# ASSISTIVE KIT FOR VISUALLY IMPAIRED FOR OUTDOOR NAVIGATION

V.Malathi, H.Meenakshi Bansal, Mrs.G.Jenny Niveditha.

*Student, ECE, Prince Shri Venkateshwara Padmavathy Engineering College, Tamilnadu, India*

*Student, ECE, Prince Shri Venkateshwara Padmavathy Engineering College, Tamilnadu, India*

*Assistant Professor, ECE, Prince Shri Venkateshwara Padmavathy Engineering College, Tamilnadu, India*

**ABSTRACT**

*This article proposes the use of a system that detects and recognizes nearby obstacles, giving a Audible feedback to the user, avoiding a collision. Is a wireless system to make it comfortable for the user. The system helps people with visual impairment to move in indoor or outdoor scenario. The objectives of the system is detect obstacles that white canes or guide dogs cannot, expanding their detection range. We are going to implement four modules: Face Identification,MRP Detection,Sign Board detection,Voice command based on-off system.*

**Keyword :** - *obstacle detection , Visually impaired.*

## 1. Introduction:

According to who fact sheet of 2013, 39 million people are blind and 246 million have low vision. Almost 82% of blind population are about 50 years old or above, there are many who have lived majority of their lives with an inability to do tasks like read, write or walk without help. Finger Reader is the technique which was proposed to overcome this. To use Finger Reader, the user must be practiced with usage of touch screens and mobile phones which adds to the inconvenience. OrCam is another commercially available product which allows the user to read newspaper texts along with many other functions. But the technologies used were costly. The contribution of this paper is threefold. An effort to minimize the dependence of the user on the other people . The concept of a wearable device, which supports the general human tendency of pointing at objects to interact with the environment. A prototype to a low cost solution to the problems faced by the visually impaired while interacting with their environment.

Visually impaired people generally depend on a white cane or a guide dog while walking outdoors. Although a white cane is a simple and robust device, it has a disadvantage that it can only detect obstacles through making contact with them: its range is very short. A guide dog performs well for important tasks such as avoiding obstacles and basic navigation. However, it is arduous to train guide dogs, and they can be challenging and inconvenient for a visually impaired person to look after. To solve these problems, researchers have devised a variety of methods and systems to help visually impaired people. So, we devise a computationally simple algorithm that can execute rapidly on light-weight and low performance devices.

## 2. Proposed system:

In this project we present a progressive work for developing an assistive aid for visually impaired,which will help them in face identification, MRP detection, GPS location detection and Voice command based device control. This acts as a complete assistive aid for blind people which performs multi tasks. It consists to two kits A wearable kit for first three modules and an Indoor kit to implement voice command based On-Off module.

The block diagram for the proposed system is as shown.

