



*Liftians, Inc.*

Make Things Easy

# Proposal of Robotic Warehouse Automation

**Liftians, Inc.**

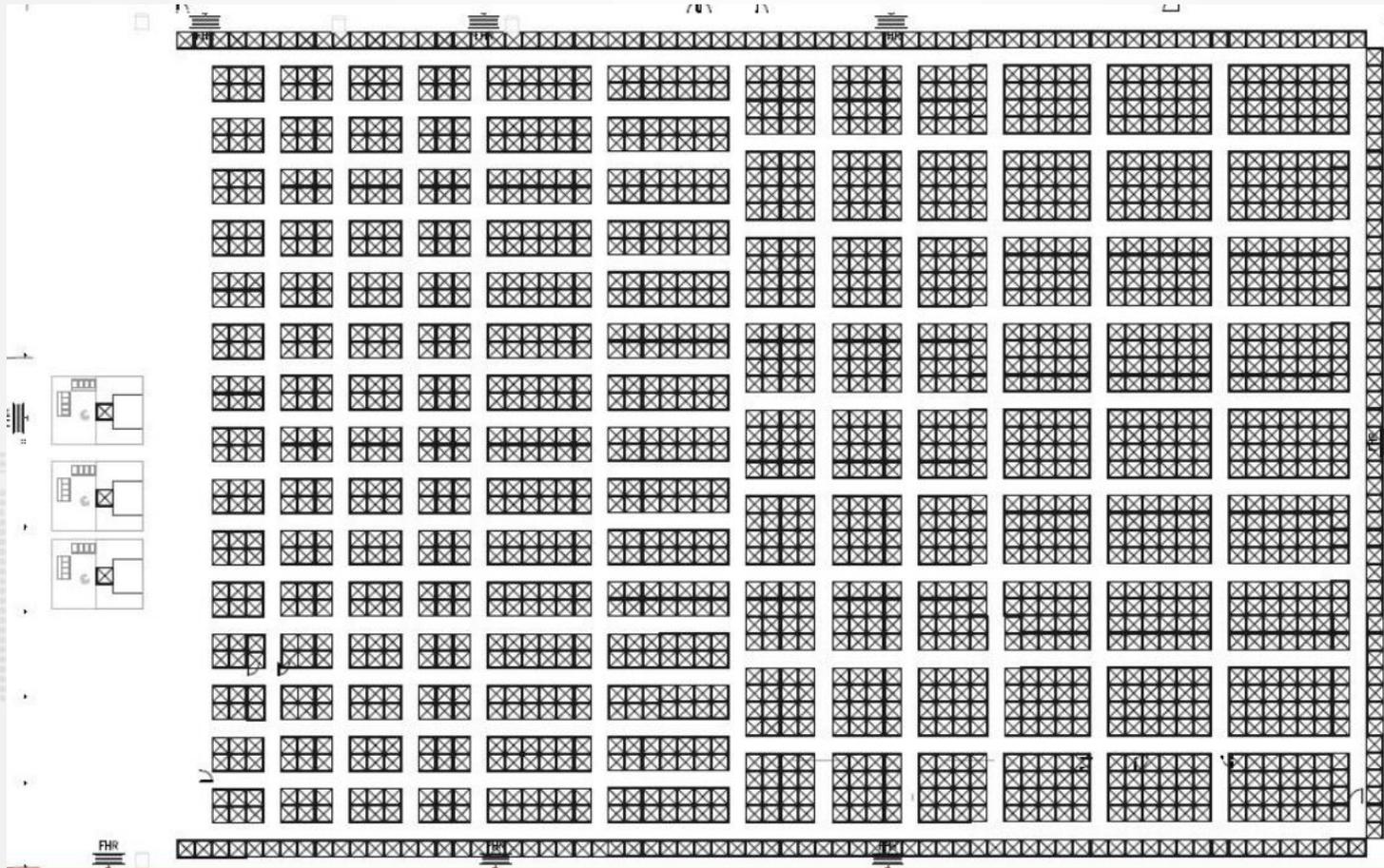
# Data Analysis (Peak values)

Picking and Replenishment	Operating time per item	Rack delivery time (Travel & Wait)	Peak hourly output per operator	Total hourly output of 3 work stations (operators)
1000 pcs/hr	7 seconds	32 seconds	337 items	1011 items
Average Traveling Cycle per robot	Number of robots per work station	Average time interval between adjacent robots	Hourly output per robot	Total hourly output of 3 work stations (robots)
180 seconds	8	30 seconds	360 items	1080 items

Based on the above-analysis, the required yields are met.

# Site Planning

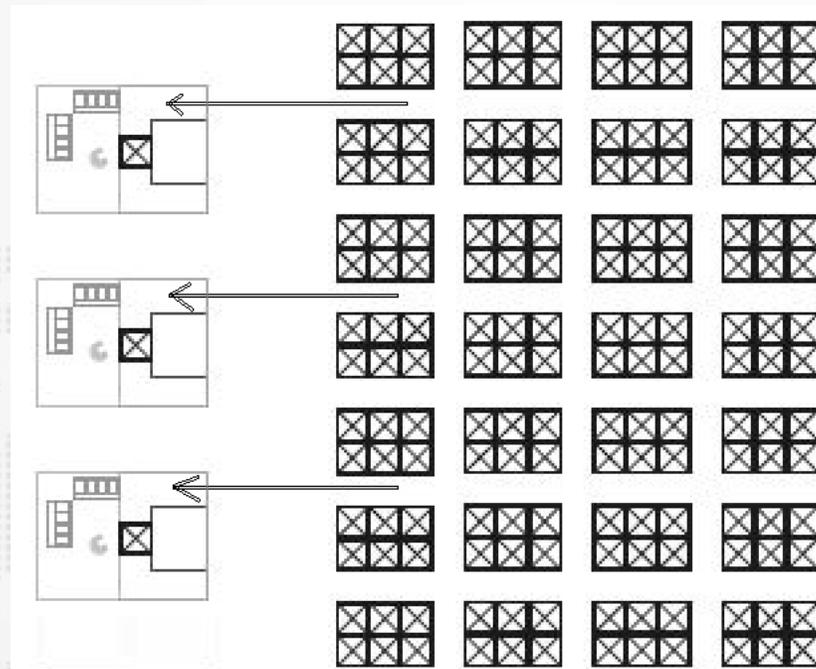
The existing site planning meets current productivity requirements, with room for optimization.



