is drawing large crowds of bibliophiles from all age groups. But a special group among them - the visually-challenged - seems particularly happy about the facilities the book room has to offer.

II. Related Work

In order to acquire wide knowledge about Smart assistant for library management for visually challenged people using raspberry pi, many research papers of various authors related to this project have been studied thoroughly. The papers listed below will give brief explanation of the whole theme.

2.1 Text to Speech for the Visually Impaired

In 2017, Mrs. Shilpa Reddy K, Mounika S.k, Pooja K, Sahana proposes Text to Speech for the Visually Impaired. An assistive content perusing system to help outwardly impeded people to peruse writings from different questions in their day by day lives. Pre-handling incorporates steps like dark scale and linearization, question of intrigue acknowledgment. The utilization of OTSU calculation to change over the dim scale picture into binaries one. The content districts from the caught picture are then separated and perceived by utilizing optical character acknowledgment programming (OCR).

The principle calculation in OCR to be specific MODI is utilized here. This extricated content of different textual styles and sizes then can be perceived independently and afterward consolidated in a word giving its yield as sound utilizing Text-to-discourse utilizing the SAPI libraries.

2.2 A Reading Aid for the Blind People using OCR and Open CV

Optical character recognition (OCR) is the identification of printed characters using photoelectric devices and computer software. It coverts images of typed or printed text into machine encoded text are converted into audio output. OCR is used in machine process such as cognitive computing, machine translation, text to speech, key data and text mining. OCR the character code in text files are processed using Raspberry Pi device on which it recognizes character using tesseract algorithm and python programming and audio output is listened.OCR for pattern recognition to perform Document image analysis (DIA) we use information in grid format in virtual digital library's design and construction. It promotes Python programming as main programming language.

2.3 The Voice Enabled Stick

In 2017, Hafiz M. U. Munir, Fahad Mahmood, Ayesha Zeb , Fahad Mehmood ,Umar S. Khan, Javaid Iqbal proposes blind people need a device which is used in avoiding obstacle and helping in navigation. This paper introduces a novel embedded system device called voice enabled stick (VES) which is used to help the visually impaired people to navigate among the obstacles. This device is comprised of a long handle and three ultra-sonic sensors mounted at the end to extract the distance from the nearest obstacle. The output of the stick is in the form of voice to a head phone which gives commands to the user (visually impaired-person) to move right, turn left, and go straight or to stop. The user hears the voice commands from the device and navigates through the obstacles easily without any prior knowledge on the device.

In this paper past existing devices have reviewed and the parameters related to these devices and VES are discussed. The improvement in different existing devices for blind people, their limitations and their advantages and

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disadvantages are examined. Comparison of different existing sticks with our proposed device is also recognized. Challenges issues and difficulties related to propose VES needs to be overcome have been highlighted.

2.4 Finger Reader: A Wearable Device to Support Text Reading

In 2019, Roy Shilkrot, Jochen Huber, Connie Liu, Pattie Maes proposes Visually impaired people report numerous difficulties with accessing printed text using existing technology, including problems with alignment, focus, accuracy, mobility and efficiency. We present a finger worn device that assists the visually impaired with effectively and efficiently reading paper-printed text. We introduce a novel, local-sequential manner for scanning text which enables reading single lines, blocks of text or skimming the text for important sections while providing real-time auditory and tactile feedback. The design is motivated by preliminary studies with visually impaired people, and it is small-scale and mobile, which enables a more manageable operation with little setup.

