Chapter 12
Location Acquisition and Applications in Mobile and Ad–Hoc Environments

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ABSTRACT

This chapter addresses the relevance of location information as an important resource that supports other applications. This information is important for better network planning, development of new location-based services, fast deployment of assistance services, and support of surveillance and safety regulations, among others. Accuracy of location acquisition processes is an important factor because the potential for multiple new location-based services depends on it. However, noise is always present at least in two forms. Measurements taken with electronic instruments are inherently noisy and estimation algorithms introduce noise of their own in the assumption process. For this reason, this chapter explores several methods and techniques. A well- balanced solution should take into account the compromise between accuracy and delay and/or complexity. Many solutions have been proposed for new needs and new applications which demand more timely and accurate position locations of users or objects.

INTRODUCTION

Currently, wireless communications have modified our daily lives where people not only communicate among themselves but also access diverse ways to entertain, exchange data and trigger emergency and safety alarms, to mention just a few examples.

The fundamental problem of position location (PL) can be formulated as that of finding or estimating the location of a device in a multidimensional space. The space dimensions will be determined by the applicability scenarios as well as the available technologies for the particular solution.

New technologies are used in the communications industry to create new services and cover new needs in the market. Wireless technologies experience continuously increasing growth, where cellular networks, Wimax, WiFi, and Bluetooth, are presently among the most common. However, new technological and market trends will foster the appearance of new applications and services.

Mobile Ad-Hoc Networks (MANETs) are based on prior technologies in hardware, but they work differently. One big difference is that communication between two terminals is not always direct. Links can be re-engineered in a cooperative manner so that all users can help locate a specific mobile in the network, depending on neighbors' information and capabilities.

This cooperative way of working enables the development of new services based on the interaction among users in the area. This can be exploited to create new working scenarios to satisfy new customers as well and providers' needs to development new services, based on location information, named Location-Based Services (LBS). This location information can be obtained by employing different PL techniques. It is worth mentioning that location information requires the presence of processing units in order to make it available to users and providers. These entities are known as LBS platforms.

This chapter addresses the relevance of location information as an important resource that supports other applications. This information is important for better network planning, development of new location-based services, fast deployment of assistance services, and support of surveillance and safety regulations. The accuracy of location acquisition processes is important because the potential for multiple new location-based services depends on it.

Following these objectives, the chapter is organized in six sections. The first section describes location information, in general. What is it? Where is it used? How it is acquired? What are the technical challenges? The second section briefly describes Internet Protocol (IP) based location. A third section is dedicated to comprehensively review PL techniques, discussing the advantages and disadvantages of each. MANETs are described and location strategies for these networks are mentioned in the fourth section of this chapter. The fifth section is dedicated to Location Based Services. This section includes the description, technological components, feasibility and accuracy and platforms in MANETs. Finally, some conclusions are presented in a sixth section.

LOCATION INFORMATION

Location information can be referred to as the knowledge of the place where a person or device is. This information is crucial for any service or application that provides site-dependent solutions. There will always be location uncertainties due to impairments caused by the environment or any other interfering element. However, the need to more for more accurately estimate position has motivated the invention of more accurate PL methods, because the applications depend on the accuracy of the location process.

Measurements and estimations for certain kinds of services demand accuracy (i.e. emergency services). PL methods can be used to provide navigation and geographical information, emergency location, movement tracing and tracking, selection of geographical coverage of communication areas and sensor measurements based on position and location patterns and the improvement of network system operations, among others. Location information data can include spatial distribution of users and assets, finding people or places of

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