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PORTABLE CAMERA BASED IDENTIFICATION SYSTEM FOR VISUALLY IMPAIRED PEOPLE

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ABSTRACT

In this paper, we present a reformative work for developing an assistive aid system for visually impaired people. This device act as an identification system and text navigator that are capable of assist or guide people with vision loss, ranging from partially sighted to totally blind, by means of sound commands. This device involves the sequential operations of color identification, currency denomination recognition, obstacle detection in indoor as well as reading newspapers and books. Here the text navigator device and identification systems are integrated into the single chip which is represented as Raspberry pi ARM11 (BCM2836). This Raspberry pi has 900MHz of high speed and accuracy. The text navigator system is used to captures an alphabetic and numeric letters by using a camera module as an image object and convert to text file using OCR(Optical Character Recognition) engine then convey that text file information using the speaker. This identification system and text-to-speech converter (Text navigator system) are specifically designed for visually impaired (VI) people, So that they can easily use this device without having to ask for help to others.

Keywords: OCR, Raspberry pi, Text navigator system (TNS), Identification System (IS).

1. INTRODUCTION

Low vision and blindness is the one of the disorder in the human body it causes lacking visual observation due to neurological and physiological factors of health. Taking care and guiding of visually impaired people and giving pedestrian secure mobility is one of the biggest problems faced by their family members in daily life and the visually impaired people always need the help of others. According to the WHO factor 285 million people are calculated to be visually

impaired worldwide, from that 39 million are blind and 246 million have low vision.

This identification system provides a low cost aid to help the visually impaired people.

The paper is explained as follows, Section II describes about the related work for document analysis, text block extraction, portable devices and other visual aid modules. Section III describes limitations and existing system. Section IV representing the proposed assistive aid text navigator system, identification system and various modules present in it. Section V represents the result and discussions about the entire system. Then the Section VI exits the paper with conclusion of the entire system.

II. RELATED WORK

Chiai Yi [7] presents the concept of a camera-based assistive system for visually impaired or blind persons to read text from signage and objects that are held in the hand. The system is able to read text from complex backgrounds and then communicate this information aurally to the visually impaired people.

Rushikesh Dhananjay I made [9]Using the concept of resort to audio feedback to access information on electronic devices like smart phones running on Android OS. However, this modality is not always an appropriate form of output. This approaches that allow for private and obscure interaction are hegemonic. The Eye ring technology is the finger-worn device that allows using a pointing gesture. It opens up a world of possibilities for solving day-to-day problems for the visually impaired and the sighted alike.

D.Koubaroulis [13] used the multimodal neighborhood signature (MNS) algorithm represents local object appearance by stable color-based invariants efficiently computed from image neighborhoods with multimodal color density function. This kind of system helps the visually impaired people to the color based image retrieval.

II.EXISTING SYSTEM

In existing approaches only color identification module used to identifies the colored object then it is conveyed as audio message to visually impaired people. Then the text block extractor, currency recognition module and obstacle detection modules are separately available in market.

The main drawback of existing approaches is difficult to carrying different modules with them. Then it has the high complexity to managing the modules.

III.PROPOSED ASSISTIVE AID SYSTEM

In this paper, the text navigator system (TNS) and identification systems (IS) are overcomes the following problems faced by the visually impaired people. Braille language is used by the blind people for reading purposes but there is a lack of access to reading resources because of unavailability of reading materials. So the text navigator system (TNS) is used for reading newspaper or books. Then the color identification system (CIS) is used for concept of colors of objects present around the user. The currency denomination and recognition module (CDRM) is used to avoid the restrictions in identifying various currency notes while making payments and also used to identify the fake notes. And the obstacle detection system (ODS) is used to in avoiding obstacles present in path while walking indoors. This systems are integrated into the raspberry pi ARM11(BCM 2386) which is shown in figure1.

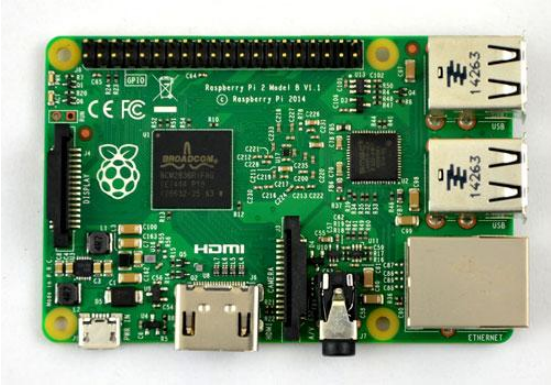

Figure 1: Raspberry pi ARM11 (BCM2836)

Description about Raspberry pi board: The Raspberry Pi 2 delivers 6 times the processing capacity of previous models. This second generation Raspberry Pi has an upgraded Broadcom BCM2836 processor, which is a powerful ARM Cortex-A7 based quad-core processor that runs at 900MHz. The board also features an increase in memory capacity to 1Gbyte.