# Recommendations

Optimization:

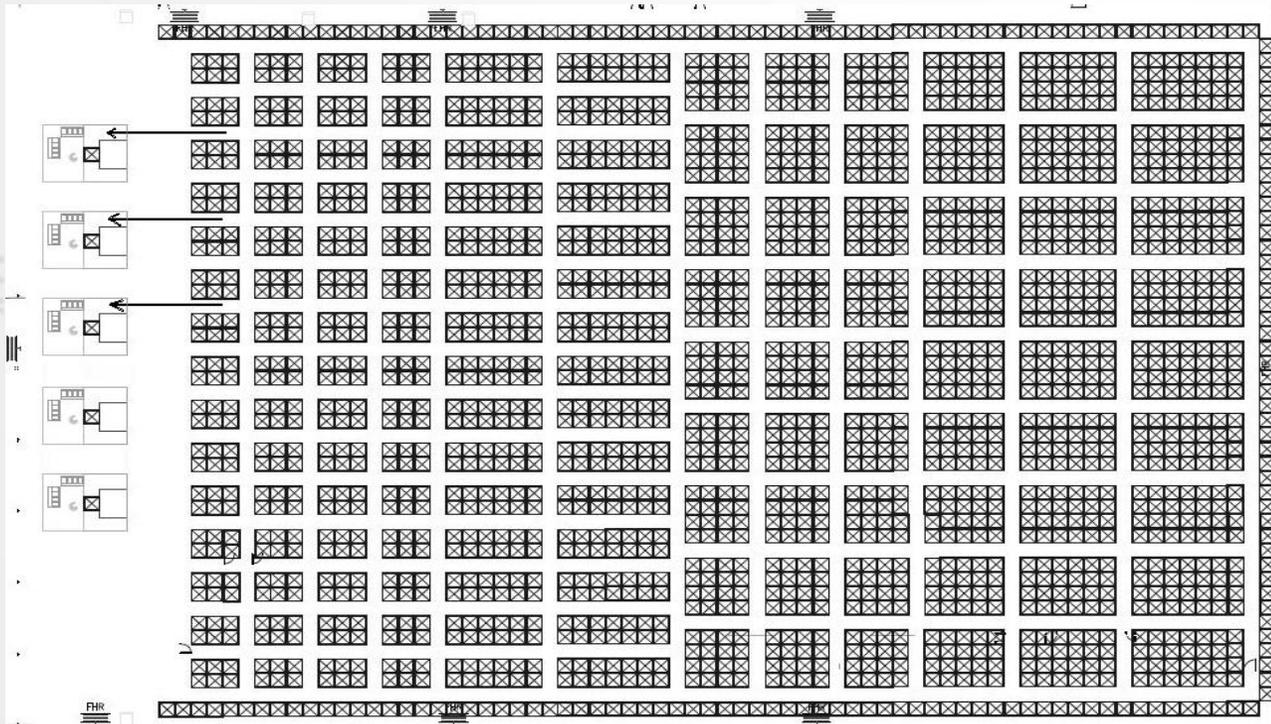
1. The entry and exit channels of the workstation should be aligned with the rack delivery path in order to reduce robot traveling distance, thus improving efficiency.



# Recommendations

2. Increase number of work stations to five and PDA units with Liftians PDA systems installed to two, to improve the flexibility of the system such as urgent picking and replenishing operations, as well as inventory check.

A Liftians hand-held PDA unit is equivalent to a mobile work station. With PDA units, parallel inventory checks can be achieved in a fixed work station or other locations



Liftians hand-held PDA unit

# Floor Surface Requirements

1. Ground bearing capacity should not be less than  $1.5T/m^2$ , and the ground allowable pressure is 1.5MPa.
2. Ground roughness should be less than 5 mm in the range of  $1000mm \times 1000mm$ .
3. Anti-static epoxy floor paint should be added to meet the ground roughness. The ground must be kept clean and dry. Any floor joints, garbage, liquids, floor cleaners, compounds may damage the walking ability of AGV. Electrostatic operation and excessive wheel friction may lead to scrap of components.
4. AGV trolley should adopt concrete structure in principle.
5. There are certain design requirements for expansion joints, settlement joints, seismic joints and split joints.
  - a) Every effort should be made to avoid seams in AGV driving paths. The location, size and AGV path planning of concrete surface seams need to be considered comprehensively.
  - b) AGV can pass through seams less than 5mm without special treatment.
  - c) For joints with a width of 5-50 mm, the upper part of the joint can be filled with asphalt paste, the lower part with 100 mm foam plastic strips, or with M10 cement mortar, and the surface of the joint can be covered with silicone paper as isolation layer.
  - d) For joints with a width of 50-450mm, the metal cover can be used for treatment.
  - e) For settlement joints of a certain width, special methods or tools can be used, such as CoGri Joint Stabilisers (CJS). Unlike forklift trucks, AGV uses fixed driving paths, and AGV uses polyurethane tires instead of pneumatic tires. Therefore, the AGV road surface must meet certain bearing requirements: the load per unit area of the ground should be higher than the load per unit area of the AGV horizontal projection area.
6. Other building requirements: In order to make AGV run smoothly and smoothly, ground surface finishing can be carried out. This refers to laying a layer of cement, epoxy resin, P-type ceramic tile, wood floor or other chemical fibers on AGV running pavement to improve ground smoothness and reduce the impact of joints on AGV.

# Robot



Warehouse AI-AGV

Dimensions: L900\*W780\*H300mm

Maximum Load Capacity: 500KGS

Model	L10000
Control	PCB
Movements	Forward and backward, left and right turn, bifurcation choice, in situ turn
Communication	WIFI
Load Capacity	500kg
Security	Laser obstacle avoidance, emergence button
Navigation	QR Code
Navigating Precision	±10mm
Climbing ability	≤5 degrees
Stopping precision	±10mm
Alarm form	Sound and light
Charging	Auto charging
Duration of endurance	6 hours
Charge time	1.5 hours
Traveling speed	0 ~ 90m/min
Turning radius	450mm
Driving mode	Differential drive
Voltage	DC48V
Safety induction range	Angle: 0 ~ 180°, Distance: 0 ~ 3m adjustable
Battery	20AH lithium, 48V charging cycle > 2000 times

# List of Major Hardware Equipment

Item	Product	Specification/Model	Units	Note
1	Robot	500KG/L1000	25	Lithium batteries included
2	Charger	Customized	9	Auto-charging
3	QR Codes	Customized		Robot navigating and positioning
4	Central control system	Customized	1	Robot dispatching, traffic control, monitoring, system and data integration with customer WMS/ERP
5	Computer, monitor, scanner, printer	Customized	3	Operator work space
6	Robotic communication network	Customized	1	
7	Hand-held PDA	Customized	2	Liftians PDA system included
8	Server, UPS	Customized	1	
9	Work station and pick-to-light station	Customized	3	Cartons/totes with lights
10	Racks and boxes	Customized		

# Central Control System

The Liftians central control system (LCCS) realizes data transmission through Wi-Fi and computer network, in addition to real-time map monitoring, remote dispatching and other functions.

