12

TECHNOLOGY IN INVENTORY PICKING

Inventory management deals with optimal policies and measures for the procurement of commodities. Since it is quite difficult to imagine a real work situation where the required material will be made available instantaneously, maintaining inventories becomes almost indispensable. Thus, inventories could be visualised as a 'necessary evil'.

One of the very vital activities in Warehouse management is inventory picking. The handling of different inventory is supported by various inventories picking technology.

LEARNING OUTCOMES

After completing this lesson the Learner

- defines the Inventory picking technology;
- identifies different types of the Inventory picking technology;
- distinguishes the different types of Inventory Picking types for different Inventories;
- explains the Warehouse Management System with the usage of Technology;
- summarizes the WMS,IoT and AI in Inventory Picking Technology.

12.1 INVENTORY PICKING TECHNOLOGY

A fast-growing company has made sound product expansion, manufacturing, marketing and sales outcomes to achieve its current success. And chances are, that

same business has attainedexceptionalclient service levels with reasonable operating costs to stand growth over the long haul. After all, the impact of deteriorating delivery competencies can have a long-term detrimental effect on a company's name and brand value. However, many fast-growing businesses that have made such savvy decisions along their growth trajectory often make poor choices or fail to make necessary operational investments at the distribution centre, ultimately eroding their reputation for unique customer service. Automate Picking, Putting and Sorting to Create a Reliably, Effortless Process.

There are many order picking technologies available to support inventory management and order fulfilment tasks – ranging from fairly simple to highly automated. No matter the solution, the basic components of the order picking system are the same. At their most fundamental, these systems provide associates and the service in identifying, tracking, verification, business, storage, location, sorting and handling of inventory.

There are various options offered; how do you know what you need? It comprises five fundamental technologies and makes them work at the same time.

I. Inventory Management Software (IMS)

Software is the system's brain – it keeps records of all the individual SKUs, their quantities and their storage locations as they go through, move within and leave the warehouse or distribution centre. Basic warehousing systems can use spreadsheet software, but a more advanced operation will need a higher level of support. It documents inventory data at obtaining, then directs putaway, slotting, picking, packing, order consolidation, shipping, expressing, and all other purposes related to picking orders.

II. Storage Systems

Used to physically store goods, many different storage systems are available, from constant to Automated Storage and Retrieval Systems (ASRS), representing items to employees in a goods-to-person methodology.

The nature of the order picking system is normally a mixture of:

1. Static Shelving: Convenient and cost-effective, open- or closed-side shelving is used to store smaller, lightweight, and hand loaded items, typically in cartons or reusable plastic parts bins.
2. Pallet Rack: Engineered for storage of palletised loads or cartons, these systems are generally accessed with forklifts. They can be sub-divided with

a roller track to create a flowrack for packing smaller items. They can also be planned with different levels of flooring or as part of a mezzanine floor or work platform to create pick modules where workers pick items at distinctive heights and vertical positions.

3. **A-Frames:** Self-contained and automated, this machine's vertical storage networks dispense small, specific items at high-level speeds to totes or containers passing on underneath it via conveyor.

4. **Horizontal Carousel Modules:** Consisting of bins installed on an oval track that rotates horizontally to deliver stored items to an operator. These self-controlled, dynamic ASRS save up to 60% of floor space when matched to standard shelving.

5. **Vertical Carousel Modules:** Consist of a series of layers that rotate around a track – similar to a Ferris wheel – these ASRS immediately deliver collected items to an ergonomically placed work counter at the operator's control. They save up to 75% of floor space.

6. **Vertical Lift Modules (VLMs):** An attached ASRS includes two columns of trays with a central inserter/extractor that routinelydetects and retrieves deposited trays from both columns, then presents them to the worker at a waist-high pick window.

7. **Mini- and Micro-Load ASRS:** Also crane-based, these tinier versions of Unit-Load ASRS cope withsimilarly smaller, lighter loads, typically held in trays, reusable totes or cartons.

