**Lab One: Intelligent Agent in 2D grid world**

**Course Name: Introduction to Artificial Intelligence**

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**Agent Behavior Report**

**1. Sensing the Environment:**

* The agent in this simulation senses its environment through a grid-based map. Each cell of the grid represents a part of the environment, and the agent identifies the state of the cell it intends to move to:
  + **Obstacles** (represented by 0 in the grid): The agent recognizes these cells as blocked and avoids them during movement.
  + **Free Space** (represented by 1 in the grid): These cells are considered accessible and traversable by the agent.
  + **Target** (represented by 2 in the grid): The agent aims to find and reach this cell to complete its objective.
* The agent keeps track of the cells it has visited using a list (self.visited) to avoid revisiting locations unnecessarily.

**2. Decision-Making Process:**

* The agent's decision-making is based on a Depth-First Search (DFS) approach. It explores one direction fully before backtracking if it encounters an obstacle or reaches a dead end.
* **Movement Strategy:**
  + The agent attempts to move in four possible directions (up, right, down, and left).
  + It checks each direction to see if the movement is within bounds and if the cell is accessible and not visited yet.
  + The canMove function verifies whether a new position is valid by checking if the new cell is free and unvisited.
  + If the agent cannot move forward in any direction, it triggers a **backtracking** mechanism where it moves to the last valid position (stored in its visited list) until it finds a new path or exhausts all possibilities.
* **Target Detection**: When the agent moves to a cell containing the target (2), it recognizes that it has found its destination (self.foundTarget is set to True), and its score is updated.

**3. Movement Mechanism:**

* **Moving Forward:**
  + The agent moves by updating its coordinates (self.x, self.y) based on the chosen direction and adjusts the corresponding grid position (row, col).
  + The movement is visualized as the agent’s image moving to the new coordinates on the screen.
  + Each valid move increases the agent's steps and points, rewarding exploration.
* **Backtracking:**
  + If no forward movement is possible, the agent backtracks to the previous position using the stored path in self.visited.
  + During backtracking, the agent decreases its points to represent the cost of revisiting previously explored paths.
* **Staying Still:** If the agent cannot move and has returned to its starting point, it identifies that no further movement is possible thus no path to target (self.noPath is set to True).

**Summary**

The agent's behavior is driven by a simple exploration strategy that prioritizes depth-first movement, exploring paths until reaching dead ends or the target. It uses sensing to recognize obstacles and the target, decision-making to plan its movements and adjust its path, and backtracking to recover from dead ends. This approach allows the agent to efficiently explore the environment and find the target, while visualizing its path and movements in a grid-based simulation.