Chapter 30

Location-Based Services to Improve Elderly and Handicapped Citizens’ Mobility

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ABSTRACT

This chapter is aimed at the analysis and description of various wireless technologies and methods for indoor location of mobile/portable devices in order to provide support services to elderly and handicapped people as well as to care and medical services. Indoor location is an open problem that has been analyzed in the last years in order to provide location-based positioning services that can improve the quality of life of end users. GPS location is not possible in these environments due to the lack of satellite coverage. Satellites’ signals are absorbed by buildings’ elements and cannot reach GPS receivers. As a consequence, no location is obtained. One must take into account that many elderly and handicapped people are most of the time in an indoor location. Thus, new technologies and techniques have to be investigated in order to provide additional location services indoors that complement those provided in outdoor situations by the GPS system.

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INTRODUCTION

Actually there are many location based applications and services which provide support to users in different ways. Routing, positioning, tracking, leisure, sports, and information are common services which are widely spread over the population. Most of these services and applications are aimed at outdoor environments and use the GPS system to obtain the actual location. Moreover, many mobile devices are incorporating GPS receivers at low cost. Devices and applications have become cost-effective due to their massive use. On the other hand, when such kinds of services are going to be deployed in an indoor environment we obtain a key problem: the GPS system does not provide coverage in those situations because satellite signals are absorbed by building structures. Thus, new technologies and techniques have to be investigated in order to provide additional location services in indoor environments that complement those provided in outdoor situations by the GPS system. The other issue to be overcome is the cost of non-popular systems due to new infrastructures and equipment specifically designed for those applications.

One of the premises to construct a successful indoor location system is the use of already existing and in use technologies. This premise has a double purpose: on one hand avoiding the construction and use of new specific terminals; on the other hand to meet users’ cost expectations and make the technology transparent to end users, increasing its acceptance. There are various wireless technologies, which are possible candidates to build indoor location systems and are already used in data transmission systems: Bluetooth, WiFi, Zigbee, Wimax, RFID and ultrasounds. At the same time, there are several location techniques that can be used in some of them. The use of some techniques is impracticable due to implementation and cost restrictions, as the use of multiple antennas and required equipment and terminal size. Each technology has its advantages and drawbacks from the technological, deployment and cost perspectives. Technologies are analyzed and compared to select the one which is more appropriate or their combination, depending on their availability in real situations.

When various technologies are available, the merging of the location provided by each one may result in a more accurate estimated location providing a more reliable and precise system. The system should have a coordination subsystem aimed at analyze the positions provided by the various available technologies and decide the confidence level of each one and, when possible, combine them to provide a more accurate positioning information.

There are several location technologies available for indoor environments whose capabilities (range, accuracy, etc.) are quite different. Furthermore, commercial exploitation of just one of those technologies into most of the actual scenarios may be unfeasible due to complexity and deploying difficulties. Therefore the use and coordination of multiple indoor location technologies facilitates building more accurate and reliable systems.

Nowadays mobile devices offer the possibility to enjoy location based services (LBS) using the GPS technology. On the other hand, manufacturers are incorporating more and more different kinds of sensors as part of the localization technologies. Those sensors habilitate indoor localization based on existent infrastructures like WiFi networks. Furthermore, digital compass, proximity sensor, accelerometer sensor, etc., are becoming common within the devices sensors and they are able to optimize the location process by providing additional and valuable information.

Those hardware (HW) capabilities, may offer the required flexibility to combine, in a simple manner, location technologies for enabling easy to install indoor location environments within any accessibility service and medical care.

Apart from the technological approach to this problem, we must consider the potential users’ perspective. The system will be useful if the us-
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