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Negative Obstacle Detection for Visually Impaired People using Wearable Assistive Devices

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ABSTRACT

As we see in India most of the people are visually impaired. And we also know these people commonly use white cane or guided dog to help for the navigation purpose. They use cane for the scanning the environment in front of them. Commonly this white canes are less than 2m to 2.5m in length. So it will not help all time for blind person. So we use a stereo vision system to identify and track negative obstacle located in front of the user. Tracking and identification of Negative obstacles are done by the high pixel camera which helps to capture the image. According to image it will compute area, then filter the image if any error or noise present in that, that will be remove. After Validation it will give or send speech alert to blind person using android device. So in short we detect the image, process on it and if it is harmful to blind person then provide a speech alert immediately.

Keyword: Visually Impaired, Negative Obstacle, Sound of Vision (SoV), Ultrasonic Sensors.

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I. INTRODUCTION

According to W.H.O (World Health Organization), It is estimated that approximately there are 1.3 billion people have a problem of visually impairment. Above that 188.5 million people have mild vision impairment , 217million have the moderate vision impairment and 36 million people are totally blind. And from that majority of people with vision impairment are over the age 50 years. And they have low income also. So in upcoming days the research area focuses in developing different assistive devices for visually blind person. Such devices are use or help to blind user to navigate in environment. Commonly the blind persons are used white canes or the guided dogs for navigation purpose. Generally Obstacle which are categorize in both indoor and outdoor environment. But compare to indoor, outdoor obstacles are harmful and complex. The detection of Obstacles plays an important role in smart robot, smart vehicles etc. different applications. There are two types of Obstacles Presents: Positive Obstacles and Negative Obstacles. Positive is define an Obstacles above the ground surface. And negative obstacles are the obstacles below the ground surface. In this paper we use an algorithm for finding indoor as well as outdoor obstacles. We use the Sound of Vision (SoV). It is a Affordable and create wearable system that will allow blind people to build a rich mental image of the environment and adapt to all real life situations. It includes customize hardware and software allowing real time operation. The SoV enables visually impaired people to determine obstacles free spaces between objects and identify dynamic and evaluated obstacles. It increases awareness and hence it leads to more active life style and improve wellbeing for many blind people. The propose algorithm that are working on the basis of mobile device. As we developed an android application so it will use an android device such as mobile. With help of SoV system it will compute the disparity map of image and integrate in SoV device. It helps to minimize the computation time. The paper is organized as follows: Section 2 describes the related work. In Section 3 the context and details of our algorithm are presented. The results of an experimental

evaluation are discussed in Section 4. The paper is concluded in Section 5.

II. LITRATURE SURVEY

Over the past few decades some research has been dedicated to navigation assistance for the blind or visual impaired persons. Many of these navigation assistances can be categorized into basic obstacle avoidance systems for example like

A. Echolocation

That an Ultrasonic sensors and bluetooth sensors are used and this will help to blind person for detection of obstacles and prevent them from injuries also GPS is used for the navigation to find right path or way to blind person to reach at desire destination. [1]It contains a separate database and in that database the definitions of different objects is defined. It performs all calculation and computations and this is totally dependent on Smartphone app and its reliability.

B. Electronic Travel Aid (ETA)

The affordable approach is introduced here and it is efficient in many ways as well as it is simple and focuses on mobility of blind people.[2] ETA plays an important role for the costing and efficiency. The main concept in this is calculation of distance from obstacle to blind people and provide then audio and vibration alert. Two ultrasonic sensor is used one is at bottom of stick and one is in front of user that is on stick and detect two types of obstacles in first we keep the distance between ground surface to stick during calibration so we can detect bump on the ground and if the current distance is more than the value stored in the database then we say that a pothole is there. And in second type the distance between blind person and the obstacle present in front of the blind person is calculated and provide the alert.

C. Stereo Vision Based Mapping

In this the real time stereo mapping algorithm is used on various obstacles present in environment like incline surfaces and drop-offs it construct the 3D model as an point cloud with 3D grind the output information captured in 2D grid form and tell or inform the blind people the safe and unsafe region. [3] The flow is like this 1) Segmentation of 3D grid - Find Traversable Ground Segments in a 3D Grid 2) Least Square fit - Labeling Segments and their Planes for Connectivity and Safety After this Evaluation of Framework and Result get calculated by A. Error rates B. Detection of latency and Distance C. Plan fitting Accuracy.

