ABSTRACT

This paper made analysis of present situation and development trend of the positioning in small range at first and then made summary about the technologies and algorithms of the positioning in small range. According to the above content, wireless location technology has broad application prospects, especially the applications related to the location in small range. This new wireless positioning scheme mainly aims at improving the positioning method based on time difference of arrival (TDOA) in small range. This paper designs an improved positioning system which uses matched filter to calculate TDOA value. Then the system estimated the position of signal source by Chan’s algorithm and used the first-order difference method to optimize the positioning results. From the simulation results by Matlab, it can be seen that this improved positioning system has improved the positioning accuracy and met the demand of the high precision positioning.

Keywords: Correlation Inspection, First-Order Difference, Matched Filtering, Time Difference of Arrival (TDOA), Wireless Positioning

1. INTRODUCTION

Early positioning originated in the needs of navigation. Wireless positioning precision has improved greatly since the global positioning system (GPS) was invented and its accuracy can reach meters-range level (Rappaport, Reed, & Wonerner, 1996), however, GPS doesn’t work so well in providing the location information within small range, which cannot meet the positioning requirement.

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As the demand for small range wireless positioning grows, in many fields such as: parking lot, robot localization, environment monitoring, health care, construction, etc, the application prospect of small range wireless location is becoming broader and broader. In the field of construction engineering, more and more people are concerned about the security issues because of the improvement of human rights consciousness, attaching high importance to the wireless location. In the industrial field, wireless positioning is also a rising star in monitoring employee safety and dealing with the problems of logistics and inventory. In terms of some high-risk fields like mining, metal smelting and offshore drilling, wireless location network can provide some assistance in order to avoid accidents and guarantee employees safety. Thanks to the rapid improvement of communicating technology, embedded computing technology, and information processing technology, the appearance of many small wireless devices which are suitable for the complex environment has brought much convenience for the research of small range wireless positioning as well as its application. In conclusion, small range positioning technology has been paid more and more attention during recent years, and it will continuously be the very hot spot in the near future (Bai Yan & Lu Xiaochun, 2009).

Under the condition of small range, the environment is usually complex. Indoor layouts, material structure, building scale give rise to the fact that every different signal path loss is very large. At the same time, complex environment in small range will cause the signal reflection, diffraction and scattering and form the multipath phenomenon, which makes the time of arrival, amplitude and phase of the received signal changed. As a result, it is difficult to make localization with the received signal (Reed, Krizman & Woerner, 1988). Although the small range positioning is a positioning technology which has something in common with outdoor wireless positioning technology based on base station, the environment of small range positioning is more complex and it needs special requirements on precision and safety, which makes small range wireless positioning technology much more different from ordinary long range positioning technology. Therefore, the identification and classification standard of both areas are different. Based on its own characteristics, small range positioning technology and algorithms have become hot topics. How to improve the positioning precision will be the focus in the future research.

The rest of the paper is organized as follows. Section 2 introduces the related work and existing problems, section 3 describes the principle and the related problems of the proposed algorithm, section 4 makes simulation and analysis of the proposed algorithm, and section 5 draws a conclusion.

2. RELATED WORK AND PROBLEM STATEMENT

With the development of communicating technology and intelligent transportation technology, the service based on location has rapidly developed. Wireless location technology, as the basic technology of this service, has important research value. With the development of technology and the increasing demand of positioning, wireless location technology has made great progress (Tekinary, Chao, & Richton, 1998). In recent years, wide application of infinite positioning technology mainly includes received signal strength indication (RSSI) localization method, time of arrival (TOA) or time difference of arrival (TDOA) localization method, angle of arrival (AOA) localization method and all kinds of hybrid localization methods (Kegen Yu & Y. Jay Guo, 2009).

The RSSI algorithm principle is: first record the signal strength received by the receiver and compare with the original signal strength of the transmitter; then according to the intensity attenuation model of the signal, calculate the signal loss in the transmitting process to obtain the distance between the transmitter and receiver; finally get the location information of the measured object according to the triangulation technology (Chen Liu, Dingyi Fang, Zhe
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