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GPS Jamming Detection

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Introduction

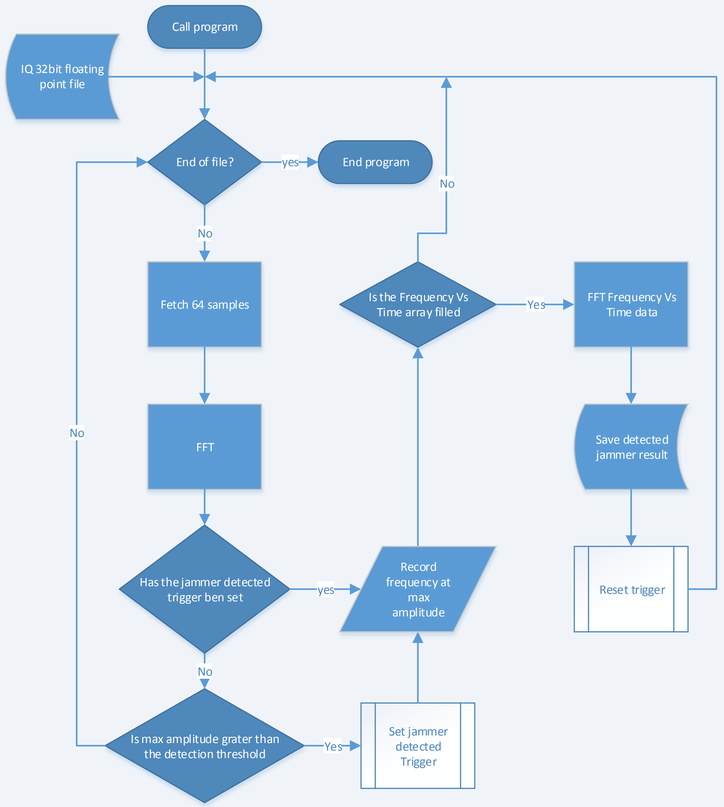
GPS systems are used for much more than finding your way home or tacking cargo. In fact GPS has become an essential part of modern day systems; medical pagers, cellphone towers, and stock market trades utilize the precise clock information from GPS to hand off signals between towers or time stamp transactions. Because of this GPS jammers have become increasingly hazardous for modern infrastructure.

Solution

To help reduce the use of GPS jammers, primarily used by civilian drivers, a portable detector was developed. The first design consideration was functionality.

The device is aimed to work independent of the signal capture system. In order to accomplish this a set requirement was established that the detector would use IQ data as its data input do to its common use and formatting standards.

To allow for portability, the device should by implemented on a FPGA. This will also decrease the processing time of the detection algorithm.



Program

The program operates on a Xilinx Zedboard using the zynq 7000 FPGA.

User Input

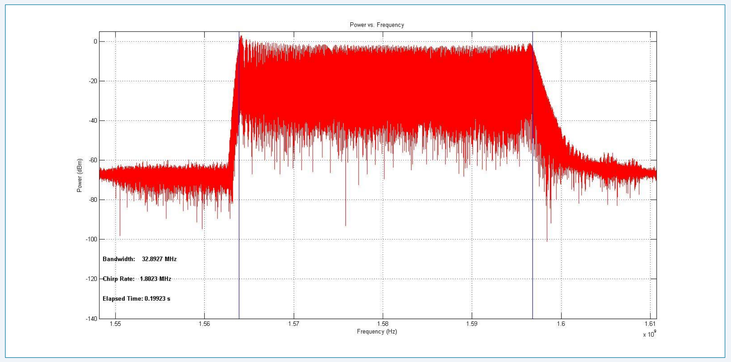
- Program expects a .tar file containing XML and 32bit floating point interleaved IQ data.
- Device communicates with an external computer via TCP connection

Output

- Exports a text document containing the chirp rate of the detected jammer.
- Aluminates an onboard LED while a jammer is detected.

Performance

Optimization is currently ongoing. In order to minimize the probability of a false alarm or a missed detection, the program must be rigorously tested over a wide range of jamming signals to find the ideal thresholds. Due to the highly illegal nature of jamming a GPS signal, test signals must be synthesized in MATLAB.



Conclusion

The program satisfies all requirements but may be improved by:

- Adding additional algorithms to distinguish between CW and Pulse jammers
- Using a cross correlation algorithm to increase dynamic range by effectively reducing the noise floor
- Preforming a statistical analysis of the detection algorithm to optimize trigger levels

Resources

1) Logan Scott, Introduction to GPS Interference and Mitigations, January 2015

Department of Electrical and Computer Engineering