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

, 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

(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

, after autonomous deployment of the robot, navigating the robot along the planned navigational path to a target location;

(iii) during the movement along the planned navigational path, upon detection that the robot is displaced~~,~~:

~~(iii)~~ (a) constructing a local occupancy grid map of a vicinity of the displaced robot;

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

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

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

~~(vii)~~ (e) upon finding the location, recalling the robot pose associated with the visual cue from the cognitive map to return the robot to the planned navigational path.; and

(f) if the location is not found when the mobile robot reaches the destination point, repeating steps (b) to (d) by selecting a new destination point in step (b).

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.

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.

5. A method according to any preceding claim, further comprising rotating the robot 360º to construct the local occupancy grid map.

6. A method according to any preceding claim, wherein the destination 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.

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 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.

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

(i) during the movement along the planned navigational path to a target location, upon detection that the robot is displaced:~~,~~

(a) constructing a local occupancy grid map of a vicinity of the displaced robot;

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

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

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

~~(v)~~(e) upon finding the location, recalling a pose of the robot associated with the visual cue from the cognitive map to return the robot to the planned navigational path~~.~~; and

(f) if the location is not found when the mobile robot reaches the destination point, repeating steps (b) to (d) by selecting a new destination point in step (b).

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 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 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 along the planned navigational path to a target location and upon detection that the robot is displaced;

a path planner configured to select a destination point in the local occupancy grid map in response to the detection of the robot being displaced;

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

a place recognition module configured to ~~identify~~search for a location along the designated path to the destination point that corresponds to a visual

cue of the visual cue set defined in the cognitive map of the planned navigational path; and

a recovery module configured to recall the robot pose if the location is found, ~~associated with the visual cue~~ to return the robot to the planned navigational path~~.~~, the robot pose being associated with the visual cue from the cognitive map; and

if the location is not found, the path planner is configured to select a new destination point for the place recognition module to repeat the search for a location that corresponds to a visual cue of the visual cue set.

13. A system according to claim 12, further comprising a lost detection 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 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 claims12 to 14.