A Summary of STRIPS, GRAPHPLAN, and ASPEN

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The Stanford Research Institute Problem Solver (STRIPS) was the result of the efforts of Richard Fikes, Nils Nilsson, Bertram Raphael, Thomas Garvey, John Munson, and Richard Waldinger. STRIPS is a framework for problem solving that was central in AI research during its time. As a problem solver, STRIPS attempts to transform initial world conditions through a sequence of operators in order to achieve a goal state. STRIPS focused on a "...class of problems faced by a robot in re-arranging objects and in navigating..." (Fikes and Nilsson, 1971). From 1966 to 1972, Shakey the Robot, the seminal contribution to AI, used STRIPS to assess its environment and construct a plan to achieve various goals during this project (Kuipers, et. al., 2017).

GRAPHPLAN revolutionized the study of AI planning. It was developed by Avrim Blum and Merrick Furst in 1997 and develops plans in "STRIPS-like" domains by constructing and analyzing a planning graph, and generating a shortest possible partial order plan. The planning graph is represented by levels of states and actions of the planning problem, and from which is extracted a solution by conducting a regressive search of the solution for each subgoal. By using mutual exclusion to prune the search space, recording unreachable goal sets at specific points in time, considering partial parallel plans that to keep search cost low, and constructing planning graphs in advance of search, GRAPHPLAN outperformed other planners of its day (Blum and Furst, 1997, and Weld, 1999).

Automated Scheduling and Planning Environment (ASPEN) has been used in automating space operations (Chien, et. al., 2000). It automates the generation of low-level spacecraft sequences from high level goals. The central data structure ASPEN is an activity, which describes a specific function the spacecraft performs for a specific time using one or more resources (Sherwood, et. al., 1998). ASPEN uses an iterative repair algorithm to search the space of schedules and resolve activity conflicts (Rabideau, et. al., 1999). ASPEN's heuristics for plan selection include preferring those conflicts that require new activities, preferring moving an activity over other types of deconfliction, and time intervals that resolve the conflict but do not create other conflicts. ASPEN has been used in Citizen Explorer-1, Antarctic Mapping Mission-2, and the Deep Space Terminal.

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