Wiimote as a Navigation tool for Pedestrians

Ricky Jacob, Adam Winstanley, Declan Meenagh
Computer Science Department
National University of Ireland Maynooth
Maynooth, Kildare, Ireland
rjacob@cs.nuim.ie, adam.winstanley@nuim.ie

Eoin Mac Aoidh
National Centre for Geocomputation
National University of Ireland Maynooth
Maynooth, Kildare, Ireland
eoin.macaoidh@nuim.ie

Abstract — **Pedestrian Navigation requires effective communication between the mobile device and the user. The Mobile device should be able to give feedback to the user ensuring there is minimum input and attention of the user required. Mobile interaction for navigation has mostly been through the use of visual interfaces with maps and annotations. This paper describes a Multi-modal, haptic interface with the visual interface of an OpenStreetMap on a mobile platform. The Wiimote is used as the haptic tool which will vibrate based on the navigation path to be taken by the user with signals from the mobile application via a wireless connection using bluetooth.**

Keywords- Multi-Modal, Haptic, OpenStreetMap, Wiimote, Pedestrian navigation

I. INTRODUCTION

According to a new study from ABI Research [5] the number of subscribers to handset-hosted location based services (LBS) increased in 2008 to more than 18 million. Thus we can see an enormous growth during the coming years in the use of mobile services. For good Location Based Services (LBS), there is always the need of an effective medium of interaction between the human and the mobile device. The various ways in which we can achieve that can roughly be classified under the following: graphical user interfaces (GUI), speech user interfaces, haptic user interfaces, gaze interfaces, and computer vision.

When selecting an interaction technique, we must know what is the task that we are looking to make easier and more natural for the user and how do we plan to do that decides upon which modalities we are going to use for input and output.
Part of this is

- graphic feedback, haptic feedback, auditory feedback, speech synthesis
- manual (haptic) input, speech input, voice input, eye tracking, computer vision.

If multimodal interaction is going to be used, then how do we overcome the complexities that come with it? The need for psychological aspects is required inorder to assess which of the methods are easy and hard for understanding and which people prefer using. We must select the programming platform and additional software packages based on the modalities we choose for our work. Lots of work to make the browser a location-aware one is going on and with the Geolocation API, the browser will now be able to recognize you current location and give you search results based on that. This will cut down on the human interaction part. Mozilla [6] has recently included a new experimental add-on called Geode to their famous web browser - Firefox. Geode provides a rudimentary implementation of geolocation for the current version of Firefox by using a single hard-coded location provider to enable Wifi-based positioning conforming to the W3C Geolocation specification [7] so that developers can begin experimenting with enabling location-aware applications today.

Since mobile devices have issues such as small memory, small display, latency, and user input constraints, we need to ensure the application does not overlook those factors. Also the need to choose between broswer based and widget based application is of importance. The use of graphical display like maps or texual description, requires the user to look into the screen while he is on the move thus interupting the user's other major work. Use of audio feedback also requires the users attention at all times just limiting the user from performing other tasks at the same time.

Car navigation systems have evolved well over the years to provide better communication between the user and the system. These navigation systems work better with the GPS satelliites as the cars travel on roads and it is quite easy to get good signals from the satellites. Also in case of the car, the user's context does not vary also his field of view, thus it is comparitively easier to provide effective navigation to the user. The pedestrian navigation system is much more complex, as user context various quite rapidly and the system should dynamically change accordingly. Also it requires the user's attention if the system is a visual interface or audio feedback. Haptics on the other hand will not need much of the user's attention when on the move. In this paper. we propose the need for haptic feedback for pedestrian navigation along with the visual interface on the mobile device.

II. NAVIGATION USING HAPTIC FEEDBACK

The word haptics refers to the capability to sense a natural or synthetic mechanical environment through touch. Haptics also includes kinesthesia (or proprioception), the ability to perceive one's body position, movement and weight (Hayward et al. [1]).