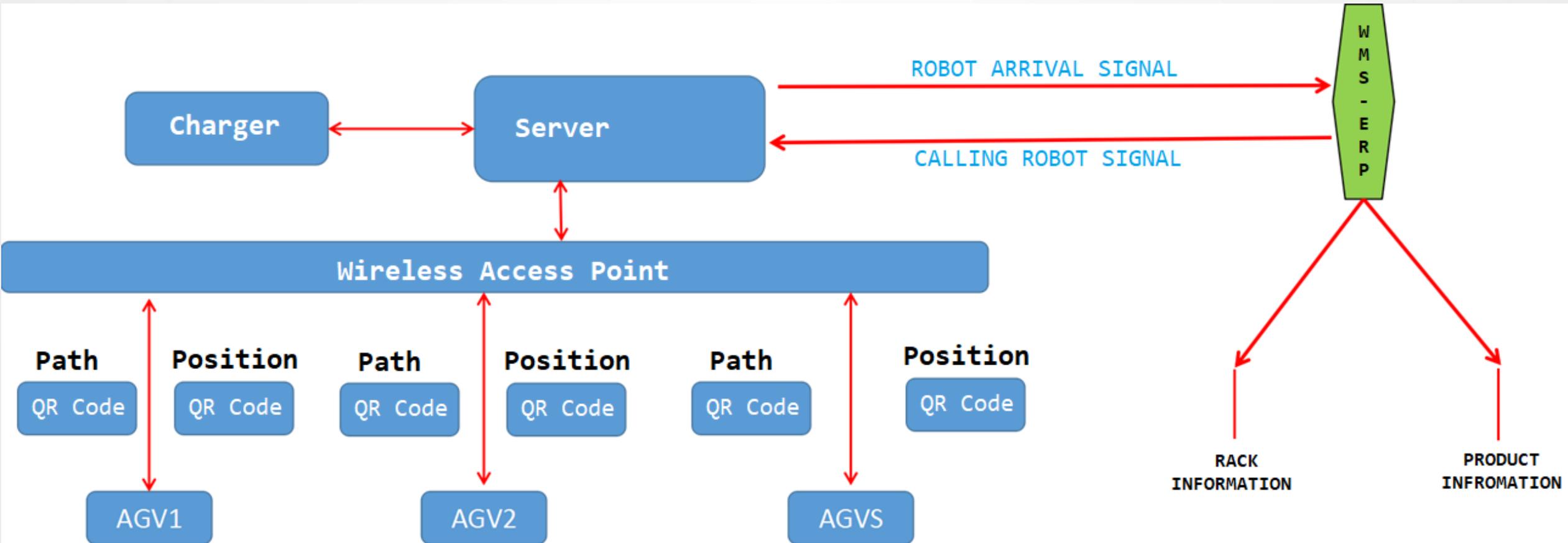
The LCCS decides where to move and store each rack. It manages the movement of robots and contains a WMS/ERP interface and a complex set of algorithms to minimize operator dwell time.

## **Main Functions of LCCS:**

1. Real-time information exchange and data transmission with WMS/ERP systems
2. Robot map, navigation, material handling information
3. Database functionalities
4. Real-time monitoring and alarm information
5. Traffic control: Real-time information such as position, status of each robot, complex path finding algorithms to ensure optimal operations
6. Communication with external systems
7. Integrations with external system and equipment