2.5 Wearable Real-Time Stereo Vision for the Visually Impaired

In 2018, G. Balakrishnan, G. Sainarayanan, R. Nagarajan and Sazali Yaacob proposes visually impaired find their navigation difficult as they often lack the needed information for bypassing obstacles and hazards. Electronic Travel Aids (ETAs) are devices that usesensor technology to assist and improve the blind user's mobility in terms of safety and speed. Modern ETAs does not provide distance information directly and clearly. This paper proposes a method for determining distance using a stereo matching method to help blind individuals for their navigation. The system developed in this work, named Stereo Vision based Electronic Travel Aid (SVETA), consists of a computing device, stereo cameras and stereo earphones, all molded in a helmet. An improved area based stereo matching is performed over the transformed images to calculate dense disparity image. Low texture filter and left/right consistency check are carried out to remove the noises and to highlight the obstacles. A sonification procedure is proposed to map the disparity image to stereo musical sound, which has information about the features of the scene in front of the user. The sound is conveyed to the blind user through stereo headphones. Experimentations have been conducted and preliminary investigations have proven the viability of this method for applying in real time environment

2.6 Navigation Assistance for the Visually Impaired using RGB-D Sensor with Range Expansion

Navigation Assistance for Visually Impaired (NAVI) refers to systems that are able to assist or guide people with vision loss, ranging from partially sighted to totally blind, by means of sound commands. In this paper, a new system for NAVI is presented based on visual and range information. Instead of using several sensors, we choose one device, a consumer RGB-D camera, and take advantage of both range and visual information. In particular, the main contribution is the combination of depth information with image intensities, resulting in the robust expansion of the range-based floor segmentation. On one hand, depth information, which is reliable but limited to a short range, is enhanced with the long-range visual information. On the other hand, the difficult and prone-to-error image processing is eased and improved with depth information. The proposed system detects and classifies the main structural elements of the scene providing the user with obstacle-free paths in order to navigate safely across unknown scenarios. The proposed system has been tested on a wide variety of scenarios and data sets, giving successful results and showing that the system is robust and works in challenging indoor environments.

2.7 A Haptic Handheld way Finder for People with Visual Impairments

Orientation and position information are vital for people with visual impairments if they are to avoid obstacles and hazards while walking around. We develop and evaluate a haptic direction indicator that delivers directional information in real time through kinesthetic cues. The indicator uses a novel kinesthetic perception method called the pseudo-attraction force technique, which employs the nonlinear relationship between perceived and physical acceleration to generate a force sensation. In an experiment, we find that the haptic direction indicator allowed people with visual impairments to walk safely along a predefined route at their usual walking pace without any previous training, independent of the existence of auditory information. The findings indicate that the haptic direction indicator

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is effective at delivering simple navigational information, and is a suitable substitute for and/or enhancement to conventional way finding methods.

2.8 A Haptic Solution to Assist Visually Impaired in Mobility Tasks

Electronic travel aids are used for detecting obstacles, identifying services, and, generally, obtaining useful information from the surroundings, thus enabling a safe and effective exploitation of the environment. A drawback is unnatural codification, which may lead to usability concerns. This paper introduces a haptic device aimed to provide the user with information on the presence of obstacles inside the environment. The haptic interface is intended to reproduce the stimuli provided by a traditional white cane, without any contact with the environment. A prototype, implemented through a short cane with an embedded smart sensing strategy and an active handle, is presented. Twenty-five blindfolded normally sighted users participated to assess system performance in detecting obstacles and correctly conveying their position by the haptic interface. With respect to detecting obstacles and their positions, the average values of the sensitivity in the case of left, center, and right positioned obstacles are 0.735, 0.803, and 0.830, while the specificity values are 0.924, 0.835, and 0.827, respectively.

2.9 Design, Development, and Clinical Evaluation of the Electronic Mobility Cane for Vision Rehabilitation

This paper proposes a new electronic mobility cane (EMC) for providing obstacle detection and way-finding assistance to the visually impaired people. The main feature of this cane is that it constructs the logical map of the surrounding environment to deduce the priority information. It provides a simplified representation of the surrounding environment without causing any information overload. It conveys this priority information to the subject by using intuitive vibration, audio or voice feedback. The other novel features of the EMC are staircase detection and non-formal distance scaling scheme. It also provides information about the floor status. It consists of a low power embedded system with ultrasonic sensors and safety indicators. The EMC was subjected to series of clinical evaluations in order to verify its design and to assess its ability to assist the subjects in their daily-life mobility. Clinical evaluations were performed with 16 totally blind and four low vision subjects. All subjects walked controlled and the real-world test environments with the EMC and the traditional white cane. The evaluation results and significant scores of subjective measurements have shown the usefulness of the EMC in vision rehabilitation services.

