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TOWARDS EXPLAINABILITY OF ON-BOARD SATELLITE SCHEDULING FOR END USER INTERACTIONS

Abstract

On-board satellite scheduling is a requirement for automating routines and tasks prior to execution on given satellite/s. Various techniques and tools are used with the optional incorporation of AI depending on the technicalities of the schedule and available resources for memory allocation. Regardless of the technique and approach taken, most autonomous scheduling systems experience challenges enabling an interaction between the user and the system. This affects trust in the system that can lead to manual handling of data that wastes time and resources. Therefore, to reduce these situations from occurring and save costs, the user needs explanations on decisions made autonomously on board.

An optimal scheduling approach was taken with the use of Mixed-Integer Linear Programming (MILP) for allocating on-board tasks for a single satellite's schedule. A schedule was derived from a fixed total time where tasks were evaluated on duration, cost and resource requirements while mimicking real world incidents such as reduction in available time or loss of resource, generating various schedules. These results were analyzed for their feasibility and optimality automatically; and in doing so, an Abstract Argumentation (AA) layer was developed and used to determine whether the tasks scheduled, supported, or conflicted with the temporal and/or resource constraints.

To depict the stages and relationships of these internal arguments, an algorithm was created to derive an entity relationship graph containing the proposed schedule solutions that were evaluated based on their corresponding conflicts/agreements. Due to the nature of these arguments and their respective constraints, another algorithmic approach was used to derive basic causalities to provide information on reason of failure and impact on schedule.

For end user interactions, the graph generated was displayed to the user allowing them to select the causalities that have occurred with a basic output description displayed to assist and enhance the users understanding on the generated proposed schedules. The graph approach will also give the user the possibility to propose changes in the solution and evaluate its feasibility/optimality as well as deriving conflicts with the current schedule. This will allow for growth to build more advanced explainable techniques for sophisticated and complex schedules.