

Subj: Artificial Intelligence

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Topic: Vacuum cleaning AI.

Aim:

The aim of this project is to simulate the operation of a vacuum cleaner bot using Python, specifically focusing on how it cleans a room represented as a grid of cells.

Theory:

The simulation of a vacuum cleaner bot is based on the concept of grid-based env. cleaning, where each cell in room can either be dirty or clean. The bot traverses through the grid and 'cleans' each cell by assigning it a cleanliness level. The cleanliness of the room after cleaning process is evaluated based on the percentage of cells that meet or exceed a specified cleanliness threshold.

The bot traverses only once through the grid, it gives the value of how clean each cell is, gives value between 0.0 to 1.0.

The value more towards 1.0 the more dirtier it is, works vice-versa as well.

Key concepts:

1. Grid Representation:

The room is represented as a 2D grid where each cell can have a binary value (1 \rightarrow dirty, 0 \rightarrow clean).

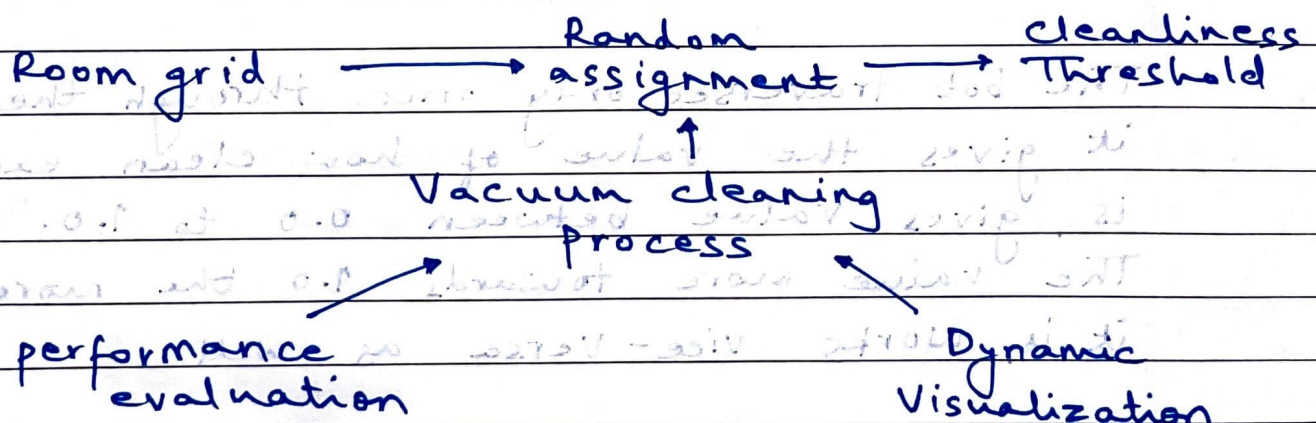
2. Random cleaning:

Each cell's cleanliness is determined randomly to simulate the variability in real-world cases/scenarios.

3. Performance Metrics:

The performance and accuracy of the cleaning process are calculated based on how many cells were cleaned effectively & the overall cleanliness of the room.

Architecture chart:



Mechanism:

1. Room Initialization:

The room is initialized as a grid where all cells are marked as dirty (value = 1).

2. Random Assignments:

Each cell in the room is randomly assigned a cleanliness level between 0 & 1, representing the degree of cleanliness after vacuum cleaner passes over it.

3. Threshold check:

The cleanliness level is compared against a threshold to determine if cell is considered clean.

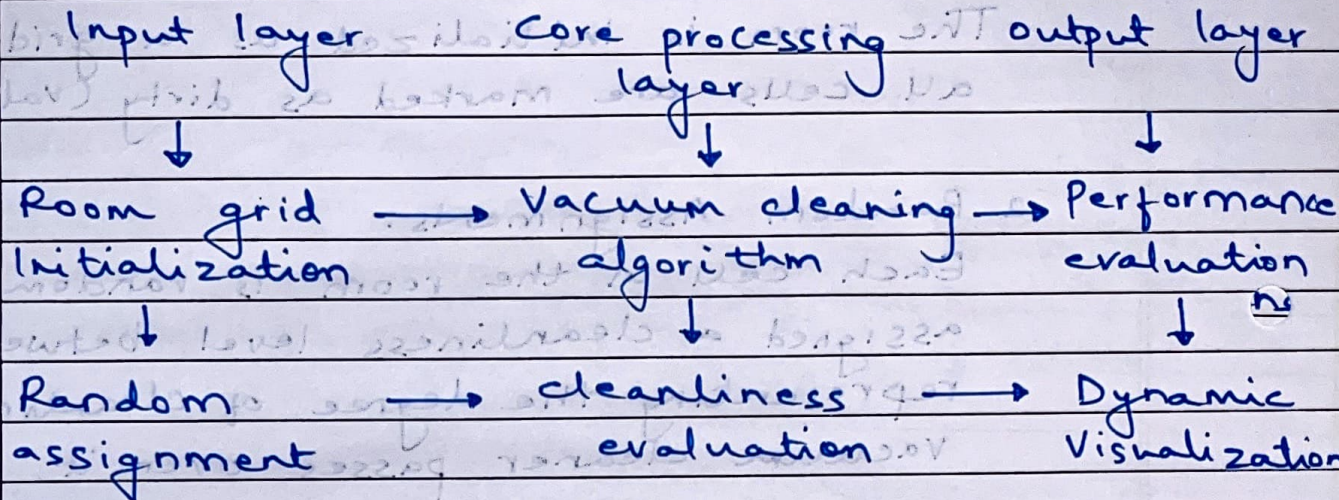
4. Performance calculation:

The percentage of cells that are clean is calculated to determine the vacuum cleaner's performance.

5. Visualization:

The process is visualized using Matplotlib animation to show the cleaning process in real-time.

Model Architecture:



Conclusion:

This simulation successfully models the cleaning process of a vacuum cleaner bot in a grid based environment. By randomizing the cleanliness levels & implementing a threshold for cleanliness, the simulation provides a realistic approach for assessing the bot's performance. The final performance & accuracy metrics give insights into how well the robot cleaned the room, providing a basis for further improvements in algorithms for autonomous cleaning systems.