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Automatic georeferencing for 3D underwater reconstructions using indirect GPS information

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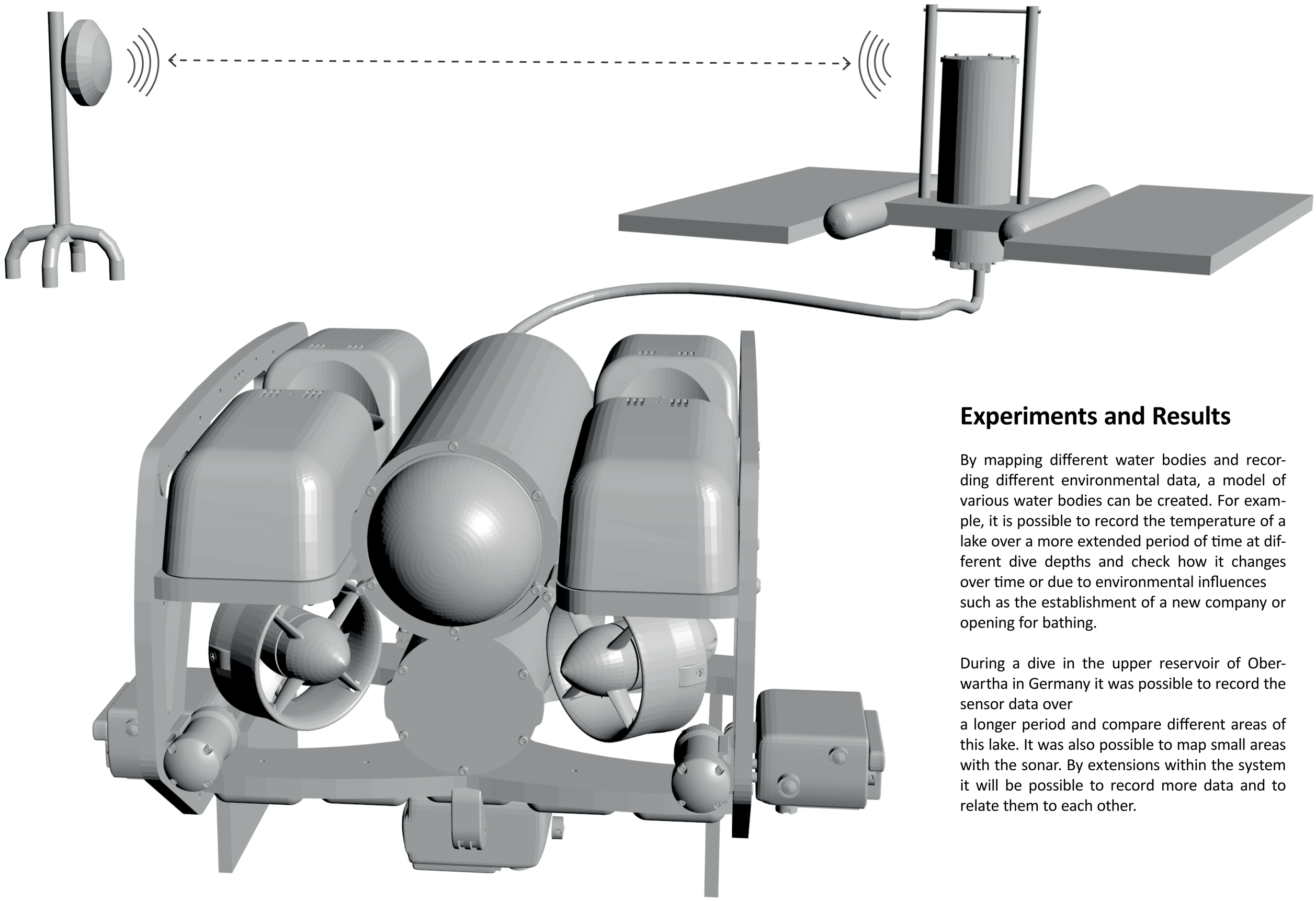
Introduction and motivation

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[1,2,3].

UUV Cousteau-II: Technical summary

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

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.



Experiments and Results

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.

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.

Conclusions

This advanced system shows great potential in the long-term monitoring of water bodies and the mapping of irrigation systems. This makes it possible to detect in archaeological excavations if there is any influence on the water and to classify the excavation sites. It could also be possible to predict the influence in the retrospective time. Through the extension of the solar panels it is also easy to monitor water bodies over a longer period of time and to record a better temporal course.

Bibliography

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