Indoor Positioning System based on Sensor Fusion for the Blind and Visually Impaired

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ABSTRACT

There are over 1.2 million Australians registered as having vision impairment. In most cases, vision impairment severely affects the mobility and orientation of the person, resulting in loss of independence and feelings of isolation. GPS technology and its applications have now become omnipresent and are used daily to improve and facilitate the lives of many. Although a number of products specifically designed for the Blind and Vision Impaired (BVI) and relying on GPS technology have been launched, this domain is still a niche application area and ongoing R&D is needed to deliver all the benefits of GPS in terms of information and mobility to the BVI. The limitations of GPS indoors and in urban canyons have led to the development of new systems and signals that attempt to bridge the gap and provide positioning in such challenging environments. Although still in their infancy, there is no doubt indoor positioning technologies will one day become as pervasive as GPS. It is therefore important to design those technologies with the BVI in mind, to make ensure they are accessible from the very start. This paper will describe an indoor positioning system that has been designed in such a way, examining the requirements of the BVI in terms of accuracy, reliability and interface design. The system runs locally on a mid-range smartphone and relies at its core on a Kalman filter that fuses the information of all the sensors available on the phone (Wi-Fi chipset, accelerometers and magnetic field sensor). Tests were conducted in which blindfolded sighted people on the one hand, and blind and visually impaired people on the other hand, were guided in a typical office building to various points of interest such as lifts, stairways or to a specific room in the building. The paper will present the outcomes of these tests, focusing on feedback from the test participants.

KEYWORDS: Kalman filtering, sensor fusion, indoor positioning and navigation, blind and visually impaired, user centred design.