**ANATOMY OF A SMART WAREHOUSE**

**BATTERY MANAGEMENT SYSTEM (BMS)**
- Critical for: Efficient battery usage, Reduced downtime, Opportunistic charging
- Key challenges: High power density requirements, system overload feedback, efficient energy management, efficiency in an extreme environment, maintaining efficient energy distribution
- Where to find it: Within a piece of equipment, BMS working in tandem with autonomous charging connectors that also have power connector capabilities
- Trend to watch: Increase charging power, Reduce battery failure, Cell balancing
- Specifications:
  - High power density requirements
  - Reliability in an extreme environment
  - High precision
  - High efficiency

**CHARGING STATION**
- Critical for: Cell balancing, Condition monitoring
- Key challenges: Increasing number of charging periods, reducing battery failure, increasing equipment uptime, increasing equipment efficiency
- Where to find it: Mounted or box-style device to charge. In the manual charging station, a human operator uses a cable to connect the vehicle battery to a wall-mounted charger. In an automated station, a robotic arm or ASRS shuttle docks itself to the charging unit.
- Trend to watch: Contactless charging (especially in lower charging levels), In autonomous charging, connectors must allow for a robotic arm to fit battery specs. The connectors, sensors, and dedicated equipment that allows for automation components (such as photoelectric switches) are the nerves, muscles, and connective tissue that make this type of movement possible; they are the points at which electrical power is sent and received.
- Specifications:
  - Automatic charging
  - Contactless charging
  - High density of charging

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