System Implementation Considerations of an High Sensitivity Assisted GPS Receiver Acquisition Scheme

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INTRODUCTION

Giving a reliable position promptly is a problem in places where the global positioning system (GPS) signal is extremely weak. We proposed a fast high-sensitivity acquisition scheme, which includes high-sensitivity fast C/A code search method and fast frequency search method, for assisted GPS (AGPS) architecture based on a timing-synchronized third generation (3G) mobile network. In this paper, we focus on the system construction considerations. We discuss the communication method of transmitting time-tagged navigation message data bit stream to make long time correlation possible. Then, how to provide Doppler frequency caused by the motion of satellite is analyzed. The service mode of server, the computational load of the server and user, and amount of data that transferred via network are the issues we concern.

HIGH SENSITIVITY FAST C/A CODE SEARCH METHOD AND APPLY CONSIDERATION

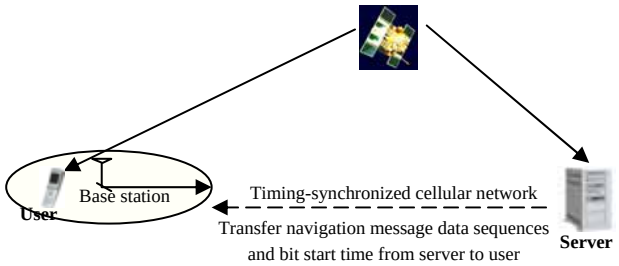

Figure 1. System structure

As shown in Fig. 1, we proposed that the server broadcasted the navigation message data bit stream and corresponding start time of this stream via timing-synchronized cellular network in the context of an AGPS architecture. By referring to the start time and the navigation message data stream, polarity changes due to the navigation message can be removed. The user's receiver can perform the long-time correlations for high acquisition sensitivity.

If we assume the time of correlation performed by user is 1 s, 50 bits navigation data and its start time should be broadcasted by the server. This broadcasting information will not change until the next 20 ms navigation data bit is converted from tracking results.

FAST FREQUENCY SEARCH AND APPLY SCENARIOS

In Table 1, we compare three apply scenarios of frequency search range, computational load and data amount of transmission.

1.Server calculates and broadcasts Doppler

The Server calculates its Doppler and the Doppler difference between server and a certain location. The user handset determines Doppler according to the information from server and distance between the server and user. The computational load of the server and user is medium. The amount of transferred data via network is medium because the almanac data has more bits.

2. User handset calculates its own Doppler

The server broadcasts the almanac data to the user, and the user handset can calculate the Doppler. The computation at server side is not need. The computational load of the user is the heaviest. The amount of transferred data via network is also the largest. The user does not need communicate with the server after received whole almanac data once and can predict its accurate Doppler till 1 weak with latest almanac data.

3. Server calculates Doppler for user handset

The user handset transmits its approximate location to the server. The server calculates the Doppler and returns information to the user. The computational load of server is determined by the number of the user who will use the service. The user's computational load is lightened most. The amount of transferred data via network is smallest. The frequency search range is the same as scenario 2, though there is transfer delay which affects the acquisition processing speed. Bi-direction communication is needed, which brings time delay.

Table 1. Three Application Scenarios

Doppler	**Server-based calculation**	**User-based calculation**	**Network-based calculation**
Communication	Broadcast	Broadcast	Bi-direction
Server computational load	Server's Doppler and Doppler difference according to different distance	None	According to the number of user
User computational load	Medium	Heavy	None
Data transferred	Multiple vales of Doppler frequency difference	Almanac data	User's location & Doppler