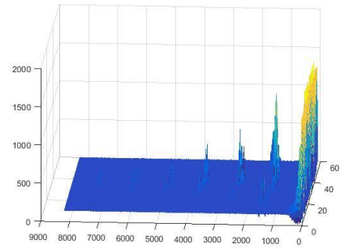
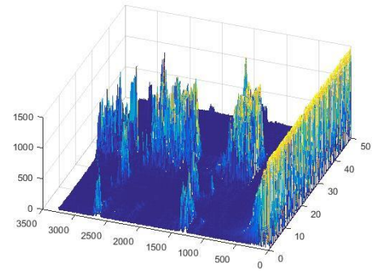
DECEL : Digital Electronics Collabora anced Learning

Co-funded by the European Union

Ultrasound board and Redpitaya ecosystem





Dedicated low level solution

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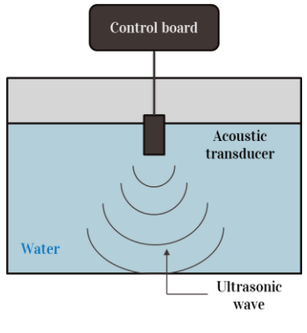
Abstract: The aim of the project was to representate a 2D image of an object at the bottom of the tank. In order to do that we had to capture the signal using a servo motor and making changes to its control. After that we had to process the image with the data that was extracted. Even with some technical issues we presented a solution to make this project work. We concluded that the main way to accomplish the goal of the project is to cooperate with the elements of the team and make the knowledge equal between each element.

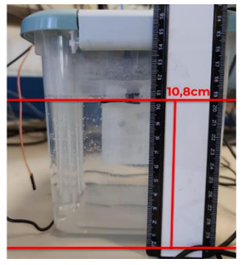
1. Ultrasound Board and Redpitaya Ecosystem

In this first part we propose to measure and digitalize a single ultrasonic pulse/echo in a tank filled with water. To do this, we need a piezoelectric ultrasonic probe, connected to a pulser board, an oscilloscope, a trig signal generator and a Redpitaya board.

- 1.1 Comparative study between signal reading and physical measurements

Here we compared the Time of Flight (ToF) values obtained by the signal analysis from the osciloscope with the ones from real physical observation measured with a ruler. By using the ruler, the distance bewteen the transducer and the bottom of the water tank was obtained.



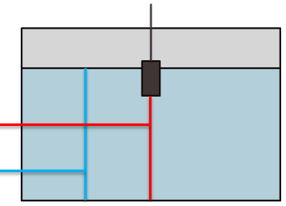


1.2 Precise calculation of the transducer level and the water level

In this part we have used the reflection signal and the first eco to calculate the distance between the height of the transducer and the the level of the water

$$d1 = v * t = \frac{1500*0{,}000144}{2} = 10{,}8cm$$

$$d2 = v * t = \frac{1500*0{,}000168}{2} = 12{,}6cm$$



2. Modification on the servo motor control

In this part we increased the sample frequency in order to have a shorter acquisition time and we changed the decimation factor to choose the best sample and the average to normalize it. Then we decreased the range of the position of the servo in order to have a smaller angle so that we can focus on the region of interest and we changed the offset position to the central position.

3. Considerations

Our amplifier was broken so all of the work was delayed, which caused us to run our code in another redpitaya system and be dependent of the time that other group spents to run their code. As a possible solution we could improve the image processing part of the project, by adding some zeros at the beginning of the data, to make the image less curve and more linear. As the sensor captured to images, we could use the convolution of the two images and remove the high frequency noise using a low pass filter. Also by representing the image in black and white we could see better the representation of the object at the bottom of the tank.

4. Conclusion

With this project we learned how to collaborate and work in team and explore the field of digital electronics and image processing. We learned to use and explore the software inside the redpitaya and to work with ultra-sounds waves.