ECE 133 Modified Project: Maze Solving and Path Planning

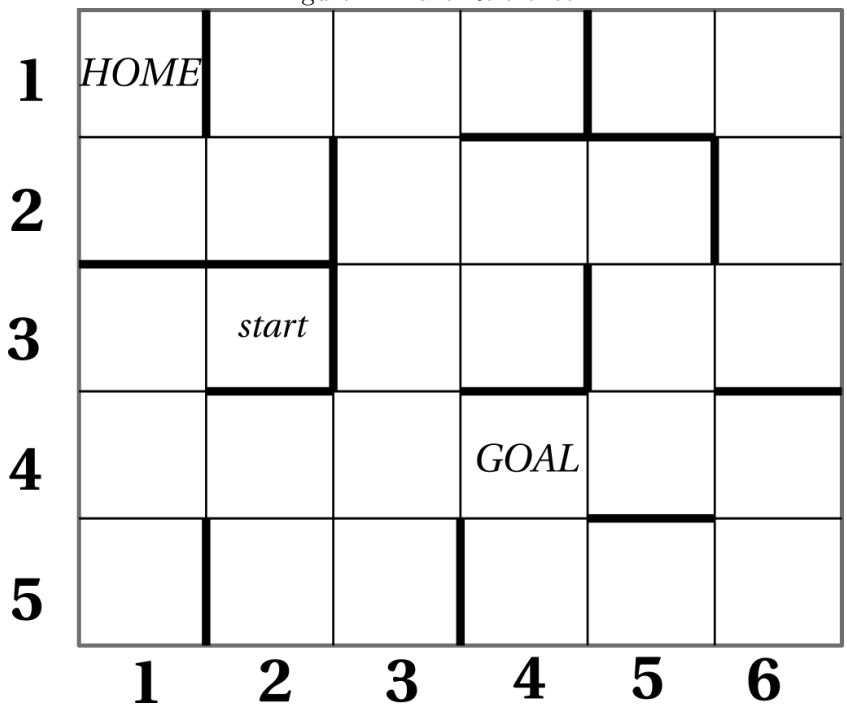
1st semester 2020-2021

Each student must be able to solve a maze and optimize a path to the goal position, implemented in Mobot-Sim platform. The robot is virtually ideal with a platform diameter of 50 cm, and with 3 range sensors, spaced 90 degrees apart and able to detect a maximum of 2 meters away.

Known and Unkown Parameters

The map includes 30 grid spaces which are each 100 x 100 cm in dimension. The grid spaces will be arranged among 5 rows and 6 columns as depicted in Figure 1 below.

Figure 1: Maze Reference



The heavy lines between grid spaces represent walls which indicate the non-adjacency of the grid spaces on either side of them. The wall assembly in Figure 1 is simply for reference of task specifications, and will be modified during checking. The robot will begin in a random space, denoted as "*start*" space and will always be facing the top of the screen. The goal position, denoted as "*GOAL*" space, will be exactly in cell **(4,4)**. Grid space **(1,1)** is considered as the "*HOME*" position of the platform. This means that the path following portion of the task must begin from grid space *HOME* and end at *GOAL*.

Starting and Ending Protocols

The first task of the platform will be to find Home position before executing the maze solving algorithm. Each time the platform enters Home space, a Home Target Action (HTA) must be executed before performing any other movement. Similarly, upon entering into the goal space, a Goal Target Action (GTA) must be executed. An HTA is rotation of the robot platform by 720 degrees in the CW direction. A GTA will be a 360 degree rotation in the CW direction followed by a 360 degree rotation in the CCW direction. Both HTA and GTA will

be executed with zero value turning radius. Note that the robot must end up in the exact same orientation as it did when it enters either target space.

Sequence of Tasks

The robot platform will be programmed to execute two processes sequentially. Upon hitting the Run command, the robot must first execute a search algorithm in order to map the maze and generate adjacency information. The search process *MUST* begin with finding the home space. The search tree must then be reset, assigning the home space as the root node. The last action of the platform during search process will be to return back to the home space as preparation for the path solving process. The second process to be executed is path solving. Using the information derived from the search process, the program must compute the most efficient path, movement-wise, to get from home space to goal target space, and accomplish the path. After execution of GTA, the platform must halt, and stay in place. Continued movement will connotate incorrect identification of the map and lack of platform state awareness.

Maze Solving

A run will be considered successful if (1) Home target space has been discovered and returned to, after the search, (2) no collisions occur, and (3) an optimal path is demonstrated.

Grading Scheme

Groups will be graded as follows:
Maze Solving

- Finding Home space - 20 points
- Grid search/discovery of all spaces - 30 points
- Identifying Goal space - 10 points

Optimal Path

- Optimal path calculated - 40 points

Modifications to scores

- The final score for the MP will be scaled to 65.
- Your final grade will be computed as specified during the semester.

The world file is attached with this document. You may modify the maze as necessary in order to completely test your program.

The sample maze is depicted in the figure below.

Figure 2: Sample Maze