**BLOCK DIAGRAM**

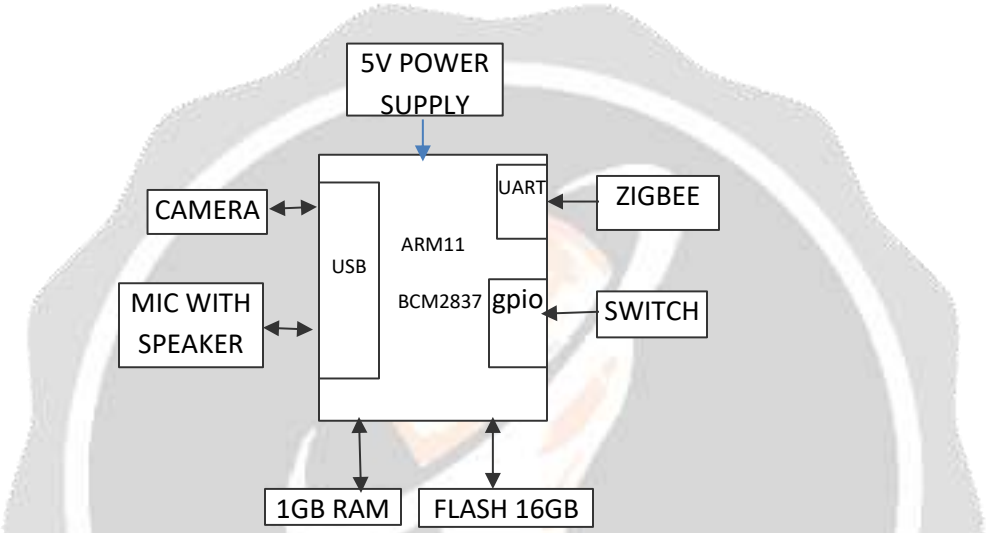


**Fig-1** wearable kit block diagram

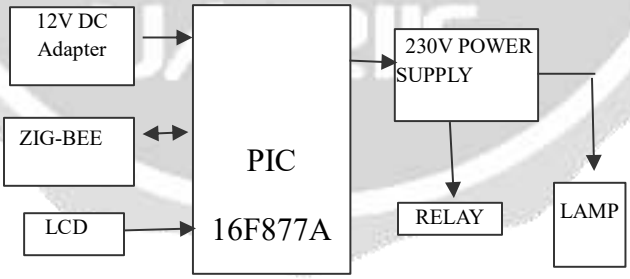


**Fig-2** Indoor kit diagram.

### Block diagram Explanation:

In Fig 1, the ARM 11 (Rasberry pi) processor is interfaced with a camera and microphone. Camera is used to capture the image which is used for face identification and MRP detection. It is combined kit which performs face identification, MRP rate detection, Signboard detection and voice command based on-off system. The output is given to the user with voice commands through speaker. In fig 2, PIC microcontroller is interfaced with Zigbee transmitter which receives voice commands through the receiver in wearable kit. The relay act as a switch. If the

command is matched, then relay gets on and the bulb glows. Each module uses detailed algorithms which are explained in detail in further sections.

**2.1 FACE IDENTIFICATION**

To intimate the blind person about the identity of person stating or talking to him we go for face identification.

It has a two process.

- Face detection
- Face identification.

**2.2 FACE DETECTION**

Face detection is done by Haar classifiers.

**A. HAAR Cascade Classifiers**

The important factor for HAAR classifier object detection is HAAR - like feature. These features are based upon change in Contrast values between adjacent groups of pixels rather than the intensity values of a single pixel. For a human face, eye pixels are darker than the nose area pixels. The contrast values between adjacent rectangular groups of pixels are used to determine relative light and dark areas. Two or three adjacent groups with a relative contrast groups forms a HAAR-like feature. HAAR like features are as is used to detect an image. Fig. 3 shows how these features detect eye and nose for a face image.

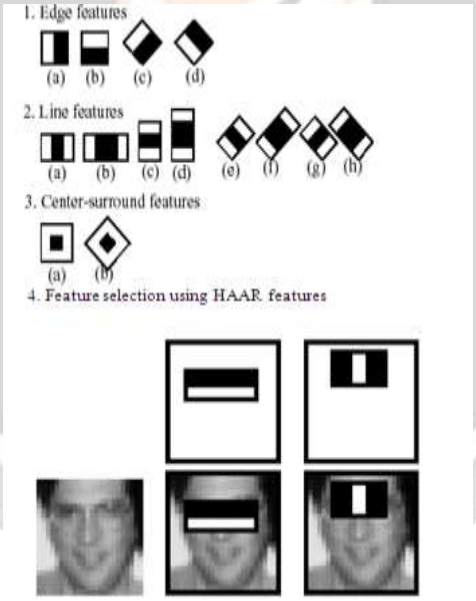


Fig. 3 Haar cascade classifiers

**2.3 FACE IDENTIFICATION**

As soon as the face is detected it is matched with the faces in database and this is done by the algorithm called LOCAL BINARY PATTERN. The working process of LBP algorithm is as follows.

