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ULTRASONIC SMART CANE INDICATING A SAFE FREE PATH TO BLIND PEOPLE

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ABSTRACT:

Any individual with limited or no sight is at a disadvantage in today's society. The loss of vision can be extremely detrimental to one's safety and mobility. Throughout the world, there are approximately 39 million individuals who are totally blind plus an additional 284 million who are visually impaired. Walking safely and confidently without any human assistance in urban or unknown environments is a difficult task for blind people. 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, 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. The objectives: Increase the safety of visually impaired or blind individuals; Provide individuals with limited or no vision a greater sense of security; Promote mobility of the user; Develop a device that is reliable, affordable and simple to use.

KEYWORDS: Gadget, Wi-Fi, Lidar, Bio-insiperd, Smart-cane.

1. INTRODUCTION

After a blind person has been trained in using a guide dog or a cane, the person may wish to establish routes around his or her home and workplace. Certain routes can cause particular difficulties. The example that motivated our work concerned a person who wished to navigate through a pedestrian underpass below a complex road junction. The underpass had a number of exits in proximity, hence, identifying the required exit proved difficult. Similar problems exist, for example, pedestrian passageways on housing estates and the entrances to buildings can be difficult to locate. Therefore, what is needed is some way of enabling a blind person to find the position of a significant landmark from a reasonable distance[1],[2].

2. LITERATURE SURVEY

2.1 Introduction

A deal of research has been performed to improve autonomy of visually impaired people and specially their ability to explore the environment. Wearable systems have been developed based on new technologies: laser, sonar or stereo camera vision for environment sensing and using audio or tactile stimuli for user feedback. Some early examples about those systems can be illustrated by the C-5 Laser Cane based on optical triangulation to detect obstacles up to a range of 3.5 m ahead. It requires environment scanning and provides information on one nearest obstacle at a time by means of acoustic feedback. The laser system measures the distance to the obstacle and a sound tone proportional to this distance is played. This system developed in the 70's is the precursor of a large series of devices trying to remove the cane of the blind user. More recent development using stereoscopic cameras coupled with a laser pointer and audio system have been developed at the University of Verona. One of the main interests here consists in the translation of the 3D visual information into relevant stereoscopic audio stimuli. The sound generated on ear phones simulates a distant noise source according to the position of the obstacle.

In this gadget the feasibility of a new approach to use the available Infrared Sensor to help the visually disabled person in avoiding collision with obstacle in indoor environment with minimum cost as to reach the large part of economy**.** A further use of two joint technology buzzers and vibrator both has been the more accurate estimates of the obstacle in the path and a manifest reduction in the localization error.

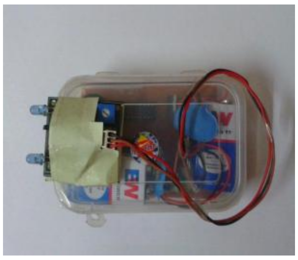

Fig.2: *Final View of Gadget*

A through measurement experiment was conducted in indoor environment to study the impact of main obstacle parameter affecting the final location accuracy, in order to determine the best operational condition. And the result testified both to the feasibility of the proposed solution and to its higher accuracy[3].

João José, Miguel Farrajota, João M.F. Rodrigues, J.M. Hans du Buf presented a system for detecting path borders and the vanishing point, such that blind persons can be instructed to correct their heading direction on paths and in corridors. A biologically inspired algorithm for optical flow based on multi-scale keypoint annotation and matching is used. Moving obstacles can be detected and tracked, such that the blind user can be alerted and informed about the approximate position on the path and whether the object is approaching or not. Detection of moving obstacles complements detection of static obstacles in front on the path, just beyond the reach of the white cane. Having a reasonably fast algorithm for optical flow, the same algorithm can be applied to stereo disparity in order to also estimate the distance to objects, both moving and static. The algorithms will be integrated in the Smart Vision prototype, which can also employ a GIS with GPS, WiFi and passive as well as active RFID tags [5]. In an already approved follow-up project of two years, algorithms can be further optimised and frame stabilisation, as depicted in Fig. 2, can be implemented. Additional problems can be solved like initial path finding when leaving an office or a building, also path bifurcations and crossing corridors. Extensive field tests are planned with ACAPO, the Portuguese organisation of blind and amblyopes. The developed vision system is not unique. Recently, a similar system has been developed for intelligent cars, for tracking roads and lanes and for detecting possible obstacles like pedestrians [19]. The basic concepts like borders, vanishing point and optical flow are the same, but the implementation is completely different. This is also due to the different requirements: a car may have a speed of 100 km/h, but blind persons with the white cane do not exceed 1 m/s. However, all CPU power of a portable computer will be required because the ultimate goal is to substitute a big part of the functionality of a normal visual system.

