

Commentary on: Towards Proactive Replanning for Multi-Robot Teams

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by

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The paper presents a proof-of-concept system developed by the authors that implements duration prediction and modification of existing tasks in a multi-robot environment. While humans are able to predict upcoming problems and act to prevent or take advantage of them, research into robotic teamwork shows that the majority of the implemented systems treat planning and execution as mainly independent. Replanning will only occur once a task has failed or completed early and executing tasks are not influenced by the planning at all. The paper describes the approach taken to utilize an existing symbolic planner/scheduler to build and optimise valid schedules and to extend the planner's repair and optimisation algorithms to support an initial form of proactive replanning.

In detail, the paper discusses the available planners and architectures on the market and justifies the choice decision. The approach to duration prediction and live task modification is presented in detail with the chosen architecture and the different modules, methods and scenarios employed. Examples are provided to exemplify the tasks and simulations performed.

The authors stress that to date robotic planning and execution systems only replan when over-runs or under-runs occur and that they do not take advantage made possible by duration prediction. Similarly, for live task modification, existing systems provide no or only very crude mechanisms for the planner to manipulate robot systems while performing a task.

While, at first, it was difficult to make a connection to space applications, the authors actually emphasize that the scenario they chose is a subset of a construction task that might be performed by a robotic team constructing habitats on Mars or the Moon. Would this also apply for work on the International Space Station?

The results of the proof-of-concept show that the introduction of task prediction and modifying currently executing tasks allow the system to execute more efficiently than otherwise possible. The authors quote a reduction in executed makespan of over 30%. Obviously, further research is required. A list of possible tasks is provided. Proactive planning, according the authors, "appears to be a fruitful

addition to the stable of approaches to planning and execution".

Conclusion

The paper presents the topic of proactive replanning and the work performed in a concise manner. While the reviewer had no prior knowledge about robotic systems, the paper provides some insight into the state of the art of planning robotic operations. Sending a robot, or rather a team of robots to Mars or the Moon may well be the cheaper and definitely less dangerous solution than sending a man.