CLAIMS

What is claimed is:

1. A system for order fulfillment using one or more robots, comprising:

a server configured to receive an order comprising an order item;

inventory storage operably connected to the server, the inventory storage comprising order items;

an actor robot operably connected to and selected by the server, the actor robot configured to perform one or more of picking the order item from inventory storage, moving the order item, and positioning the order item; and

an order robot operably connected to the server, the order robot configured to collect the order item, wherein the order item is positioned by the actor robot directly on the order robot, so as to perform order fulfillment using one or more robots;

wherein using position information from at least one robot, the server generates a currently planned path while optimizing criteria of interest and transmits the currently planned path to the robot.

2. The system of claim 1, wherein the inventory storage comprises one or more of an inventory robot, a box, a bin, a fixed shelf, a non-fixed shelf, a rack, a conveyor, a warehouse, another inventory storage location, and other inventory storage.

3. The system of claim 1, wherein the inventory storage comprises an inventory robot.

4. The system of claim 3, wherein the inventory robot is mobile.

5. The system of claim 1, wherein the actor robot is configured to pick and move the order item.

6. The system of claim 1, wherein the actor robot is stationary.

7. The system of claim 1, wherein the actor robot is mobile.

8. The system of claim 6, wherein the stationary actor robot comprises one or more arms.

9. The system of claim 6, wherein at least one order robot is configured to move from a first stationary actor robot to a second stationary actor robot, picking at least two order items.

10. The system of claim 7, wherein the actor robot receives from the server a currently planned path or the actor robot generates a currently planned path for itself.

11. The system of claim 1, further comprising a packer robot configured to pack an order item into a container to be shipped.

12. The system of claim 11, wherein the order robot is configured to position the order item so as to be accessible to the packer robot.

13. The system of claim 1, wherein the server communicates wirelessly with at least one of the actor robot, the order robot, and the inventory storage.

14. The system of claim 2, wherein the inventory robot is configured to perform one or more of carrying inventory on top of itself and carrying inventory inside itself.

15. The system of claim 1, wherein at least one of the actor robots is configured to transfer inventory from one or more of a robot and inventory storage to one or more of a robot and inventory storage.

16. The system of claim 1, wherein the actor robot stays near the inventory storage after the actor robot picks an order item from the inventory storage.

17. The system of claim 16, wherein, after the actor robot picks the order item from the inventory storage, the actor robot picks a second order item from the inventory storage.

18. The system of claim 4, wherein the mobile inventory robot moves between at least two actor robots.

19. The system of claim 18, wherein at least one of the actor robots picks an order item from the mobile inventory robot.

20. The system of claim 1, wherein the order robot comprising an order item drives itself to a packing station.

21. The system of claim 20, wherein at the packing station, a packer robot packs the order item into a container to be shipped.

22. A system for order fulfillment using one or more robots, comprising:

a server configured to receive an order comprising an order item;

an inventory robot operably connected to the server, the inventory robot comprising order items;

an actor robot operably connected to and selected by the server, the actor robot configured to perform one or more of receiving from the server and generating a currently planned path for the actor robot, the actor robot further configured to perform one or more of picking the order item, moving the order item, and positioning the order item; and

an order robot operably connected to the server, the order robot configured to collect the order item, wherein the order item is positioned by the actor robot directly on the order robot, so as to perform order fulfillment using one or more robots;

wherein using the position information from at least one robot, the server generates a currently planned path while optimizing criteria of interest and transmits the currently planned path to the robot.

23. The system of claim 22, wherein the actor robot communicates one or more of its past position, its present position, its future position, and position information affecting its currently planned path.

24. The system of claim 23, wherein the actor robot communicates position information affecting its currently planned path comprising position information regarding an obstacle affecting its currently planned path.

25. The system of claim 24, wherein the actor robot communicates position information regarding an obstacle preventing timely and cost-effective execution of the currently planned path.

26. The system of claim 24, wherein the actor robot communicates position information regarding an obstacle blocking the current planned path.

27. A method for order fulfillment using robots, comprising:

receiving, by a server, an order comprising an order item;

computing, by the server, a currently planned path configured to enable a task robot to reach a destination while optimizing criteria of interest;

transmitting, by the server, the currently planned path to the task robot

selecting, by the server, the task robot to perform a task relating to fulfillment of the order;

determining, by the server, the destination for the task robot;

receiving, by the server, position information from the task robot;

determining, by the server, using the position information, that the task robot is positioned so as to be ready to perform the task;

transmitting, by the server, one or more of the task and the destination to the task robot;

positioning the order item, by the task robot, directly on an order robot configured to collect the order item, so as to perform order fulfillment using one or more robots; and

receiving, by the server, from the task robot, a task confirmation confirming that the task has been completed.

28. The method of claim 27, wherein the task robot comprises one or more of an inventory robot, an actor robot, an order robot, and a packer robot.

29. The method of claim 28, wherein the task robot comprises an inventory robot configured to perform one or more of picking and moving the order item.

