Secured Application for Generating Acoustic Signal for Blind People

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Abstract—Visionless people face many difficulties in their daily activities. This paper is basically designed to facilitate blind people for autonomous navigation. It is based on ‘image to sound’ conversion. The mobile camera is used to capture the image in front of the blind user. This image is then equated with the database and the processed information is fetched by blind user through a set of earphones. Color information of the object is also measured and it is informed to the blind user through the set of headphones.

Keywords—Color identification, edge detection, gray scale, object identification

I. INTRODUCTION

According to World Health Organization, there are many blind people over the world. Day by day the count of blind people is increasing. Numerous problems are faced by blind people every day with navigation and finding objects. Blind people can’t identify the object or barriers in the environment, so for them navigation is restricted.

In image processing, to identify the color of an object in image, it is necessary to separate the object from the image by removing background of that image. If the background remains in image it produce incorrect output. To capture the particular object from image, initially we have to determine where the object is located specifically in the image. By mobile camera, the scene in front of visually impaired people or blind user is captured and it is converted into human audible sound. This sound heard by the blind people through headphones.

II. LITERATURE SURVEY

Blind people face many problems performing their day to day activities with navigation and finding objects. There are many technologies that support blind people, visual impaired and other physically challenged; e.g. scanners for blind people, remote controllers for physically challenged people and facsimile devices for deaf people.

The previous developments related to navigation for visually impaired people have been well covered in historic period. One of the most recently development in IEEE by R. Nagarajan (2001) et.al. have been proposed.

Navigation Assistance for Visually Impaired (NAVI) is a vision substitute system designed to assist blind people for autonomous navigation. The vision sensor, which is mounted on a sunglass, captures the image in front of blind user. NAVI processing unit processes the captured image and enhances the significant vision data by employing a set of image processing procedures. The processed information is then presented as a structured form of acoustic signal and it is conveyed to the blind user using a set of earphones. This paper proposes a new object identification and colour recognition module for NAVI system. Image processing techniques are proposed to identify objects in the captured image and then the processed image is transformed into stereo sound patterns. Colour information from the interested object is evaluated to determine the colour of the object. The colour output is informed to the blind user through ‘verbal voice’. [2][3]

III. FLOW OF SYSTEM

The image is captured via mobile camera and then gray scale algorithm is used to convert this image into 8 bit format. After this, edges of the image are measured through edge detection algorithm. Blurring technique is applied to remove the Gaussian noise from the image; due to this the image becomes more accurate. The actual object is separated from the background by boundary detection and blob detection algorithm.

The object is now cropped and converted into HSV. Image histogram is used to plot the graph of object. This histogram is stored into database. When the camera captures an object, it is compared with the histogram which
is stored in database. If the object matches with the database then sound is produced.

**Flow of System**

Once an image is captured, it is necessary to separate it from background. This object can be separated by using following techniques. The following techniques describe the way in which the object is identified and separated.

**A. Edge detection:**

In Edge detection the edges of image or object are detected. Edge detection is one of the mathematical methods used for identifying the points in an image at which the image brightness changes sharply which are typically organized into a set of curved segments called as edges.

First step in edge detection is, all the edges of the images are found by analysing the adjacent pixel in colour. Second step is that the object is in the centre of the image and from the edges of the image the pixels are made transparent and that object moving towards the Centre until and edge is reached. This edge detection method eliminates an image with a transparent background and object in the centre.

**B. Blurring technique:**

Blurring means that each pixel in the source image gets spread over and mixed into surrounding pixels. Blurring an image reduces the sharpening effect; this makes the detection more accurate. Here, grayscale blurring technique will be used to blur the image. Mathematically, applying a blur to an image is the same as convolving the image with a Gaussian function.

The equation of a Gaussian function in one dimension is,

$$G(x) = \frac{1}{\sqrt{2\pi}\sigma}e^{-\frac{x^2}{2\sigma^2}}$$

Equation for two dimensions is the product of two such Gaussians, one in each dimension,

$$G(x, y) = \frac{1}{2\pi\sigma^2}e^{-\frac{x^2+y^2}{2\sigma^2}}$$

Here, \(x\) is the distance from the origin in the horizontal axis, \(y\) is the distance from the origin in the vertical axis, and \(\sigma\) is the standard deviation of the Gaussian distribution. When the formula is applied in two dimensions, it creates a surface whose contours are concentric circles with a Gaussian distribution from the Centre point; values from the distribution are used to build a convolution matrix which then is applied to the original image.

The value of each new pixel having new value is set to a weighted average of that pixel's neighbor. The value of original pixel receives the heaviest weight and neighbor pixels receive smaller weights. Hence, the distance to the original pixel increases. This results in a blur which preserves boundaries and edges.

**C. Blob Detection:**

Blob detection involves scanning of image for the pixels and compares them with adjacent pixels for finding the group of same colour pixels. The group of same colour pixels adjacent to each other is called the blob of pixels.

**D. Cropping:**

A separation of particular object from the captured image is done in the cropping. By using blob detection technique, the particular object is identified from the image. After detecting the blobs in the image, by finding the maximum and minimum values of \(X\) and \(Y\) for particular blob, we store each blob of pixels into the separate vector. There is a separate vector for each blob in the image.
E. Color Identification:

Color is an important factor in daily life of human being which plays a vital role in communication and recognition.

