Using a ROS-Based Low-Cost System for Bathymetric Surveys

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SUMMARY

Much of the world's oceans is uncharted. Crowd-sourced bathymetry has the potential to improve our knowledge of the oceans and to provide opensource bathymetric charts for the public. Installing bathymetric measurement equipment aboard a large number of vessels, such as commercial and pleasure craft, requires a low-cost, accurate and easy-to-use bathymetric measurement system. Within a master thesis such a system was designed and tested.

In addition to crow-sourced bathymetry, this MSS may be useful for hydrographic organisations with modest budgets, such as educational organisations and the national agencies of developping countries.

Using low-cost sensors and a software framework based on Robot Operating

System (ROS) software, a low-cost Multi-Sensor System (MSS) was developed

and tested. The system was successful in producing geo-referenced depth estimations.

Vessel attitude is determined using a temperature-compensated MPU-9250

Micro-electromechanical System (MEMS) array. Timestamps are based on

a PPS (Pulse Per Second) signal from a GNSS module, which uses atomic

clocks on satellites as a

reference.

Depth is determined based on water temperature, salinity and the time taken

for an acoustic pulse to travel from the vessel transducer to the sea floor and

back.

All sensor data can be recorded and played back using ROS software. A

bathymetric map can be produced and visualised in 3D during a survey. The

Raspberry Pi 3 used for this task is susceptible to freezing if 3D visualization

is done during a survey due to insufficient processing power. Therefore, as

an alternative, it is possible to record sensor data during a survey and process

this data after concluding the survey. It was found that survey data could be

collected non-stop for 34 days before an SD card (128 Gigabyte) swap was

required.

First tests have shown good usability and good results. Further tests should be carried out to determine the system's accuracy.