Claims

1. A Flexible assembly line ~~(30, 210, 212, 276)~~ for tray packaging comprising
   - a tray dispenser ~~(32, 62)~~ for providing a tray ~~(76, 80, 84, 88, 90)~~, and
   - a loading station ~~(34, 36, 38, 214, 216, 218, 234, 236, 238, 250)~~ adjacent to the tray dispenser ~~(32, 62)~~ for placing food or non-food items onto the tray ~~(76, 80, 84, 88, 90)~~ automatically.

2. The flexible assembly line ~~(30, 210, 212, 276)~~ of Claim 1 further comprising a tray-to-cart loading station ~~(44, 68)~~ connected to the loading station ~~(34, 36, 38, 218, 234, 236, 238)~~ for removing a completed tray package away from the loading station ~~(34, 36, 38, 218, 234, 236, 238)~~.

3. The flexible assembly line ~~(30, 210, 212, 276)~~ of Claim 1 or 2 further comprising
   a conveyor ~~(46)~~ that connects the tray dispenser ~~(32, 62)~~, the loading station ~~(34, 36, 38, 218, 234, 236, 238)~~, the tray-to-cart loading station ~~(44, 68)~~ or a combination of any of these.

4. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims further comprising
   an inspection and reject station ~~(42, 43)~~ for checking quality of food and non-food items ~~(242)~~.

5. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims further comprising
   at least one sorter ~~(54, 56, 58)~~ for organizing the food or non-food items.

6. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims, wherein the tray dispenser ~~(32, 62)~~, the loading station ~~(34, 36, 38, 214, 216, 218, 234, 236, 238)~~, the tray-to-cart loading station ~~(44, 68)~~, the conveyor ~~(46)~~, the inspection and reject station ~~(42, 43)~~ or a combination of any of these comprise an industrial robot ~~(32, 78, 82, 86, 292)~~ for picking the food or non-food items ~~(242)~~.

7. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims, wherein the tray dispenser ~~(32, 62)~~, the loading station ~~(34, 36, 38, 214, 216, 218, 234, 236, 238)~~, the tray-to-cart loading station ~~(44, 68)~~, the conveyor ~~(46)~~, the inspection and reject station ~~(42, 43)~~, the industrial robot ~~(32, 78, 82, 86, 292)~~ or a combination of any of these have machine vision for recognizing shapes of various objects.

8. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims, wherein the tray dispenser ~~(32, 62)~~, the loading station ~~(34, 36, 38, 214, 216, 218, 234, 236, 238)~~, the tray-to-cart loading station ~~(44, 68)~~, the conveyor ~~(46)~~, the inspection and reject station ~~(42, 43)~~, the industrial robot ~~(32, 78, 82, 86, 292)~~ or a combination of any of these have machine vision for surface texture of various objects.

9. The flexible assembly line ~~(30, 210, 212, 214, 216, 218)~~ of any of the preceding Claims,
Wherein at least two of the tray dispenser ~~(32, 62)~~, the loading station ~~(34, 36, 38, 214, 216, 218, 234, 236, 238)~~, the tray-to-cart loading station ~~(44, 68)~~, the conveyor ~~(46)~~, the inspection and reject station ~~(42, 43)~~, the industrial robot ~~(32, 78, 82, 86, 292)~~ or a combination of any of these are connected for neural net processing.

10. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims, wherein the tray dispenser ~~(32, 62)~~, the loading station ~~(34, 36, 38, 214, 216, 218, 234, 236, 238)~~, the tray-to-cart loading station ~~(44, 68)~~, the conveyor ~~(46)~~, the inspection and reject station ~~(42, 43)~~, the industrial robot ~~(32, 78, 82, 86, 292)~~ or a combination of any of these are modularly connected to the flexible assembly line ~~(30, 210, 212, 214, 216, 218)~~ such that it can be disconnected to other parts of the flexible assembly line ~~(30, 210, 212, 214, 216, 218)~~ without affecting others.

11. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims, wherein

the loading station ~~(34, 36, 38, 214, 216, 218, 234, 236, 238)~~ comprises a conveyor ~~(232)~~ for feeding bins ~~(222, 224)~~ with food or non-food items ~~(242)~~, and another conveyor ~~(230)~~ for removing empty bins ~~(226, 228)~~.

12. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims further comprising

a manual loading station ~~(40)~~ for manually loading, unloading or checking food or non-food items ~~(242)~~.

13. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims further comprising

a shelving carousel that has movable loading trays ~~(268)~~ for transferring food or non-food items ~~(242)~~.

14. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims further comprising

a touch screen display ~~(50, 52)~~ connected to a main computer ~~(48)~~ of the flexible assembly line ~~(30, 210, 212, 214, 216, 218)~~ for controlling.

15. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims further comprising

an automatically guided vehicle ~~(274)~~ for fetching packaged tray assemblies or empty trays ~~(76, 84, 88, 90)~~.

16. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims further comprising

an auto food items dispenser ~~(252)~~ that comprises a rotatable food hopper ~~(254)~~, a diverter ~~(256)~~ and a conveyor ~~(46, 258)~~, the rotatable food hopper ~~(254)~~ having at least one compartments for storing food items ~~(242)~~.

17. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claim 6 to 10, wherein
the industrial robot ~~(32, 78, 82, 86, 292)~~ has an end effector ~~(298)~~ for rotating.

18. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claim 6 to 10 or 17, wherein
the industrial robot ~~(32, 78, 82, 86, 292)~~ has an end effector ~~(298)~~ for shaking.

19. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claim 6 to 10 and 17 to 18, wherein
the industrial robot ~~(32, 78, 82, 86, 292)~~ has an end effector ~~(298)~~ for heating.

20. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims, further comprising
a cleaning and sterilization station for cleaning an end effector ~~(298)~~ of the industrial robot ~~(32, 78, 82, 86, 292)~~.

21. The flexible assembly line ~~(30, 210, 212, 276)~~ of any of the preceding Claims, further comprising
a cleaning and drying station for cleaning a belt ~~(60)~~ of the conveyors ~~(46, 220, 230, 232, 240, 258)~~.

22. A catering center having one or more of the flexible assembly line ~~(30, 210, 212, 276)~~.

23. Method ~~(100)~~ of using a flexible assembly line for tray packaging comprising
receiving a tray ~~(76, 80, 84, 88, 90)~~,
providing a food or non-food item ~~(242)~~, and
loading the food or non-food item ~~(242)~~ onto the tray ~~(76, 80, 84, 88, 90)~~ automatically.

24. Method ~~(100)~~ of Claim 23 further comprising
inspecting the tray ~~(76, 80, 84, 88, 90)~~, the food or non-food item ~~(242)~~, a loaded tray ~~(84, 88, 90)~~ by machine vision.

25. Method ~~(100)~~ of Claim 23 or 24 further comprising
transferring a loaded tray ~~(84, 88, 90)~~ into a cart ~~(68)~~ for transporting.

26. Method ~~(100)~~ of installing a flexible assembly line for tray packaging ~~(30, 210, 212, 276)~~, the method comprising
providing a tray dispenser ~~(32, 62)~~ for presenting a tray ~~(76, 80, 84, 88, 90)~~, and
presenting a loading station ~~(34, 36, 38, 214, 216, 218, 234, 236, 238, 250)~~ adjacent to the tray dispenser ~~(32, 62) (with a fixing tool)~~ for placing food or non-food items onto the tray ~~(76, 80, 84, 88, 90)~~ automatically.

27. Method ~~(100)~~ of configuring a flexible assembly line for tray packaging ~~(30, 210, 212, 276)~~ comprising
loading a software package for image processing of machine vision.