Strategies from artificial intelligence area to solve the problem of real-time Planning and Re-planning

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Abstract. The space area community has a strong interest in reducing costs related to control of satellites. The ground stations can track multiple satellites, and consequently, scheduling conflicts may occur between different satellite passes over the same ground station. In particular case of INPE – there is a concern to increase the reliability of mission operations, which in some cases are still manually performed. This article presents an architecture consisting of modules that manage the allocation of ground resources for tracking multiple satellites and plan to control operations of these satellites.

Key-words: Satellites Control, Flight Plan, Planning, Artificial Intelligence.

1. Introduction

The communication of the ground control system with the satellite is established by tracking stations when it passes over the region of antenna visibility. During periods of the visibility signal transmitted by the satellite is sent by its antenna providing a downlink communication. The received signal contains the information of the satellite telemetry to reveal your current state of operation. After the establishment of the downlink, the station also provides an uplink, which is used for sending telecommands and implementation of tracking measures (ranging and range rate).

A strategy in the area of ground control of artificial satellites is the planning of operational activities involved in order to use the least resources and generate maximum product of the space mission(scientific, technological data, images, and telecommunications),without compromising the safety of the satellite. This task is complex because it involves decision making. Automation helps reduce risks and costs of the mission to monitor interactions routine mission, in addition to reducing the effort required operational and eliminate human error (KOLLER, Reggestad, Adamson, & Kay, 2010)

2. Methodology

The satellite control is done by a planning generated for each satellite in the form of an operation script routine called in Flight Operation Plan (FOP), that is executed by the Satellite Control System (SCS).

For the generation of FOPs has been used as the basis all the resources and time constraints imposed by the planning problem. The PVP files are generated by the software application Orbital Dynamics (SOD) (GONÇALVES 2006)

3. Results and Discussion

The architecture proposed in this article presents the organization of the Mission Planning and Re-Planning system, and interaction with other systems of the control ambient for satellites.

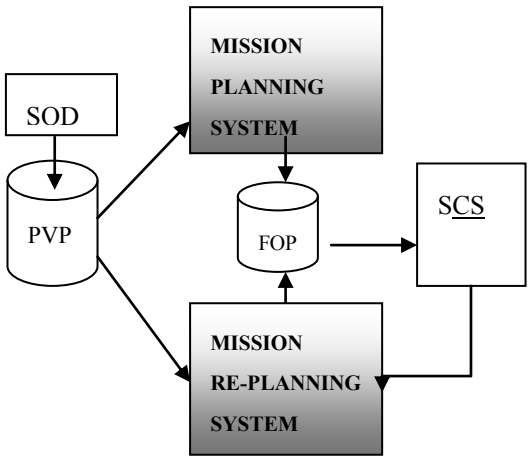

Figure 1 . Mission Planning Architecture

The main goal of the re-planning mission is to detect problems and failures during the execution of a FOP, identifying information about the current plan, determine the problems that this causes the plane, generate corrections to change the old plan, verify that the changes made by the corrections not will conflict with the remaining actions of the old plan.

The re-planning through the application of algorithms and heuristic derivation is a sequence of actions that meet the proposed objective. It held an automatic generation of a new plan using data from the knowledge base.

4- Conclusion

It is a fundamental need to the automation of INPE satellite operations. Some results of research works show that AI planning technology is undoubtedly one of the promising and viable ways to meet this need for automation. Despite the limitations shown, technology planning using AI is growing and new solutions are being found in order to facilitate their use in real-world systems.

Referências

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