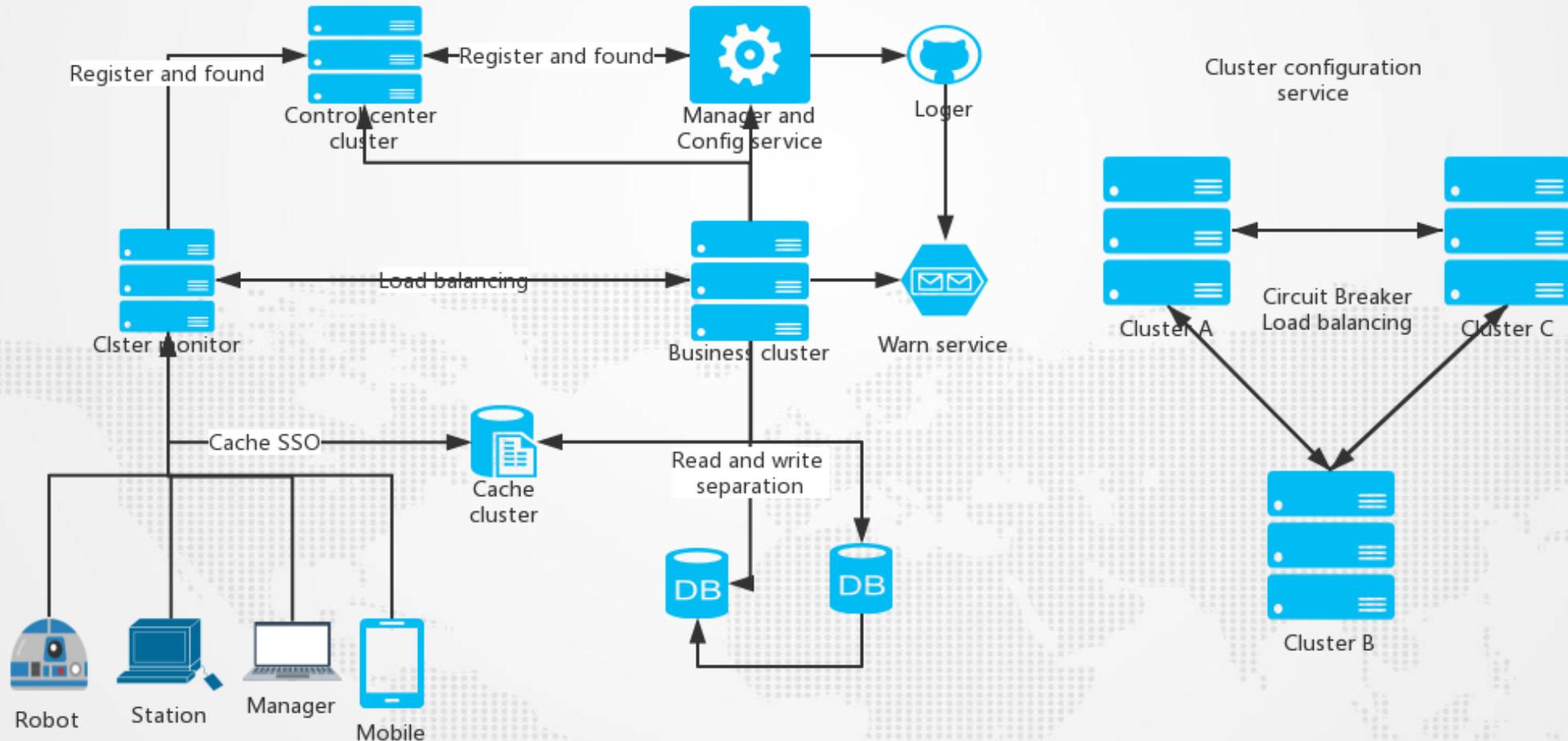
# Robotic System Integration

Operator in the work station scans product and shelf barcode for put-away operation. The scanned information is sent to the central control system. The LCCS sends commands to robots to arrange racks in the storage area based on the algorithms. Information is exchanged between WMS/ERP and LCCS via data integration such as JSON, Webservice or database transfer.



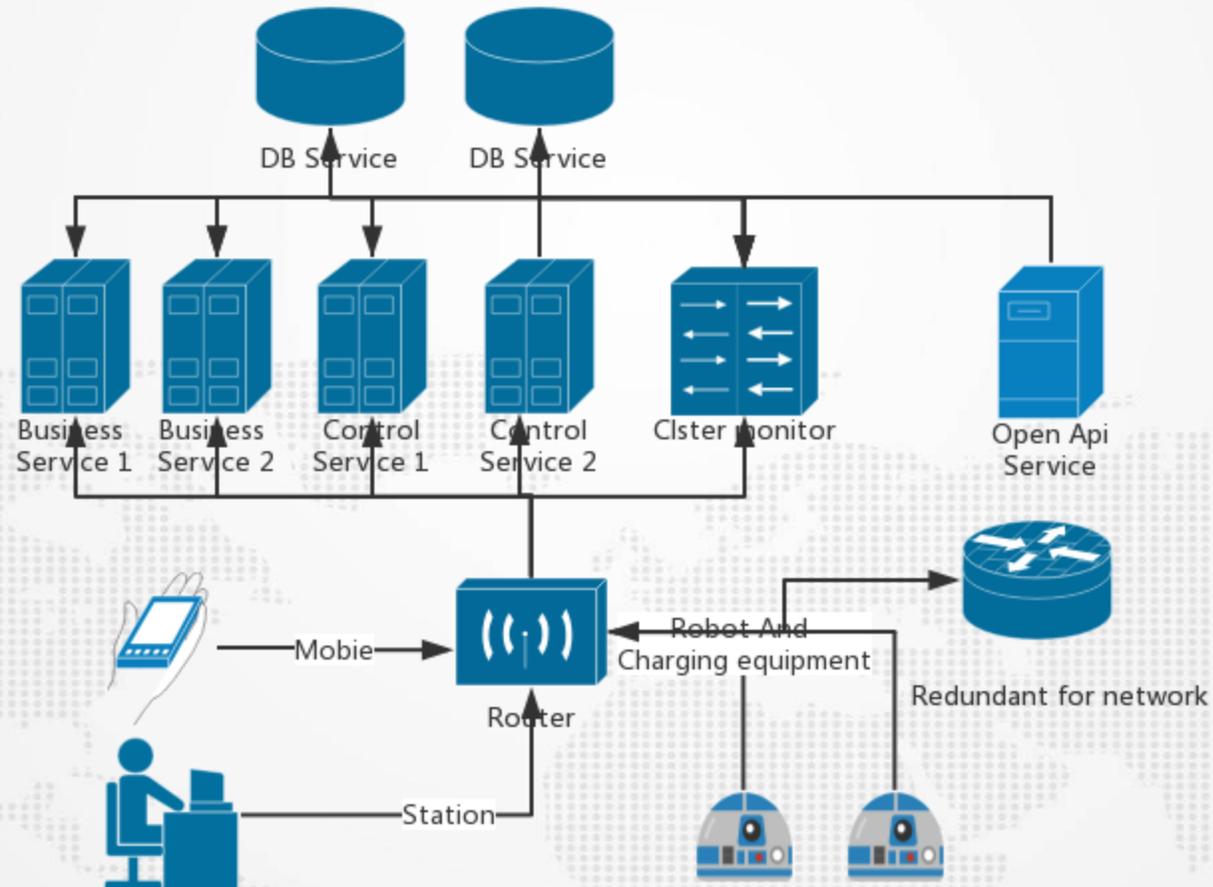
# Robot Cluster Failover

Reliability and scalability are critical to any business. Every service should be equipped with load balance and failover mechanism. A visual monitoring system will be provided to monitor the system operation status in real time.



