Chapter 9

Modified Backward Chaining Algorithm Using Artificial Intelligence Planning IoT Applications

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ABSTRACT

In this chapter, an automated planning algorithm has been proposed for IoT-based applications. A plan is a sequence of activities that leads to a goal or sub-goals. The sequence of sub-goals leads to a particular goal. The plans can be formulated using forward chaining where actions lead to goals or by backward chaining where goals lead to actions. Another method of planning is called partial order planning where all actions and sub-goals are not illustrated in the plan and left incomplete. When many IoT devices are interconnected, based on the tasks and activities involved resource allocation has to be optimized. An optimal plan is one where the total plan length is minimum, and all actions consume similar quantum of resources to achieve a goal. The scheduling cost incurred by way of resource allocation would be minimum. Compared to the existing algorithms L2-Plan (Learn to Plan) and API, the algorithm developed in this work improves optimality of resources by 14% and 36%, respectively.

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INTRODUCTION

In today’s world, automation of activities using artificial intelligence finds extensive applications in several areas. To ensure adequate quantum of resources for tasks, the wastage of resources should be avoided. When IoT devices are used the resource constraints become critical. This is mainly because when multiple IoT devices are integrated, each device would be having a separate goal. When multiple devices are integrated, sub-goals of each individual IoT device would be combined to get the final goal of the application.

Automated planning is used to schedule tasks and activities. A plan is a sequence of actions leading to sub-goals and goals. The actions, sub-goals and goals are decided based on the underlying functional behavior of the application.

A collection of actions leading to sub-goals and goals leads to a plan formulation. A number of such plans may be formulated based on the functionality of the application. The plan length is decided based on the number of actions and resource utilization by these actions.

The plans may be formulated by the following methods:

- Forward Chaining
- Backward Chaining
- Partial Order Plans

Forward Chaining

In Forward Chaining approach, a sequence of actions lead to sub-goals and goals. This approach is used in scenarios where the programmer has complete clarity on the actions involved in realizing sub-goals and goals. The information of the entire set of actions is presented in the plan. Plan length in many situations is minimum. It does not handle exceptional conditions and actions. If these need to be handled the programmer needs to address them.