Navigation for Visually Impaired with Object Recognition and Voice Assist

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Abstract – The visually impaired who have to rely on others for travelling and other activities find difficult in mobility in unknown environment. The paper presents the architecture as well as the implementation of a system that helps the blind person navigate independently. It has additional components to provide refined location about environmental information. The system assist visually impaired people in different ways like camera, voice and ultrasonic based assistance. It provides information not only about obstacles along the travelled path, but also guide the user in selecting the preferred travel path. The idea of the proposed system to make person aware to walk and to detect the obstacle in the path and object recognition. In addition, the system is provided with a convenient and easy navigation aid for unsighted person, which helps in artificial vision to provide the information about the environmental scenario of static and dynamic objects around them.

Index Terms – Path Guiding, Obstacle Detection, Object Recognition, Voice Alert.

1. INTRODUCTION

According to the World Health Organization statistics, approximately 40 million people are blind all over the world. The Blind people faces great problem to recognize the barriers nearby them and to move from one place to another. 39 million are blind and 246 million have less vision. Around 90% of the visually impaired live in low income conditions. 82% of people living with blindness are around 50 and above. In 2015, blind pedestrians were killed in road accident-an increase of 5% from 2014. The biggest problem for blind persons is to detect the unknown environment and sense the movement around them. People who suffer from vision loss usually use dogs or walking stick to help them to detect obstacles. The stick cannot scan the platform as such and it just serve as a device to help people from danger in case of situation like traffic and in road crossing. To develop a Blind navigation system with multiple sensing inputs. To guide the Blind persons with dynamic object recognition. A hybrid sensory based blind Navigation system will be provided. To detect the proximity of the objects and recognition objects can be done. Dedicated proximity sensor along with camera interface provides street shop assistance as voice alert will enhance the experience of the blind persons. From the survey of World Health Organization, in the year of around 7 billion human populations 285 million people are blind and which 19 million are children who are below 15 years. Ninety percentages of school children did not pursue their secondary education because of this suffering from vision loss. There are totally 39 million blind people in this technical world. But there are fewer devices available to help them with their daily struggle. Predominantly IOT (Internet of Things) products serve as a major backbone for them. There are IOT products that help them to find objects ahead them. Since early decades, together with the sensors development, many efforts have been made to develop new and sophisticated Electronic Travel Aids (ETAs) able to perceive and represent the surrounding environment. The idea underlying the development of such devices was to overcome human sense limitations, such as blindness. These devices would help blind people to perceive their surrounding environment. It also helps them to navigate around without hurdle, without clashing with world. To develop a user-friendly low cost gadget for safe movement of visually impaired people.

2. RELATED WORK

People who suffer from vision loss usually use dogs or walking stick to help them to detect obstacles. The stick cannot scan the platform as such and it just serve as a device to help people from danger in case of situation like traffic and in road crossing. Secured feeling and confidence could be enormously increased using such devices that give a signal and warning to find the direction of an object less or obstacle less way in an changing environments. Electronic Travel Aids (ETAs) is a device that warns the user with help of some signals either the sound waves or by physical interaction with people such as vibratory patterns.

This system provides an important measure to reduce accidents among blind people in common traffic areas and give away warning to them by creating a great tendency to detect objects and obstacles as blind death has become common due to their inability to see and manage situations in heavy traffic. The existing system helps the visually impaired people to reach their destination by commanding them through voice recognition system via Bluetooth. The headset and walking stick are connected by Bluetooth. As soon as the data is received from the receiver in the Bluetooth headset, it is converted to text using voice recognizer.
3. PROPOSED MODELLING

A hybrid sensory based blind Navigation system will be provided. This system provides an important measure to reduce accidents among blind people in common traffic areas and give away warning to them by creating a great tendency to detect objects and obstacles as blind death has become common due to their inability to see and manage situations in heavy traffic. To detect the proximity of the objects, recognition objects and text to speech conversion can be done. Dedicated proximity sensor along with camera interface provides street shop assistance as voice alert will enhance the experience of the blind persons. Ultrasonic and IR sensors which help in obstacle detection and on hurdle recognition will ring the speaker for different durations to indicate different distances. Proximity sensor is to detect the presence of nearby objects without any physical contact. The system is to provide a convenient and easy navigation aid for unsighted which helps inartificial vision by providing information about the environmental scenario of static and dynamic objects around them. Also an approach to extract and recognize text from scene images effectively using computer vision technology and to convert recognized text into speech so that it can be incorporated with hardware to develop Electronic travel aid for visually impaired people.

