A Study of Performance Factors in the Brunel Remote Guidance System for Visually Impaired Pedestrians

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ABSTRACT

Over the last decade, the development in mobile technology, satellite navigation systems and Geographical Information Systems (GIS) have contributed to the design and development of Brunel Remote Guidance System (BRGS). This system has the potential to be utilized by visually impaired pedestrians to make their life safer and easier. Recent research on BRGS indicates that in future this technology might be an integral part of their life practices. However, before the full deployment of the system in real life, more research is needed to reach both the best setup and performance of the system. The performance of the system is subject to each factor within the sub-system of the overall system architecture. Hence, knowing each sub-system along with its method of performance assessment and its effectiveness will definitely enable the better evaluation of the whole system performance which can lead to a better system setup. Therefore, that has been the main aim of this paper which has been achieved through conducted systematic literature review on previous literature related to this project. The main finding of the study showed that there is no clear setup and performance assessment method for one essential part on the system, which is the guide terminal.

Keywords: Geographical Information System, Navigation, Remote Guidance System, Systematic Literature Review, Visually Impaired Pedestrian

INTRODUCTION

Current lifestyles and activities require individuals to commute and travel to various locations. Travel depends on the ability to change location and be mobile. The term ‘mobility’ can be defined as one’s ability to change place safely, independently and avoid obstacles including potential hazards by corrective detection (Dowling, 2005). In general, mobility is divided into two categories: navigation and...
orientation. Navigation is the ability to reach one’s destination and avoid obstacles whereas orientation is the capability to monitor one’s position in relationship to the environment. In other words, mobility can be the ability to recognize current location routing towards the destination in a safe and independent way (Szeto, 2004; Garaj, 2006b).

In recent years, several systems have been proposed to help visually impaired pedestrians navigate through familiar and unfamiliar environments and thus enhance their mobility (Völkel, Kühn, & Weber, 2008). These systems are meant to provide the user with the additional degree of freedom by allowing them to travel on foot safely and independently (Golledge & Marston, 2005; Hunaiti, 2010). The research related to the majority of these systems has been concentrated on the technical aspects of the applied technologies and equipment. The Central for Electronic Systems Research (CESR) at Brunel University has designed and developed such a system called Brunel Remote Guidance System (BRGS). The system is based on integrating the state of the art technologies, including satellite navigation (Global Positioning System (GPS)), wireless broadband, digital mapping (Global Information Systems (GIS)), databases and real-time video streaming. The BRGS was successfully tested and demonstrated the potential to assist visually impaired pedestrians (Hunaiti, Garaj, & Balachandran, 2006b; Nabhan, 2009; Garaj, Jirawimut, Ptasinski, Cecelja, & Balachandran, 2003). This paper will explain the principle of operation of BRGS and identify factors that have impacts on the system performance. The next section introduces the BRGS system prototype architecture.

BRUNEL REMOTE GUIDANCE SYSTEM PROTOTYPE

The BRGS consists of two terminals; stationary and mobile (Figure 1). The mobile terminal is utilized by the visually impaired pedestrian, who is the receptor of the sighted guide assistance during the journey. The stationary terminal is utilized by a sighted guide, who provides the guidance. The broadband wireless communication link was used to establish the connection between the mobile and guide terminals. Voice communication is transmitted via a wireless link between the user (via mobile phone in the mobile terminal by using a microphone and a single earpiece) and the guide person (via a

Figure 1. Brunel remote guide system prototype
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