**LOCAL BINARY PATTERN(LBC) ALGORITHM:**

The LBP feature vector, in its simplest form, is created in the following manner:

- The captured image is divided into cells of 3*3 pixels each.
- Each pixel is compared to each of its other 8 neighbouring pixels. The pixels are followed along a circle, i.e. clockwise or counter-clockwise.
- When the center pixel's value is greater than the neighbour's value, it is coded as "0". Else code as "1". Doing this we obtain a 8 digit binary code(which is usually converted to decimal for convenience).
- Compute the histogram over the cell. This histogram can be seen as a 256-dimensional feature vector.
- Now normalize the histogram.
- Combine (normalized) histograms of all cells. This gives a feature vector for the entire window.

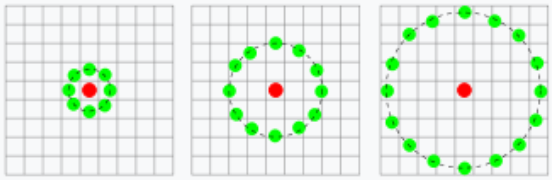

Fig 3. Local binary pattern

Three neighbourhood examples used to define a texture and calculate a local binary pattern (LBP).Fig 4. Shows the computation of binary pattern from the captured image and compare with the stored image. If the image is matched, then the name of the person is intimated to the blind person in form of voice commands through speaker which is interfaced with kit.

## 3.MRP DETECTION

This module helps the blind people to be aware of the fraud that is happening. Whenever the go for shopping there might be chances of getting cheated by the shopkeeper. So this MRP detection finds out the MRP rate of the product the person is going to buy and intimate the person through voice commands. The OCR algorithm is used for this purpose.

### OPTICAL CHARACTER RECOGNITION:

OCR stands for Optical Character Recognition. It is used to translate the images consisting of text into the editable text. It is mostly used to convert hand written(taken by scanner or by other means) into text.

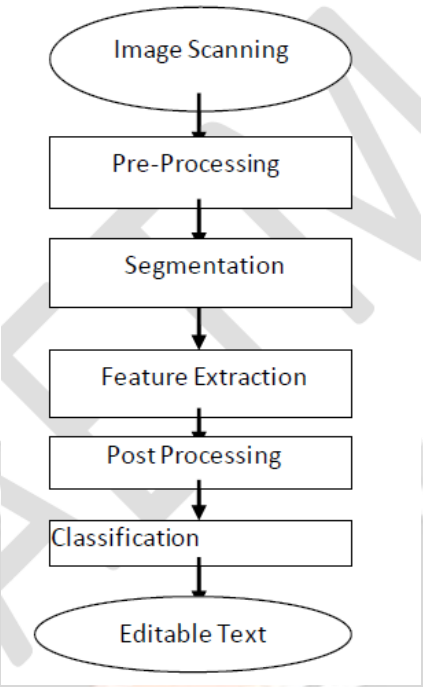


**Fig. 5 Optical character Recognition.**

The above flowchart in Fig.5 explains about the process how the input digital image is converted into editable text.

**Editable Text**: - Editable Text means any document or file which can be edited in computer like any other MS-Word or Word-Pad file.

After converting to editable text, the text is converted into voice commands and intimated to the person with the help of microphones which are interfaced in the wearable kit.

## 4.SIGN BOARD DETECTION

The sign board detection module is very useful when the blind person want to navigate outdoors. This exacts the pictures of the sign board of the roads and process it with some techniques, make use of the GPS in mobile phone and intimates the person about the current location and the indication given by the sign board. This process makes use of the SURF algorithm to process the picture of the sign board.

**SURF ALGORITHM:-**

The SURF algorithm is based on the same principles and steps as SIFT; but details in each step are different. The algorithm has three parts:

- Interest point detection
- Local neighbourhood description
- Matching

### Detection

SURF uses square-shaped filters as an approximation of Gaussian smoothing. (The SIFT approach uses cascaded filters to detect scale-invariant characteristic points, where the difference of Gaussians (DoG) is calculated on rescaled images progressively.) Filtering the image with a square is much faster if the integral image is used:

$$S(x,y) = \sum_{i=0}^{x} \sum_{j=0}^{y} I(i,j) \quad 1$$

The sum of the original image within a rectangle can be evaluated by using the integral image. To calculate sum evaluations at the rectangle's four corners are required.

