

Reflection: Importance of Path Planning and Trade-offs Between Global and Local Planners

Path planning is one of the most critical elements of mobile robot autonomy because it enables a robot to move safely and efficiently from its current location to a desired goal without human intervention. A robot that can only sense obstacles but lacks planning capabilities would behave reactively, often getting stuck or taking unnecessarily long routes. By contrast, a robot equipped with a planning system can anticipate, optimize, and execute trajectories that balance efficiency and safety, which is essential in structured environments such as warehouses, hospitals, or offices.

In the ROS2 Navigation2 (Nav2) stack, the combination of global and local planners highlights the trade-offs between different approaches to navigation. Global planners, such as A* or Dijkstra, compute a full path from the start to the goal using the known map. Their strength lies in providing an optimal or near-optimal solution, ensuring the robot follows an efficient route. However, they assume a mostly static environment and can become less effective when unexpected or dynamic obstacles appear.

Local planners, such as the Dynamic Window Approach (DWB), operate in real time to adjust trajectories around nearby obstacles. This makes them well-suited for dynamic environments, but they can produce suboptimal paths or even fail to reach the goal if the robot becomes trapped in a local minimum.

The integration of both global and local planners is therefore essential. Global planning ensures efficiency at the map level, while local planning provides adaptability in the face of uncertainty. Together, they form a robust navigation framework that makes autonomy practical and reliable in real-world robotics.