

CLAIMS

1. A method of returning a displaced autonomous mobile robot to its planned navigational path, the mobile robot having a sensor and a camera the method comprising

5 , before autonomous deployment of the robot,

(i) constructing an occupancy grid map based on data received from the sensor of the robot's vicinity along the planned navigational path, the collected data including robot poses along the planned navigational path; and

10 (ii) constructing a cognitive map of the planned navigational path based on a set of visual cues captured by the camera of the robot's vicinity along the planned navigational path, the visual cues being associated with the robot poses in the occupancy grid map; and

15 , after autonomous deployment of the robot,

(iii) upon detection that the robot is displaced, constructing a local occupancy grid map of a vicinity of the displaced robot;

(iv) selecting a destination point in the local occupancy grid map;

20 (v) navigating the mobile robot to the destination point along a designated path;

(vi) as the mobile robot travels along the designated path, searching for a location that corresponds to a visual cue of the visual cue set defined in the cognitive map; and

(vii) upon finding the location, recalling the robot pose associated with the visual cue to return the robot to the planned navigational path.

- 5 2. A method according to claim 1, further comprising, when the mobile robot is travelling along its planned navigation path, detecting if the robot is displaced by determining whether or not there is misalignment between the robot's actual location and the planned navigation path as defined by the occupancy grid map.
- 10 3. A method according to claim 2, wherein the robot is detected as being displaced only when the misalignment persists for at least 2 seconds.
4. A method according to any preceding claim, wherein the local occupancy grid map is constructed when the mobile robot is stationary.
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5. A method according to any preceding claim, further comprising rotating the robot 360° to construct the local occupancy grid map.
6. A method according to any preceding claim, wherein the destination
- 20 point is randomly selected from the local occupancy grid map.
7. A method according to any preceding claim, further comprising

collecting further information of the robot's vicinity while the robot navigates to the destination point in step (iii); and

updating the local occupancy grid map with the further information.

5 8. A method according to any preceding claim, wherein if no location is found which corresponds to the visual cue, repeating steps (iii) to (v) until such a location is identified.

9. A method according to any preceding claim, wherein recalling the robot
10 pose in step (vi) comprises replacing the local occupancy grid map with the occupancy grid map.

10. A method according to claim 9, further comprising performing a 360° rotation of the robot to converge the robot's laser with the occupancy grid map.

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11. A method of returning a displaced autonomous mobile robot to its planned navigational path based on a cognitive-occupancy grid map, the cognitive-occupancy grid map having a set of visual cues associated with locations along the planned navigational path, the method comprising

20 (i) upon detection that the robot is displaced, constructing a local occupancy grid map of a vicinity of the displaced robot;

(ii) selecting a destination point in the local occupancy grid map;

(iii) navigating the mobile robot to the destination point along a designated path;

(iv) as the mobile robot travels along the designated path, searching for a
5 location that corresponds to a visual cue of the visual cue set defined in the cognitive-occupancy grid map; and

(v) upon finding the location, recalling a pose of the robot associated with the visual cue to return the robot to the planned navigational path.

10 12. A system for returning a displaced autonomous mobile robot to its planned navigational path, the mobile robot having a sensor and a camera, the system comprising

a global map builder configured to construct an occupancy grid map based on data received from the sensor of the robot's vicinity along the
15 planned navigational path, the collected data including robot poses along the planned navigational path, and construct a cognitive map of the planned navigational path based on a set of visual cues captured by the camera of the robot's vicinity along the planned navigational path, the visual cues being associated with the robot poses in the occupancy grid map, before
20 autonomous deployment of the robot;

a local map builder configured to construct a local occupancy grid map of a vicinity of the displaced robot, after autonomous deployment of the robot and upon detection that the robot is displaced;

a path planner configured to select a destination point in the local
5 occupancy grid map;

a navigator configured to navigate the mobile robot to the destination point along a designated path;

a place recognition module configured to identify a location along the designated path that corresponds to a visual cue of the visual cue set
10 defined in the cognitive map; and

a recovery module configured to recall the robot pose associated with the visual cue to return the robot to the planned navigational path.

13. A system according to claim 12, further comprising a lost detection
15 module configured to detect if the robot is displaced by determining whether or not there is misalignment between the robot's actual location and the planned navigation path as defined by the occupancy grid map stored.

14. A system according to claim 12 or 13, wherein the recovery module
20 further comprises a pose-reinitialization module configured to replace the local occupancy grid map with the occupancy grid map.

15. An autonomous mobile robot comprising the system of any one of claims 12 to 14.