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CASBliP Cognitive Aid System for Blind People

CASBliP - a new cognitive object detection and orientation system for impaired people

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Abstract: During decades researchers worked in the development of an Electronic Travel Aid (ETA) for blind and elderly people, device which will return their independence and mobility.

The recent developed device CASBliP is one of the last ETA system aimed to help visually impaired people to travel safety and independently through known and unknown environments. The implementation of high-technology with the object detection, orientation and navigation systems, make CASBliP a universal ETA. Through sensory and stereo-vision the system completes the object detection; when through GPS system solve the orientation aim. While blind user walk through the environment, acoustical approach generate cognitive load. CASBliP has been tested with 25 blind users from Germany, Italy and Spain, with two type of blindness (congenital and adventitious), different onset of blindness and ages. Several exercises for static and dynamic object detection and outside navigation were carried out. The main measured variables were walking time and number of hits. As initial trainings, the users bet for number of hits, that's why the registered time value was not too much important. From the results we can see that with some training the blind user is able to navigate safety and independently through unknown environment at its normal walking rhythm. They detected and estimated the object position and direction interpreted by acoustical signals without any difficulties in a short time.

Introduction

Nowadays, white cane and seeing-eye dogs are widely used as walking support for blind people (Bruce V., et al., 1996; National Federation for the blind, 2007). Nevertheless, for new unknown destinations the limitations of these aids become clear (Shoval S., et al., 2000). The necessity of possible obstacle detection with a high precision, in near and far area, for total and partial sighed people, becomes crucial.

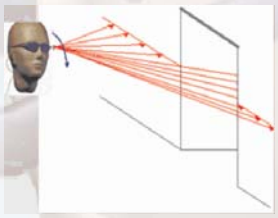
Remarkable work and advances have been made in the development and technical optimization of assistant systems for the visually impaired. A variety of electronic travel aid systems, offering different levels of environmental information, using sensor and/or video data acquisition, and focused on sound and/or tactile representation have been developed (Kawai Y. and Fumiaki T., 2002); Loomis J.M., et al, 1998). Moreover, technologies such as Global Positioning System (GPS) (Loomis J.M., et al., 2001) and Geographical Information Systems (GIS) are being researched for macro-navigation (Golledge R.G., et al., 1998). Also, systems using ultrasonic waves as Sonic Vision, Laser Cane (Bradyn J.A.), that display images by differences in frequency pitch and volume, using speaker array and/or using stereophonic

CASBliP system

Before building the system is extremely necessary to define the aspects of the visual scene which represent the most important features for navigation and object identification (presence of the objects and its position in space). The auditory system, which is capable of combining information by classes of cues and by frequencies in order to synthesize a unitary spatial image, plays a crucial role for the navigation. Indeed, the auditory system solves a difficult problem when localizing sounds, mainly when there are more than one sound source (Takahashi T. T., Keller C. H., 1994). The main drawback of the existing systems is the complexity of the computational algorithm and the high cost of the necessary resources.

Sensory System

It is desirable for the visual information input unit to be small and lightweight because these devices will be mounted on the user head. The sensory system with all the optical components, analogue and digital electronics and laser were assembled on a pair of glasses. The maximum distance reached by the sensor is 5 m at 64º in azimuth. A fully solid state micro system is embedded on FPGA.



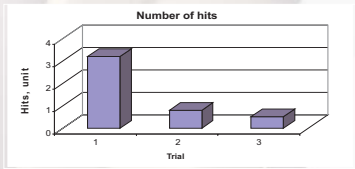
Artificial Vision System

A more complex and performed device is the Real–Time Assistance Prototype based on artificial vision. The head mounted system is able to classify the obstacles according to their level of danger for the user, estimating their position, speed and direction of motion.

Acoustically, the system warns the user about the objects within the area of vision in a perimeter better 5 and 15m in distance and 64º in azimuth. The Real–Time Assistance Prototype emits short acoustical signals through headphones at a rate of 64 pixels per image at 2 frames per second.

Results

Several tests were developed in order to verify the different features of the systemThe main parameters registered were the walking time and number of heats for the laboratory test and the average time spent to complete the outside test, which has 29m in distance including various soft obstacles.



Conclusion

A cognitive object detection and navigation system able to help visually impaired people in their daily mobility is presented; describing the prototype system and auditory processing methods. Promising results ware obtained. The users demonstrated good abilities to manage the system.

Literature

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