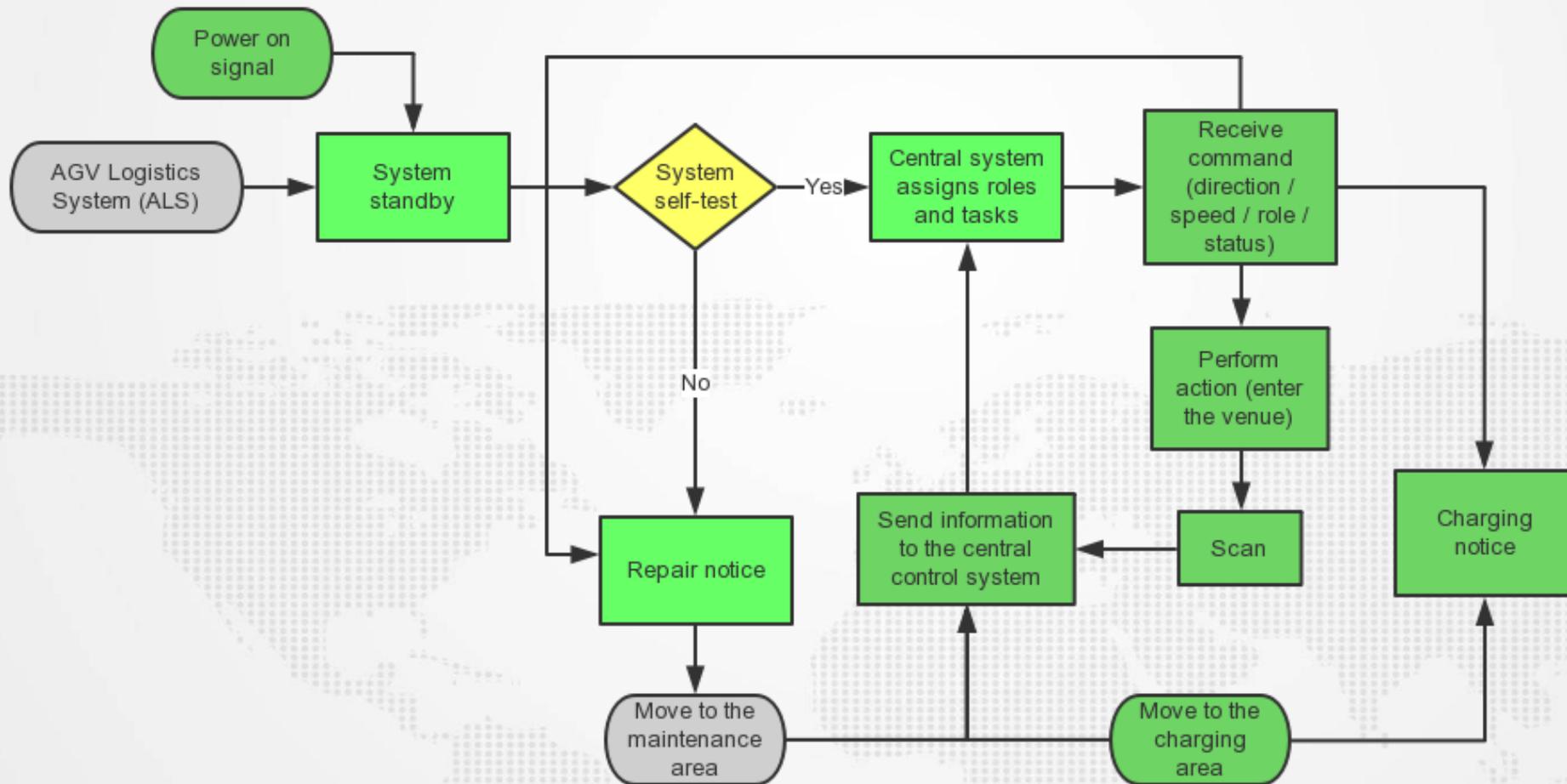
# Robots Network Topology

Robots can be added on-the-fly (hot) without complex configuration. A new robot can be automatically discovered and added to the working area by simply turning it on at any QR code on the floor.



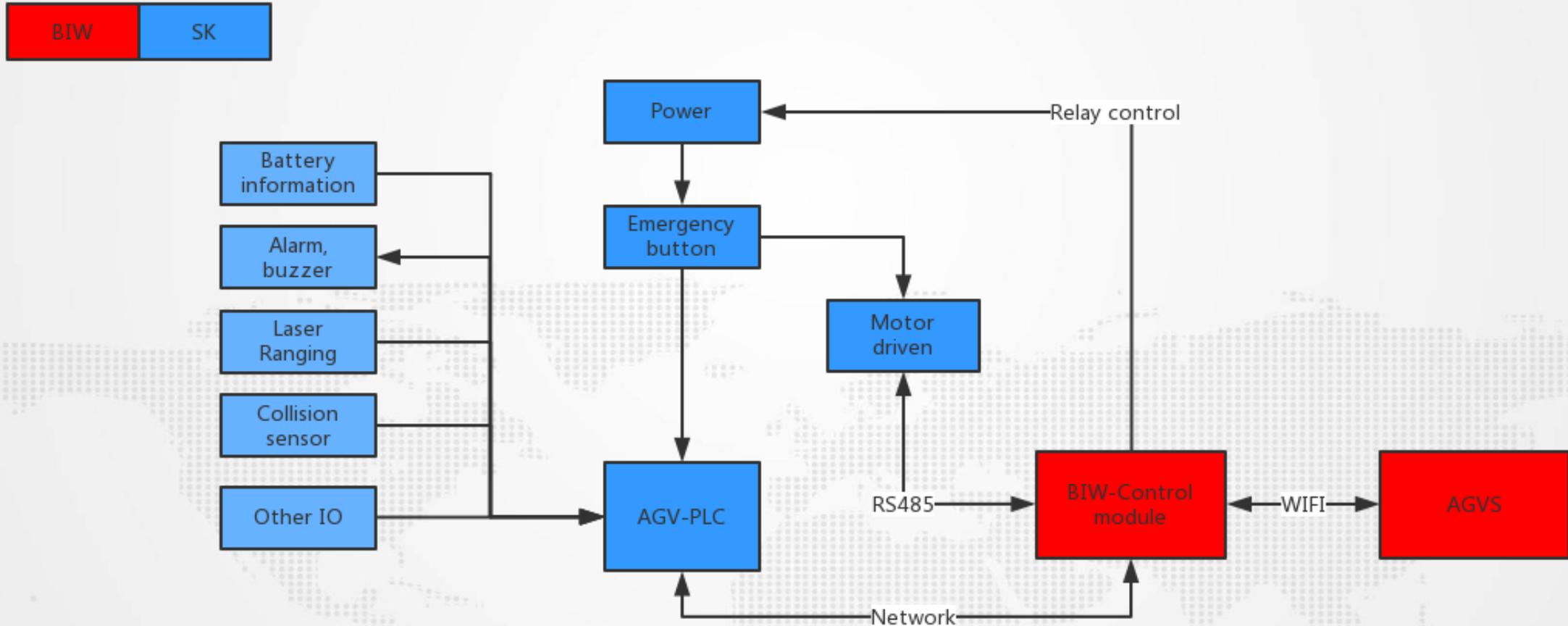
# Work Flowchart

**Comprehensive self checking function:** When a robot fails, its location will be blocked without interference normal operation of other robots. A work path can be manually created for repair and/or maintenance.