2.10 National Evaluation of Electronic Travel Aids for Blind and Visually Impaired Individuals: Implications for Design

The last decades a variety of portable or wearable navigation systems have been developed to assist visually impaired people during navigation in known or unknown, indoor or outdoor environments. There are three main categories of these systems: Electronic Travel Aids (ETAs), Electronic Orientation Aids (EOAs), and Position Locator Devices (PLDs). This paper presents a comparative survey among portable/wearable obstacle detection/avoidance systems (a subcategory of ETAs) in an effort to inform the research community and users about the capabilities of these systems and about the progress in assistive technology for visually impaired people. The survey is based on various features and performance parameters of the systems that classify them in categories, giving qualitative-quantitative measures. Finally, it offers a ranking, which will serve only as a reference point and not as a critique on these systems.

2.11 Electronic Pen Aiding Visually Impaired in Reading and Visualizing

In 2018, Joshi Kumar A. V.; Visu A.; Mohan Raj S.; Madhan Prabhu T.; Kalaiselvi V. K. G proposes Visually impaired people, in order to understand printed or hand written media, need the material to be present in Braille. They also require an understanding of the Braille language. The proposed system instead uses other senses that visually challenged person possesses, such as the ability to listen and convert the textual material into an audio stream. This concept starts with the capturing of the image and recognizing the text in the image using OCR/ICR. It then loads the required font templates for printed text into the conversion software. Subsequently for hand-written documents sub-stroke matching, segmentation and merging are used. The output of this process generates an electronic form of the

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printed media, like a text document. This is then cross referenced with a word repository for maximum accuracy, and in turn converted into an audio file. This information is then broadcast/multicast/unicast to the receiver who is paired with the source using ZigBee or Wi-Fi protocols. Since this technology is in the form of a pen, it is very convenient to use and is also portable. This instrument is a radically new one and can definitely be an empowering force in a blind person's life, and can be helpful in relieving them of their frustration of not being able to read whatever they want, thus enhancing the quality of their lives.

III. Proposed System

This prototype system is to read printed text on hand-held objects for assisting blind persons. In order to solve the common aiming problem for blind users, we have proposed a motion-based method to detect the object of interest, while the blind user simply shakes the object for a couple of seconds. The automatic ROI detection and text localization algorithms were independently evaluated as unit tests to ensure effectiveness and robustness of the whole system.

A Raspberry Pi board, an ultrasonic sensor and a webcam to recognize the text in the scene. In this, the webcam is focussed on the scene. A video streaming is obtained, from which the images are captured frame by frame. We subsequently evaluated this prototype system of assistive text reading using images of hand-held objects captured by ten blind users in person. Two calibrations were applied to prepare for the system test. First, we instructed blind users to place hand-held object within the camera view. Since it is difficult for blind users to aim their held objects, we employed a camera with a reasonably wide angle. Then the images are refined in order to eliminate any noise that is present in it.

A feature called segmentation is used in order to separate each character from other in the text. Graphical details such as icons or logos, if any, are eliminated. Each obtained character is compared with the datasets that are created as a part of the Tesseract library.

The Tesseract OCR is the most efficient algorithm available that checks for the obtained character in ten dimensions. Once, the character is recognized, it must be made available as an audio output. For this, we use a software called festival. The festival is used to provide the audio output for the recognized character. Apart from these features, an extra feature is added, that enables the blind to know the type of object that he/she interacts with. (a menu, newspaper and the like). An ultrasonic sensor is included as a part of the project, that makes the project obtain characters only within a particular distance.

