ROV Hovering

Autonomous Vision-Based Station Keeping for a Remote-Operated Vehicle (ROV)

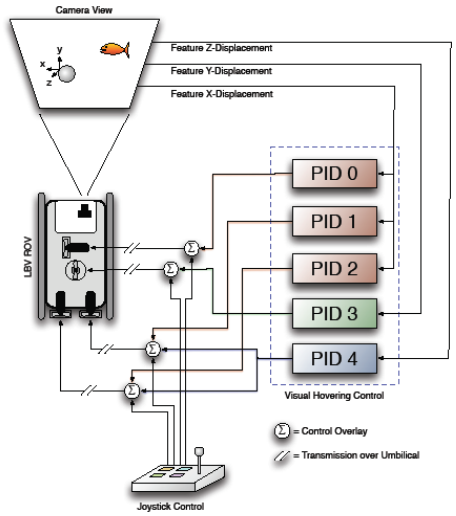

Fig. 1: Structure of the ROV Hovering system controller

Fig. 2: Application of the autonomous station keeping on the LBV 150B² in the underwater testbed of the Robotics Innovation Center.

ROV Hovering

In recent years, the number of small- and middle-sized remote-operated vehicles (ROV) has risen significantly. The main task of those systems is the inspection of miscellaneous underwater structures, e.g. sluices or pipelines. Due to their low weight and relatively small size, these systems are quite susceptible to external disturbances like currents or the effects of the umbillical (control cable). Therefore it is very difficult for a pilot of such a vehicle to hold a steady position in front of the particular underwater structure.

This is the context the ROV Hovering project is set in. Comparable to the driver assistance systems in modern automobiles, a vision-based station-keeping control was developed within the project. Once activated by the ROV pilot in front of an underwater structure, the vehicle is kept on position automatically and the pilot can fully concentrate on his inspection task.

The core of this assistance system is a computer vision algorithm which automatically detects salient image regions in the video stream of the ROV. Subsequently, the movement of these image regions is tracked and the movement of the vehicle is deduced from this data. Finally, a total of five PID controllers control the thruster of the ROV (fig. 1) and compensate the detected movements.

A special focus in conjunction with the development of the particular computer vision algorithms lies on the development of particularly robust methods, which allow usage in varying environments without a tuning of the system. This focus is the basis for a fast transfer of the developed technologies from the lab to the real-world application.

As a first demonstrator, the LBV 150B² by Seabotix was equipped with the described autonomous station-keeping control. Figure 2 shows the vehicle in the underwater testbed of the DFKI with activated hover control.

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