



Trilateral FM Signal

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Background and Project Goal:

The goal of the project is to realize FM signals source positioning based on time difference of arrival(TDOA) algorithm that would benefit aided-navigation and indoor positioning. Indoors, for instance, the GPS positioning is unstable due to the weak satellite signals. With the help of trilateral positioning, the positional accuracy is higher. The structure of the project include two main parts: the hardware, which apply to data acquisition, and the software, which corresponds to achieve the TDOA algorithm.

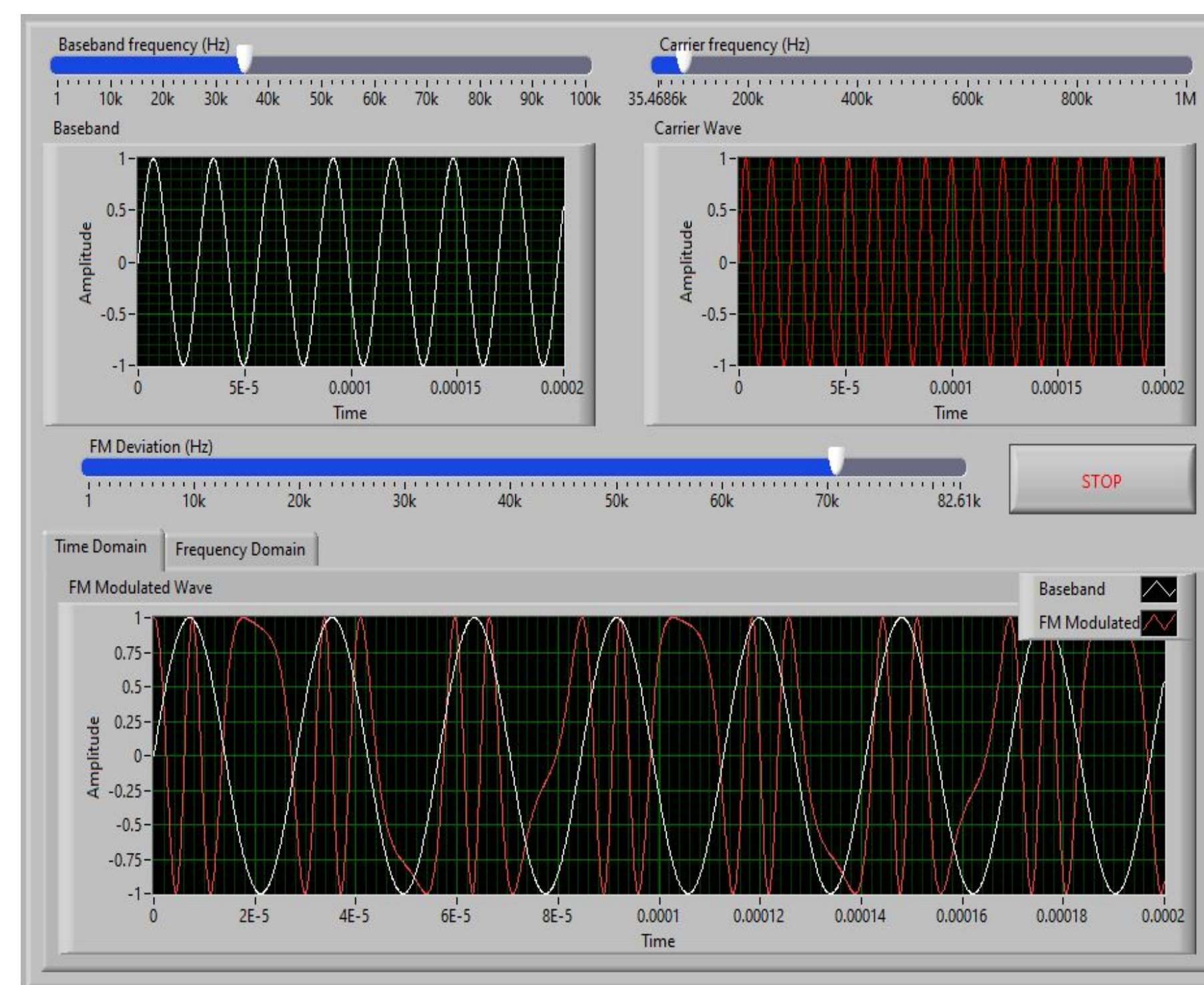
Materials:

- Two receiver units; each containing
 - FM radio antenna to receive the 99.9 MHz FM signal
 - USRP 2920 converts the signal into data for the Arduino
 - GPS module for the location of the receiver
 - Arduino UNO process GPS and radio signal data and send it to the computer
- FM Radio source that sends a 99.9 MHz signal
- PC with MATLAB-based program to process signal data

Milestones:

1. Learning how to use the software(LabVIEW and MATLAB) and understand the basic concepts of multilateration and radiolocation.
2. Simulate a FM Radio Signal and research: Kalman filter, Doppler effect
3. Program the Arduino to process data from the GPS module and USRP 2920 and send it to the PC
4. Implement TODA (time difference of arrivals) algorithm.
5. Use PC to process data received from four receivers to determine the location of the FM Radio Source.