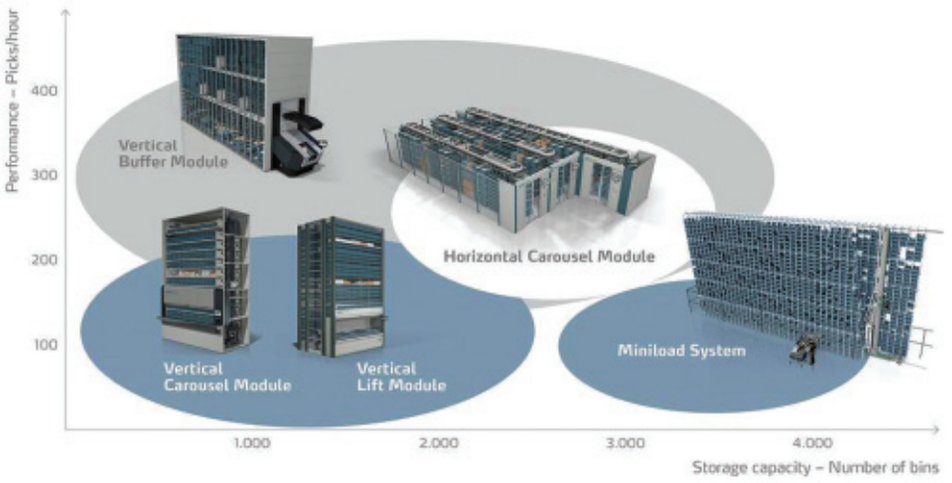

Fig. 12.1: Inventory picking technology

8. **Robotic Shuttles:** Handling cases, totes or trays, this ASRS utilises autonomously moving robotic shuttles introduced into the system.

9. **Vertical Buffer Modules:** A bin handling system was created for smaller applications that consist of enclosed shelving and a movable mast running down a centre aisle for picking and storage space of totes. The unit works in advance of the operator and queues up the next pick.

10. **Unit-Load ASRS:** Machines automatically store up and retrieve pallet loads from a long, narrow aisle of storage rack with a magnifying, crane-based device that travels to and from certain storage locations.

INTEXT QUESTIONS 12.1

1. What is the full form of IMS?

2. ..... Consisting of bins installed on an oval track that rotates horizontally to deliver stored items to an operator.

III Transport Systems

How to move the product inside the warehouse. From different manual to highly automated, one or more of the subsequent transportation apparatus and technologies be employed to shift inventory within the warehouse, to and from receiving, storage, forward picking, replenishment, consolidation, packing, and outbound shipping. Many operations use several transportation systems differing on the volume and weight of the inventory or loads being relocated.

1. **Pallet Jacks:** These manually used forked vehicles move a single pallet load pile up at floor level.

2. **Hand Trucks and Carts:** Manually droved via a lever or hauled behind a vehicle with a harness in a series known as a train, these units feature two to four wheels and move non-palletised, unstacked loads of cartons or totes.

3. **Lift Trucks:** Categorised into seven separate categories by OSHA, power-driven industrial trucks move palletised loads. They're operated by batteries, fuel cells, liquified petroleum gas (LPG), gasoline or diesel and are designed for indoor and outdoor load handling applications. They are frequently used to load and unload vehicles, stock storage locations and retrieve pallet loads for replenishment.

4. **Fixed Transport Systems: C**onveyors can be orientated horizontally, vertically or on an incline, moving loads ranging from individual products to cases to full pallet loads from one area to another inside an operation. Typical picking applications consist of placement between pick zones to transfer pick totes from one picker to the next, transporting completed picks to consolidation and pack out, and packaging to shipping docks.

5. **Automatic Guided Vehicles (AGVs): Computer-controlled**, wheeled load carriers autonomously navigate onboard or towed loads throughout a facility. They can be employed to follow a picker who places picks onto a pallet transported by the AGV.

6. **Autonomous Mobile Robots (AMRs):** Computer-controlled and smaller than AGVs, AMRs transport smaller loads throughout a facility autonomously.

IV Automatic Identification and Data Capture (AICD) Systems

These technologies predictably collect data from an object and transfer it into a computer system without any manual data entry. Thisguaranteed data accuracy and improved operator productivity in order picking environments.

AICD Systems Include:

1. **Bar Code Scanning:** Barcode labels are especially common and can be scanned by handheld or fixed-location Radio Frequency (RF) scanners or camera-based imagers to rapidly validate the code's information, then transmit that data to another system for processing and use.