IV. Methodology

4.1 Image Capturing

The initial step is the one in which the archive is put under the camera and the camera catches a picture of the set report. The nature of the picture caught will be high in order to have quick and clear acknowledgment because of the high-goals camera.

4.2 Pre-Processing

The pre-preparing stage comprises of three stages: Skew Correction, Linearization, and Noise Removal. The caught picture is checked for skewing. There are conceivable outcomes of the picture getting skewed with either left or right introduction. Here the picture is first lit up and binarized. The capacity for skew recognition checks for an edge of introduction between ±15 degrees and whenever distinguished then a straightforward picture pivot is completed till the lines coordinate with the genuine flat pivot, which creates a skew rectified picture. The commotion acquainted amid catching or due with the low quality of the page must be cleared before further handling.

4.3 Image To Text Converter

The ASCII estimations of the perceived characters are handled by Raspberry Pi board. Here every one of the characters is coordinated with its comparing format and spared as standardized content interpretation. This interpretation is further conveyed to the sound yield.

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4.4 Text To Speech

The extent of this module is started with the finish of the retreating module of Character Recognition. The module plays out the undertaking of transformation of the changed content to capable of being heard structure. The Raspberry Pi has an on-board sound jack, the on-board sound is created by a PWM yield and is negligibly separated. A USB sound card can incredibly improve the sound quality and volume. As the acknowledgment procedure is finished, the character codes in the content record are handled utilizing Raspberry Pi gadget on which perceive a character utilizing Tesseract calculation and python programming, the sound yield tunes in.

V. EXPERIMENT AND RESULTS

5.1 Hardware Setup

A prototype for automatic document reader for visually impaired people using raspberry pi is developed and tested. The prototype implementation was successful and it meets our goals. This system was mainly developed to enhance the capabilities of visually challenged people by providing them a solution so that the information can be fed to them in the form of a speech signal. With furthermore testing and advanced development of this model, we can implement it in real-time. We hope that this project helps the visually impaired people with their disability and encourages them to upgrade themselves.

