CLAIMS

What is claimed is:

1. A method comprising:

associating each of a plurality of object categories for objects in an environment with corresponding containers situated in the environment;

activating a robot at a base station;

navigating the robot around the environment using cameras to map a type, a size, and a location of the objects;

for each object category:

choosing one or more of the objects to pick up in the category;

performing path planning from a current location of the robot to one or more of the objects to pick up;

navigating to an adjacent point of one or more of the objects to pick up;

actuating manipulators to open and close across a front of a bucket at a front end of the robot to move obstacles out of the way and manipulate the one or more objects onto the bucket,

wherein the manipulators include a first manipulator member coupled to a first manipulator pivot point adjacent to a first front side of the bucket and a second manipulator member coupled to a second manipulator pivot point adjacent to a second front side of the bucket, and

wherein the first manipulator pivot point allows the first manipulator member to open and close across the first front side of the bucket and the second manipulator pivot point allows the second manipulator member to open and close across the second front side of the bucket;

one or both of tilting or raising the bucket and actuating the manipulators to retain the objects in the bucket;

navigating the robot adjacent to the corresponding container for the category;

aligning a back end of the robot with a side of the corresponding container; and

raising the bucket over the robot and toward the back end to deposit the objects in the corresponding container.

2. The method of claim 1, further comprising:

operating the robot to organize the objects in the environment into clusters, where each cluster comprises only objects from one of the categories.

3. The method of claim 1, further comprising:

operating at least one first arm to actuate the manipulators of the robot to move obstacles out of the way and manipulate the one or more objects onto the bucket; and

operating at least one second arm to tilt or raise the bucket.

4. The method of claim 3, where each first arm is paired with a corresponding second arm, and further comprising:

operating each pairing of first arm and second arm from a common originating pivot point.

5. The method of claim 1, wherein actuating the manipulators of the robot to move obstacles out of the way comprises actuating the manipulators to form a wedge in front of the bucket, and

wherein the wedge formed in front of the bucket is configurable to form an opening sized to allow passage of a target object between the manipulators while preventing collection of unwanted objects.

6. The method of claim 1, wherein actuating the manipulators to retain the objects in the bucket comprises actuating the manipulators to form a barrier in front of the bucket.

7. The method of claim 1, further comprising:

operating a neural network to determine the type, size and location of the objects from images from the cameras.

8. The method of claim 1, further comprising:

generating scale invariant keypoints within a decluttering area of the environment based on input from a left camera and a right camera;

detecting locations of the objects in the decluttering area based on the input from the left camera and the right camera, thereby defining starting locations;

classifying the objects into the categories;

generating re-identification fingerprints for the objects, wherein the re-identification fingerprints are used to determine visual similarity between the objects;

localizing the robot within the decluttering area based on input from at least one of the left camera, the right camera, light detecting and ranging (LIDAR) sensors, and inertial measurement unit (IMU) sensors, to determine a robot location;

mapping the decluttering area to create a global area map including the scale invariant keypoints, the objects, and the starting locations; and

re-identifying the objects based on at least one of the starting locations, the categories, and the re-identification fingerprints.

9. The method of claim 8, further comprising:

assigning persistent unique identifiers to the objects;

receiving a camera frame from an augmented reality robotic interface installed as an application on a mobile device;

updating the global area map with the starting locations and the scale invariant keypoints using a camera frame to global area map transform based on the camera frame; and

generating indicators for the objects, wherein indicators include one or more of next target, target order, dangerous, too big, breakable, messy, and blocking travel path.

10. The method of claim 9, further comprising:

transmitting the global area map and object details to the mobile device, wherein the object details include at least one of visual snapshots, the categories, the starting locations, the persistent unique identifiers, and the indicators of the objects;

displaying the updated global area map, the objects, the starting locations, the scale invariant keypoints, and the object details on the mobile device using the augmented reality robotic interface;

accepting inputs to the augmented reality robotic interface, wherein the inputs indicate object property overrides including change object category, put away next, don't put away, and modify user indicator;

transmitting the object property overrides from the mobile device to the robot; and

updating the global area map, the indicators, and the object details based on the object property overrides.

11. A robotic system comprising:

a robot;

a base station;

a plurality of containers each associated with one or more object categories;

a mobile application; and

robotic control system logic configured to:

navigate the robot around an environment comprising a plurality of objects to map a type, a size, and a location of objects;

for each of the categories:

choose one or more of the objects to pick up in the category;

perform path planning to the objects to pick up;

navigate to points adjacent to each of the objects to pick up;

actuate manipulators to open and close across a front of a bucket at a front end of the robot to move obstacles out of the way and manipulate the one or more objects onto the bucket;

wherein the manipulators include a first manipulator member coupled to a first manipulator pivot point adjacent to a first front side of the bucket and a second manipulator member coupled to a second manipulator pivot point adjacent to a second front side of the bucket, and

wherein the first manipulator pivot point allows the first manipulator member to open and close across the first front side of the bucket and the second manipulator pivot point allows the second manipulator member to open and close across the second front side of the bucket;

one or both of tilt and raise the bucket, and actuate the manipulators to retain the objects to pick up in the bucket;

navigate the robot adjacent to the corresponding container for the category;

align a back end of the robot with a side of the corresponding container; and

raise the bucket over the robot and toward the back end to deposit the objects to pick up in the corresponding container.

12. The system of claim 11, the robotic control system logic further configured to operate the robot to organize the objects in the environment into clusters, where each cluster comprises only objects from one of the categories.

13. The system of claim 11, wherein the robot comprises at least one first arm and at least one second arm, the robotic control system logic further configured to:

actuate the manipulators of the robot to move obstacles out of the way and push the one or more objects onto the bucket and operate the at least one second arm to tilt or raise the bucket.

14. The system of claim 13, where each first arm is paired with a corresponding second arm, and each pairing of first arm and second arm have a common originating pivot point.

15. The system of claim 11, the robotic control system logic further configured to actuate the manipulators of the robot to form a wedge in front of the bucket.

16. The system of claim 11, the robotic control system logic further configured to actuate the manipulators to form a closed barrier in front of the bucket.

17. The system of claim 11, further comprising:

a neural network configured to determine the type, size and location of the objects from images from the cameras.

18. The system of claim 11, the robotic control system logic further configured to:

generate scale invariant keypoints within a decluttering area of the environment based on input from a left camera and a right camera;

detect locations of the objects in the decluttering area based on the input from the left camera and the right camera, thereby defining starting locations;

classify the objects into the categories;

generate re-identification fingerprints for the objects, wherein the re-identification fingerprints are used to determine visual similarity between the objects;

localize the robot within the decluttering area to determine a robot location; and

map the decluttering area to create a global area map including the scale invariant keypoints, the objects, and the starting locations.

19. The system of claim 18, the robotic control system logic further configured to:

re-identify the objects based on at least one of the starting locations, the categories, and the re-identification fingerprints.

20. The system of claim 19, the robotic control system logic further configured to:

classify the objects as one or more of dangerous, too big, breakable, and messy.