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GUIDING A SAFE FREE PATH TO VISUALLY IMPAIRED PERSON

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Abstract In this paper we propose A Safe Free Path to Visually Impaired Person Using ARM9. Visually impaired people generally use either the typical white cane or the guide dog to travel independently. Although the white stick gives a warning about 1 m before the obstacle. There is a disadvantage in detection of obstacle, which is done for shortest distance only and also it does not gives details about thing are in front of him. So, Our system is designed by using 32-bit ARM S3C2440 controller which supports features and algorithms for designing of blind people guidance stick. This supports image processing which are used to processes images and give voice response after detection. Suppose if it detects person coming in front him it gives voice message as "Person is in front of you" etc.

Keywords: ARM, S3C2440, Guidance System, Real-time System, Visually Impaired.

1. INTRODUCTION

WALKING safely and confidently without any human assistance in urban or unknown environments is a difficult task for blind people. Generally they use either the typical white cane or the guide dog. The white stick gives a warning about 1 m before the obstacle, for a normal walking speed of 1.2 m/s, the time to react is very short (only 1 s). The stick scans the floor and consequently cannot detect certain obstacles (rears of trucks, low branches, etc.). Safety and confidence could be increased using devices that give a signal to find the direction of an obstacle-free path in unfamiliar or changing environments. But the main disadvantage of this system is detection of obstacle is done shortest distance only and also it does not gives details about thing are in front of him. To overcome above disadvantage we replace sensors or GPS trackers with a camera which acts as an eye to blind person. The camera with controller is placed to stick this camera monitor's environment in front of person. The monitored conditions are sent to controller continuously if it finds any obstacle in front of camera it alerts person giving signal through voice like "obstacle. The main advantage of our

system is it shows difference between each and everything it detects.

2. IMPLEMENTATION

We propose a guidance system based on the fact that in almost every man made structure, there exists a geometrical symmetry. Human visual system uses these structures to perceive the location and assist the person in navigating in a path. However this is not the case with computer vision programs where this is viewed as a 2D image with parallel edges converging to a point . Our proposed approach simulates a system which is similar to human visual system and provides the visually impaired person with the information about their deviation from the straight path.

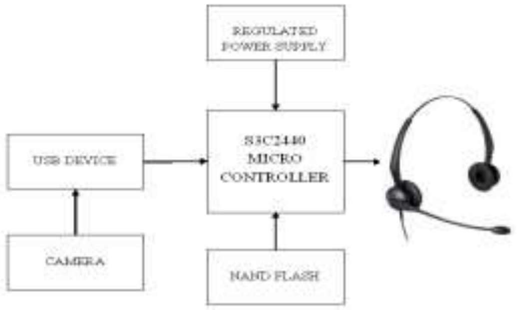

Figure 1 Block Diagram

Our proposed guidance system consists of three major blocks, which are shown in Fig. 1. These blocks are discussed in detail in subsequent sections.

One of the most important step in any computer vision application is the extraction of relevant features. This extraction step should focus on both extracting relevant information and minimizing out all the outliers. This process can then be followed by much more complex operations only on the relevant and small set of features. An efficient feature extraction step is essential for the implementation of real-time systems.

These systems have limited time to process and present results, and with an proper feature extraction technique they can be more robust and efficient. The proposed system uses several feature extraction techniques which are discussed below. In the proposed system the features extracted are edge features of the parallel lines in straight paths. It was observed from the results of testing phase of this system, that from all the edges detected only a few prominent edges actually contributed towards the guidance decision.

Feature selection process is also a trivial part of a realtime system. This process makes use of the observations and selects the best possible features for further processing. It uses the edge detected output of the feature extraction step, and selects the relevant lines in order to facilitate the guidance system with required information. This step is further divided into two steps. First step deals with mapping prominent lines into mathematical equations and the second step involves selecting lines which are relevant to the system and also connecting disconnected lines due to occlusion and illumination changes.

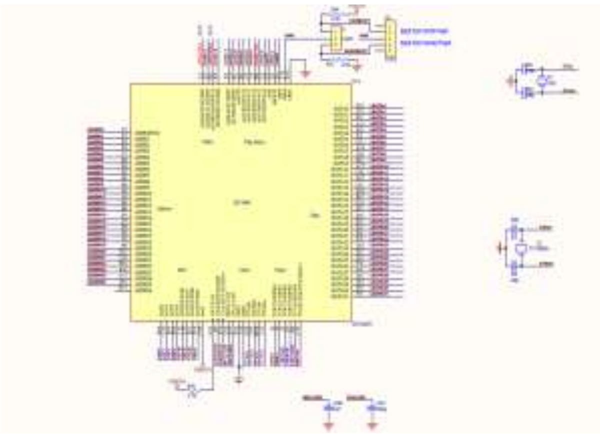

Figure 2 Main Circuit layout Model

The vanishing point is a point to which all the edges of a straight path converge. In reality, these edges are parallel to each other, however when looked at from a specific point, they all seem to converge to one point. Using the mathematically mapped equations from previous step, this imaginary vanishing point can be found easily. These points are not always inside the range of the frame as vanishing point itself is imaginary point, therefore these intersection points are also imaginary and sometimes are even out of the range of the image. This results in a cluster of a lot of intersection points with many points near the actual vanishing point and some outliers as a result of edges which do not converge to the vanishing point.

3. SIMULATION RESULTS

The algorithm was tested in different lighting conditions both outdoors and indoors. A laptop mounted on a 2-D robotic platform was used for testing and development of this algorithm. Later, a smart phone application was developed using OpenCV R libraries for android and the algorithm was tested. For testing, the smart phone was mounted onto the chest of a user, so that it was facing directly into the direction the person was moving in. The guidance decision was then given to the user using an audio signal. This algorithm was tested in many straight paths, with and without other pedestrians. It was observed that the algorithm correctly guided the person even if there were other pedestrians occluding the path partially.

These frames were first classified into one of the three possible decision categories using the actual location of vanishing point. The algorithm was then run with maximum number of lines selection limit of 20 lines from hough transform. Out of 499 frames, 420 frames output had correct decisions. This made the overall system accuracy of 84.1% in real world path with pedestrians. The algorithm was also tested on Hall sequence and Highway sequence. Table I presents the system accuracy for each of these sequences. The proposed approach produced 90.4% accuracy on Hall Sequence and 95.5% accuracy on Highway Sequence.

Sequence	Accuracy
Mobile Scene Analysis	84.1%
Hall	90.4%
Highway	95.5%

Table 1: System accuracy on different sequences (Theoretical)

4. CONCLUSIONS

In this paper, a guidance system for visually impaired person is proposed. This system makes use of the vanishing point concept to make a guidance decision for the visually impaired person. A real-time application on an android smart phone was developed for this guidance system, giving an average execution of 20 frames per second and an accuracy of 84.1% with pedestrians and above 90% without pedestrians. This difference in accuracies is due to the fact that some sequences have a lot of occlusion due to pedestrians and the background is also cluttered. This system uses the edges from different surrounding structures; hence if these edges are not present it loses its accuracy.

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