30. The method of claim 28, wherein the task robot comprises an actor robot configured to perform one or more of picking the order item, moving the order item, and positioning the order item.

31. The method of claim 28, wherein the task robot comprises a packer robot configured to pack an order item into a container to be shipped.

32. The method of claim 28, wherein the step of computing comprises computing an optimal path.

33. The method of claim 28, wherein the step of computing comprises computing one or more of a time optimal path and a cost optimal path.

34. The method of claim 28, wherein the server distributes one or more of the steps in the method among more than one task robot.

35. The method of claim 34, wherein the step of computing comprises computing a currently planned path configured to enable the task robot to reach a destination while optimizing criteria of interest.

36. The method of claim 35, wherein the step of computing comprises computing a currently planned path configured to enable the task robot to reach the destination while optimizing one or more of the expense of the currently planned path and the time required to execute the currently planned path.

37. The method of claim 36, wherein the step of computing comprises computing a currently planned path configured to enable the task robot to reach the destination while minimizing one or more of the expense of the currently planned path and the time required to execute the currently planned path.

38. The method of claim 35, wherein the step of computing comprises computing the currently planned path assuming an obstacle-free path to the destination.

39. The method of claim 35, wherein the step of computing comprises computing the currently planned path assuming a path to the destination that is obstacle-free apart from one or more known obstacles.

40. The method of claim 27, wherein the step of transmitting the task comprises transmitting a pick order.

41. The method of claim 27, wherein the step of receiving the task confirmation comprises receiving a pick confirmation confirming that the ordered items have been picked.

42. A method for order fulfillment using robots, comprising:

receiving, by a task robot, from a server, one or more of a selection of the task robot and a destination;

computing, by the task robot, a currently planned path configured to enable the task robot to reach the destination while optimizing criteria of interest;

executing, by the task robot, the currently planned path;

communicating position information, by the task robot, to the server;

determining, by the task robot, using the position information, that the task robot is positioned so as to be ready to perform a task relating to fulfillment of an order;

receiving, by the task robot, from the server, the task;

performing the task, by the task robot;

positioning the order item, by the task robot, directly on an order robot configured to collect the order item, so as to perform order fulfillment using one or more robots; and

sending, to the server, by the task robot, a task confirmation confirmed that the task has been completed.

43. The method of claim 42, wherein the task robot comprises one or more of an inventory robot, an actor robot, an order robot, and a packer robot.

44. The method of claim 42, wherein the task robot comprises an inventory robot configured to perform one or more of picking and moving the order item.

45. The method of claim 42, wherein the task robot comprises an actor robot configured to perform one or more of picking the order item, moving the order item, and positioning the order item.

46. The method of claim 42, wherein the task robot comprises a packer robot configured to pack an order item into a container to be shipped.

47. The method of claim 42, wherein the step of performing comprises picking an order item.

48. The method of claim 47, wherein the step of performing comprises picking the order item from an inventory storage.

49. The method of claim 42, wherein the step of performing comprises packing an order item.

50. The method of claim 49, wherein the step of packing is performed by a packing robot.

51. The method of claim 49, wherein the step of performing further comprises shipping one or more of the one or more items.

52. The method of claim 42, wherein the method further comprises a step of receiving the currently planned path configured to enable the task robot to reach a destination while optimizing criteria of interest.

53. The method of claim 42, wherein the step of receiving the task comprises receiving a pick order.

54. The method of claim 53, wherein the step of sending comprises sending a pick confirmation confirming that the ordered items have been picked.

55. The method of claim 42, wherein the step of communicating comprises communicating one or more of a past robot position, a present robot position, a future robot position, and position information regarding an obstacle affecting the currently planned path.

56. The method of claim 55, wherein the step of communicating comprises communicating position information regarding an obstacle blocking the current planned path.

57. A method for order fulfillment using robots, comprising:

receiving, by a server, an order comprising an order item;

selecting, by the server, a task robot to perform a task relating to fulfillment of the order;

receiving, by the task robot, from the server, the selection of the task robot;

determining, by the server, a destination for the task robot;

computing, by one or more of the server and the task robot, a currently planned path for the task robot configured to enable the task robot to reach the destination while optimizing criteria of interest;

transmitting, by the server, the currently planned path to the task robot;

receiving, by the task robot, from the server, the currently planned path;

executing, by the task robot, the currently planned path;

communicating position information, by the task robot, to the server;

receiving, by the server, position information from the task robot;

determining, by one or more of the server and the task robot, using the position information, that the task robot is positioned so as to be ready to perform the task;

transmitting, by the server, the task to the task robot;

receiving the task, by the task robot, from the server;

performing the task, by the task robot;

sending, to the server, by the task robot, a task confirmation confirmed that the task has been completed;

positioning the order item, by the task robot, directly on an order robot configured to collect the order item, so as to perform order fulfillment using one or more robots;

receiving, by the server, from the task robot, the task confirmation;

and determining, by the server, that the task robot is not to be sent to another destination.