2. **Radio Frequency Identification (RFID):** Information is coded into a small tag or label using an integrated circuit and antenna. Data is then captured by an RFID reader using radio waves and transmitted to a host data system.

V. Pick Indicator Systems

Pick indicator systems to help operators swiftly and accurately locate required items. They direct the operator to a particular location and provide information to complete the task. Pick indicator approaches are paperless and allow the operator to work hands-free, resulting in particularly high precision rates, reduced training time and faster picking rates.

12.2 TYPES OF PICK INDICATOR SYSTEMS INCLUDE

1. **Light Directed.** Pick-to-light and put-to-light systems are a sequence of components with coloured lights and (sometimes) alphanumeric displays

attached to the face of a storage location or pick a destination (such as on a put-wall or tiered picking cart). This light displays an operator directly to a storage location and provides information to complete a task, such as a pick number or part number. Alphanumeric displays, pushbuttons, and lights can also be applied in reverse to direct put tasks by creating a Put to Light system. Prompted by a barcode scan, the lights illuminate, blink, or display a message suggesting the pick (or put) location. The picker pushes a button to extinguish the light and validate the pick.

2. **Voice Directed:** Voice-picking systemscomprise a wearable headset where the operative is told by a computerised voice (in their native language) what item to pick and how many. The operator approves the pick by speaking back into the headset.

12.3 JOURNEY BY WAREHOUSE SYSTEM FROM THE 1990S TO 2030

Now think what the distribution centre of 2030 will look like if technology persists in interrupting logistics as intensely as it has done since the 1990s. Is your mind-boggling yet?

To save you from a breakdown, let's take a concise journey through Warehouse Operating Advancements from 1990 to 2030. While some inspiration will still be necessary on this expedition, you can shut down the imaginative journey through this rundown of **Technology's Influence on Warehouses** and **Distribution Centers**.

12.4 1990: A CLASSIC OUTLOOK FOR WAREHOUSE OPERATORS

Welcome to the time travel of a logistics warehouse in the second half of the 20th century. While having the rewinding for the structural changes in the building, the tremendous development took place, but have enormous significance in **Warehouse Efficiency and Productivity.**

Fig. 12.2: Outlook for Warehouse Operators

Perhaps the first thing you'll notice that how many people there are. See that supervisor over there, observed by his distinct coloured Hi-Vis Vest from the operatives? Look!

Today's warehouses require fewer operatives and hence, a small number of line managers because certain labour-reducing technologies have either made labour more effective or removed it altogether.

Let's briefly have the journey of those technologies in the Warehouse

12.5 WAREHOUSE MANAGEMENT SYSTEMS (WMS)

Warehouse management systems have developedsignificantly in the last couple of decades. They have created many **warehouse activities quicker** for people to operate and **generated productivities** to lower labourintensity. The few components of WMS arePaperwork and data entry:

WMS has lowered the need for people to use time completing paper forms or recording data from documents into spreadsheets and other datamanagement functions.

1. Picking efficiency

Warehouse operators can pick more rapidly with WMS because the technology helps manage warehouses more efficiently and (with elements such as system-guided picking) allow more efficient working practices to be observed.

2. Task Interleaving

As WMS results have become more effective, they have expanded the concept of systemguidance across all activities, especially those executed by forklift operators.

3. Scanning Technologies

In 1990, picking was a mission in which a warehouse operator would spend almost as much time recording activities on paper documents as executing the actual task of moving items from pick-face to pallet. More advanced systems minimise the data entry entirely, leaving the operative to focus solely on the actual picking. This technology had a similar impact in other areas of warehouse operation, such as ***receiving, put-away, and dispatch***.

4. Warehouse Automation

The initial stage of all warehouse technologies, warehouse automation, has been accountable for more warehouse labour decrease than any other innovation. It only presents a fraction of its potential thus far.

Automated solutions are widespread and becoming more so as the technology develops in affordability and sophistication. The warehouse of 1990 was predictably bereft of automation, with the exemption perhaps of simple (but still significant) solutions such as gravity-fed racking or in businesses with a larger investment, ***like pick-to-light systems***.

