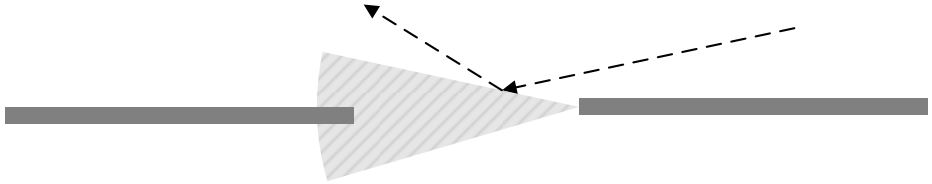
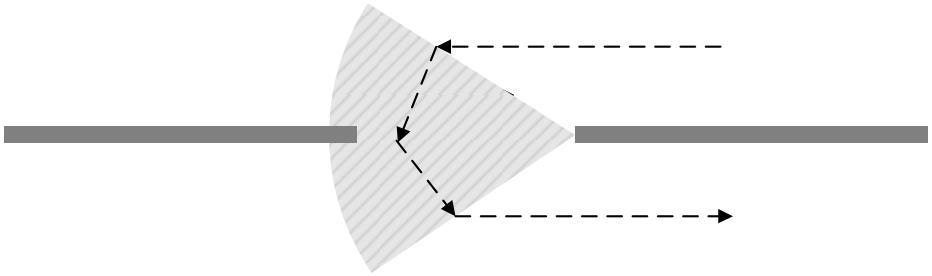
Preliminaries

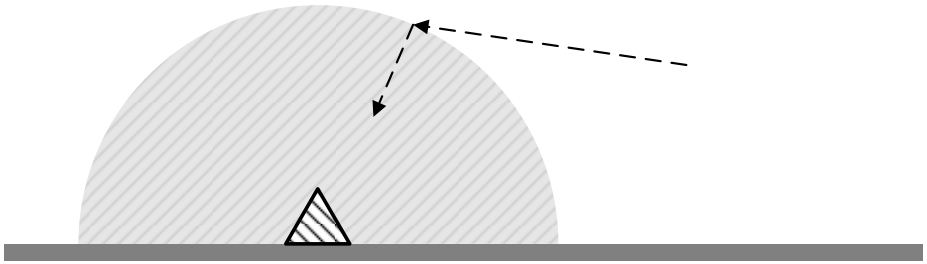
Assumption1—lighthouse sensor system ***Assumption2—self navigation algorithm***



