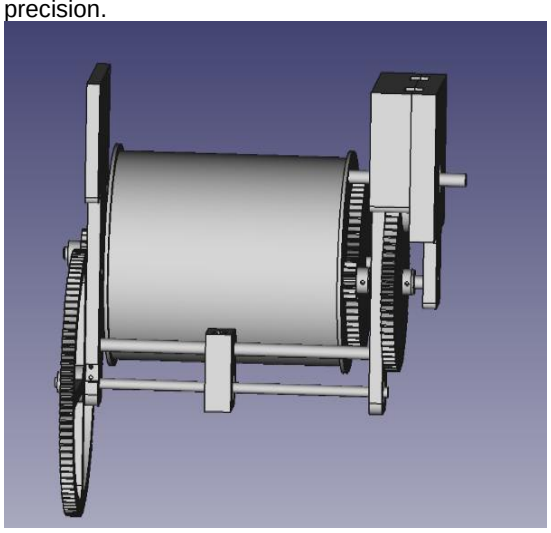
Development of a Winch for an Autonomous Surface Craft

Ivan Pantelic

Professor : Alcherio Martinoli
Assistant(s) : Alexander Bahr

In the DISAL laboratory, with the help of the Hydromea startup, an autonomous surface craft was developed. The goal of this vehicle is to autonomously gather information on a lake with the multiparameter probe YSI EXO2. It's a commercial datalogger provided with sensors. The problem is that the probe has to be lowered in the lake to measure the parameters. This project aimed at finding a solution to this issue: develop a winch that would be attached to the ASC to lower the probe at different depths with precision.



Second design with CAD

The main scope of the project was as follows:

1) Draw a mechanical design and fabricate it

2) Include a leveler for the string

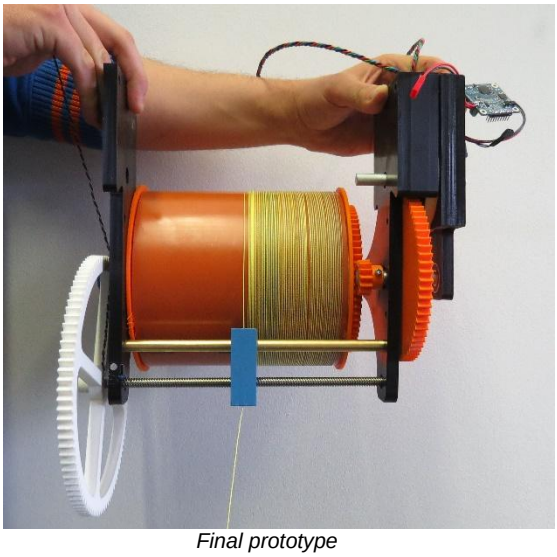
3) Develop a simple circuitry with wireless communication

4) Achieve a waterproof enclosure

4) Produce the prototype

5) Test it

In the beginning of the project, a portfolio of solutions was given to analyze the problem. Then with the help of Mr. Bahr, an elegant solution was selected. The main idea was to design a barrel large enough to fit only one row of wire on it. This way, the calibration of the winch is the easiest, as the diameter doesn't change. Then the mechanical design itself began with the software Freecad. The prototype was developed in order to achieve the project within the time limit and with the use of the tools present at the DISAL laboratory; mainly a 3D printer and some hand tools. The main issue was the choice of the motor: since the whole system should be waterproof, we selected a motor basically used for thrusters from Hydromea. This solution simplified some aspects and raised other issues. I proposed a solution based on two 3d printed covers for the shaft of the motor.



Final prototype

After the production of a first prototype, a second one was built. It worked very well although it was quite noisy, due to the quality of the 3d printed gears. The next step of the project consists in testing the winch before its launch on the lake.

In this project, I tried to fulfill the goals in a global view of the system, especially regarding the time constraint and budget. Nonetheless, the CAD models I developed are modular and can be easily reused for other projects involving the waterproof motor.