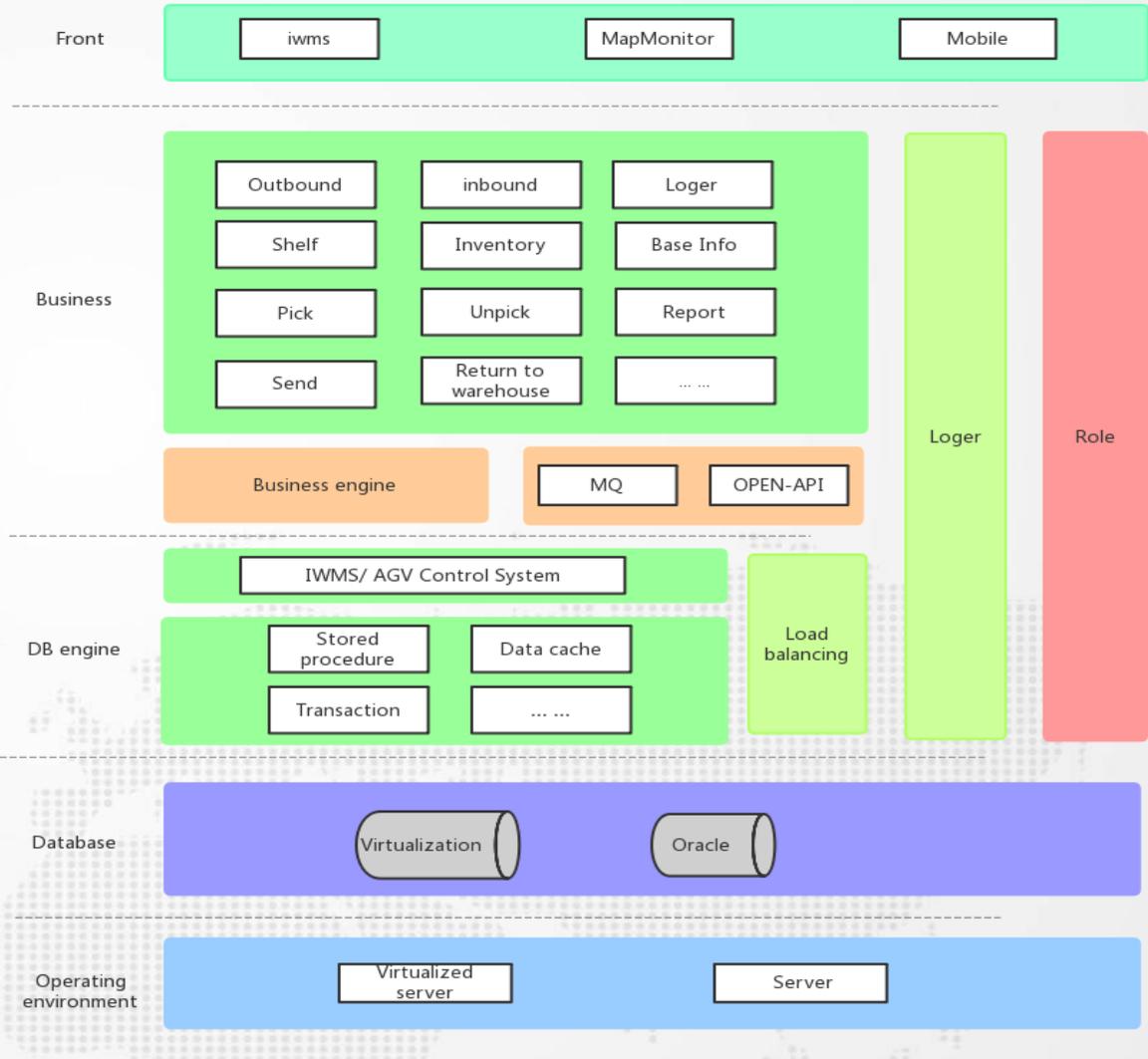
# Robotic Safety Feature

Enhanced laser avoidance and emergency stop button are equipped to ensure safety robotic operations

