Chapter 3.11

A Novel Application of Information Communication Technology to Assist Visually Impaired People

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ABSTRACT

This chapter presents a novel application for wireless technology to assist visually impaired people. As an alternative to the medical model of rehabilitation, the information explosion era provides the foundation for a technological solution to lead the visually impaired to more independent lives in the community by minimizing the obstacles of living. A "SmartGuide" caregiver monitoring system is built as a standalone portable handheld device linked. The objective of this system is to assist blind and low vision people to walk around independently especially in dynamic changing environments. Navigation assistance is accomplished by providing speech guidance on how to move to a particular location. The system delivers dynamic environmental information to lead the visually impaired to more independent lives in the community by minimizing the obstacles of living. Information of changing environments such as road blockage, road closure, and intelligent navigation aids is provided to the user in order to guide the user safely to his or her destination. This system also includes a camera sensor network to enhance monitoring capabilities for an extra level of security and reliability.

INTRODUCTION

Visual impairment can be quantified in terms of the remaining visual acuity and visual field. Visual acuity is expressed as a fraction of full acuity (Pun, Roth, Bologna, Moustakas, & Tzovaras, 2007). A visual acuity of 1/10 means that a sight handicapped person has only 10% visual acuteness or clearness if compared to a normal sighted person. Visual field or sometimes field of view refers to the physical objects and light sources in the external world that impinge the retina (Wikipedia, 2008a), in other words, the total area in which objects can be seen in the side vision when the eye is focused on a central point. A normally sighted person has a visual field of 60 degrees.

Visual impairment can result from damage at any time in the life cycle of human beings. There are four levels of visual function, normal vision, moderate visual impairment, severe visual impairment and blindness. Severe visual impairment leads to a person being totally blind. Less severe cases cause a person to have partial vision loss that cannot be corrected called low vision. Total blindness means no remaining visual perception at all. Genetic and developmental anomalies can cause visually impairment from birth. Visual impairment may also occur during adulthood when many diseases and genetic patterns manifest themselves. According to the World Health Organization (WHO, 2009) fact sheet, there are 314 million visually impaired people worldwide, where 45 million of them are blind. Still according to WHO, 87% of the world's visually impaired people live in developing countries (WHO, 2009).

The goal of this project is to develop an intelligent wireless assistive system to assist the visually impaired to walk around independently and safely especially in an indoor environment. This project proposes a system which utilizes the advancement of the current Information Communication Technology (ICT), for e-inclusion in current transportation systems and indoor environment to tap new digital opportunities for the inclusion of visually impaired people. Navigation aids are accomplished by providing speech guidance on how to move from one location to another. Public transportation systems like airports, bus terminals and mass rapid transport stations would be made more accessible to this segment of society. They would be able to travel in unfamiliar indoor locations successfully and have a workable strategy for self-familiarization within complex changing environments.

BACKGROUND

A typical guidance system consists of three components: Input Component, Processing Component and Output Component. The input component includes information sources to be used by the system which is normally made up by analog/digital sensors, instructions and raw data. The processing component is made up by one or more microcontrollers that utilized the data obtained from the input components to further process the data. Data is processed by using a pre programmed algorithm to calculate further subsequent actions and maintain proper heading. The output component is the component that directly affects the system's velocity and heading. For example, engine control unit, and actuators that will affect the system's overall course.

Several researchers have proposed technological solutions using RFID and GPS technology to assist visually impaired people (D'Atri et al., 2007; Chang, et al., 2005; Ran, Helal & Moore, 2004; BrailleNote, n.d.; Cardin, Thalmann & Vexo, 2007). Amongst the assistive systems which have been reported are SESAMONET (D'Atri et al., 2007), iCane (Chang, et al., 2005), Drishti (Ran, Helal & Moore, 2004), BrailleNote (n.d.) GPS and Werable Systems(Cardin, Thalmann & Vexo, 2007).

The research on assistive technology is finding a way to reduce the barriers of the lives of visually impaired people and to enrich their lives with more

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