We request a bonus for **three main additions** this time:

1. <mark>Logger:</mark> We have implemented a comprehensive logging mechanism that captures detailed runtime information, which is essential for debugging and analysis. The logged details include:

   + "Distance From Docking -> " logged as information on every iteration.

   + "Need Charging, Decided To Go Back To The Docking." logged as information when the robot is low on battery and needs charging.

   + "Charging..." logged as information while charging the robot.

   + "Moving Towards The Docking." logged as information the moments we are on the way to the docking.

   + "Looking For Dirt." logged as information while looking for dirt.

   + "Finished And Going Back To Docking." logged as information when cleaning is finished(all reachable dirt was cleaned) and the robot decided to return to docking.

   + "On My Way To Clean." logged as information when on the way to clean the dirt.

   + "Simulation started" logged as information at the beginning of the simulation.

   + "Battery State: " logged as information on every iteration, showing us the battery state.

   + "Current Position: " logged as information on every iteration, to show the current position of the robot.

   + "Overall Steps: " logged as information on every iteration, to show the overall steps.

   + "House State:" logged as information on every iteration, in every iteration to keep track of the house.

   + "House Cleaned." logged as information when the house is fully cleaned.

   + "Vacuum Dead." logged as a warning when the vacuum battery is 0 and it's dead.

   + "Reached Maximum Number of Steps." logged as a warning when we reach the maximum number of steps.

   + "Simulation Finished." logged as information when the simulation is finished.

2. <mark>Visualization Upgrades:</mark> We have significantly enhanced the visual simulation with the following upgrades:

   + Displaying the current battery level and steps count at the top corners of the screen.

   + Adding progress bars to visually represent the battery level and steps progress.

   + The battery level is represented by a green bar that decreases when moving and increases when charging.

   + The steps progress bar indicates the proportion of steps taken relative to the maximum steps allowed, with a gradient colour change.

   + The overall simulation includes the previous features such as walls, dirt levels, and docking station representation.

Existing Visual Simulation Features (The Previous Ones):

❖ Displaying the house matrix with walls, dirt levels, and the docking station.

❖ A rotating circle representing the vacuum cleaner, with a directional line indicating its movement.

❖ Dirt levels represented by varying shades of gray (white for clean, darker gray for more dirt).

❖ A flashing plus sign at the docking station when the vacuum cleaner is charging.

❖ Pause and resume functionality through on-screen buttons.

How to Check(the cyan coloured below are the new additions):

✓ **Generating Output Files:** Run the main function of the program, which will generate two JSON output files (initial_house.json and steps_history.json) based on the last input the user provided.

✓ **Running the Simulation:** Execute the visualize.py script to start the visual simulation.

✓ **Observing the House Matrix:** Take a look at the visual representation of the house matrix. Notice the walls, dirt levels, and the docking station.

✓ **Vacuum Cleaner Movement:** Observe the movement of the vacuum cleaner represented by a rotating circle with a directional line. This adds a dynamic and realistic feel to the simulation.

✓ **Dirt Levels:** Notice how the dirt levels are displayed using different shades of gray. The darker the gray, the more dirt is present. As the vacuum cleaner moves over these cells, the dirt level decreases. Cleaning occurs when the vacuum cleaner stays in place.

✓ **Docking Station:** Pay attention to the docking station symbol. A flashing plus sign will appear when the vacuum cleaner is charging, adding a clear visual cue for this state.

✓ **Pause and Resume:** Use the on-screen buttons to pause and resume the simulation. The vacuum cleaner will remain in its last position when paused.

✓ **Battery Bar:** Notice the green bar at the top left corner representing the current battery level, which decreases when moving and increases when charging.

✓ **Steps Bar:** Observe the steps progress bar at the top right corner, indicating the proportion of steps taken relative to the maximum steps allowed.

✓ **End of Simulation:** At the end of the simulation, the vacuum cleaner will remain in its final position, and a message "End of Simulation" will be displayed at the top of the screen.

Note: You can change the clock tick in the visualize.py file(the last line in the code file), increment it to make the simulation faster.

3. **HLD pdf file:** Which Includes:

o UML Class diagram
o UML Sequence diagram