III. METHOD DISCRIPTION

A. System Architecture

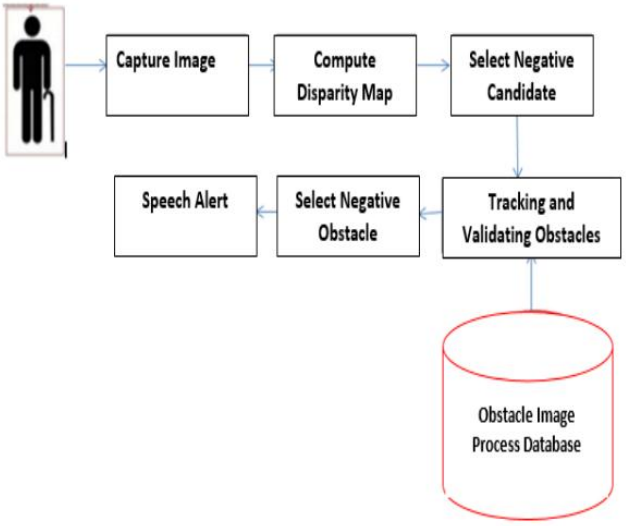


Fig: System Architecture

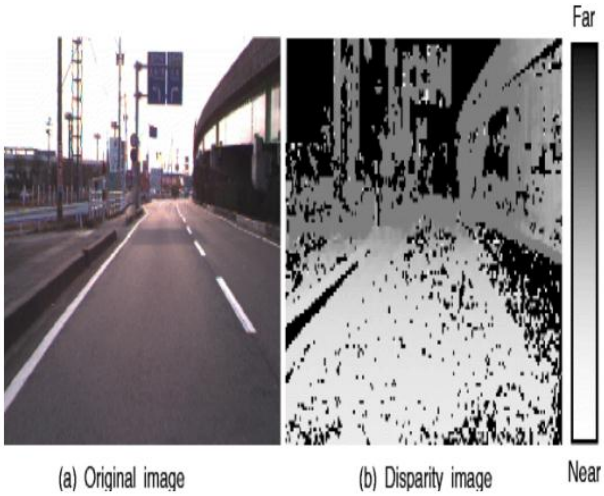
B. Working

The System Flow will be goes as firstly it will capture the image with the help of high pixel Cameras. After capturing image this Image transfer to the server. With the help of stereo vision system it will compute disparity map of this image if noise present in that, that will be removed with the help of preprocessing techniques. And after it will detect the ground surface and select the Negative obstacle Candidate. With the help of ultrasonic sensors it will track the distance of obstacle apart from that user. If the image is valid then it will send the text message to android device through database and device get an speech alert to the user.

The main steps for our algorithm is:

1 .Disparity map Computation

With the help of ELAS algorithm we find the features of Negative Obstacles which are valid for the disparity maps. In that the several other Stereo matching schemas have been conducted



2. Ground Surface Detection

It is an Important step in our algorithm. After the Computation of Disparity map irrespective of feature of negative obstacle algorithm only consider the candidate which are connected to the ground . In this we detect the regions with the negative elevations. The detection of Ground Surface can be achieved using Detection using Camera tilt and process the point cloud associated to the disparity map

3 .Selection of Negative Obstacles

Basically Negative Obstacles are two types: The region which is present in the disparity map having some properties and on the basis of following properties the negative candidate are categorized as Candidate 1 and Candidate 2

Candidate 1: This negative obstacle candidate have valid disparity values and all the pixels are present inside the region. And that region is connected to the ground pixels.

Candidate 2: This negative obstacle candidate have invalid disparity values and all the pixels are present inside the region. But the mean color of pixels are not connected with ground pixel and the region color is black.

4. Tracking and Validation

1. Calculate the Centroid of current frame .Apply the camera transformation matrix to transform the 3D centroids computed in the last frames

2. Calculate the distance between 3D centroids of current frame and the previous frame. The distance between two 3D centroid is lower than a threshold update the frame no of 3D centroid from current frame with the frame no which is transformed 3D centroid.

3. If the difference between current frame and updated frame is higher than a threshold consider the centroid as belo nging to a region that has to be avoided.

If the image is Valid then it will consider as a negative obstacle

5. Speech Alert:

After the Validation it will give the speech alert to the blind person using headphones.

IV. CONCLUSION

This paper mainly focuses on the prevention from the harmful injury from negative obstacles. The Technique that we introduce is affordable and efficient in many ways. The size of stick is small so it does not affect mobility of user so it overcomes the drawbacks of mobility aids. We uses the SoV system for detecting the harmful Negative obstacles .the system that are used in this paper is work efficiently and give the information to the android device with the help of device it will send the speech alert to blind user with the help of headphones.

IV. ACKNOWLEDGMENT

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