CLAIMS

1. A system arranged to control movement of one or more transporting devices said transporting devices arranged to transport containers, said containers being stored in a facility, in which the facility is arranged to store the containers in a plurality of stacks, the facility further having a plurality of pathways arranged in a grid-like structure above the stacks, the one or more transporting devices arranged to operate on the grid-like structure, the system comprising:

one or more computers configured to execute computer instructions which when executed provide:

one or more utilities arranged to determine and reserve routes for moving the one or more transporting devices through the plurality of pathways and determine and reserve routes for moving the one or more transporting devices when transporting one or more of the plurality of containers; and

one or more utilities arranged to determine and control retrieval of the one or more containers by the one or more transporting devices from within one or more of the plurality of stacks, wherein retrieval of the one or more containers from within the one or more stacks further requires moving one or more other containers in the stack prior to accessing the one or more containers for retrieval,

wherein the utilities together are arranged to control retrieval and movement of the one or more containers once retrieved by the or each transporting device, said utilities being further arranged to instruct one or more of the transporting devices to move one or more other containers from within one or more stacks to an alternative position within the facility,

the system further comprising a product placement optimisation means arranged to determine the alternative position from an available pool of empty locations within any one of the stacks other than the stack from which the or each container was removed,

wherein the product placement optimisation means is further arranged to determine the alternative position based on at least one of: the layout of the grid-like structure, the frequency at which a particular item is requested, future ordering, predicted future ordering, the location of workstations, the location of charging stations, and the congestion level of particular areas and branches of the pathway.

2. A system according to any preceding claim in which the or each of the containers contain objects, the objects being stored in the containers in the stacks for subsequent retrieval.

3. A system according to any preceding claim comprising one or more further utilities providing a clearance system for permitting or stopping movement of the one or more transporting devices to avoid collisions.

4. A system according to any preceding claim comprising one or more further utilities comprising optimizing means configured to optimise the movement and actions of the one or more transporting devices through the plurality of pathways.

5. A system according to claim 4 said optimising means comprising placing means configured to optimise the placement of the plurality of containers by the one or more transporting devices in the facility.

6. A system according to claim 4 or claim 5, wherein any one of the utilities that optimise the movement and actions of any one of the transporting devices use one or more path finding algorithms.

7. A system according to claim 4 or claim 5, wherein any one of the utilities that optimise the movement and actions of any one of the transporting devices use one or more machine learning techniques.

8. A system according to claim 5, wherein any one of the utilities that optimise the placement of the plurality of containers within the facility, further comprises updating means for updating stock levels of the facility based on the depletion of one or more of the plurality of objects within the facility.

9. A system according to any preceding claim comprising one or more further utilities that control movement or operations on one or more of the containers conducted within one or more workstations.

10. A system according to claim 9 wherein any one of the utilities further comprises control means that controls the movement of the one or more of transporting devices based at least on throughput of the one or more workstations.

11. A system according to any preceding claim wherein any one of the utilities comprises determining and reserving means arranged to determine and reserve routes, and instruct a plurality of transporting devices to cooperate in transporting one or more of the plurality of containers.

12. A system according to any preceding claim wherein any one of the utilities further comprises determining means arranged to determine and reserve routes to move idle transporting devices from otherwise optimal routes for other transporting devices.

13. A system according to any preceding claim, wherein the facility is divided into a plurality of sub-grids.

14. A system according to any preceding claim, wherein one or more control commands to control the movement of the plurality of transporting devices is provided to the plurality of transporting devices in advance of the movement of the plurality of transporting devices.

15. A system according to any preceding claim wherein any one of the utilities comprises optimising means arranged to optimise the return of the or each container into the most optimal of the vacant positions in the stacks within the facility.

16. A system according to any preceding claim wherein any one of the utilities comprises operating means arranged to dynamically substitute damaged or missing objects from alternative containers within the stack.

17. A system according to any preceding claim wherein any one of the utilities comprises further optimizing means for the remainder of the stack on a cost function analysis.

18. A storage system comprising:

a facility arranged to store containers in a plurality of stacks, the facility comprising a plurality of pathways arranged in a grid-like structure above the stacks;

one or more transporting devices arranged to operate on the grid-like structure and arranged to transport containers; and

a system according to any preceding claim.

19. The storage system according to Claim 18, wherein each transporting device has a footprint of a single grid position on the grid-like structure.

20. A method arranged to control the movement of one or more transporting devices arranged to transport a plurality of containers, said devices arranged to operate in a facility, the facility comprising the plurality of containers arranged in a

plurality of stacks, the facility further having a plurality of pathways arranged in a grid-like structure above the stacks, the one or more transporting devices arranged to operate on the grid-like structure, the method comprising:

determining and reserving routes for moving the one or more transporting devices through the plurality of pathways;

determining and reserving routes for moving the one or more transporting devices when transporting one or more of the plurality of containers;

determining and controlling retrieval of one or more of the plurality of containers by the one or more transporting devices from within one or more of the plurality of stacks, wherein retrieval of the one or more containers from within the one or more stacks further requires moving one or more other containers in the stack prior to accessing the one or more containers for retrieval; and

moving the one or more other containers from within one or more to an alternative position within the facility,

wherein the alternative position is determined from an available pool of empty locations within any one of the stacks other than the stack from which the or each container was removed,

wherein the alternative position is determined based on at least one of: the layout of the grid-like structure, the frequency at which a particular item is requested, future ordering, predicted future ordering, the location of workstations, the location of charging stations, and the congestion level of particular areas and branches of the pathway.

21. A method according to claim 20 in which the containers contain objects for storage and retrieval from within the facility.

22. A method according to any of claims 20 to 21 further comprising the step of providing a clearance system for permitting or stopping movement of the one or more transporting devices to avoid collisions.

23. A method according to any one of claims 20 to 22 further comprising the step of optimising the movement and actions of the one or more transporting devices through the plurality of pathways.

24. A method according to claim 23 further comprising the step of optimising the placement of the plurality of containers by the one or more transporting devices in the facility.

25. A method according to claim 23 or claim 24 wherein optimising the movement and actions of the or each transporting device comprises using one or more path finding algorithms.

26. A method according to claim 23 or claim 24 wherein optimising the movement and actions of the or each transporting device comprises using one or more machine learning techniques.

27. A method according to claim 24 wherein optimising the placement of the plurality of containers within the facility, and updating stock levels of the facility is based on the depletion of one or more of the plurality of objects within the facility.

28. A method according to any of claims 20 to 27 further comprising the step of controlling movement of or operations on the or each of the containers conducted within one or more workstations.

29. A method according to claim 28 wherein controlling the movement of the one or more of transporting devices is based at least on throughput of the one or more workstations.

30. A method according to any one of claims 20 to 29 comprising the further step of instructing a plurality of transporting devices to cooperate in transporting one or more of the plurality of containers.

31. A method according to any one of claims 20 to 30 further comprising the step of determining and reserving routes to move idle transporting devices from otherwise optimal routes for other transporting devices.

32. A method according to any one of claims 20 to 31 wherein the facility is divided into a plurality of sub-grids.

33. A method according to any one of claims 20 to 32, wherein one or more control commands for controlling the movement of the plurality of transporting devices is provided to the plurality of transporting devices in advance of the movement of the plurality of transporting devices.

34. A method according to any one of claims 20 to 33 wherein one or more utilities is provided to determine a further optimization of the remainder of the stack on a cost function analysis.