Figure 1: Hardware Setup

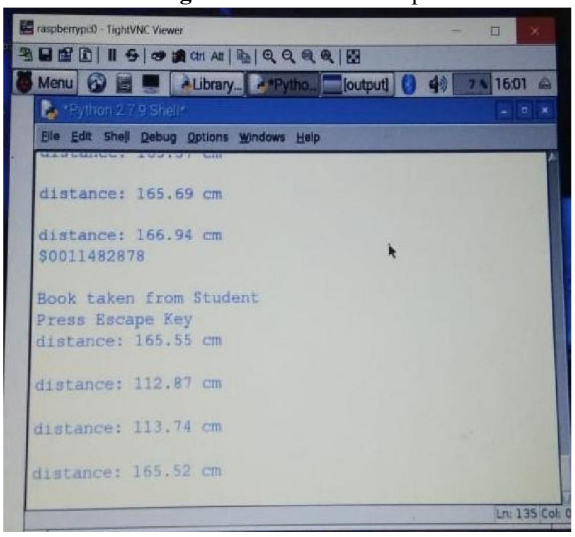

Figure 2: Distance measured from ultrasonic sensor

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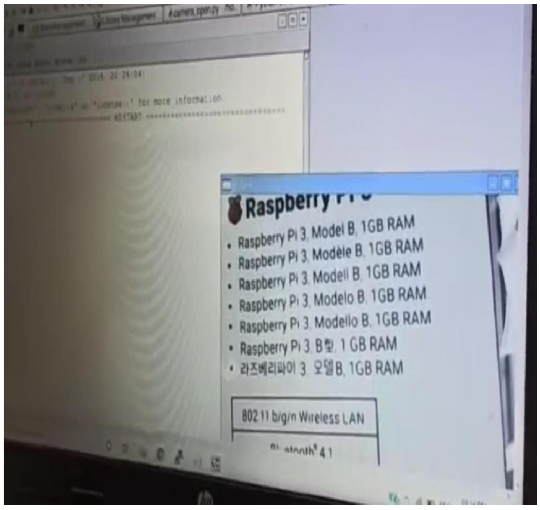
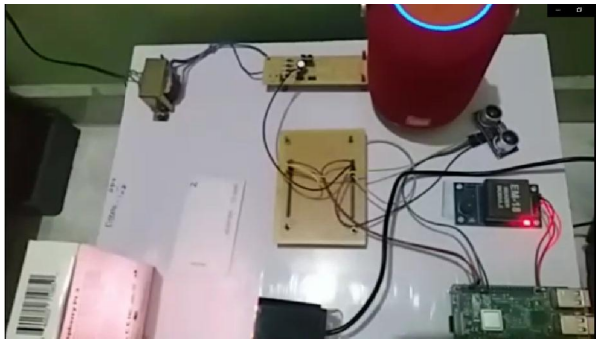


Figure 3: Captured image by webcam

VI. OUTPUT



VII. CONCLUSION

According to the survey made through the reference papers, the smart reader for blind produces a positive outcome when applied in practical world. This system is useful for visually impaired persons to access information which is in the form of documents, texts or printed forms. The future implementation may include accuracy and fulfil the limitations of existing systems.

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REFERENCES

[1]. S.Bhatlawande, M Mahadevappa, J. Mukherjee, M. Biswas, D. Das, andS. Gupta, "Design, development, and clinical evaluation of the electronicmobility cane for vision rehabilitation," IEEE Trans. Neural Syst. Rehabil.Eng., vol. 22, no.6, pp. 1148–1159, Nov.2014.

[2]. B. Andò, S. Baglio, V. Marletta, and A. Valastro, "A haptic solution toassist visually impaired in mobility tasks," IEEE Trans. Human-Mach.Syst., vol. 45, no. 5, pp. 641–646, Oct.2015.

[3]. "2006 International residential code," Int. Code Council, Washington, DC, USA, 2006. Accessed: Mar.2016. Available: http://www.qistx.com/documents/stair.installation.guide-lines.pdf

[4]. D. Carlson and N. Ehrlich, "Assistive technology and information technology use and need by persons with disabilities in the United States," Nat.Inst. Disability Rehabil. Res., U.S. Dept. Educ., Washington, DC, USA, Rep. 2001, 2005, Accessed: Jan. 2017.[Online].Available:http://www.ed.gov/rschstat/research/pubs/at-use/at-use-2001.pdf

[5]. 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.

[6]. A. Aladrn, G. Lpez-nicols, L. Puig, and J. J. Guerrero, "navigation assistance for the visually impaired using RGB-D sensor with range expansion," IEEE syst. J., Vol. 10, no. 3, pp. 922–932, sep. 2016.

[7]. T. Amemiya and H. Sugiyama, "orienting kinesthetically: A haptic handheld wayfinder for people with visual impairments," ACM trans. Accessible comput., Vol. 3, no. 2, 2010.

[8]. B. And, S. Baglio, V. Marletta, and A. Valastro, "A haptic solution to assist visually impaired in mobility tasks," IEEE trans. Human-mach. Syst., Vol. 45, no. 5, pp. 641–646, oct. 2015.

[9]. S. Bhatlawande, M. Mahadevappa, J. Mukherjee, M. Biswas, D. Das, and S. Gupta, "design, development, and clinical evaluation of the electronic mobility cane for vision rehabilitation," IEEE trans. Neural syst. Rehabil. Eng., Vol. 22, no. 6, pp. 1148–1159, 2014.

[10]. B. B. Blasch, R. G. Long, and N. Griffin-shirley, "national evaluation of electronic travel aids for blind and visually impaired individuals: implications for design," in proc. RESNA 12th annu. Conf., 1989, pp. 133–134