Location-based services (LBS) in micro-scale navigation: shortcomings and recommendations

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Abstract

Pedestrians LBS are accessible by hand-held devices and become a large field of energetic research since the recent developments in wireless communication, mobile technologies and positioning techniques. LBS applications provide services like finding the neighboring facility within a certain area such as the closest restaurants, hospital, or public telephone. With the increased demand for richer mobile services, LBS propose a promising add-on to the current services offered by network operators and third-party service providers such as multimedia contents. The performance of LBS systems is directly affected by each component forming its architecture. Firstly, the end-user mobile device is still experiencing a lack of enough storage, limitations in CPU capabilities and short battery lifetime. Secondly, the mobile wireless network is still having problems with the size of bandwidth, packet loss, congestions and delay. Additionally, in spite of the fact that GPS is the most accurate navigation system, there are still some issues in micro scale navigation, mainly availability and accuracy. Finally, LBS server which hosts geographical and users information is experiencing difficulties in managing the huge size of data which causes a long query processing time. This paper presents a technical investigation and analysis of the performance of each component of LBS system for pedestrian navigation, through conducting several experimental tests in different locations. The results of this investigation have pinpointed the weaknesses of the system in micro-scale environments. In addition, this paper proposes a group of solutions and recommendations for most of these shortcomings.

Keywords: Location based services (LBS), Pedestrian Navigation, Mobile Applications, Global Positioning System (GPS) and Wireless Networks.

Conclusion and Recommendations

In this paper, an all-inclusive analysis of LBS performance has been presented. This has been accomplished through evaluating each component including GPS, Mobile devices and Wireless Networks.
The outcome of this study did enable a full understanding of the issues that might hinder the deployment of LBS applications in a wider scale mainly within micro-environment. These issues along with some recommendations can be summarised as follows:

GPS availability and accuracy. The test results showed that the satellite signal has been blocked sometimes by obstacles such as buildings. This causes the GPS receiver to fix inaccurate location which drives the LBS server to send incorrect information accordingly. It is recommended to use accuracy enhancement methods of GPS by means of: Differential GPS, or through sending correction information over the internet (e.g. OSNet, SISNET, etc.). The integration of such accuracy improvement methods with the stand alone GPS receivers currently utilized in LBS requires several software and hardware adaptation.

Mobile Devices. The test results showed that mobile devices such as PDA and smartphones are still experiencing a lack of enough storage and short battery life time. It is recommended that the size of information, services and maps which is normally sent by the LBS system to the end user to be reduced as much as possible. There is a need also to develop new methods that will effectively utilise extra storage (e.g. Mini SD memory) to be used for LBS purposes.

Wireless Networks. The test results showed that the network is still experiencing problems with the latency, packet loss, and bandwidth. It is recommended that LBS system utilise new coming technologies such as High-Speed Uplink Packet Access (HSUPA) (Peterson & Tarallo, 2007), Long Term Evolution (LTE) (Rao et al., 2009) and Worldwide Interoperability for Microwave Access (WiMAX) (Westwick, 2008). Therefore, when designing a LBS application, the wireless network performance and capabilities should be taken into consideration. For example, applying new strategies of data-flow management can help in maintaining good performance.

Finally, more research work is being conducted to find a new method that could be applied on LBS system in order to contribute in overcoming the investigated problems. The design of the new method takes into consideration the findings and results presented in this paper.

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