

Acquisition and Tracking of GPS Signal Using Simulation

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Abstract— GPS Receivers are used for both military and civilian applications. This paper presents the GPS Receiver for System on Chip (SoC) application. In this paper the GPS Receiver is been implemented as System on Chip in FPGA board. VHDL modeling for the back end of GPS Receiver is designed. As baseband signal processing is the main aspect in the GPS receiver, it is achieved by this software GPS Receiver. Here the acquisition and tracking of the GPS signals is been designed and the data is recovered. MODEL SIM simulator is used here to validate the VHDL modeling. Hence the software defined GPS Receiver is simulated and implemented in FPGA for navigation purpose along with an analog front end.

Index Terms— Acquisition, GPS, FPGA, MODEL SIM, SoC, Tracking, VHDL

I. INTRODUCTION

There are 24 satellites in Global Positioning System (GPS) which encompasses earth one time for at regular intervals to give general Position, Time and Velocity data. By deciding separation from satellites GPS will make out to perceive the position on the globe. Utilizing GPS we can record or produce areas on the earth and help us for steering to and from those areas.

In 1980 GPS was available to occupant however at first it was expected for military utilize. By and by 24 satellites are moving the world over in 6 planes. So every time four satellites are seen by this plan. PDAs, cars utilize GPS and in exchange are utilized to follow everywhere throughout the world. Instantly these little apparatuses will give redress area and time, around some place on the earth. The main thing is we require a GPS collector.

Satellite data will be gotten dependably on the globe over dedicated RF frequencies. GPS recipients will have little processors and radio wires which will get the information straightly sent by satellites and decide our area and time.

A. PROBLEM STATEMENT

In current situation for correspondence and information transmission, GPS is broadly utilized. As indicated by an overview, 70% of armed force outfitted hardware's are reliant on GPS for directions to begin the correspondence. When all is said in done this reliance is specifically mirroring the

utilization of GPS in our security. Aside from armed force, even household life and they exercises are likewise impacted with GPS, for example, MAPS, Navigation frameworks, following, online area sharing and significantly more to tally.

These administrations are given from GPS and make the framework very reliant step by step. This reliance has made a defeat for flag examination proportion and they real inventiveness of handling, affecting greater part of correspondence and ruining the channel of transmission. This situation is only a cut of general difficulties in current GPS framework.

In this project, flag examination as for reference flag esteems is registered for flag quality advancement and making it dependable for correspondence.

B. INTRODUCTION TO GPS

GPS (Geographical Positing System) is most reliant programming cum application utilized around the world. In this framework, the clients are more advanced with information got to and obtained. When all is said in done GPS were propelled with 1957 with under advantaged route direct and the same was created and changed in 1960's by United States (US). The belief system was fundamentally to help armed force and give following and checking unit to comprehend foe's turn and operation. Later with thorough created and research it was reconsidered as GPS NAVSTAR in mid 1970's from US.

Since the introduction of GPS, the structure has composed into people's lives. For nonmilitary work force customers, GPS is overall used as a course gadget. Disregarding the way that for military clients, GPS has a basic impact in military operations that require right and clear area readings. Thusly, on particular customer's motivation the GPS utility is across the board and relies upon it. Essential recipients over overall sorted out with the end goal of standard situating administration (sps) and stated customers will has exact situating administration (pps). This framework that is GPS is the most critical key framework for the present world to give the correct area messages like it might be anytime anyplace and in any of the earth.

The GPS incorporates 24 satellites revolution typically, to give general position, time and speed data. GPS makes it conceivable to unequivocally see areas on the earth by measuring division from the satellites. GPS enables you to record or make districts from spots on the earth and enable you to explore to and from those spots. At first the System was

shaped just for military applications and it wasn't until the 1980's that it was made accessible for nonmilitary personnel use also. There are at display twenty four satellites rotating around the Earth in six planes. This blueprint engages four satellites to be unmistakable at all conditions the world over.