A. Software and hardware descriptions

To implement text navigator system (TNS) and identification system (IS) designs, a platform has been selected which includes the *Software:* OS (Linux), compiler (arm-linux-gcc_4.4.6), Language (opencv,c).these are the software requirements of the proposed assistive aid system.

Hardware: ARM11(BCM2836),speaker,PC, USB camera, Ultrasonic sensor.

The block diagram that shows various parts integrated to implement the proposed assistive aid system for visually impaired people, which is shown in figure 2.

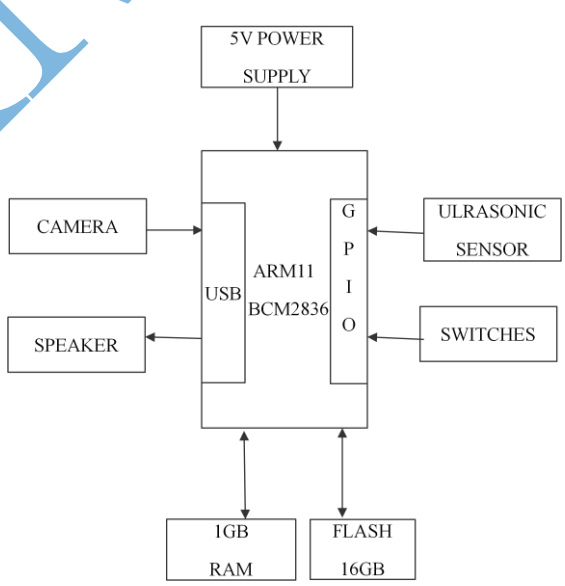

Figure 2: Block diagram of proposed assistive aid

B. Color identification system (CIS)

An Image is a matrix of pixels; an image structure has various details of the image like size, channels, origin etc. Each and every pixel is itself a matrix holding basic information like color, depth, saturation etc.

Here a colored image of 4 channels (RED, GREEN, YELLOW and BLUE). So each pixel has a RED value, GREEN and BLUE value. Our aim is to retrieve these values from an image to determine the color of the pixel. When the CIS switch is turned on in the raspberry it will starts to search the colored object by the camera then it undergoes the operation of scalar image and canny edge detection then the color is identified after that the color of the object is aurally conveyed to the visually impaired.

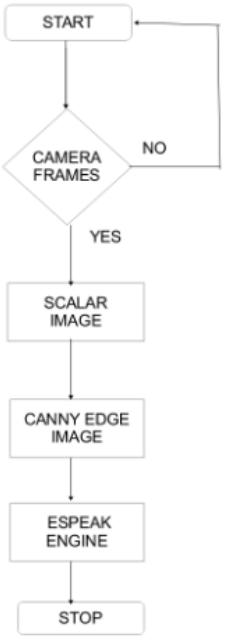

Figure 3: Flow chart for color identification system

C. Text Navigator System (TNS)

A text to speech (TTS) synthesizer is a computer based system that can read text aloud automatically, regardless of whether the text is introduced by a computer input stream or a scanned input submitted to an Optical character recognition (OCR) engine. A speech synthesizer can be implemented by both hardware and software. Speech is often based on concatenation of natural speech i.e. units that are taken from natural speech put together to form a word or sentence. The text navigator system is used to capturing the photograph of a document or book, then the noise available in the scanned object is removed at pre-processing and appropriate filters such as min-max filter, Gaussian blur effect etc. Generally grey image is the combination 0s and 1s and the binary image is the combination of 0s or 1s. The positive values above the threshold level are taken as 1s and the background with negative values are taken as 0s.

Once the image is being loaded, we can convert it into gray scale image. The image which we get is now in the form of pixels within a specific range. This range is used to determine the letters. Then the gray scale image is converted as threshold image it will be undergone the process of optical character recognition. Finally the content of the text is conveyed to the visually impaired.

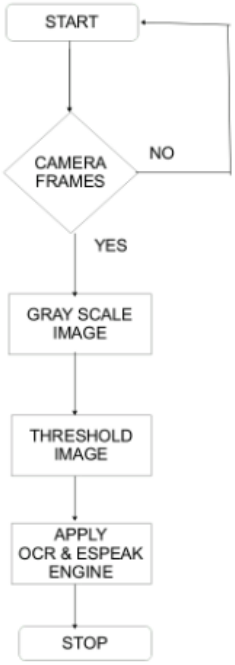

Figure 4: Flow chart for Text reading

D. Currency Denomination and Recognition Module (CDRM)

The Indian currency system has the multiple denominations of Rs.5, RS.10, RS.20, Rs.50, Rs.100, Rs.500, and Rs.1000. All the denominations are unique. These features may be color, Size and identification marks. The system based on the raspberry pi communicates with the camera module, catches frames which include a visible image

of currency amount and process them. Various methodologies are used on the surface on image for currency denomination and recognition (CDRM) which is achieved by the help of basic image processing algorithms such as HSV conversion, template matching, aspect ratio identification, dominant color and feature extraction. when the CDRM switch is turned on by the user the camera module starts to capture the image of the currency and it will matches the basic and important features of the image using the Raspberry pi, if the features are matched to the captured image means it provides the denomination of the currency otherwise it will give a fake note identification alert.