An exploration of haptic output for indoors pedestrian guidance (e.g., a room in a hospital) which is what GentleGuide [2] does is limited to indoor navigation and has fixed paths. Most of the other work done with respect to haptics is focuses on people with a visual disability, like the wearable navigation system by Ertan et al. [3]. Our work is to maximize use the sense of touch efficiently to help users navigate in an outdoor environment, similar to Keyson [4].

So here we are designing for various contexts and for a broad range of users. We also keep in mind various other aspects while we model the system which includes the user's level of experience, cultural background, physical abilities, cognitive abilities, work domain, including others. We also plan to model the location or travel history and then try to provide context aware results based on digital dairy/calendar inputs for reminders and also current weather and other environmental information too.

III. SYSTEM IMPLEMENTATION

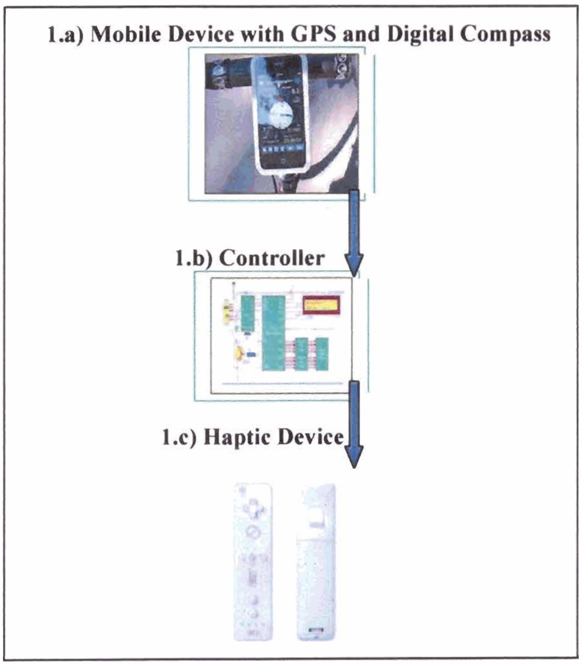

Figure 1. Flow of information in the haptic feedback system.

The digital compass along with the GPS embedded in the mobile will let the user navigate in open space. We also attempt to provide the best modality combination based on the current environment. So if it the user wants to view the path on a map in the middle of his/her navigation, he can switch to the map mode.

Our haptic feedback system (Fig 1) allows the user to keep his mobile device (Fig 1.a) inside his pocket or bag and with the help of a Bluetooth connection to a Wiimote (Fig 1.c) or with the use of the mobile phone itself, we can guide the user to his location with the help of haptic feedback in the form of vibrations. We need a controller (Fig 1.b) to decode the encoded signals that is received by the Wiimote to interpret the signals. The user will be guided toward the right path to his location by altering the intensity and/or time of duration of the vibrations. If the user changes his position to a entirely different location from the specified path (e.g., if it suddenly rains, the user might have ran towards a building for shelter), then we also plan to dynamically re-route his/her path and provide the best route to the user based on his/her current position.

IV. CONCLUSION

Getting the mobile device to interact wirelessly with the Wiimote was the first challenge and now we need to understand as to how usable the Wiimote is going to be. For this we are doing some user trials where paths have been predefined and we ask the user to reach the destination based on the haptic feedback and also by using the visual navigation and take feedback to see how effective the haptic feedback is.

We intend to use OpenStreetMap as the visual interface as it is freely available for download and we can customize it as per our requirements. During the initial stages we will use the data for Ireland which we have downloaded as our test bed. Haptic feedback will be useful as it enables the user to be involved in other work and would not need his/her attention as in the case of audio or visual feedback.

ACKNOWLEDGMENT

Research presented in this paper was funded by a Strategic Research Cluster grant (07/SRC/I1168) by Science Foundation Ireland under the National Development Plan. The authors gratefully acknowledge this support.

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