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Lab Task 2:

In this lab task, you have to design and implement an intelligent Vacuum Cleaning Agent using fundamental principles of Artificial Intelligence. The agent should operate in a simple two-dimensional environment (such as a grid-based world) where each cell can either be clean or dirty. The agent must be capable of navigating through the environment and cleaning the dirty cells efficiently. You must program the agent to perceive its current location's status (clean or dirty), decide its next action (move left, right, up, down, or clean), and execute the action accordingly. The agent should use a simple rule-based approach. Do the implementation using Python.

Code:

```
ROWS = 4
COLS = 4

class Environment:
    def __init__(self):
        self.grid = [['clean' for _ in range(COLS)] for _ in range(ROWS)]
        dirty_cells = [
            (0, 0), (0, 2),
            (1, 0), (1, 2),
            (2, 0),
            (3, 0), (3, 1), (3, 2), (3, 3)
        ]
        for row, col in dirty_cells:
            self.grid[row][col] = 'dirty'
        self.agent_row = 0
        self.agent_col = 0
        self.cleaned = 0

    def is_dirty(self):
        return self.grid[self.agent_row][self.agent_col] == 'dirty'

    def clean(self):
        self.grid[self.agent_row][self.agent_col] = 'clean'
        self.cleaned += 1
        print(f"Cleaned cell at ({self.agent_row}, {self.agent_col})")

    def move(self):
        if self.agent_col < COLS - 1:
            self.agent_col += 1
        elif self.agent_row < ROWS - 1:
            self.agent_col = 0
            self.agent_row += 1
        else:
            return False
        return True

    def show(self):
        for i in range(ROWS):
            for j in range(COLS):
                if i == self.agent_row and j == self.agent_col:
                    print("A", end=" ")
                elif self.grid[i][j] == 'dirty':
                    print("D", end=" ")
                else:
                    print(".", end=" ")
            print()
        print("-----")

    def run(self):
        while True:
            self.show()
```

```

        if self.is_dirty():
            self.clean()
            self.show()
        if not self.move():
            break
    print("Cleaning complete. Total cells cleaned:", self.cleaned)

env = Environment()
env.run()

```

Output Screenshot:

```

A . D .
D . D .
D . . .
D D D D
-----
Cleaned cell at (0, 0)
A . D .
D . D .
D . . .
D D D D
-----
. A D .
D . D .
D . . .
D D D D
-----
. . A .
D . D .
D . . .
D D D D
-----
Cleaned cell at (0, 2)
. . A .
D . D .
D . . .
D D D D
-----
. . . A
D . D .
D . . .
D D D D
-----
A . D .
D . . .
D D D D
-----
Cleaned cell at (1, 0)
. . . .
A . D .
D . . .
D D D D
-----
. A D .
D . . .
D D D D
-----
. . . .
. . A .
D . . .
D D D D
-----
Cleaned cell at (1, 2)
. . . .
. . A .
D . . .
D D D D

```