4. METHODS

There are three main phases:
1. Proximity sensor for detecting the obstacle.
2. Object Recognition.
3. Text to Speech Converter.

4.1. Proximity Sensor

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between sensor and the sensed object. Proximity sensor has transmitter and receiver in which transmitter send ultrasonic waves and the receiver will receive the reflected waves to detect the obstacle.

4.2. Object Recognition

A shop banner image image is captured and image preprocessing (background removal, noise filtering) are done. The preprocessed image is then subjected to text recognition, and the recognized text is then converted to speech.
identification and extraction in image. Extracted text images will be compared to dictionary database to predict the text equivalent of its image.

**Figure 4: Noise Removal**

### 4.2.1. Acquisition Stage

It acquires high resolution video from camera. This video will be broken into different frames. Each frame will act as separate image. In this paper, standard images from ICDAR competition are used for testing purpose. In sophisticated system, video from camera is used as input to image processing unit. The challenges occurred due to camera fixation/position problems like blurring/degradation due to motion of user, perspective distortion due to different angles of the object formed with camera lens axis. So, care must be taken while fixing camera of the system. Acquisition must be proper to produce desired output.

### 4.2.2. Image Processing

Second stage is Image Processing unit which is a heart of the system. It is subdivided into three secondary stages: Pre-Processing, Processing, Post-Processing.

#### 4.2.2.1. Pre-Processing

As acquired colour image consist of 3 planes (Red, Green, and Blue); it is difficult to process it in quick time. So, it is first converted into Grayscale image. After colour to grayscale conversion, pre-processing stage uses some enhancement techniques to eliminate challenges created by noise, blurring effect and uneven lighting. It is considered that acquired image might be mixed with noise like Salt and pepper noise, Impulse noise etc. or it can be blurred due to motion of camera. Salt and pepper noise can corrupt the image, where the noisy pixels can take only the maximum and minimum values in the dynamic range i.e. black dot on white background (pepper) and white dot on black background (salt) which degrades the text extraction performance of system. To remove such type of noise, standard median filter (SMF), which is a non-linear filter used due to its good de-noising power and computational efficiency. Removal of this type of noise in a system is shown in Figure 4. However, when noise level is more than 50%, edge details will not be preserved by the median filter. So, it is recommended filtering process should preserve the edge details without losing the high frequency components of the image edges.

Sometimes, text extraction becomes troublesome for image captured in dark or uneven lighting. So, application of contrast enhancement is necessary. Histogram Equalization method is used for Contrast enhancement. Figure 5 shows enhanced image using histogram equalization. Another challenge i.e. Blurring can be generally removed using de-blurring techniques like Lucy Richardson algorithm, Blind de-convolution algorithm, Wiener de-blurring techniques. Wiener filter is selected which is a natural extension of the inverse filter when noises are present. Figure 5 shows how de-blurring using Wiener filter is effective on text embedded blurred image. From figure, it is observed that binarization after wiener filtering on blurred image produces better result than without applying wiener filtering.

#### 4.2.2.2. Processing

Enhanced Pre-processed image from previous block is forwarded to Processing stage where text detection and extraction is done. Before processing, it is binarized with adaptive thresholding. As a result of literature survey, we used combination of connected component (CC) & region based approach on this Binarized (black and white) image. Applying CC analysis using MATLAB software, areas having text similar patterns with white pixels on dark background, are detected. Using feature extraction algorithm, these detected areas are extracted on separate windows. Figure 6 shows text detection and extraction from Scene as well as Document image. Scene image requires preprocessing whereas Binarized Document image is directly fed to Text detection block. From Figure 4, it is observed that false detections are present due to some amount of noise in scene image including the Real text of image. This false detection reduces accuracy of the system. It also increases processing time and hence, decreases speed of the algorithm.

**Figure 5: De-Blurring**
Future Scope: Using this system, in future, by calculating the speed of the blind person in order to measure the distance covered by them to intimate the traffic signal timing and also any text detection and extraction in accurately.

REFERENCE