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INITIAL DESIGN EMBEDDED MOTION CONTROL GROUP 7

The project is divided in two parts: the corridor challenge and the maze challenge. For the corridor challenge the goal is to take the first exit. For this corridor challenge a number of requirements have to be met for an arbitrary corridor:

Requirements:

- Reach exit as fast as possible.
- Be able to recognize walls.
- Don't hit the walls.
- Be able to recognize and take the first intersection.
- Be able to rotate and translate.
- Be able to recognize maze exit.
- Stop when exit is reached.

These requirements can be rewritten to specifications:

Specifications

- Reach end within 1 minute.
- Recognition walls and intersection.
 - Objects in straight line(with variation under 5 cm) are considered walls.
 - Opening of at least 0.5 m is an intersection.
- Don't hit walls.
 - Distance to walls at least 10 cm.
- be able to drive
 - Drive in direction of point (updated 30 times a second).
 - Maximal 0.5 m/s during straight line.

- Maximal 1.2 rad/s rotation.
- Recognize exit and stop
 - Drive straight for 3 seconds after being 30 cm from intersection, then stop.

In order to meet these specifications the system is decomposed into multiple functions:

Functions

- Intersection recognition: identifying where the intersection is.
- Path planning: calculating the optimal path through the corridor.
- Safety features: Ensuring that PICO does not hit the walls.

For the maze challenge the goal is to find the exit in a maze. The location of the exit is unknown, there might be loops and there is a door in the maze. The requirements of the corridor challenge also hold for the maze challenge but are elaborated with:

Requirements:

- Be able to map the maze.
- Be able to locate itself in map.
- Be able to recognize maze components (doors and walls).
- Be able to open a door.
- Be able to detect the maze exit.

These additional requirements can be written to specifications:

Specifications

- Mapping
 - Update map 30 times per second.
 - Remember path.
 - On the driven path map walls, doors, crossings.
- Be able to localize itself in map.

- Localize position with precision of 5 cm.
- Recognition possible doors.
 - Recognize dead end of at least 30 cm.
- Open door.
 - Beep when in front of detected door.
- Recognize maze exit.
 - Stop when no walls are detected in front.

The functions from the corridor challenge can then be completed to obtain the functions required for the maze challenge:

Functions

- Mapping: Save all intersections, doors, and connections.
- Optimal control: determine the best strategy for completing the maze

Interfaces

To keep track of the states in which the robot is, the states will be printed in the screen. Also is the idead to show the mapping for the maze challenge on the screen for debugging.