

# Sonar Terrain Mapping with BDI Agents

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# THE PROBLEM FACED

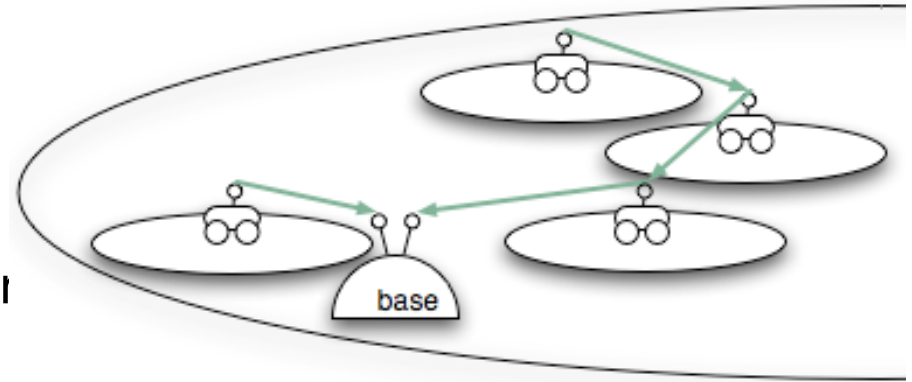
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- Scan an area of terrain
  - Has multiple mobile agents (explorer agents) and one “base station”
  - Try to continually scan the entire area (sweeping)
  - The agents only have limited wireless communication range and a limited vision
- We use Belief Desire Intention (BDI) agents to accomplish these goals
  - The BDI agents are implemented with Jadex

# AGENT OVERVIEW



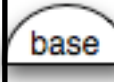

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- Two Agents: *Base* and *Explorer*
- Base is a stationary agent that is the central repository for the map.
- Base agent handles the map requests and update requests of the explorer agents
- The explorer agent is mobile and scans terrain
- The explorer reports its findings to the base station
- The explorer forms communication chains back to the base station



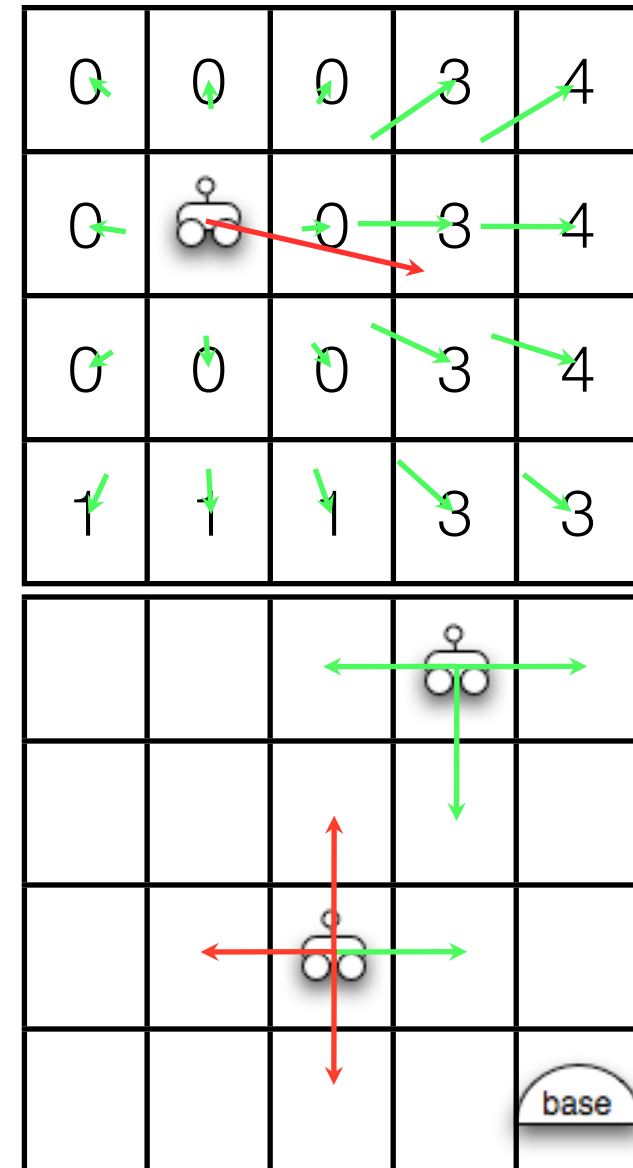
# THE ENVIRONMENT

- Represented as a rectangular, two dimensional, grid of squares
- Mobile agents and the base station can occupy squares
- Squares have a “curiosity value” based on when the squares were visited last
- A low number for a square indicates it has been visited recently
- Agents can move up, down, left or right

0	0	0	0	0	0	1	2
0		0	0		0	1	2
0	0	0	0	0	0	1	2
1	1	1	3	3	3	3	3
0	0	0	1	2		4	4
0		0	1	2	6	7	8
0	0	0	1	2	6	7	11

# EXPLORER: MOVING

- The explorer agent follows two criteria to decide where to move:
  - Which direction from my current position is calculated to have the most “curiosity”?
  - Will my moving from my current position interfere with another agent’s or my ability to communicate with the base station?
- The direction to be moved is determined:
  1. Calculate the pull from every other square in the environment (green)
  2. Sum these vectors (red)
  3. Choose a direction based on 2



$$\text{pull}(x,y) = (\text{distance penalty}) * (\text{square's weight}) * (\text{unit vector})$$

# EXTENSIONS

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- Message hopping:
  - Currently, all messages are directly sent to the base station
  - Each agent has a belief of which other agent is its link to the base station
  - Send a message to that agent
  - That agent will then do the same, until it reaches the base station
  - A response from the base station will be sent back the same path
- Learning mechanism:
  - Enables Explorer agents to predict the changing behavior of the environment and how to explore it optimally.
  - Enables Explorer agents to avoid obstacles in their environment