

DECEL week in Tour: 3-7 July 2023

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Ultrasound object detection and measurement

This project describes an ultrasonic sensor that is able to measure the distance of objects that we place in a tank full of water. The sensor is based on the measurement of the time of flight of an ultrasonic pulse, which is reflected by the bottom of the tank.

The depth can be determined by measuring the time of the initial echo, while the size of objects can be measured by employing a sweeping motion of the servo.

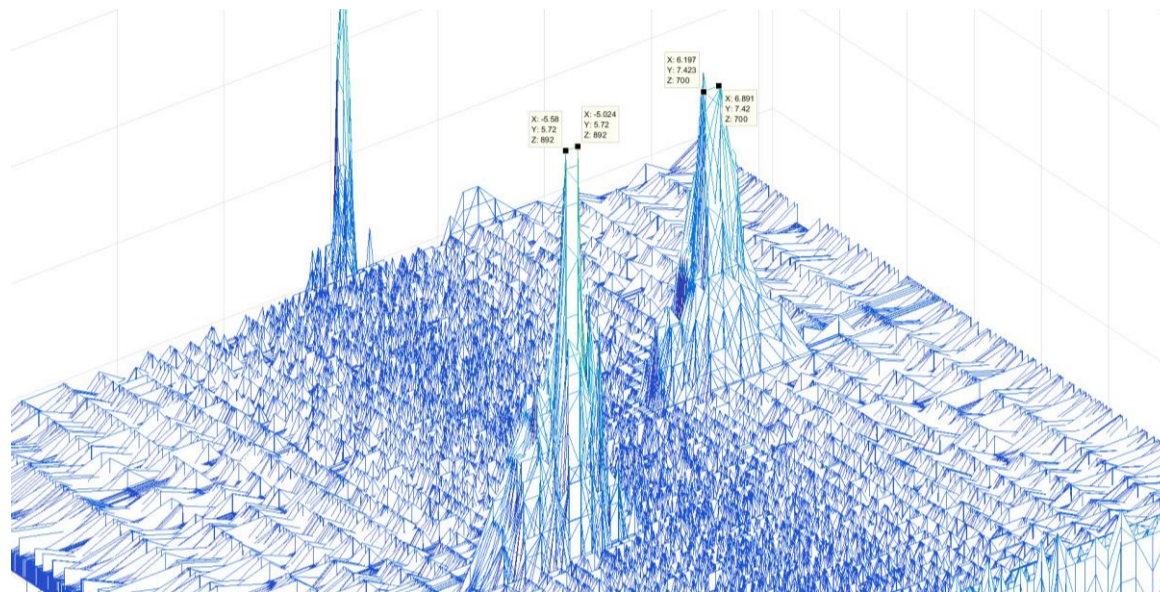


Figure 1. Representation of two parallel wires of different thicknesses in the tank

1. Project context and objectives

This project was done under the DECEL (Digital Electronics Collaborative Enhanced Learning) training C2 week, with the initial goal to see in dark waters and to collaborate in an international team.

Objectives:

- Measure the distance using ultrasound;
- Use a FPGA to acquire ultrasound signal;
- Use MATLAB to process data and represent it;
- Use the RedPitaya ecosystem.

2. Challenges

- Accuracy;
- Converting time to distance;
- Reduce the noise (Echoes).

3. Results

- It was possible to detect echoes from the ultrasound sensor and visualize them in the oscilloscope, and acquire and visualize them in MATLAB as well as post-process the data;
- It was possible to determine and verify the depth of the tank and multiple objects inside it;
- It was possible to represent the axis in terms of distance instead of time to easily visualize what was present in the tank.

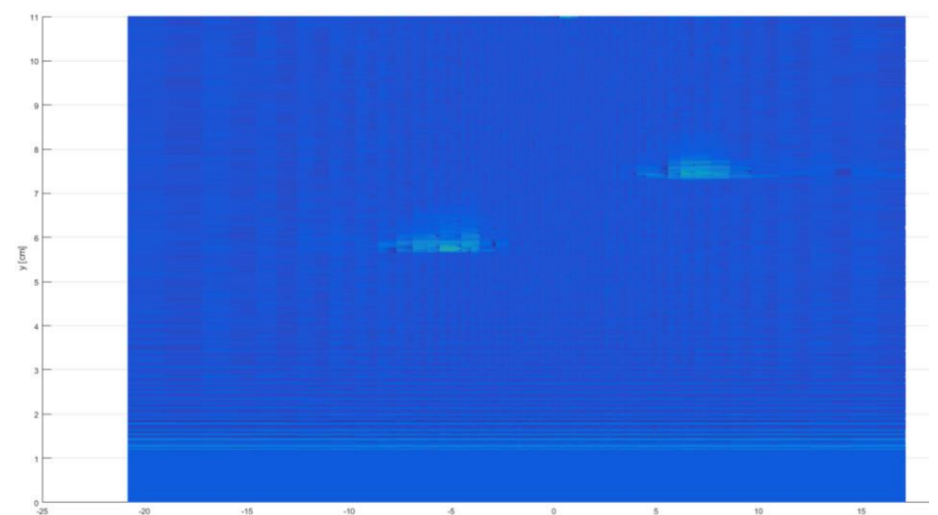


Figure 2. Two parallel wires

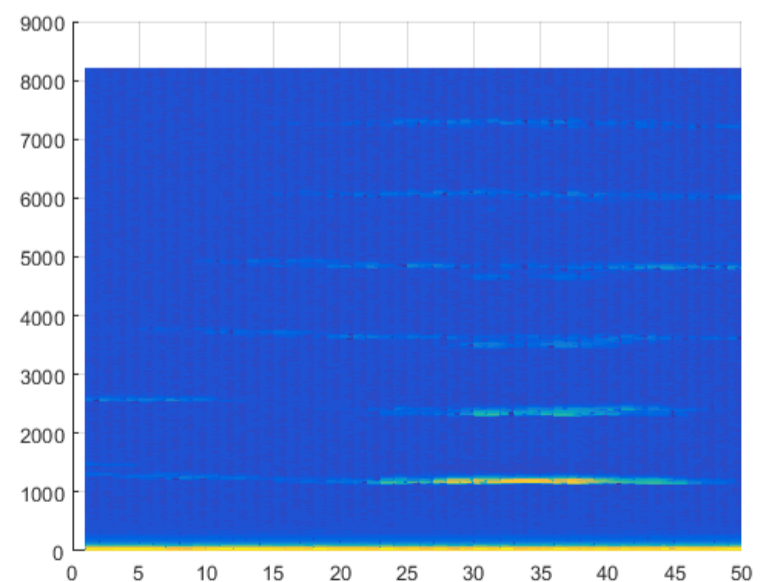


Figure 3. First try of the US system