SURF uses a blob detector based on the Hessian matrix .It is used to find the point of matrix. The determinant of the Hessian matrix is used as a measure of local change around the point. The points are chosen where determinant value is maximum. In addition to the Hessian-Laplacian detector SURF also uses the determinant of the Hessian for selecting the scale. The Hessian matrix H(p, σ) at point p in an image I with p=(x, y)and scale σ, is:

$$H(p,\sigma) = \begin{pmatrix} Lxx(p,\sigma) & Lxy(p,\sigma) \\ Lyx(p,\sigma) & Lyy(p,\sigma) \end{pmatrix} \quad 2$$

The box filter of size 9×9 is an approximation of a Gaussian with σ=1.2 and represents the lowest level (highest spatial resolution) for blob-response maps.

## Descriptor

The aim of descriptor is to provide a unique and robust description of an image feature, e.g., by describing the intensity distribution of the pixels within the neighbourhood of the point of interest. Most of the descriptors are computed in a local manner, hence a description is obtained for every point of interest identified previously.

## Matching

By comparing the descriptors obtained from different images, matching pairs can be found.

## 5.VOICE BASED ON-OFF SYSTEM

In addition to Face identification. MRP detection and sign board detection we also implement Voice based on-off system which is very helpful to control the devices by voice commands. This prevents the risk of getting shock as the persons are visually impaired. It is low cost device.

### Hardware Used

ZigBee It is a low-cost, low-power, wireless networking standard. Microcontroller: PIC 18FX. Features of PIC : It has 5 I/O ports, Interrupt sources 21, Timer4 etc.Power supply unit: 5v power supply.

### Software Used

Software design includes voice recognition, transmission and reception of wireless signal using ZigBee transceiver,read the sensors, updates the status of relay switches and displays the status on LCD display accordingly. The main program for this system is written using the embeddedProgramming language.

## ALGORITHM

1) Firstly,TRAIN the Voice.
2) Say commands for which device we want to turn ON/OFF.
3) If the Recognised word is matched, then send data to uC and transmit through zigbee Tx and receive by zigbee Rx then activate relay using Microcontroller at receiver side.
4)If the word is wrong then it shows ERROR commands on 7-segment display.

This is the overall Implementation of all the modules. The different modules are combined together by using switches. Each switch represent each module. As we press the switch the corresponding task is carried out. To stop the running task in between the stop button is pressed

## 6. CONCLUSIONS

In this paper, an improved obstacle avoidance method has been implemented. This method provides the identification of the person standing in front of them and give the response through voice commands. It also help in MRP and signboard detection when the user navigates outdoors. We develop a complete assistive aid comprising of several modules.

## 7. REFERENCES

[1] D. Dakopoulos and N. Bourbakis, "Wearable obstacle avoidance electronic travel aids for blind: a survey," IEEE Tran. Syst. Man Cybern.C, Appl. Rev., vol. 40, no. 1, pp. 22-35, Jan. 2010
.

[2] J. A. Brabyn, "New Developments in Mobility and Orientation Aids for theBlind," IEEE Trans. Biomed. Eng., vol. 29, no. 4, pp.285-289, Apr. 1982.

[3] S. Shraga, J. Borenstein, and Y. Koren, "The Navbelt-A computerized travel aid for the blind based on mobile robotics technology," IEEE Trans. Biomed. Eng., vol. 45, no. 11, pp. 1376-1386, Nov. 1998.

[4] T. Ifukube, T. Sasaki, and C. Peng, "A Blind Mobility Aid Modeled After Echolocation of Bats," IEEE Trans. Biomed. Eng., vol. 38, no. 5, pp. 461-465, May 1991.

[5] S. Cardin, D. Thalmann, and F. Vexo, "A wearable system for mobility improvement of visually impaired people," Vis. Comput., vol. 23, no. 2, pp.109-118, Feb. 2007.