Figure 5:Currency denomination and feature matching

E.Obstacle Detection Module(ODM)

Obstacle detection module is a device which is also called as ultrasonic sensor it will be connected with the Raspberrypi.While the ODM switch is turned on by the user it will detects objects by sending a short ultrasonic burst.

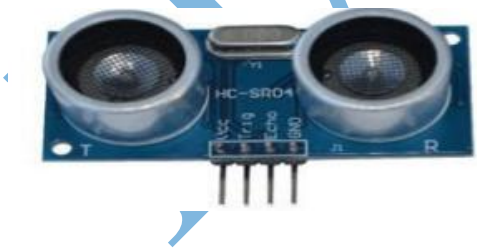

Figure 6: Ultrasonic sensor HCSR-04

Ultrasonic sensors are used for obstacle detection and calculation of distance between the obstacle and the visually impaired person. Ultrasonic sensors are used in pair as transceivers it will transmit and receive signals to detect obstacles in indoor. the obstacle detection module is used to avoid and know the obstacles in the path.

V.RESULTS AND DISCUSSIONS

Color identification system (CIS) is tested more than 5000 times to find out the accuracy of the module, example software implementation is shown in figure7 and its accuracy representation is shown in table1.This system providing the 92.25%of positive output identification. The color identification and obstacle detection modules are the external sensors and they may provide a slight changes in accuracy while detection.

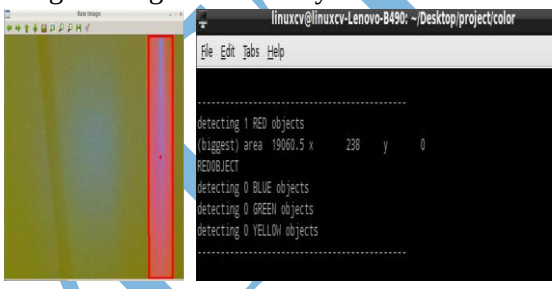

Figure 7:Software implementation to the color identification module (RED)

COLOR	ACCURACY
Red	100%
Green	89%
Blue	92%
Yellow	100%

Table 1: Accuracy of identified colors

In text navigator system (TNS) the text block extraction is used to reading the books or newspaper. The text navigator system captures the picture of the book and based on its thresholding value the letter present in the image is identified. This system is only suitable for black and white colors.

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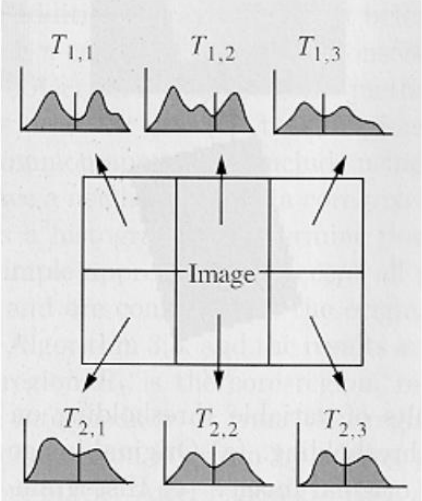

Figure 8:Captured text image and its thresholding value

Currency denomination and recognition module (CDRM) tested over 800 images it providing the accurate results of Rs.100 and it has the inabilty to diffentiate Rs.50 and Rs.500 this CDRM providing the 87.5% of accurate results.

Obstacle detection module (ODM) is an electronic device is built in the form of a Raspberry Pi to detect obstacles. The device is tested, by placing various obstacles at different positions and distances. The system is successful in warning alert to the user about the presence of obstacles in their path. It can detect any object within a pre-specified minimum distance in any direction. This obstacle detection module is only suitable for indoor operations. For out tests, we set the minimum distance value to 1m. The obstacle beyond 100cm is cannot be detected.

VI.CONCLUSION

The proposed assistive aid system is a simple, cheap, configurable and easy to handle electronic guidance for blind and visually impaired persons. This system helps to read the text and converts it into a audio format, and it also performs the various tasks such as color identification, obstacle detection, currency denomination and recognition. With the proposed assistive aid architecture, if constructed with at more accuracy and efficiency, the blind will be able to move from one place to another without others help.

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