INTEXT QUESTIONS 12.2

1. Technologies that predictably collect data from an object and transfer it into a computer system without any manual data entry is known as .....
2. What does the types of pick indicator systems include ..... and .....
3. ..... has lowered the need for people to use time completing paper forms or recording data from documents into spreadsheets and other datamanagement functions.

12.6 PAPERLESS WAREHOUSE

WMS software and other IT applications in the warehouse have exterminatedmost paper forms and records from the warehouse environment.

Fig. 12.3: Paperless Warehouse

Warehouse technology has replaced data entry processes, allowing data to be entered directly into digital storage and reducing the range of errors caused by **readability problems, lost paperwork, and other concernsthat** arise from the translation of handwritten data into electronic bits and bytes.

By eliminating the need for paper processes, warehouse technology has **reduced operating costs** (because businesses don't have to spend money on paper, associatedstationary or the supply of pre-printed documents).

In our less labour-intensive warehouse locations, technological progress remains to interrupt and transform the way we manage inventory storage and throughput.

12.7 DIRECT IMPACT OF TECHNOLOGY ON TODAY'S WAREHOUSES

Now we're back from 1990 when recollecting all around today's warehouse. By visiting the Distribution centres and Warehouses, we can identify and understand the vast development of technology directly influenced by such operations. This can be done through a physical visit to DCs or warehouses located nearby locations.

To begin with,let's visit this distribution centre managed by a medium-sized organisation. Apart from the absence of people with paper, let's see what proof we can find of **technological influence**.

Partly Automated Warehouse

This warehouse is relatively advanced in technology but not at the cutting edge. How do we know that?… The lights are on for one thing, so although we can find some signs of automation, this is a warehouse in which people still play a considerable role.

Yes, warehouse operations are currently being interrupted by the development of **advanced robotic systems**, the most basic of which use alpha numeric(Digital) add-on systems to transform forklifts and other types of MHE asset into robots.

Observing the vast developments and technology influences the labour-intensive tasks replaced with automatic/mechanised systems.

A combination of sensors, cameras, lasers, and software can be used to enable forklifts to work alongside people, but without the need for human operators.

12.8 FULLY AUTOMATED WAREHOUSE

The fully automated high bay warehouse, housing an Automated Storage and Retrieval System (AS/RS). Linked to the centre's WMS, cranes on rails fly up and down aisles of racks that expand from the floor to giddying heights above.

Automated warehouses certainly seem to be the ultimate in modern distribution centres, needing very few people to operate, offering high levels of productivity (because as well as being fast, they can operate 24/7/365), and offsetting some of

the power they use by operating in an unheated or un-cooled environment, with little if any need for artificial lighting.

Full automation is still a big-ticket item in terms of capital costs, often requiring a customised warehouse structure to house high-bay storage and specialised infrastructure. That's why it's rare to see such improved levels of technology in use by smaller supply chain organisations.

Do you Know

What are the current solutions and future trends in warehousing automation?

Warehouses have already achieved a magnanimous level of automation in the last one decade, and everybody has experienced the benefits of it first-hand. Deliveries have become quicker, cheaper and free at times for the consumer. This has been possible due to Automated Storage and Retrieval System (AS/RS), Autonomous Case-handling Robots (ACRs), Conveyors, Sortation Systems, Autonomous Mobile Robots (AMRs), Automated Guided Vehicles (AGVs) and Warehouse Management Systems (WMS), among others.

It is being predicted that AMR, AGVs and other robotic technologies will be next boost in the warehouse industry. Drones for inspecting stocks, barcode scanning and retrieving goods will be a part of automated warehouses really soon. IoT enabled smart devices and systems to collect, store and share date will be the next big boon to the industry.

12.9 BENEFITS OFAUTOMATED WAREHOUSE

With the internet and digital technology transforming how customers make purchases – disrupting supply markets, changing customer buying patterns, and adding complications to the supply chain – fulfilment operations need to meet the modifications with a digitally connected solution of their own.