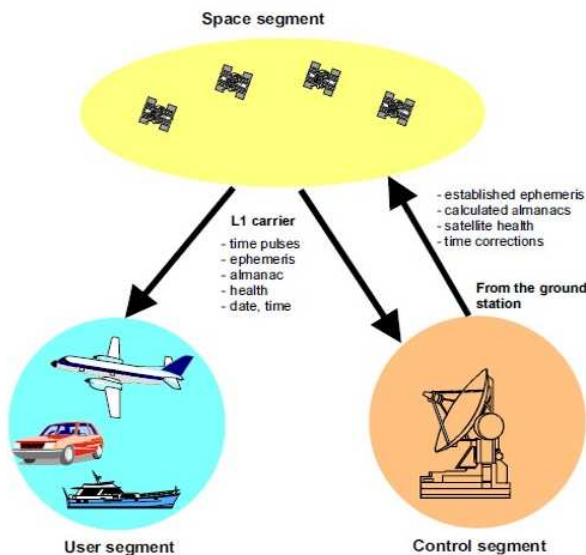
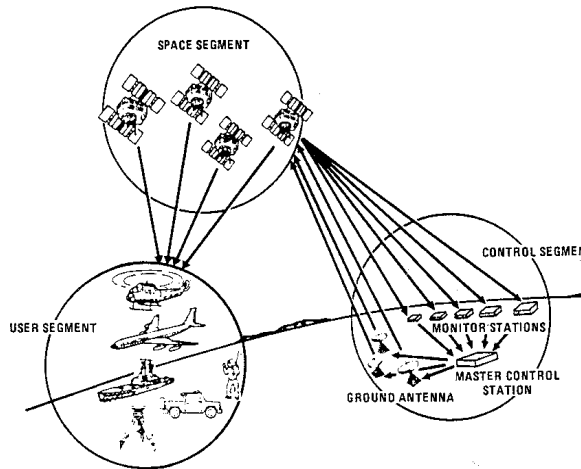


Fig 1: Three segments of GPS

II. RELATED WORK

A. IMPLEMENTATION OF GPS SIGNAL ACQUISITION AND TRACKING IN FPGA –

In this paper they have done GPS flag securing and following utilizing programming GPS collector. The product GPS collector comprises of a radio frequency (RF) frontend, analog to digital convertor (ADC), and software receiver part which runs in computer (PC). The radio frequency (RF) frontend down-proselytes the flag from radio frequency to intermediate frequency, and analog to digital converter tests the intermediate (IF) flag. The various preparing comprises of signal securing, following, information unraveling, and explaining position are altogether executed in programming

utilizing signal handling methods. The neighborhood Coarse, Acquisition code and bearer copy signs are in advance produced, put away in memory, and utilized monotonously amid flag procurement and tracking.

B. REAL-TIME ACQUISITION AND TRACKING FOR GPS RECEIVERS -

This journal I have extracted information about Doppler Effect and PRN code and is as below Doppler Effect: Doppler Effect is a type of error where the Doppler frequency shift occurs because of the radiative motion from transmitter and receiver. it affects both acquisition and tracking of the signal. It is the change in carrier frequency.

C. SIGNAL ACQUISITION AND TRACKING FOR A SOFTWARE GPS RECEIVER –

The complete architecture of software GPS receiver includes hardware portion such as an antenna, low noise amplifier, filter, down-converter from RF (Radio Frequency) to IF (Intermediate Frequency), Analog to Digital Converter (ADC) and software portion for signal processing such as acquisition, tracking and navigation The front-end gadget that changes over the radio recurrence motion from the reception apparatus to a middle recurrence GPS

beneficiary board.

III. SYSTEM SPECIFICATIONS AND REQUIREMENTS

A. SYSTEM REQUIREMENTS

The proposed system is designed on multiple software platforms and this includes the following software requirement.

| Software | Requirement |
|------------------------|--------------------|
| 1. Operating System | Windows Family 7 |
| 2. Software package | Networking Drivers |
| 3. Supporting packages | MATLAB 2013 |
| 4. Clock | Yes |

Fig 3.1: System requirements

HARDWARE REQUIREMENTS

| | |
|-----------|--------|
| Processor | I3 |
| RAM | 4GB |
| Speed | 1.1GHz |
| Hard disk | 20GB |

Fig 3.2: Hardware Requirements

B. OVERVIEW OF MATLAB

MATLAB is built up by means of math works intended for fourth-generation programming language. A variety of process approved within MATLAB contains control concerning the matrix, purpose as well as plotting of data, execution regarding algorithms, design of user interface, as well as integrating by means of programs formed within other languages like C, C++, and java. Despite mathematical calculation, MATLAB can be meant for representational calculation as well. MATLAB can be meant for embedded methods and by the guide regarding extra package known as Simulink. Specifically MATLAB permit intended for matrix estimation as well as thus can be intended for image processing.