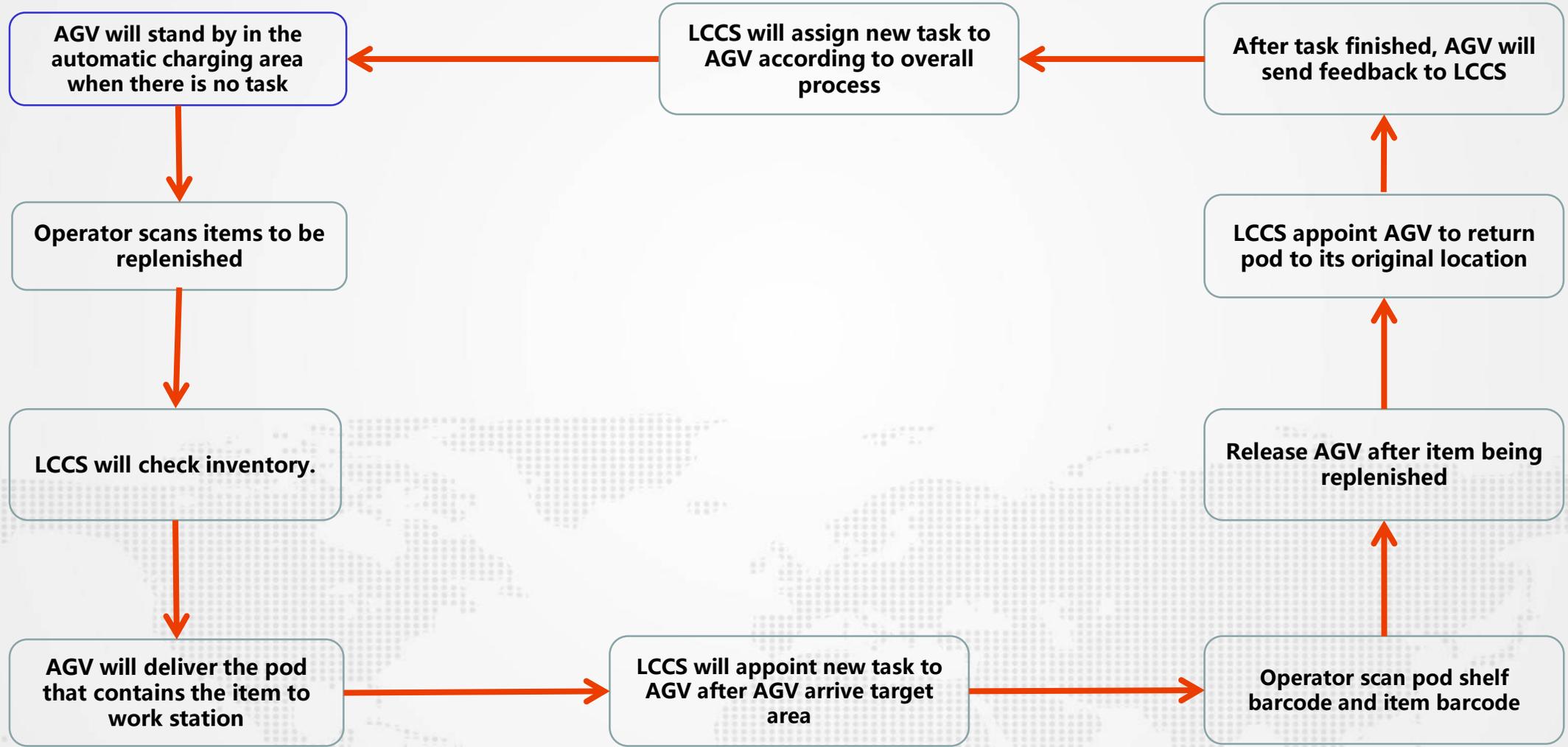


# Summary of Robotic System

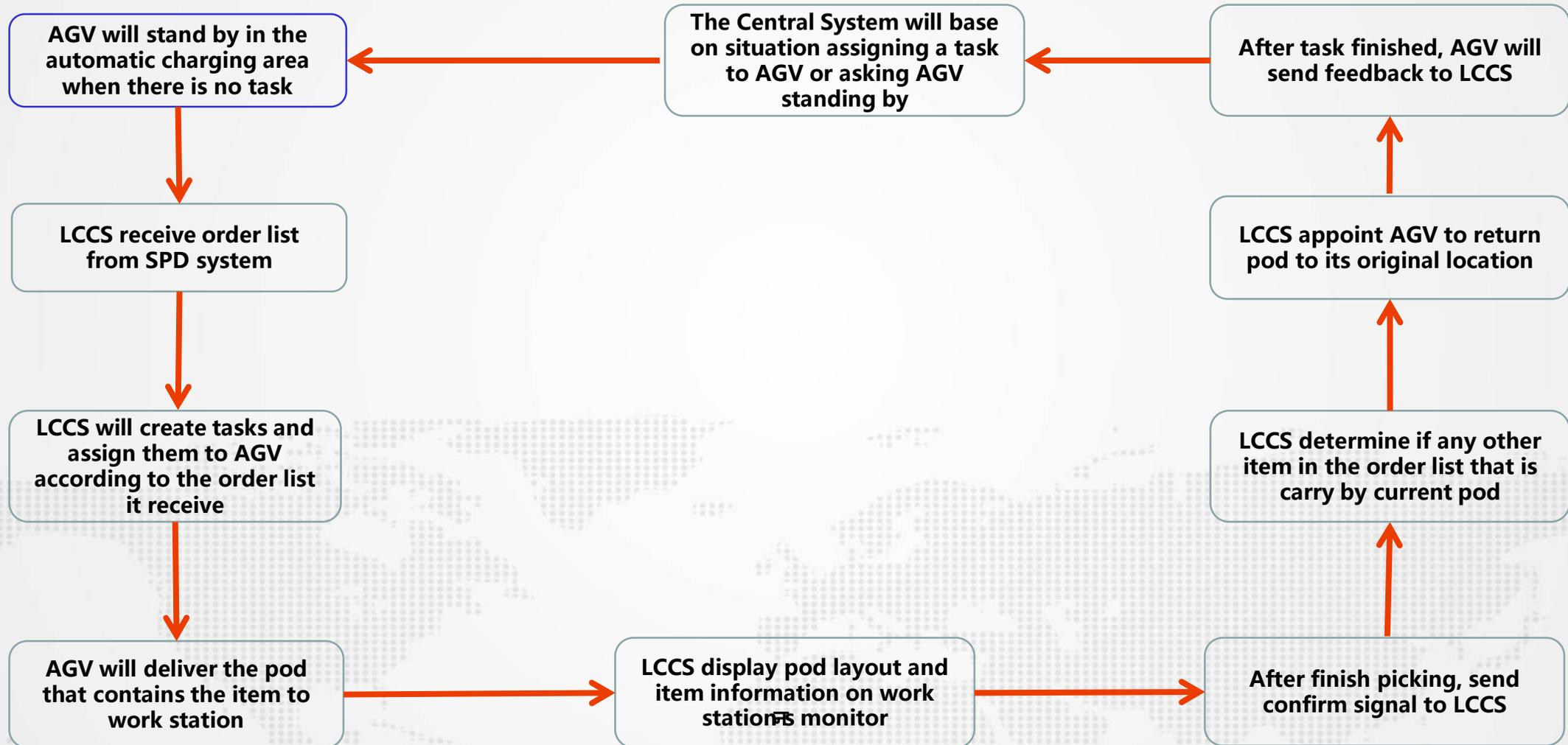
The LCCS includes integrated WMS (iWMS) that open enterprise API to integrate with various external systems with speed and flexibility.



