SUMMARY OF PRESENTATION

Title of presentation: Design of an Object Identification and Orientation Assistant for the Deafblind

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Summary: ***(up to 1000 words)***

Introduction

Remarkable advances have been made in the development and technical optimisation when considering stationary solutions of assistant systems for the visually impaired. For example, recent progress in web accessibility allows sensory handicapped people to receive in many cases the same amount of information as sighted persons. While looking at mobile solutions, there are still many other challenges to achieve equal opportunities concerning information access. In 2004 we presented a design for a new type of an indoor navigation and object identification system for the blind [1]. The basic idea of this system is to combine local sensor information with 3D environment models. The local sensor information can be acquired using a hand-guided sensor module. This sensor module consists of a stereo camera, a 3D direction sensor, and a keyboard. It is also possible to attach the sensor module to the cane. By pressing keys, inquiries can be sent either to the connected portable computer or to a platform of one or more servers distributing information about the closer and distant environment. The location of the user can be determined using conventional WiFi installations. The system enables users to recognise modelled objects, i.e. the closest object in front of the user. The name of this object is transmitted to the user over a text-to-speech engine.

Object Identification and Orientation Support for the Deafblind

Recently, we combined our object identification system with a commercial portable Braille display (Braillex EL40s by Papenmeier). This solution is designed for deafblind persons. Using this combination deafblind persons will also be able to identify modelled objects by pointing at them. The name of the corresponding object in this case can immediately be transmitted to the connected Braille display. It is also possible to switch the tactile output or the speech output to other languages by pressing one of the keys. This offers the opportunity to playfully learn object names in foreign languages just by exploring one's own environment [3]. This possibility might also be helpful for blind and deafblind children while learning their native language. For the deafblind the speech output might also serve as a tool for the communication with other persons.

Augmented Navigation Support

During usability tests of our first prototype it became clear that important objects can be missed if the scanning of the environments is done in an unsystematic manner. Within an unknown environment it can easily happen that the blind user points into an arbitrary direction with the hand-guided sensor module while walking on stairs. This fact made us integrate augmented information into the 3D indoor models. Therefore, we newly introduced the concept of virtual navigation areas [2]. These areas are simple rectangles within our 3D model which are positioned in front of important objects. However, in reality there is no corresponding object at these areas. Virtual navigation areas were placed in front of entries into the building and in front of doors and hallway intersections. Furthermore, location information was introduced at nearby stairs, elevators, emergency exits, and sanitary facilities. If a blind person walks into one of these navigation areas - especially in critical situations, as in front of a stairway - it is possible to give appropriate tactile or spoken information for example concerning the existence of banisters or landings and the number of steps. In the near future it will also be possible to solve complex navigation inquiries using the so called Nexus platform, a platform of several servers which will also include spatial-temporal features of the user's environment [4].

Discussion

First of all, let us emphasize that the proposed prototype is not yet suitable for widespread deployment due to its size and other restrictions. Especially the cables are a big concern. However, the first usability tests show that blind subjects are at least able to use the prototype. Considering the miniaturization progress during the last years, we look forward to the next hardware generation that will make it possible to use discreet systems which can be integrated into clothes or maybe even into jewellery. It is possible to extend the current client-server solution to global dimensions by using an appropriate server platform and environment models that are optimised for deafblind users' demands.

Results

We have developed a new portable system enabling object identification of modelled objects and augmented indoor navigation support for the deafblind within unknown and complex environments. The object identification can be done interactively and the name of the closest object or navigation advices can be presented on a portable Braille display.

Usability tests with blind persons have shown the potential of this new system that will offer particularly to the deafblind new possibilities concerning learning, navigation, communication options and in summary more autonomy. As a closing remark we must admit that there are still a lot of challenges that have to be resolved especially with regard to the ergonomics of the system.

References

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