motors, to move the vehicle along a vertical path segment extending between a support surface underlying the vehicle and one of the destination areas; a second drive system having a first plurality of drive elements configured, by operation of a second subset of the plurality of motors, to engage the underlying support surface and drive movement of the vehicle in a non-vertical direction; a transfer mechanism configured to at least one of transfer an item from the platform to one of the plurality of destination areas or retrieve an item from one of the plurality of destination areas; and a clutch mechanism configured to engage and disengage the transfer mechanism from the second subset of motors, whereby the second drive system drives movement of the vehicle independently of the transfer mechanism.

[0003b] In another aspect, the present disclosure refers to a vehicle operable in an inventory management system having a plurality of destination areas and a guide system, the vehicle comprising: a first motorized drive system configured to engage the guide system to guide movement of the vehicle along a vertical path segment; a second motorized drive system dimensioned and arranged to maneuver the vehicle upon a surface while the first drive system is out of engagement with the guide system; a transfer mechanism operative to transfer an item between the vehicle and one of the plurality of destination areas; and a clutch mechanism operative to engage and to disengage transmission of power from and to the transfer mechanism, whereby each of the first drive system and second drive system is operable independently of the transfer mechanism; wherein the first motorized drive system includes first and second pairs of motor driven rotary elements, the rotary elements of each pair being configured to interact with the guide system to control the position of the vehicle along the guide system.

[0003c] In another example, the present disclosure refers to a vehicle operable in an inventory management system, the vehicle comprising: a first motor and a second motor; a first pair of omnidirectional rollers and a second pair of omnidirectional rollers, wherein a first omnidirectional roller of each pair is dimensioned and arranged to rotate about a first axis of rotation and wherein a second omnidirectional roller of each pair is driven by the first motor or the second motor for rotation about a second axis of rotation; a fifth roller driven by the first motor or the second motor; and an actuator having an actuation surface configured to move from a first position to a second position to selectively urge the fifth roller in a direction toward an underlying support surface; wherein a surface of each of the first and second pairs of omnidirectional rollers, and a surface of the fifth roller are dimensioned and arranged to contact the underlying support surface while the actuator is maintained in the first position, and wherein movement of the actuator into the second position causes a transfer of load from one or more of the omnidirectional rollers to the fifth roller.

[0004] In accordance with examples of the present disclosure, the disadvantages and problems

associated with conventional warehouse automation approaches have been substantially reduced or eliminated by one or more vehicles configurable to perform a variety of tasks relevant to an inventory management operation. In examples, each vehicle is configured and operable to perform a first set of one or more inventory management tasks according to a first mode of operation and, in order that they may perform one or more inventory management tasks according to an additional mode of operation, to interact

Claims:

1. A vehicle configured to perform inventory management tasks in an inventory management handling system having a plurality of destination areas and a guide system, the vehicle comprising:

a platform dimensioned and arranged to receive an item to be at least one of transferred to or received from one of the destination areas;

a plurality of motors;

a first drive system having a first plurality of drive elements configured to engage the guide system, by operation of a first subset of the plurality of motors, to move the vehicle along a vertical path segment extending between a support surface underlying the vehicle and one of the destination areas;

a second drive system having a first plurality of drive elements configured, by operation of a second subset of the plurality of motors, to engage the underlying support surface and drive movement of the vehicle in a non-vertical direction;

a transfer mechanism configured to at least one of transfer an item from the platform to one of the plurality of destination areas or retrieve an item from one of the plurality of destination areas; and

a clutch mechanism configured to engage and disengage the transfer mechanism from the second subset of motors, whereby the second drive system drives movement of the vehicle independently of the transfer mechanism.

2. The vehicle of claim 1, wherein the first subset comprises a single motor configured to rotate the first plurality of drive elements of the first drive system.

3. The vehicle of claim 2, wherein the second subset comprises a plurality of motors, and wherein a first motor of the second subset drives rotation of a first drive element of the second drive system and a second motor of the second subset drives rotation of a second drive element of the second drive system.

4. The vehicle of any of claims 1-3, wherein the second subset comprises a plurality of motors, and wherein a first motor of the second subset drives rotation of a first drive element of the second drive system and a second motor of the second subset drives rotation of a second drive element of the second drive system.

5. The vehicle of any of claims 1-4, wherein the first plurality of drive elements of the first drive system includes a plurality of gears dimensioned and arranged to interact with complementary teeth of the guide system to control the position of the vehicle along the guide system.

6. The vehicle of claim 5, wherein the first drive system further includes a pair of drive axles, wherein the driven gears are fixed to the drive axles so that the gears are synchronously driven to drive the vehicle along the guide system.

7. The vehicle of any of claims 1-6, wherein the second drive system includes a first drive element driven by a first motor of the second subset to rotate about a first axis of rotation, and a drive element driven by a second motor of the second subset to rotate about a second axis of rotation, wherein each of the first and second drive elements is dimensioned and arranged to engage a respective portion of the underlying support surface for movement of the vehicle thereupon.

