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A haptic feeding GPS navigation solution for the visually impaired

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According to a fact sheet published by the World Health Organization (WHO) in 2014, it is estimated that 285 million people are visually impaired worldwide and out of which 39 million of people are blind. Further, about 90 percent of the visually impaired people in the world live in low-income settings. Among many difficulties that they encounter in their day-to-day activities, the visually impaired people are often disadvantaged particularly when travelling due their inability to see the obstacles and visual signs of directions that are essential to navigate not only through the unfamiliar terrains but also in the familiar environments. Therefore, the visually impaired people usually use a white cane to detect obstacles on their path and also get the assistance of the trained guide dogs. However, when they roam in an unfamiliar environment, they always have to rely on a third party for finding their directions.

With the advancement of the Global Positioning System (GPS) technology, development of GPS navigation solutions for the visually impaired people have become an active domain of research in the recent years. They include the Brunel Navigation System for the Blind, BrailleNote GPS, Trekker Breeze and BlindSquare to name a few. However, the most of the present GPS navigation solutions for the visually impaired people are based on the auditory perception of visual information. These navigation systems capture data from various sensors and information services, process them and convert the navigational instructions into sounds. As the visually impaired people see the world through their ears due to their lack of vision, these sonification systems not only pose a high risk of interference to a visually impaired traveler's perception of environmental sounds, but also attract an unnecessary attention.

In this paper, we propose a novel GPS navigation solution for the visually impaired, with a haptic feeding system as an alternative to the sonification systems. The objective is to develop an economically viable haptic feeding GPS navigation system that could be used, to assist them in their everyday activities without having to depend on care providers. The proposed solution contains two interconnected main components, a wearable device and a navigational directions providing server. The wearable device consists of a haptic feeding system, a GPS locator, a GSM module, an electronic compass and an embedded processor. The navigational directions providing server, obtains real-time navigational directions from the free Google Map Direction API using the GPS location of the wearable device and intended destination to be reached. The obtained navigational directions are then narrowed-down into simple navigational directions in order to meet the requirements of the haptic feeding system. These simple navigational directions are transferred into the wearable device via a GSM link. Based on the simple navigational directions, the visually impaired user is then guided with simple and easily understandable haptic instructions until the destination is reached.

Keywords: Blind, GPS navigation, haptic, visually impaired