HSV: HSV is strong model than RGB because it offers a more sensitive representation of the color. It selects more specific color from the color wheel. In HSV model, if the value of ‘V’ changes, value of ‘H’ and ‘S’ remain constant, but as we made change value of ‘V’, value of RGB changes.[2]
H (hue) - Specify the position of pure color on the color wheel.
S (Saturation) - Describe the how white the color is.
V (Value)- It shows ‘lightness of color’. It represents the intensity of color (brightness in the color).

The below diagram represents HSV coordinate system model. [2]

Conversion of RGB to HSV:
1. Capture image and load.
2. Read each pixel from image.
3. Separate RGB color for each pixel.
   - R = col & 0xff;
   - G = (col >> 8) & 0xff;
   - B = (col >> 16) & 0xff;
4. Find minimum value and maximum value of Red, Green, and Blue.
5. Assign max to value.
6. If value equal to zero then
   - Assign hue=saturation =0.
   - Set pixel in image again.
   // finding Saturation.
7. Set each pixel again on image.
8. End.

F. Histogram:

An image histogram is a type of histogram that represents the tonal diffusion in a digital image. Histogram technique is applied to place the number of pixels for each tonal value. By watching at the histogram for a specific image an observer will be able to recognize the entire tonal distribution at a scan. The vertical axis of the graph represents the number of pixels in that precise tone and horizontal axis of the graph signifies the tonal deviations, whereas the left side of the horizontal axis shows the black and dark areas, the middle part represents medium grey and the right hand side represents light and clean white areas. The vertical axis shows the size of the area that is captured in each one of these zones. Thus, the histogram for a very dark image will have the wide data points on the left side and centre of the graph. By oppose to this, the histogram for a very bright image with rare dark areas and/or shadows will have most of its data points on the right side and centre of the graph.

Image editors typically have authority to create a histogram of the image being edited. The histogram plots the number of pixels in the image with a particular brightness value. Algorithms in the digital editor provide facility to the user to visually alter the brightness value of each pixel and to dynamically display the results as alterations are made. Improvement in picture brightness and contrast can thus be gained.

G. Normalization:

Normalization is a procedure that modifies the range of pixel intensity values. The distribution of colour...
values in an image is dependent on the illumination which may vary depending on different lightning condition or different cameras. Colour normalization is used in object recognition technique based on colour, to recompense for these variation.

After normalization the object is compared with histogram which is stored in java serialization database. If the match is found then by using text to speech conversion technique sound will be generated and it will be heard by blind person.

H. Comparison:

A complex system may be decomposed into simpler elements, in order to understand it. Networks are one approach for achieving this. There are a large number of different types of networks, but they all are characterized by the following components: a set of nodes, and connections between nodes.

The complexity of real neurons is highly abstracted when modelling artificial neurons. These basically consist of inputs (like synapses), which are multiplied by weights (strength of the respective signals), and then computed by a mathematical function which determines the activation of the neuron. Another function (which may be the identity) computes the output of the artificial neuron (sometimes in dependences of a certain threshold). ANNs combine artificial neurons in order to process information.

The higher a weight of an artificial neuron is, the stronger the input which is multiplied by it will be. Weights can also be negative, so we can say that the signal is inhibited by the negative weight. Depending on the weights, the computation of the neuron will be different. By adjusting the weights of an artificial neuron we can obtain the output we want for specific inputs.

IV. EXPERIMENTAL RESULTS

The figure below shows the view of application which is developed by us. This snapshot shows three options which will help the blind person for navigation.

![Image of application view with options: Train New Objects, Detect Objects, Reset Memory.]

As blind person cannot see the surrounding objects so, the person who is not visually impaired will have to train the objects in training phase. By clicking on “Train new Object” option, the person can train the objects for blind people. This figure 9 shows view of training phase.

![Image of training phase with options: Input neurons, Output neurons.]

The rectangle shown in fig 10 is used to capture the object that is in front of camera. It will cover the area surrounded by the object.
The person can train maximum 3 objects at a time. So when the object is captured, the person has to register it. The above figure shows, the view of registration phase.

The systems keypad is used to give name of object.

By clicking on OK button the object will be registered successfully and the features of objects are extracted by the image processing technique shown in the architecture and stored in java serialized database.

Here in this fig.11 a unique name of registered object is provided by the person who is training the object. As per the object which is captured by camera name must be provided.

Once the objects features are stored they are trained using ANN for comparison. Here the training phase is completed and now the mobile phone is given to blind person for recognition of objects.

Fig 10: Registration of Objects

Fig 11: Unique name given to object

Fig 12: Successful registration of object

Fig 13: ANN comparison

Fig 14: Recognition Phase
The object which is in front of camera will be compared with the object features stored in database. If match is found then a sound will be generated through a set of earphones to blind person.

![Image of object recognition](image.png)

**Fig 15: Recognize the Object**

This fig shows the name of object i.e. laptop.

V. CONCLUSION

The proposed system is designed to assist autonomous navigation of visionless individuals. It is used to capture the image and converts it into acoustic sound. The colour image is taken as an input and various technique are applied on this input to extract the object from image. Applying these techniques not only discriminates the object’s properties such as size, shape but also identifies the colour of an object which is helpful for blind person to identify the object. It is necessary to differentiate the object from bulk of objects so this can be done using blob detection, edge detection, blurring, cropping techniques. Implementation of this paper is in process which will be helpful for blind people.

**References**


[5] Secured Application for Generating Acoustic Signal for Blind People by Phursutkar Prachi, Bajaj Apurva, Choramale Tai, Veer Priyanka