CLAIMS

1. A method of localizing a mobile robot with respect to a target object using an initial map of a reference object which is a representation of the target object, the method comprising

(i) obtaining LiDAR data of the target object captured by a LiDAR device of the mobile robot as the mobile robot traverses in an environment associated with the target object, the LiDAR data including respective point cloud representations of the target object and the environment in various sampling instances;

(ii) iteratively updating pose data representing an estimated pose of the mobile robot with respect to a known reference location of the target object in corresponding sampling instances as the mobile robot traverses the environment;

(iii) extracting a subset of LiDAR data points in the point cloud representation of a previous sampling instance, the subset of LiDAR data points corresponding only to features of the target object in the initial map based on the estimated pose of the mobile robot associated with the previous sampling instance, the subset of LiDAR data points excluding information that corresponds to other objects in the environment;

(iv) obtaining desired LiDAR data points in the point cloud representation in a current sampling instance, the desired LiDAR data points including current LiDAR data points which correspond to the extracted subset of LiDAR data points in the previous sampling instance, the desired LiDAR data points excluding information that corresponds to other objects in the environment; and

(v) determining a localization pose of the mobile robot with respect to the target object in the current sampling instance based on the desired LiDAR data points.

2. A method of claim 1, wherein (iv) further comprises:
generating an improved map having a higher density of information than the initial map; determining correspondence between the desired LiDAR data points and the improved map of the reference object to produce a confidence value of each correspondence; and
obtaining the localization pose based on the confidence values.

3. A method according to claim 2, further comprising updating the pose data representing estimated pose of the mobile robot based on the confidence values.

4. A method according to any preceding claim, wherein updating the pose data includes using odometry data of the mobile robot.

5. A method of any preceding claim, wherein obtaining the desired LiDAR points further comprises:

filtering the current LiDAR data points based on respective distances of the LiDAR device to the current LiDAR data points; the desired LiDAR data points further including the distance-filtered LiDAR data points.

6. A method according to claim 5, further including random filtering the distance-filtered LiDAR data points to produce a reduced number of data points as the desired LiDAR data points.

7. A method according to any preceding claim, further comprising repeating (ii) to (v) in the next sampling instance.

8. A method according to any preceding claim, wherein the reference object for creating the initial map is not exactly the same as the target object.

9. A system for localizing a mobile robot with respect to a target object using an initial map of a reference object which is a representation of the target object, the system comprising

(i) a LiDAR device mounted to the mobile robot and arranged to capture LiDAR data of the target object when the mobile robot is arranged to traverse in an environment associated with the target object; the LiDAR data including respective point cloud representations of the target object and the environment in various sampling instances;

(ii) a pose data update module arranged to iteratively update pose data representing estimated pose of the mobile robot with respect to a known reference location of the target object in corresponding sampling instances

when the mobile robot is arranged to traverse the environment;

(iii) a processor configured to:

a. extract a subset of LiDAR data points in the point cloud representation of a previous sampling instance, the subset of LiDAR data points corresponding only to features of the target object in the initial map based on the estimated pose of the mobile robot associated with the previous sampling instance, wherein the subset of LiDAR data points excludes information that corresponds to other objects in the environment;

b. obtain desired LiDAR data points in the point cloud representation in a current sampling instance, the desired LiDAR data points including current LiDAR data points which correspond to the extracted subset of LiDAR data points in the previous sampling instance, the desired LiDAR data points excludes information that corresponds to other objects in the environment; and

c. determine a localization pose of the mobile robot with respect to the target object in the current sampling instance based on the desired LiDAR data points.

10. A system according to claim 9, wherein the processor is further configured to: generate an improved map having a higher density of information than the initial map; determine correspondence between the desired LiDAR data points and the improved map of the reference object to produce a confidence value of each correspondence; and obtain the localization pose based on the confidence values.

11. A system according to claim 10, wherein the processor is further configured to update the pose data representing estimated pose of the mobile robot based on the confidence values.

12. A system according to any one of claims 9 to 11, further comprising an odometer, and wherein updating the pose data includes using odometry data of the mobile robot.

13. A system according to any one of claims 9 to 12, further comprising a distance- based filter operable to filter the current LiDAR data points based on respective distances of the LiDAR device to the current LiDAR data points; the

desired LiDAR data points further including the distance-filtered LiDAR data points.

14. A system according to claim 13, further comprising a random filter to filter the distance-filtered LiDAR data points to produce a reduced number of data points as the desired LiDAR data points.

15. A system according to any one of claims 9 to 14, wherein the reference object for creating the initial map is not exactly the same as the target object.

16. A mobile robot comprising a system of any one of claims 9 to 15.

17. A computer readable medium storing instructions which, when executed by a processor, cause the processor to perform the method of any one of claims 1 to 8.