Sonda Ammar Bouhamed, Imene Khanfir Kallel, Dorra Sellami Masmoudi presented that

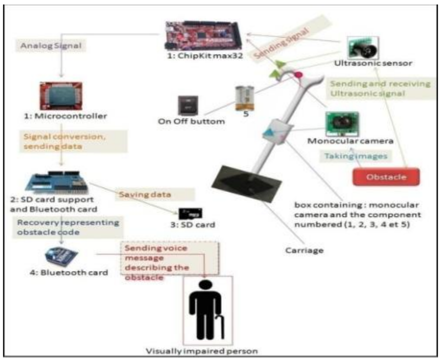

Fig.3: *Electronic white cane*

Blinds and visually impaired people need some aid to interact with their environment with more security. Accordingly, a multi-sensor system that scans floor surfaces and detects the presence of stairs was developed.

In this paper, we have presented a new electronic tool that incorporates two ultrasonic sensors and one monocular camera, intended for visually impaired assisting. Only one ultrasonic sensor was used to detect and identify three floor states, even floor, ascending stair case and descending stair case. To this end, we developed an approach for detection as well as identification of floor states. Such performances are challenging, since no existing solutions has proposed detecting stairs. Besides, most of existing tools aiming to detect objects basing on ultrasonic measurements make use of a series of ultrasonic sensors. The recognition result is estimated to 82.7% for detecting stair presence and 89.8% for précising if it consists in either ascending or descending type[4].

The results of this study allowed us to prove how much using one ultrasonic sensor to recognize the floor state is interesting. The recognition result is not perfect, as it doesn't reach the zero error performance, that is crucial for the tool that we are developing, but it is sufficiently satisfactory to contribute in the decision. Our future works will focus on this topic. Indeed, we are working on merging data captured from two different sources of knowledge, precisely ultrasonic sensor and monocular camera, to improve the system's performances.

3. PROPOSED SYSTEM

The proposed System block diagram is as shown below which consist of number of blocks which are in subsequent as the power supply, driving circuit, Microcontroller unit, speech synthesizer, vibration circuit & ultrasonic Sensor. A simple ultrasonic transmitter and receiver efficient protection to blind people except in the case of specific obstacles.

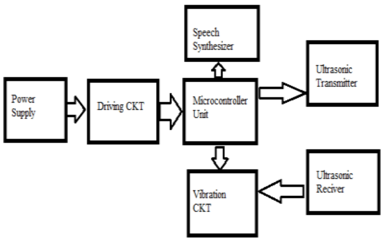

Fig.4. *Proposed System block diagram*

We will develop a detachable unit that can be placed on one fold of the white cane. The device employs directional, ultrasound based receiver-transmitter technology to detect obstacles above knee height. The user obtains distance information through vibratory patterns that vary with changing obstacle distance. As the obstacle comes closer the vibration frequency increases incrementally.

3.1 Objectives

1. 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).

2. Blind users generally claim that it is difficult to perceive narrow but still human-sized paths with 4-m anticipation.

3. The divergence of the emitted beam is far from being satisfactory information.

4. Our purpose is to detect shoulder-width openings that are a long distance away (4–6 m), without detecting openings that are too narrow (less than 0.5 m wide).

5. To detects obstacles above knee level and ground level also.

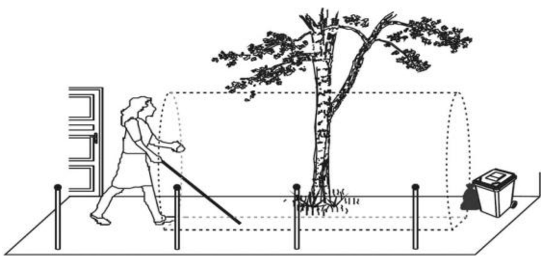

Fig.5: Ideal protection area

4. CONCLUSION

Blinds and visually impaired people need some aid to interact with their environment with more security. Accordingly, a multi-sensor system that scans floor surfaces and detects the presence of obstacles was developed. Since nothing is purely good or bad. There always exists some ray to improvement. A main limitation of this gadget is that we still have to detect obstacles coming from both left and right side. A main improvement that can be done to the present system is to incorporate a set of sensor at different angle with a narrow field. Typical obstacles (walls, openings, and vertical rods) have been used to draw the protection zone of the ultrasonic device. The ability of the ultrasonic sensor to find a path wide enough for a person to go through has been demonstrated. Theoretical and radiometric calculations based on optical geometry have been made to improve the design and performance of the system. The importance of intensity distribution to determine the protection zone has been highlighted. The technical compromises used in our new generation of ultrasonic devices have been presented.

4. FUTURE SCOPE

The newest version of the Smart Cane has a second beam for the height, it is fixed to the cane, and it is used more outside. These devices will progressively replace the white cane. Very thin obstacles such as shiny dark posts are difficult to detect with enough anticipation (only 1.5 m). To solve this problem, a triangulation laser telemeter can be added. The triangulation laser telemeter can detect a shiny dark post up to 8 m away, and it is a good complement to the ultrasonic device. In the near future, we are going to propose a device including the laser telemeter and various ultrasonic detectors: The laser detects small parts with low albedos, and the ultrasonic detector finds obstacle-free paths that are wide enough for a person to go through.

5. REFERENCES

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