CLAIMS

What is claimed is:

1. A material handling system, comprising:
a plurality of destination areas;
a plurality of vehicles for delivering items to the destination areas or retrieving items from the destination areas, wherein the vehicles travel a path;
a controller for controlling movement of the plurality of vehicles;
a detector for detecting whether an item on one of the vehicles extends beyond a pre-determined dimensional threshold relative to the vehicle, wherein the detector is positioned adjacent the path on which the vehicles travel and the detector is operable to create a depth data set representative of a three-dimensional representation of a target area;
wherein the controller controls operation of the vehicle in response to the detector determining that an item projects beyond the dimensional threshold.

2. The system of claim 1 wherein the predetermined dimensional threshold is the height above the vehicle.

3. The system of claim 1 or 2 wherein in response to the detector determining that an item projects beyond the dimensional threshold, the controller stops the vehicle from advancing until the item no longer projects above the dimensional threshold.

4. The system of any of claims 1-3 wherein the detector comprises an emitter and a sensor wherein the sensor comprises a two-dimensional array of pixels.

5. The system of claim 4 wherein the emitter comprises an infrared or near infrared light source.

6. The system of claim 4 wherein each pixel comprises a photodetector.

7. The system any of claims 1-6 wherein the detector comprises a structured-light 3D scanner.

8. The system of claim 7 wherein the detector comprises an emitter operable to project a light pattern and an imaging element spaced apart from the emitter, wherein the imaging element is operable to detect the light pattern emitted onto the target area.

9. The system of claim 8 wherein the detector is operable to detect the distortion of the projected light pattern to determine the depth data set.

10. The system of claim 9 wherein the detector uses triangulation to calculate the 3-dimensional position of surface points onto which the emitter projects the light pattern.

11. The system any of claims 1-10 wherein the detector comprises a time of flight camera.

12. The system of claim 11 wherein the time of flight camera comprises a light source and an image sensor comprising a plurality of pixels that detects the time light has taken to travel from the light source to objects in the target area and then back to the image sensor.

13. The system of claim 12 wherein the time of flight camera comprises a light source and an image element that measures the phase difference between light emitted from the light source and the light reflected back from objects in the target area to the imaging element.

14. The system of claim 11 wherein the detector identifies three reference points that identify a plane generally parallel with an upper surface of the vehicle.

15. The system of claim 14 wherein the plane is at an angle to the horizon.

16. The system of claim 14 wherein the detector is configured to use the identified plane to identify depth data representative of items that extend above the pre-determined height.

17. The system any of claims 1-16 wherein the detector is positioned so that the vehicles pass by the detector as the vehicles travel along the path.

18. A material handling system, comprising:

a plurality of destination areas;

a plurality of vehicles for delivering items to the destination areas or retrieving items from the destination areas, wherein the vehicles travel a path;

a controller for controlling movement of the plurality of vehicles;

a detector for detecting whether an item on one of the vehicles extends beyond a pre-determined dimensional threshold relative to the vehicle, wherein the detector is positioned adjacent the path on which the vehicles travel and the detector is operable to create a depth data set representative of a three-dimensional representation of a target area; and

a track that guides the vehicles, wherein the destination areas are disposed on either side of the track and wherein the track comprises a front track and an opposing rear track with an aisle between the front track and the rear track; and

wherein the controller controls operation of the vehicle in response to the detector determining that an item projects beyond the dimensional threshold.

19. The system of claim 18 wherein a picking station is positioned at the end of the aisle.

20. The system of claim 19 wherein the detector is positioned between the front track and the rear track.

21. The system of claim 20 wherein the detector is positioned adjacent the picking station so that the target area is a location in the picking area where the vehicles are stopped.

22. The system of claim 20 wherein the detector is operable to detect whether a part of an operator extends into the path between the front track and the rear track.

23. A material handling system, comprising:

a plurality of destination areas;

a plurality of vehicles for delivering items to the destination areas or retrieving items from the destination areas, wherein the vehicles travel a path;

a detection assembly for detecting whether items on the vehicles extend beyond a pre-

determined dimensional threshold relative to the vehicle, wherein the detection assembly is positioned adjacent the path on which the vehicles travel and the detection assembly comprises:

an emitter for projecting a light source onto one of the vehicles when the vehicle is at a location along the path; and

an imaging element configured to detect the light projected onto the vehicle;

an image processor configured to receive image data from the detection assembly to determine the distance that elements on the vehicle project from the vehicle;

wherein in response to the image processor determining that an item projects above the pre-determined dimensional threshold, movement of the vehicle along the path is altered.

24. The system of claim 23 wherein the dimensional threshold is the height above the vehicle.

25. The system of claim 23 or 24 wherein in response to the image processor determining that an item projects above the dimensional threshold, movement of the vehicle along the path is stopped until the item no longer projects beyond the dimensional threshold.

26. A material handling system, comprising:

a plurality of destination areas;

a plurality of vehicles for delivering items to the destination areas or retrieving items from the destination areas, wherein the vehicles travel a path;

a controller for controlling movement of the plurality of vehicles;

a detector detecting whether an item extends into the path of the vehicle wherein the detector is positioned adjacent the path on which the vehicles travel and the detector is operable to create a depth data set representative of a three-dimensional representation of a target area;

wherein the controller controls operation of the vehicle in response to the detector determining that an item projects into the path.

27. The system of claim 26 wherein in response to the detector determining that an item projects into the path of one of the vehicles, the controller stops the vehicle from

advancing until the item no longer projects into the path of the vehicle.

28. The system of claim 26 or 27 wherein the detector comprises and emitter and a sensor wherein the sensor comprises a two-dimensional array of pixels.

29. The system of any of claims 26-28 wherein the detector is positioned so that the vehicles pass by the detector as the vehicles travel along the path.