MATLAB interfaces programming surroundings, calculation as well as mental picture. This contains integrated correcting, data compositions as well as object-oriented correcting devices. These integrated tasks create MATLAB appropriate used for education as well as do research. To resolve scientific trouble MATLAB includes other benefits than usual programming language like c plus java. MATLAB arrived into promotion in 1984 in addition to now it is employed globally. Additional graphical instructions are offered within MATLAB that builds the visual effects obtainable right away.

C. IMAGE PROCESSING TOOLBOX

Image processing device box permits carrying out image improvement, deblurring of image, characteristic identification, decreasing of noise, image segmentation, arithmetical alteration, as well as registration of image. Image processing device intended for the execution regarding methods proposed are specified below:-

1. Fundamental import as well as export
2. Display

D. FEATURES OF MATLAB

[1] Interactive background meant for aim investigation as well as resolving the difficulty.

& [2] MATLAB is a sophisticated language intended for creating, calculating as well as building up a purpose.

&

[3] It contains numerical tasks such as figures, calculus, sorting out, developments, mathematical integration, as well as working out equations.

[4] Graphics integrated intended for visualization.

&

[5] Intended for generating traditional plot integrated equipment's is accessible.

IV. SYSTEM DESIGN

A. Methodology of Design

The item GPS Receiver as showed up in fig 4.1 includes a radio recurrence frontend, a simple to computerized converter, and a product GPS program that continues running

on PC. The radio recurrence fr0ntend d0wn-changes over the banner from radio recurrence to middle recurrence, and the simple to advanced converter tests the transitional recurrence hail. The different get ready including signal securing, following, data translating, and fathoming position are inside and out executed in programming using signal preparing procedures. The area C/A c0de and transporter copy signs are pre-created, secured in mem0ry, and utilized bleakly in the midst of banner securing and following.

B. Acquisition

Obtaining is a coarse synchronization handle used to secure the flag for expelling code stage and Doppler Effect. Following is the subsequent stage done to expel code and transporter recurrence, this is a fine synchronization handle. The objective of securing is to play out a relationship with the approaching sign and a PRN c0de. Here the PRN code is created utilizing the straight input move registers (LFSR).Navigation module contain the data about the circles and the position of the flag to explore.

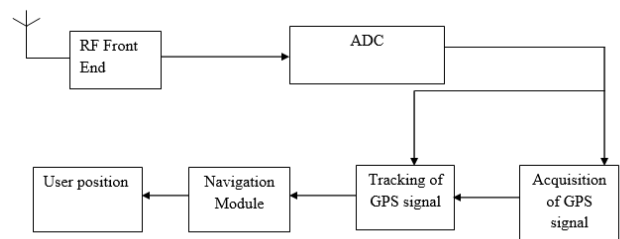


Fig 4.1 GPS Receiver block diagram

The front-end gadget that changes over the radio recurrence motion from the reception apparatus to a middle recurrence GPS beneficiary board. A simple to-computerized at that point digitizes the yield motion from the RF front-end. The information is then prepared utilizing Matlab package for projects to accomplish procurement & following of GPS applications.

C. TRACKING

Satellites always move in the circle. Consequently the separation between the transmitter and collector differ a considerable measure. Henceforth once if the flag is obtained, the following must be begun by synchronization technique for privately produced bearer and privately created code.

D. TRACKING METHODS

[1] **Code tracking:** Code following is the way toward progressing or postponing the neighborhood imitation code. Early code, Late code, Prompt code are the three copy been created. These three sorts of code are contrasted and the transmitted flag. The code must be half of the chip remove from incite code to such an extent that if the early or late code is expanded than the approaching code then it corresponds with other PRN chip, consequently blunder happens. Code following strategy is in this manner done utilizing Delay Locked Loop (DLL).The code following technique is to create a correct code imitation and it is corresponded with the

approaching sign.

[2] **Carrier tracking:** To demodulate the route information effectively, a correct bearer wave copy must be produced. To track a bearer wave flag, stage bolt circles (PLL) or recurrence bolt circles (FLL) are frequently utilized. The issue with utilizing a common PLL is that it is delicate to a 180phase move of the information flag transporter wave. Because of route bit moves, the PLL utilized as a part of a GPS beneficiary must be heartless to 180 stage shifts.

