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 outdoor 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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