

Performance Evaluation of a Software GPS Receiver for Mid-End Host Platforms

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INTRODUCTION

Fastrax Ltd recently introduced a new, software-based GPS receiver solution targeted for platforms with medium range CPUs, such as those used in PDA's, PND's and other similar products. The Fastrax Software GPS Receiver is optimized in performance, footprint, cost efficiency and flexibility and extends the use of location-based services further into various consumer electronics. The Fastrax Software GPS Receiver consists of a GPS RF front-end combined with software that implements the complete signal processing and navigation algorithms of the GPS receiver. The bill-of-material of the Fastrax Software Receiver is less than 3\$. Fastrax's software solution is intended to achieve state-of-the-art GPS performance equivalent to stand alone HW GPS receivers. This paper presents a performance analysis of the Fastrax Software GPS in more detail and demonstrates its flexibility for various target applications. We present the Fastrax Software GPS by analyzing its CPU requirements, the sensitivity, and the ground track performance.

FASTRAX SOFTWARE GPS SOLUTION

A software GPS receiver, differently from a classic GPS receiver with RF and baseband, accomplishes all digital signal processing on the host processor rather than on a separate baseband IC. Nowadays, mobile devices have powerful CPUs and plenty of memory to be utilized. Therefore, the usual hardware baseband functionality of a GPS receiver can be implemented completely in software on a host processor. This eliminates the need for a baseband IC, allowing for considerable reductions in cost. In addition, a software GPS receiver can easily be upgraded to support future satellite navigation systems such as the modernized GPS signals, Galileo, as well as various augmentation systems.

CPU AND MEMORY CONSUMPTION

The CPU consumption for the Fastrax Software GPS receiver in continuous navigation is in the low hundreds of MIPS (million instructions per second), and the memory required is a few megabytes. The exact numbers depend on the configuration of the acquisition, tracking and navigation software. A set of test results are presented in this paper, showing the requirements in various circumstances. The Fastrax Software GPS is a unique software-based GPS solution since it can be further

accelerated by moving the correlation tasks to hardware and therefore additionally saving in required processing power.

PERFORMANCE EVALUATION

The performance of the Fastrax Software GPS is comparable to any other receiver solution targeting a similar market. With a cold start sensitivity of -144 dBm and a navigation sensitivity of -162 dBm, the receiver can perform well even in a very difficult environment, as shown in the test results presented in this paper. Results are shown from real world deep urban canyon test setups in places where tall sky-scrapers surround the streets, as well as simulator test setups.

The flexibility of a GPS receiver implementation in software also allows convenient implementing of many different receiver architectures and features which are not feasible on a traditional hardware receiver. An example of a receiver feature which is simple to implement on a software receiver is a correlator with continuously variable finger spacing. We present results from a test using various correlator spacings and show their effect on the ground track in challenging signal environments.

SUMMARY

This paper presents the Fastrax Software GPS solution and an evaluation of its performance regarding sensitivity, CPU requirements, and accuracy. In addition, the flexibility of a software-based approach is demonstrated with presenting the performance advantages of changing correlator spacings within the receiver architecture.

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