V. IMPLEMENTATION

On in regards to of framework plan and improvement the stacking and information instatement is prepared with PRN code procurement and stacking of inward information factors of GPS, the code must be changed over into baseband for handling. The procedure is then proceeded with testing for coordinating and adjustment. This is required to keep up a standard esteem thresholding in summed up securing of flag from GPS. On progress, set the recurrence extend and apply cross relationship for characterizing the scopes of information flag. With the effectively gaining the standards, rely upon the satellite ID and attach the progressive coordination for handling.

VI. RESULTS AND DISCUSSIONS

A. Signal Acquisition Process

The GPS signal is supposed to be acquired and thus the related system is deployed and developed for overall signal retrieval as shown in Fig 6.1 below.

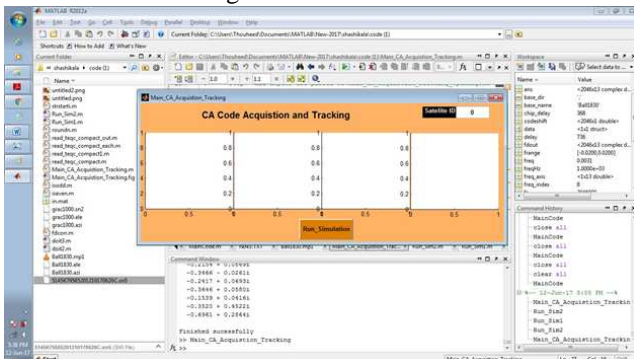


Fig 6.1 CA Code Acquisition and Tracking Main File

A file console with GUIDE supporting application framework is shown for the extraction of codes of GPS signals from the main system under satellite view in random. This process is supposed to be run on various intervals of time for various values to fetch the signal and compute and then compare the same with threshold value signals of FFTs to fetch the strong signal and eliminate the other half.

B. Signal Acquisition and Computation

Once the simulation is initiated, the process begins and the overall signals are retrieved from one PRN value to another based on the intervals of time. This is continuously shown in Fig 6.2 onwards