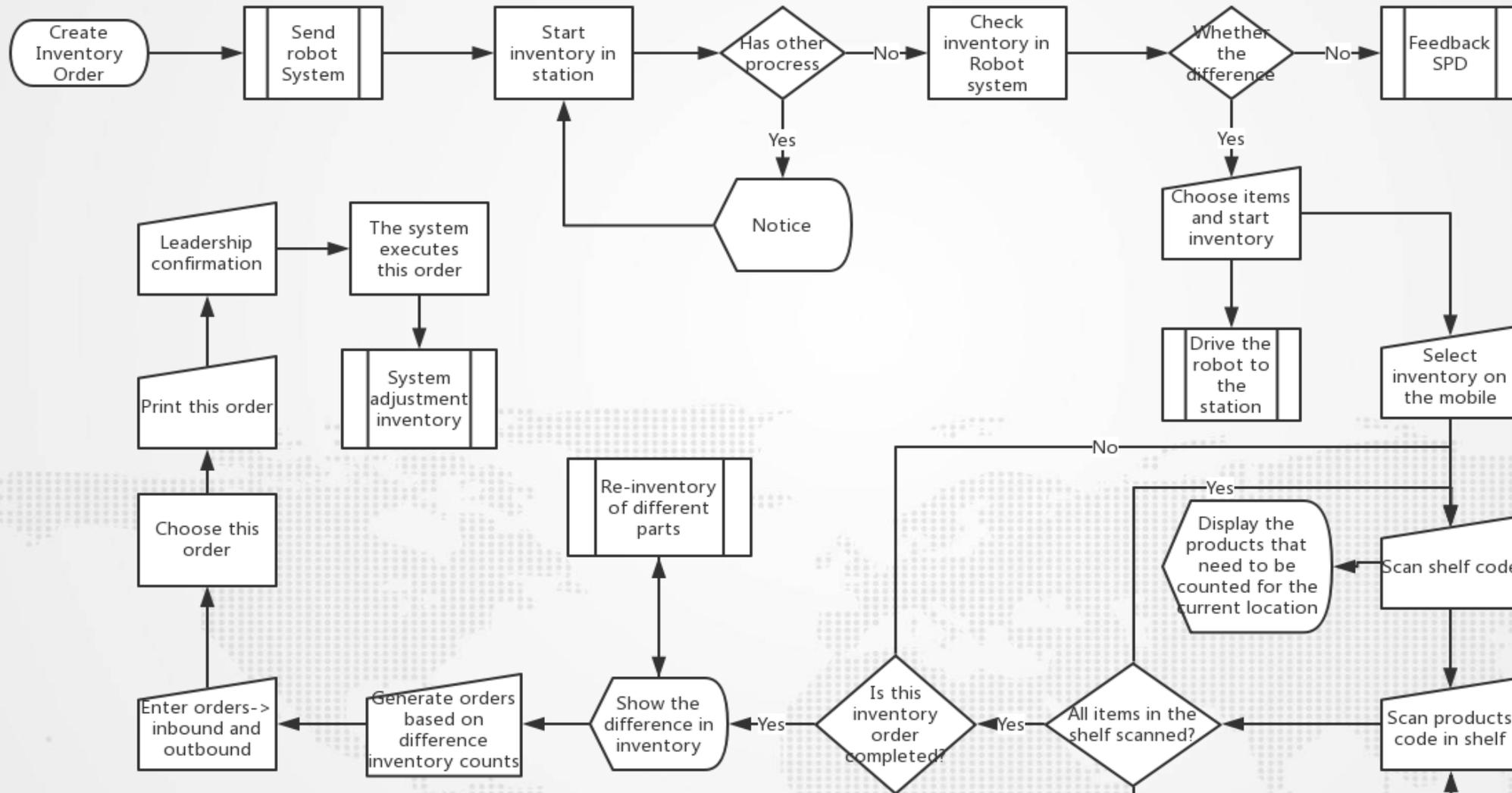
# Replenishment Process



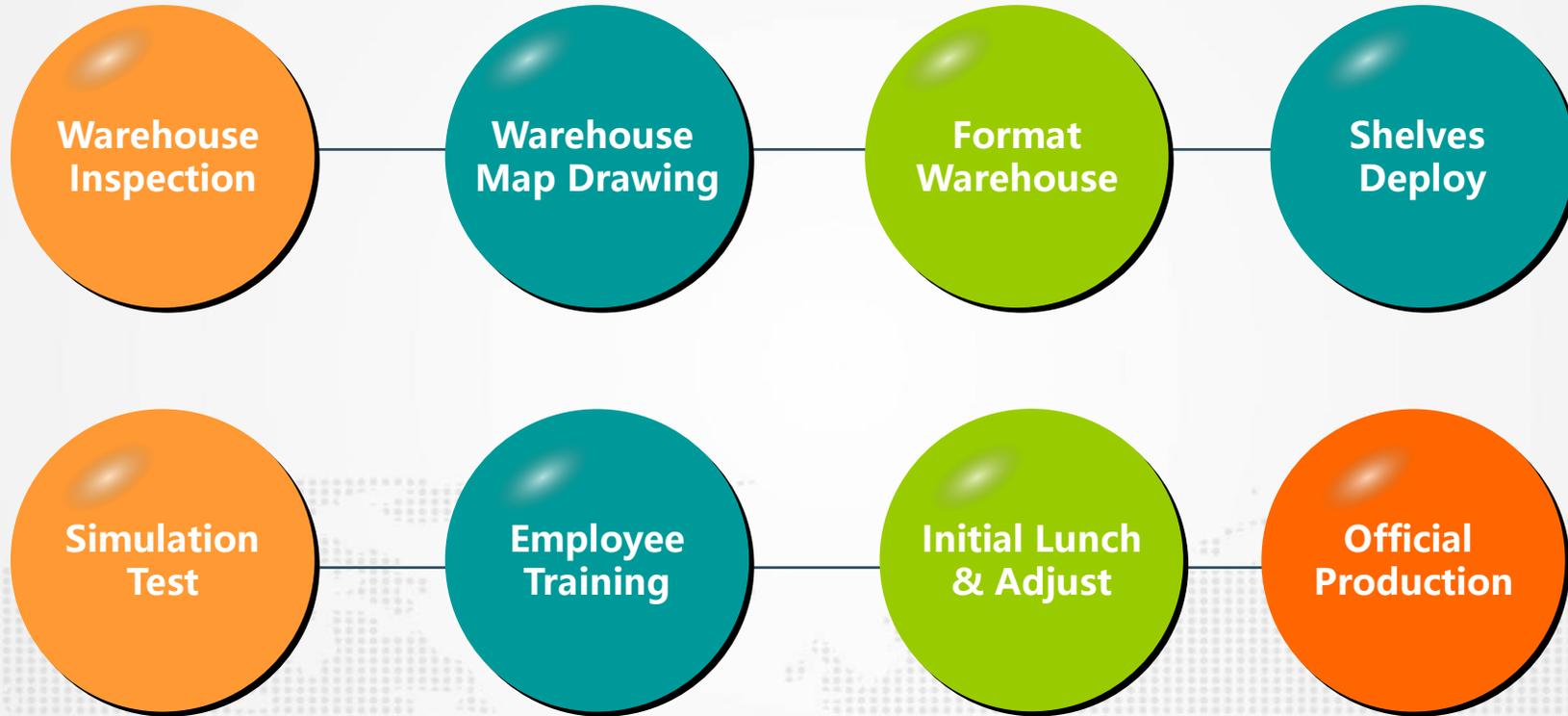
# Picking Process



# Inventory Check



# Project Execution Flowchart



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**Entire Period: Approx. 3 months  
(Warehouse Inspection – Official Production)**

# Employee Training

## Training Requirements:

1. **Equipment Manager:** 1~2 people. Training time: 2 days
2. **Electrical maintenance engineer:** 1 ~ 2 people. Training time: 5~7 days
3. **Mechanical maintenance engineer:** 1 ~ 2 people, Training time: 5~7 days
4. **Operator:** 2 ~ 3 people, Training time 3~5 days

## Training content:

1. Trained maintenance engineers should have the ability to correctly use all types of inspection equipment to accurately determine the fault location.
2. Trained operators should be able to properly operate AGV and its support systems in accordance with the operating procedures, and be able to properly handle all types of emergency faults.
3. Providing a full maintenance manuals and training materials.

# AFTER-SALE SERVICE

- 1、 **Delivery**: After received down payment, it will delivery in 45~60 business days
- 2、 **Warranty**: One year form the date of equipment acceptance; provide technical support and free maintenance support during the warranty period. For the equipment problems that occur after the warranty period, spare parts are available at discounted price. Serious damage caused by illegal operations will be the company' s full responsibility.
- 3、 **Delivery Location** : Send All equipment to the company' s warehouse and packed according to company standards.
- 4、 **Installation**: The manufacturer is responsible for the installation of equipment.
- 5、 **Service**: After the equipment fails during use, the company need to call tech-support. If the technical problems cannot be solved under guidance of the manufacturer, the manufacturer will respond for making sure system can normal operate within 2 hours.