

Cousteau-II: A semi-autonomous underwater recording system for long-term recording

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Motivation and Introduction

The time course of data plays a significant role in environmental influences. For example, it can be remarkably interesting to see to what extent the location of a company at a lake has an impact, or what effect the addition of certain chemicals has on a lake. There are many flooded mining lakes in Germany with unfavourable PH values. Research is being done on how to improve them. Infield tests it is therefore usually necessary to be able to collect data about a water body over a more extended period from different positions. For this purpose, it is essential to keep a sensor-rich device in the water for a more extended period, which can travel from these positions. This can also be realised by a diver who dives the points several times. Still, the fluctuating PH values and even the diving and the associated deco premiere represent an increased risk as well as an increased difficulty.

The use of low-cost mini-submarines is a candidate to meet these challenges. On the one hand, no decompression breaks are required, and on the other hand, available systems can penetrate to a diving depth of 100 meters and more in-depth. In combination with self-localization algorithms, which enable live 3D reconstruction and are used in autonomous robotics, orientation and localization tasks can also be solved with a good view of the subsurface [Block et al. 2018]. This poster shows the extended semi-autonomous underwater recording system Cousteau-II, which was extended by solar panels for long-term recording. It can dive deep without decompression and to record various data via its sensors.

Construction

The basic building block was a BlueROV 2 from Bluerobotics. This has already been equipped with motors for easy movement and a few sensors to measure the temperature of the water or the current depth. It has also a software to control the submarine. Within the project, a buoy for the submarine was developed, so that a direct connection via cable is no longer necessary. Therefore, distances of up to 500 meters can be bridged. These sensors were extended by a sonar. By this, the underground of the respective water can be recorded very precisely. And depth maps of different standing waters can be created (see Fig. 1).

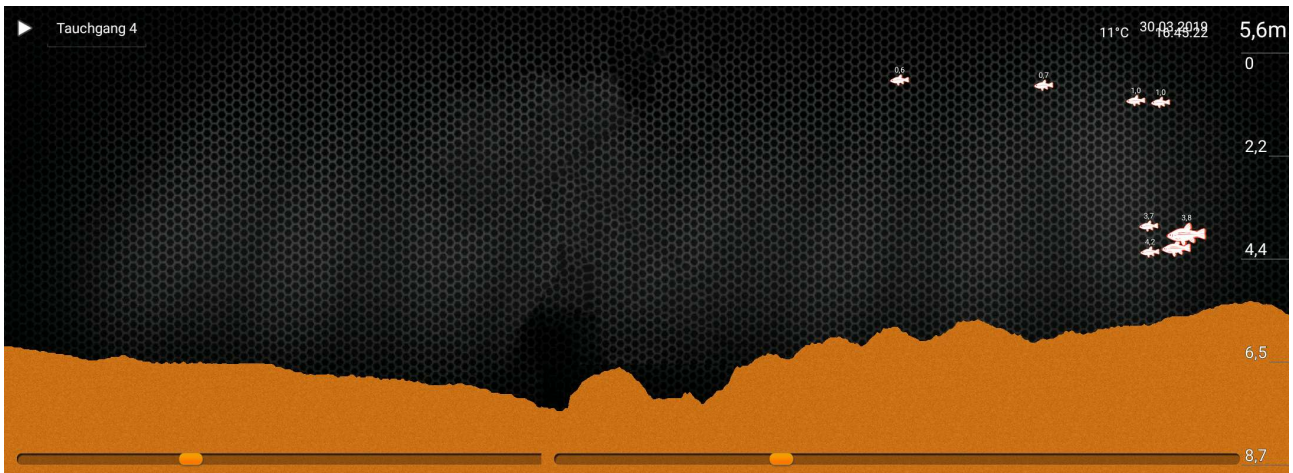


Fig. 1. This is the data of the sonar sensor Deeper Pro Plus. The available data is read outlive and also transmitted via the radio link. You can see a time series during one of the dives at Lake Keutschacher See.

On the submarine, an additional camera was installed on the bottom. With this camera, the ground under the submarine can be observed exactly. When mapping lakes and their bottoms, it is possible to detect possible foreign bodies in the lakes and to point them out to the user. In this way, the possible pollution of a lake can be determined. It is also possible to indicate the points where this pollution is present in order to carry out a cleaning operation.

There exists a flap mechanism for the submarine so that it will be possible to take samples at different positions or at different times in the water. This allows a more accurate water analysis over a longer period of time. Also, the buoy was extended with solar panels. This makes it possible to leave the boat in the water for a more extended period without changing batteries and to run a genuinely automatic analysis. The buoy was also expanded with an LTE module, which allows a continuous query of the current system parameters and sensor values. As well as the possibility for the submarine itself to give an alarm at any time if a problem occurs.

By mapping different water bodies and recording different environmental data, a model of various water bodies can be created. For example, it is possible to record the temperature of a lake over a more extended period of time at different dive depths and check how it changes over time or due to environmental influences such as the establishment of a new company or opening for bathing.

Experiments and Results

During a dive in the upper reservoir of Oberwartha in Germany it was possible to record the sensor data over a longer period and compare different areas of this lake. It was also possible to map small areas with the sonar. By extensions within the system it will be possible to record more data and to relate them to each other.

References

Block M., Gehmlich B., Bommhardt-Richter M., Bochmann H.: "Archaeological underwater documentations with Manio", Congress Visual Heritage, 23rd Conference on Cultural Heritage and New Technologies (CHNT 23) in Vienna/Austria, 2018