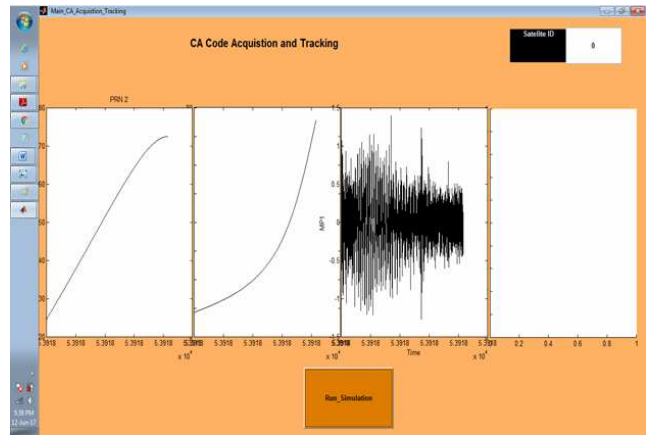


Fig 6.2 Acquisition of Signal at PRN 2

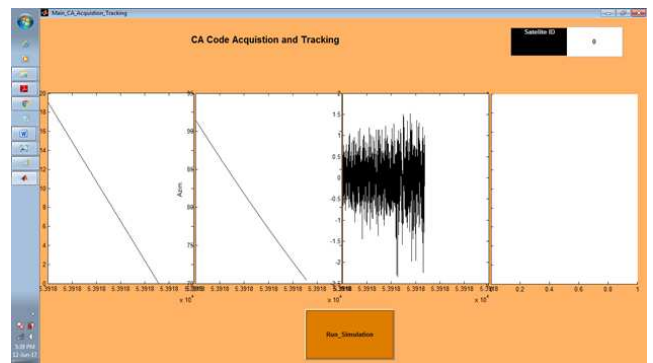


Fig 6.3 Acquisition of Signal at PRN 3

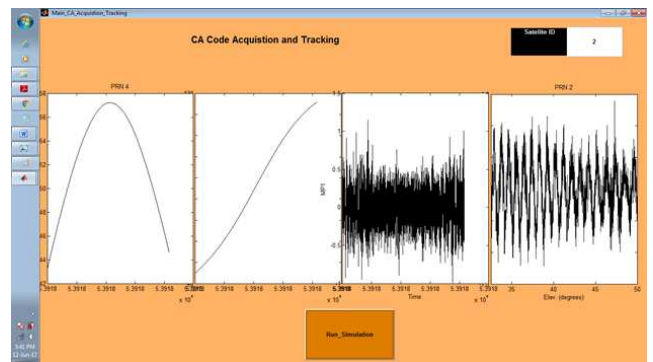


Fig 6.4 Acquisition of Signal at PRN 4

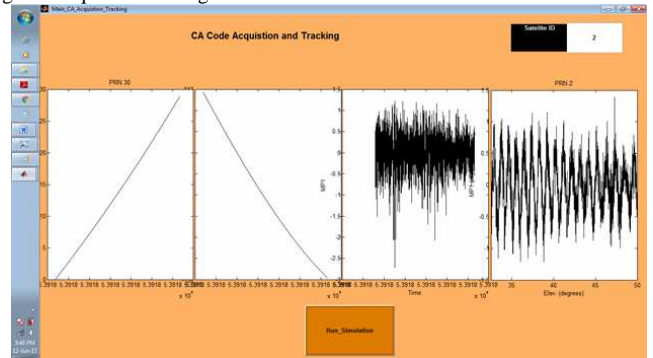


Fig 6.5 Acquisition of Signal at PRN 27

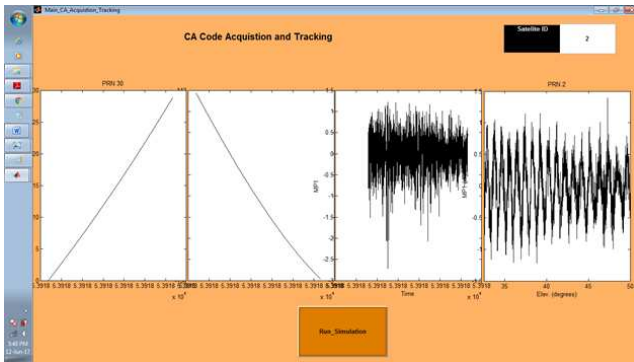


Fig 6.6 Acquisition of Signal at PRN 30

C. Signal Comparison 3D Analysis

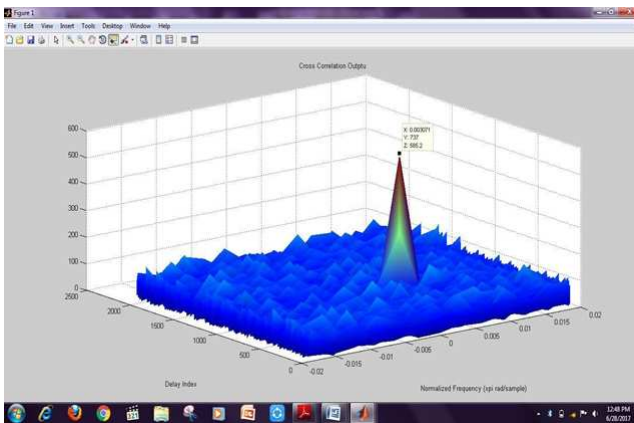


Fig 6.7 Output Analysis on GPS Signal that is the acquired signal

VII. CONCLUSION

The planned convention was actually meant to accomplish a higher estimation of flag quality of any GPS flag considers on different securing approaches. This in-certainty has enhanced the general constancy of the framework.

Distinctive satellites were looked for a given scope of frequencies utilizing the FFT seek approach .Proper securing of the satellite was checked graphically. The recurrence and the code stage at which most extreme relationship control happened were gotten .The gained motion from the FFT hunt will be followed in which the cross connection of the signs performed and the followed flag will be shown.

VIII. FUTURE SCOPE

[1] The Matlab code that is generated here can be used to for further implementation of tracking and acquisition using the Field programmable gate array (FPGA) in real time based applications.

[2] Filters with higher precision such as Kalman filters can be used to in order to increase accuracy in terms of output delay for tracking and other purposes.

[3] By tracking output at 20ms,its still easy to extract the Navigation message transmitted by satellite.

[4] Sub functions can be included in order to increase the precision in data collected, by using the error signal transmitted from a reference point .Thus we can implement a Differential GPS.

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