Virtual Wall Service



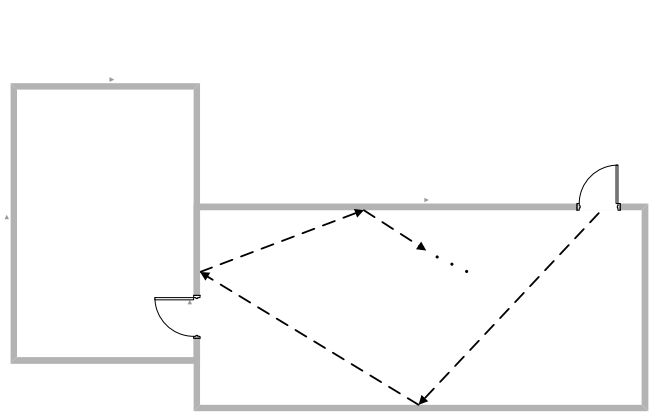
Traversing Service



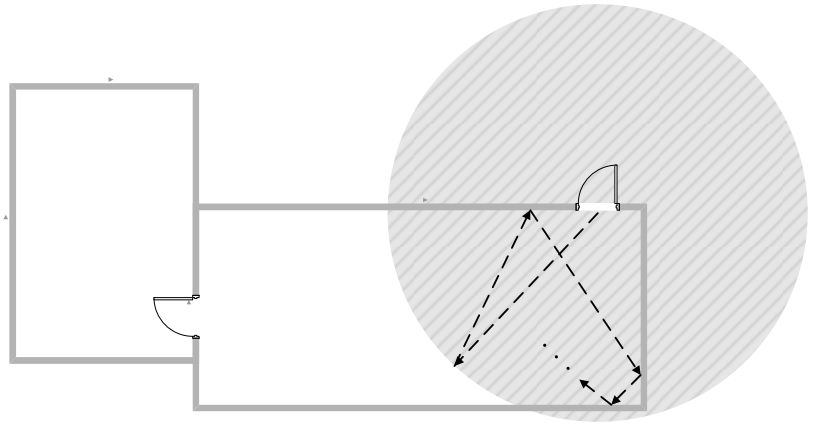
Docking Navigation Service

Problem Formulation

Key concept 1—cleaning in a battery-reserving mode

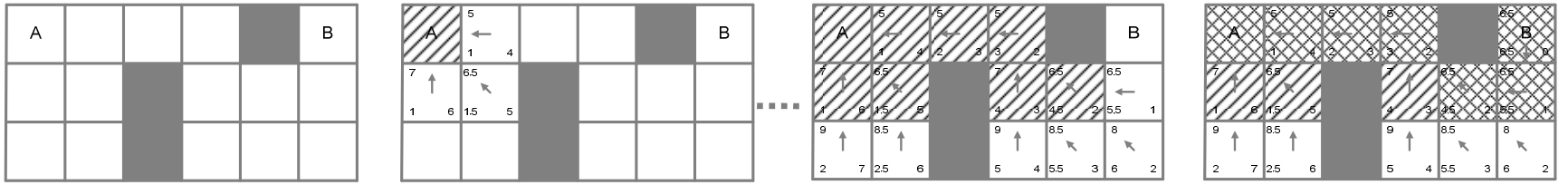


The original tour



The tour in battery reserving mode

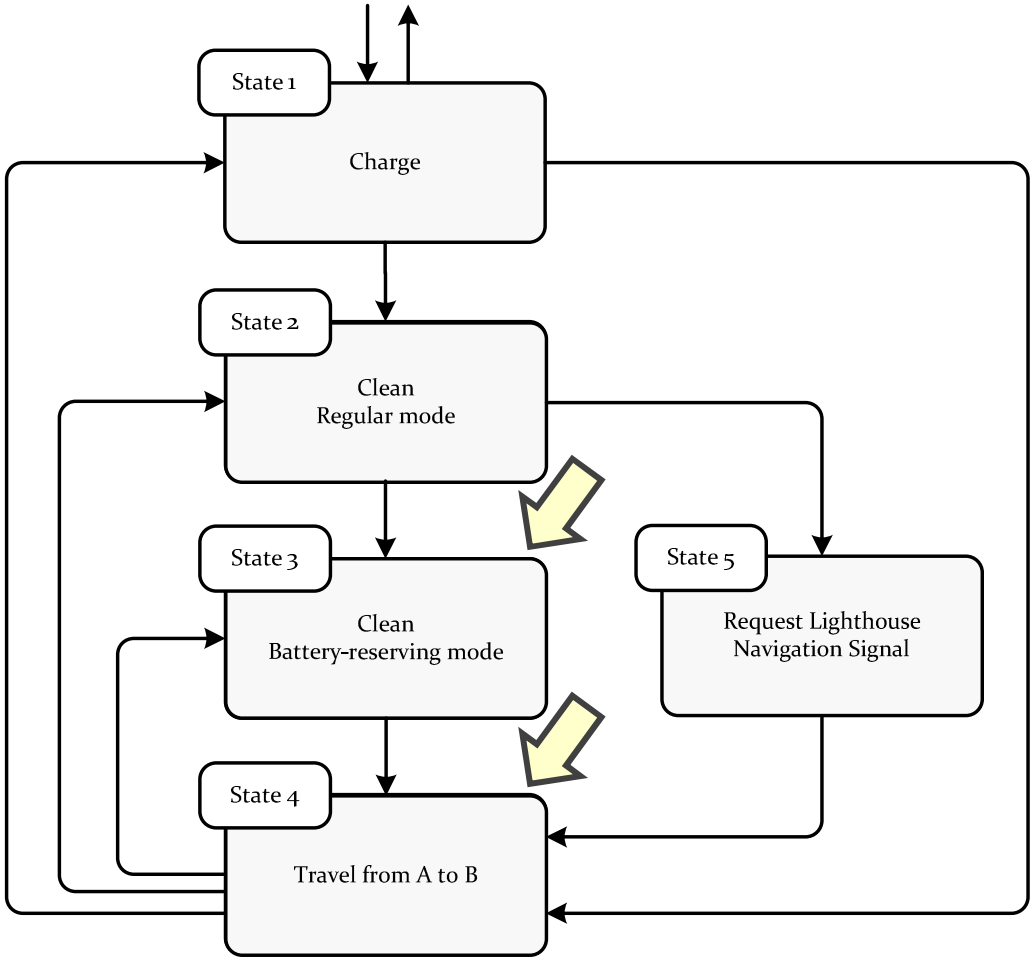
Key concept 2—the shortest path on an explored map



A demonstration of using A* algorithm to resolve the shortest path on a continuous map

Problem Formulation

“ ”: The states added to perform the new feature proposed in this paper



Problem is formulated as a state machine

Model Analysis

State 1: charging

Entry action

1. Starts manually
2. Starts as self-charging

Exit action

1. Enters state 2, cleans in the regular mode
2. Enters state 4, travels from A to B
3. Enters state 6, terminates state machine

State 2: cleaning in the regular mode

Entry action

1. Starts after charging
2. Starts after finding the right position
3. Starts when entering a new room

Exit action

1. Enters state 5, requests for lighthouse signal
2. Enters state 4, travels from A to B
3. Enters state 3, cleans in the battery-reserving mode

State 5: requesting for the lighthouse navigation signal

Entry action

1. Starts after cleaning a room with sufficient battery
2. Starts after cleaning a room with the battery-reserving mode

Exit action

1. Enters state 4, travels from A to B

State 3: cleaning in the battery reserving mode

Entry action

1. Starts after charging with regular mode

Exit action

1. Enters state 4, travels from A to B
2. Enters state 5, requests the lighthouse signal

State 4: traveling from A to B

Entry action

1. Starts after charging
2. Starts after receiving the signal
3. Starts after finishing the task in the regular mode
4. Starts after finishing the task in the battery-reserving mode

Exit action

1. Enters state 2, cleaning in the regular mode
2. Enters state 3, cleans in the battery-reserving mode
3. Enters state 1, charging