Second Laureate
Research & Development

Project title: Design, Implementation and Test of Space GPS Receiver for Navigation of Satellites in LEO Orbits

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Abstract:

Commercially available Global Positioning System (GPS) receivers are capable of determining the user position under ordinary conditions, i.e. a low-dynamics user is on the ground. However, with a high-dynamics user, commercial receivers are not able to provide position. Design of the receiver baseband, especially its major sections including Tracking and Acquisition, is influenced by user dynamics and attributes.

In order to design a GPS receiver capable of operation in a micro-satellite two major tasks have been pursued during the course of this project, built upon a thorough commercial GPS receiver know-how already available within KavoshCom research group. First, Structure of loops in the baseband design have been modified to cope with user dynamics. This included having knowledge of the available receiver operation and the requirements of the desired receiver with high dynamics as well as their modeling, simulation and finally implementation and testing. Changes were applied to both software and hardware (i.e. VHDL codes) segments of the baseband; even some components were redesigned. Second, a Space GPS board has been designed which receives GPS satellites signal and outputs position, velocity and accurate time data on a serial port with configurable rate.

The designed receiver comprises of three essential components: power, baseband and RF. Apart from considering user dynamics in space, severe environmental conditions have as well been taken into account. The result was a GPS receiver redesigned to meet the space requirements. Parts used in the design of the board have been chosen such that they meet environmental requirements of the user. With these considerations in mind during the design procedure, the result is a receiver successfully passing functionality, environmental and radiation tests essential to operation in a LEO orbit.

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