Progress and Future:

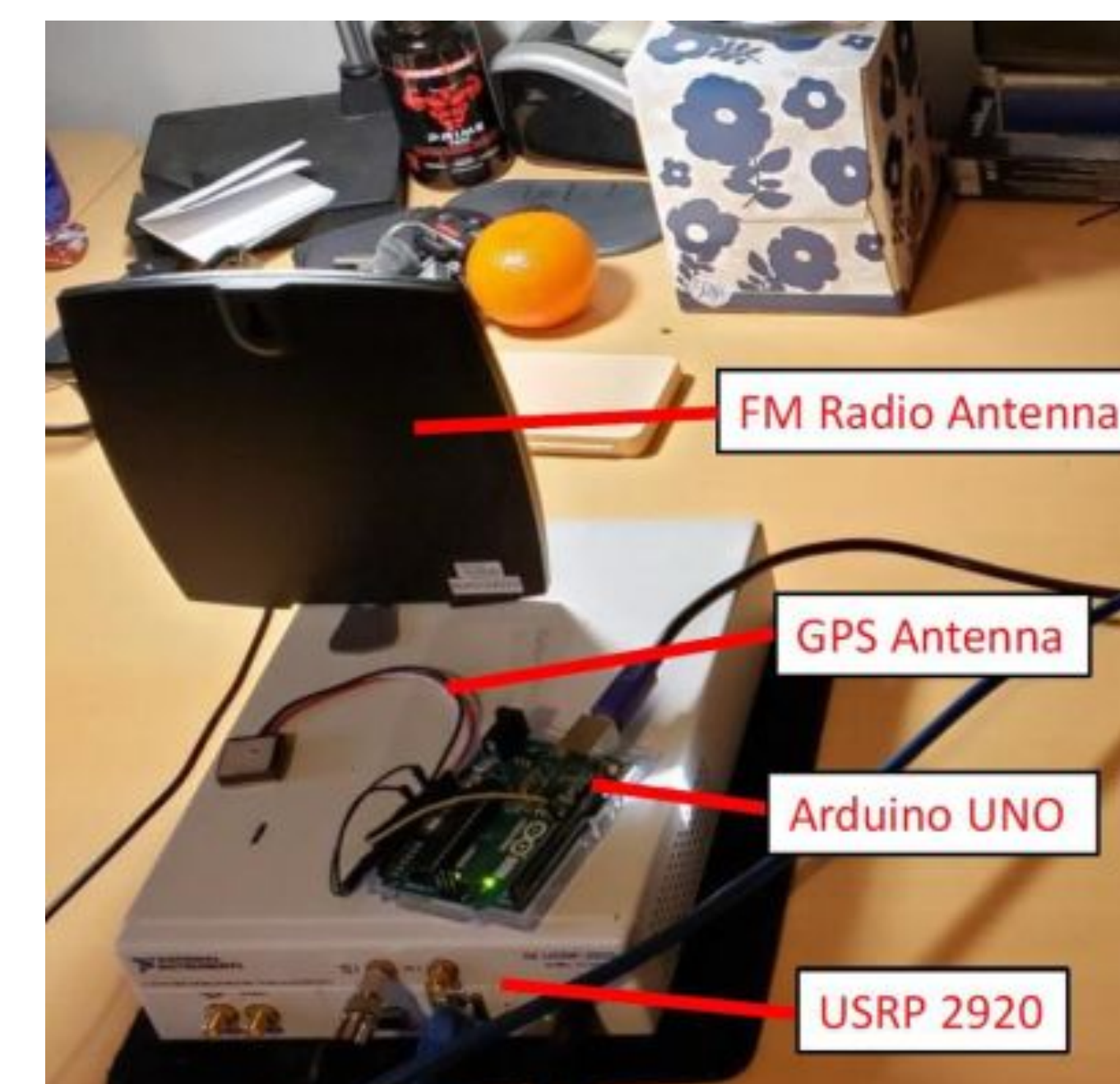


LabVIEW FM Signal Simulation

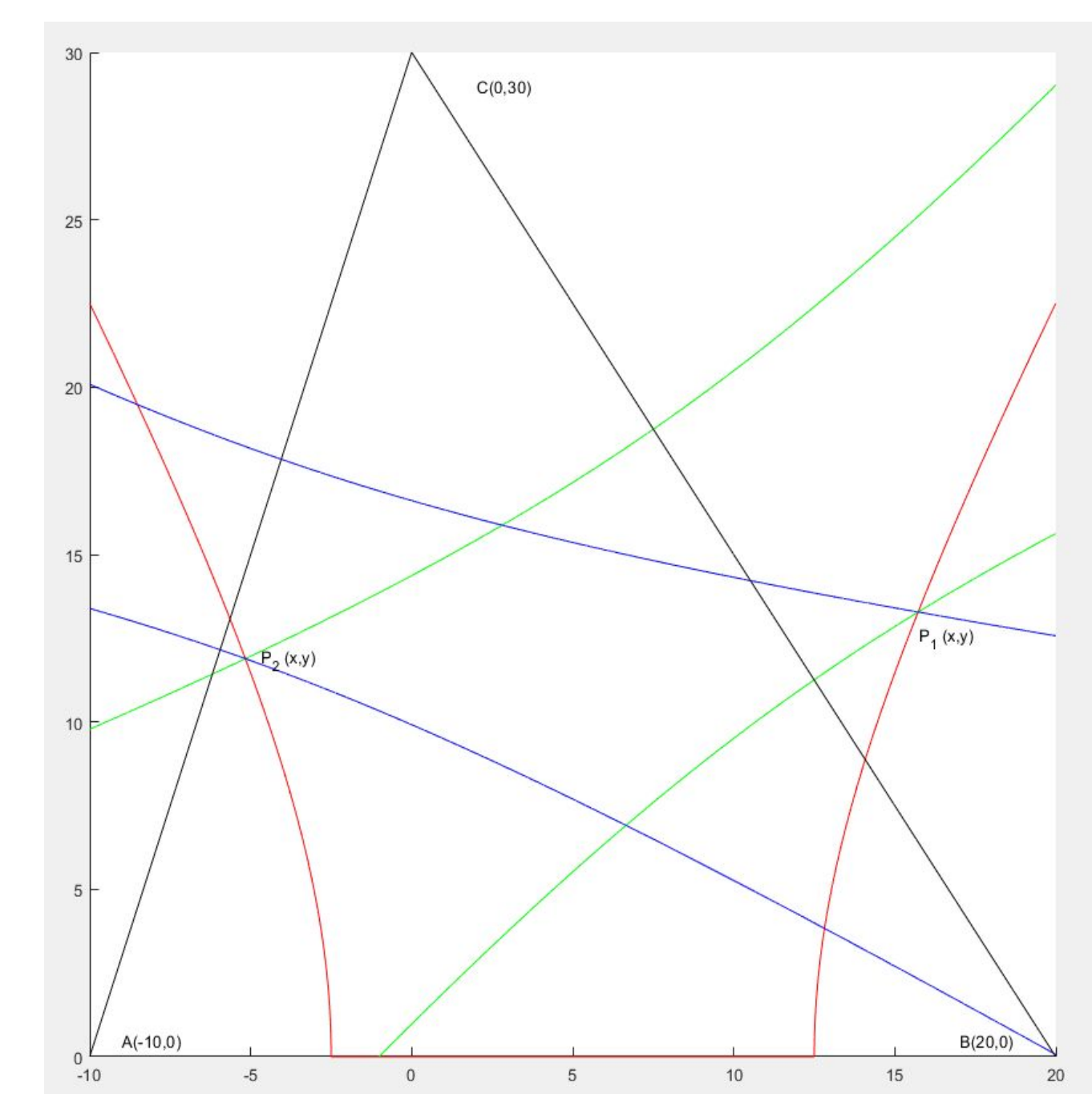
Reference:

Guolin Sun, Jie Chen, Wei Guo and K. J. R. Liu, "Signal processing techniques in network-aided positioning: a survey of state-of-the-art positioning designs," in IEEE Signal Processing Magazine, vol. 22, no. 4, pp. 12-23, July 2005.

Shareef, A. and Zhu, Y. Localization Using Extended Kalman Filters in Wireless Sensor Networks, 2009. [online] Digitalcommons.library.umaine.edu.



On the left, we use the LABView to simulate an FM signal so that we can test the filter by the software. On the next step, we will record the FM signal we received from the USRP. The data will look similar to our simulation except the noise part.



MATLAB Multilateration Simulation



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