Advisor's review of Master's thesis

Thesis author: Andrés España Cabrera

Thesis title: Rapid Prototyping of Mobile Robot Control Algorithms

Advisor: Ing. Michal Sojka, Ph.D.

The goal of this thesis was to enable rapid prototyping of control algorithms in distributed systems based on Real-Time Publish-Subscribe middleware called ORTE. This middleware has already been used to build several large-scale applications as well as smaller ones. One smaller application was a mobile robot developed at our department. It uses ORTE internally, but the control code has had to be written by hand. This thesis aimed at replacing the "manual coding" with automated code generation from Matlab/Simulink.

To some extent, this goal was fulfilled. The ORTE is integrated with Simulink and one can create robot control algorithms in its graphical environment. However my initial wish was to achieve much better level of integration and develop a more generic solution that could be used not only for a particular robot but for most applications based on ORTE. Unfortunately, this has not been achieved. Similarly, development of more complex Simulink-based algorithms for controlling the robot has not been done. I believe that the reason is that the student had almost no background in computer science/engineering and this resulted in long delays in the initial "study" phase of the thesis.

As far as he could, the student worked independently. He often came to consult his progress or the lack thereof. I have to admit that due to my other duties it sometimes took me quite long time to respond his questions. However, he was made aware of this situation before he had subscribed to the thesis. In summary the cooperation with the author was good albeit slow. I believe he learned a lot during the course of the thesis.

I grade the thesis as **satisfactory** (D).

Prague, June 17, 2014

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CTU Diploma Project Review
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CTU Diploma Project review- 2ⁿᵈ reviewer's evaluation of master thesis with title "Rapid Prototyping of Mobile Robot Control Algorithm" by Space Master student Andres E. Cabrera.

I find that the goal of the thesis project fulfils the requirements of a master thesis in space technology. The project includes implementation of an ORTE interface using Simulink S-functions and simulations of two control algorithms where the implemented interface is used in a closed loop.

The thesis includes theory, implementation of the S-functions, Simulink modelling, controller implementation, and testing in simulation environment. I judge that the student has put sufficient effort in the task.

The literature survey is brief regarding other type of controller applications already tested for ORTE. The thesis would have benefited from a comparison on earlier relevant ORTE projects.

The background part of a thesis is intended to give the reader background knowledge and to show that the student understands the problem and has knowledge within the whole process of the performed project. Since main parts are copied word by word from other sources (such as ORTE-manual) without further clarifying what is of special importance to this project, this part do not show to what extent the student has understood the theoretical background. Figure 4.4 is for example almost a direct copy of a figure from Sanhoury et.al and has inherited labeling mistakes from the paper which the student has not correct for. There are also small errors in equations.

The S-function implementation should have been presented in more detail. The discussion on the results is also somewhat brief and is done in very general terms. The thesis would have benefited from a deeper analysis of results and a comparison with results from similar studies. Specially I lack a discussion regarding timing, which is not included in the simulation (possible delays caused by the S-function for example). This might introduce dynamics into the system and therefore play a role for the controller behavior and for the real-time system performance. The simulation environment and the platform is not presented (Linux, Windows).

The oral presentation is still to be graded. If the oral presentation is sufficient and the student show proper background and theoretical knowledge and shows an ability to further discuss the results I recommend grading the thesis by C.

This review serves solely for the purposes of the diploma project defense at cru. LTU official evaluation for the SpaceMaster double degree will follow the thesis defense and may differ from this review report and suggested grade.

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