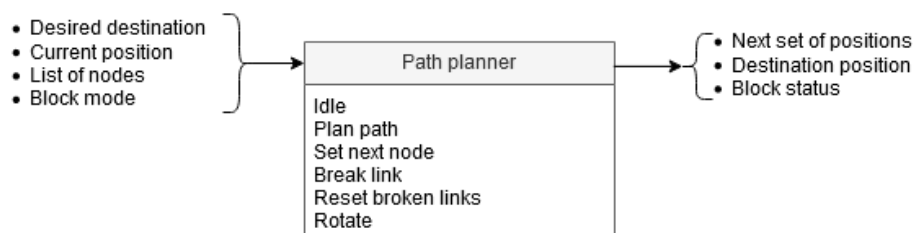


Path planner functionality

The path planner determines the path for the PICO robot based on the list of available nodes and the links between these nodes. For planning the optimal path, Dijkstra's algorithm is used and the distance between the nodes is used as cost. The choice for Dijkstra is based on it being sufficient for this application, the extra complexity of the Astar algorithm was not needed. The planned path is a set of positions that the PICO robot is going to drive towards, this set is called the 'next set of positions'. This next set of positions is saved in the world model and used by the task manager to send destination points to the drive controller.

The path planner takes the desired destination, current position, list of nodes and the block mode as inputs. The functions of the path planner are idling, planning a path, setting the next node of the planned path as current destination position, breaking a link between nodes, resetting all broken links and rotating the PICO robot. This results in the next set of positions, the destination position and the block status.



Idle

When idling, all variables are set to their initial value and the path planner waits for the task manager to set the block mode. When the path planner is idling, the block status changes to idling.

Plan paths

In this function all possible paths to the desired destination are planned based on the combined map. The combined map contains a list of doors, which contain two 'nodes' each. A node is a location point in front of the door, and since the door has two sides there are two nodes for each door. Also is checked if there are no objects, for example a wall or cabinet, in between these nodes. The planned path consists of a <Position> vector, where only the positions are listed where the PICO robot has to stop and rotate. All possible planned paths, for example through different doors, are stored in one vector and the optimal path is selected later.

Set next node

Once all possible paths are planned, PICO has to follow it. To do this, the list of nodes from the created path is followed. The next node is set if the task manager changes the mode of the path planner to set next node.

Break link

If PICO is not able to reach a node, the link between the current destination node and the last node must be broken. This is done when the task manager sets the block mode to break link.

Reset broken links

When there is no possible path because all links are broken, the broken links are set to open again and a path is planned. This is implemented in case a dynamic obstacle was blocking the path. This function is called when the task manager changes the block mode to reset broken links or when the plan path function cannot create a path towards the given destination.

Rotate

When PICO has to scan the room, it must be able to rotate. Using the rotate function the desired destination of PICO is changed, where the angle is adjusted by the in this function inserted value.

Risk analysis and fallback mechanisms

Possible risks and their fallback mechanisms:

- Static objects on the planned trajectory that are not on the global map,
- Dynamic objects crossing the planned path,
- Closed doors,
 - Implemented fallback mechanism: adjust the planned trajectory by breaking links between nodes and then plan a new path.
- Incorrect determined position from preceptor
 - Noting the path planner can do about this, just plan a route if possible.
- No possible path available
 - Reset all broken links, if there are no broken links go to error state.

Flowchart

