Keywords: Location Based Services (LBS), Pedestrian Navigation, Mobile Applications, Global Positioning System (GPS) and Wireless Networks

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.

INTRODUCTION

As a result of the rapid progress in wireless technologies and the development of portable and smart mobile devices, new range of location based services have been emerged (Rainio, 2001). The integration of wireless mobile networks, Global Positioning System (GPS), geographic information systems (GIS) and the Mobile device technologies allow the users to
receive new range of services. For example, locating and tracking objects with dynamic distribution and also information regarding the nearest business or Point of Interest (PoI) such as ATM, restaurant or hotel (Junglas & Spitzmuller, 2005). In addition, new applications in different aspects of life are utilizing the LBS concept such as Mobile Learning (Hunaiti et al., 2008), Mobile Marketing, and Visually Impaired Guidance (Hunaiti et al., 2005).

As LBS system encompasses a group of technologies: mobile device with location sensing capabilities connected to a LBS database server over a mobile wireless network and the Internet (see Figure 1). Therefore, LBS performance is subject to the overall performance of these subsystems forming its architecture (Lee et al. 2005). The performance of LBS system can also be affected by the type of application implemented within the system. For instance, if a desktop application has been made over LBS system, it might not be successful due to the capabilities of the LBS system components (Benford, 2005).

Since LBS systems are services based on the location of the end user, one of the most important components is the location-sensing method. There are a number of available positioning methods and each one could be used based on the objective of the application being designed. For example, Cell of Origin (CoO) which depends on the distance between the end user and the radio base station of a cellular network (Giaglis et al., 2002). Short Range Positioning which is widely used by in-door LBS applications based on infrared transmitters and receivers (Bahl et al., 2000). Global Navigation Satellite Systems (GNSS) which are a satellite-based location sensing method such as GPS which is operated by the United States, GLONASS which is operated by the Russian Federation and GALILEO which is being built and funded by the European Union. In this paper, GPS is presented and investigated as it is the most commonly used in real-time out doors LBS applications.

An essential step towards addressing the shortcomings of LBS systems is an all-inclusive investigation enabling a full understanding of the issues and allows the successful solution for LBS system. Therefore, this study has been conducted to evaluate the overall performance of LBS for the use in micro environments. This has been achieved by carrying out studies on GPS performance, wireless networks, and mobile devices capability.
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