8. The vehicle of claim 7, wherein the clutch mechanism comprises:

a first pivotable carrier movable between a first angular orientation relative to the platform and a second angular orientation relative to the platform. wherein the first drive element is rotatably coupled to the first pivotable carrier for angular movement therewith;

a second pivotable carrier movable between the first angular orientation and the second angular orientation, wherein the second drive element is coupled to the second pivotable carrier for angular movement therewith.

9. The vehicle of claim 8, wherein the first and second axes of rotation are co-axial while the first and second pivotable carriers have a common angular orientation.

10. The vehicle of claim 8 or 9, wherein the second drive system further includes

a first driven element rotatably coupled to the first pivotable carrier and a first endless loop element for transferring rotary power to the first driven element; and

a second driven element rotatably coupled to the second pivotable carrier and a second endless loop element for transferring rotary power to the second driven element.

11. The vehicle of claim 10, wherein each of the first endless loop element and the second endless loop element is a belt.

12. The vehicle of claim 10, wherein the second drive system further comprises

a first pulley, the first pulley and first drive element being driven by the first motor of the second subset, wherein the first pulley is dimensioned and arranged to engage the first endless loop element to thereby drive the first driven element; and

a second pulley, the second pulley and second drive element being driven by the second motor of the second subset, wherein the second pulley is dimensioned and arranged to engage the second endless loop element to thereby drive the second driven element.

13. The vehicle of claim 12, wherein the clutch mechanism further includes

a third driven element rotatably coupled to the first driven element and coaxial therewith, the third driven element being dimensioned and arranged to drivingly engage a first portion of the transfer mechanism and thereby transfer power from the first motor of the second subset while the first pivotable carrier is in the first angular orientation.

14. The vehicle of claim 13, wherein the clutch mechanism further includes

a fourth driven element rotatably coupled to the second driven element and coaxial therewith, the fourth driven element being dimensioned and arranged to drivingly engage a second portion of the transfer mechanism and thereby transfer power from the second motor of the second subset while the second pivotable carrier is in the first angular orientation.

15. The vehicle of any of claims 10-14, wherein the second drive system further includes a plurality of omnidirectional wheels dimensioned and arranged to frictionally engage respective portions of the underlying surface to thereby support the vehicle.

16. The vehicle of claim 15, wherein the second first drive system further includes a plurality of drive axles, wherein at least a pair of the omnidirectional wheels are driven by at least one of the second subset of motors.

17. The vehicle of any of claims 10-16, the vehicle further comprising:

a controller for directing operation of the plurality of motors, the controller including a processor and a memory containing instructions, executable by the processor, to operate the motors of the second subset to drive the first and second drive elements of the second drive system to thereby displace the vehicle along a substantially horizontal path upon the support surface.

18. The vehicle of claim 17, wherein the memory contains instructions executable by the processor to operate the second subset of motors to bring respective portions of the first drive system into facing alignment with corresponding portions of the guide system.

19. The vehicle of claim 18, wherein the memory further contains instructions executable by the processor to initiate driving engagement of respective portions of the first drive system with corresponding aligned portions of the guiding system and thereby cause elevation or descent of the vehicle relative to a datum plane.

20. The vehicle of claim 19, wherein the clutch mechanism is configured to enable transmission of power to the transfer mechanism responsive to elevation of the vehicle to a position above the datum plane, the memory further containing instructions executable by the processor for operating a motor of the second subset of one or motors to cause the transfer mechanism to one of transfer an item from the platform to a destination area adjacent the vehicle or to retrieve an item from the destination area to the platform.

21. The vehicle of claim 19, wherein the clutch mechanism is dimensioned and arranged to disable actuation of the transfer mechanism responsive to descent of the vehicle to a position below the datum plane.

22. A vehicle operable in an inventory management system having a plurality of destination areas and a guide system, the vehicle comprising:

a first motorized drive system configured to engage the guide system to guide movement of the vehicle along a vertical path segment;

a second motorized drive system dimensioned and arranged to maneuver the vehicle upon a surface while the first drive system is out of engagement with the guide system;

a transfer mechanism operative to transfer an item between the vehicle and one of the plurality of destination areas; and

a clutch mechanism operative to engage and to disengage transmission of power from and to the transfer mechanism, whereby each of the first drive system and second drive system is operable independently of the transfer mechanism;

wherein the first motorized drive system includes first and second pairs of motor driven rotary elements, the rotary elements of each pair being configured to interact with the guide system to control the position of the vehicle along the guide system.

23. The vehicle of claim 22, wherein each rotary drive element, of the first and second pairs of rotary drive elements, is a gear having teeth dimensioned and arranged to engage complementary teeth of the guide system as the vehicle changes elevation along the guide system.

24. The vehicle of claim 23, wherein the first drive system further includes a pair of synchronous drive axles, wherein the driven gears are fixed to the axles so that the gears are synchronously driven to drive the vehicle along the guide system.

25. The vehicle of claim 23, wherein the clutch mechanism is dimensioned and arranged to disengage from the transfer mechanism as the vehicle descends to a position beyond the datum plane, thereby disabling actuation of the transfer mechanism by the controller.

26. The vehicle of any of claims 22-25, wherein the clutch mechanism is dimensioned and arranged to engage with the transfer mechanism as the vehicle ascends to a position above the datum plane, thereby enabling actuation of the transfer mechanism by the controller.