

Embedding for Robust Electronics

Sensor Skin for an Autonomous Underwater Vehicle

Fast Facts

1. Textile skin of autonomous underwater vehicle (AUV) equipped with multiple sensors.
2. Waterproof distributed network architecture for electronics using miniaturized sensor nodes.
3. Highly robust sensor modules for metal detection, movement monitoring, pressure and human machine interface.

The vehicle: The bionic autonomous underwater robot was inspired by a manta-ray. The vehicle's body contains a number of cameras and sensors for environmental exploration, monitoring and topographic mapping of the seabed. The propulsive wings consist of a motored skeleton that is stringed with a textile skin. The skin was equipped with a sensor network to augment the vehicle's sensing functionalities.

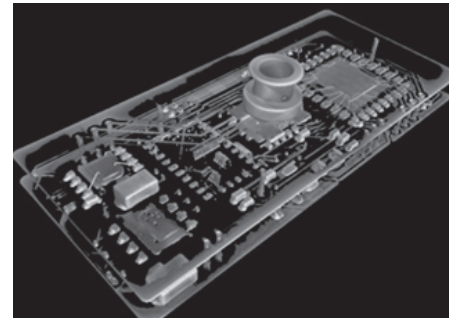
Sensors: Distributed 9 axis acceleration sensors enable the movement control of the wings and allow for improvement of the propulsion characteristics. Three large area textile touch sensors were implemented as an underwater human/machine interface. Textile antennas on the bottom side of both wings allow the detection of metals. Among the vehicle's missions are monitoring of underwater constructions or the locating of disposed ammunition on the sea floor.

Network: All sensors are integrated into a network. The backbone is a CAN-Bus integrated into the textile skin. At defined positions receptacles with multi-pin-connectors are provided in the bus. Sensor modules with the complementary connectors were inserted into the receptacles and through the pins electrically connected to the bus. The receptacles were then closed with a lid and flooded with a protective oil. The construction allows a shift exchange of sensor modules, e.g. for different mission profiles. Textile sensors were fed into the connecting receptacles. Data acquisition and processing takes place in the sensor modules.



The bionic autonomous robot platform "Manta"

Modules: Each sensor module has a hard wire address in the network, so that they can be identified individually. Sensor modules were realized using embedding technology, i.e. the integration of most of the electronic components into the build-up of a printed circuit board. This allows the miniaturization of the module while simultaneously facilitating their very high robustness. Only the pressure sensor, due to its size, and some LEDs, for visibility, had to be mounted on the outside of the modules. The project Bionic RoboSkin was sponsored by the BMBF.



X-ray image of the sensor module with embedded components

Project Partners:

EvoLogics GmbH, TITV Greiz, Sensorik Bayern GmbH, BALTIC Taucherei- und Bergungsbetrieb Rostock GmbH, and GEO-DV GmbH

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