For businesses that can afford it and operate in sectors consistent with automated logistics, full automation delivers a great many benefits, including:

1. Considerable labour cost reduction
2. Superior levels of productivity
3. A high degree of effectiveness
4. Minimal risk of processing errors
5. Increased inventory management
6. Increased supply chain speed

While full automation is still comparatively rare, even conventional man-to-goods warehouse operations have been affected by new technologies, even though people may still shoulder the biggest part of the workload

12.10 INDIRECT IMPACT OF TECHNOLOGY

When contemplating the impact of technology on warehouses and distribution centres, it would be inconsistent with over looking troublesome technology in the wider commercial ecosystem. Let's briefly reflect on how technological developments have ultimately impacted warehouse processes. While automation eliminates the need for manpower, many companies still consider it too expensive to execute or are concerned about the length of time to ROI, typically around five years.

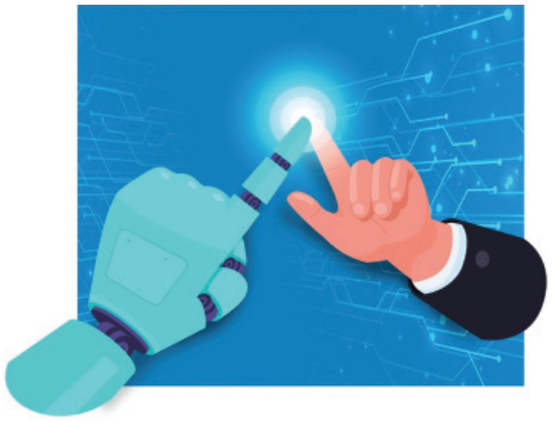

Fig. 12.4: Impact of Technology

As consumers have remained from shopping online to mobile shopping, they have driven a revolution in retail commerce, which has, in point set off a ripple effect to initiate similar changes in business-to-business.

The omnichannel experience has changed the entire supply chain profile in many industries and commercial sectors. All this revolution has led to a distinct shift in warehouse function, from being a performing point for supply chain inventory to becoming an important value chain element.

12.11 2030 HERE WE COME

To understand why warehouses may soon be empty of human presence, we should return to our tour, but instead of jumping straight to the warehouse of 2030, we'll take a slow breakthrough the next few years. Next to the way we'll look at how robotics, sensors, ML, AI and IoT make warehouses more efficient to operate, while gradually removing the need for a human workforce.

12.12 ROLE OF ROBOTIC WAREHOUSE

The need for focussed warehouse structure and the combined cost of constructing purpose-built automated warehouses. Some tasks being accomplished in today's warehouses also need human skill.

Robotics is perhaps the answer to many automation limitations in warehousing. For example, unlike automated storage and retrieval systems, robotic warehouse machinery (even at the current time) canfunction in any industrial space without costly structural modifications.

In future, human warehouse operatives will likely be a rare sight indeed, as multi-functioning robots become an inexpensive investment for many companies. Smaller businesses may also gain access to robotic technology by contracting with third-party warehouse sources that, thanks to robotic advances, will make subcontracting the most reasonably feasible way to stage and store inventory.

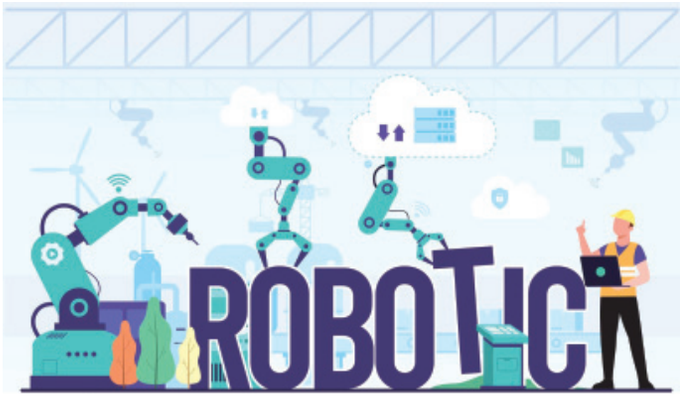

Fig. 12.5: Robotic Warehouse

The lighting solutions are slowly but surely fading from the modern warehouse ecosystem, to be replaced by more cost-effective and ecologically friendly light sources, such as LED and induction lamps.

The cost of lighting warehouses is significant, since illumination is vital for staff to work efficiently and safely. The companies are ready to take improvement of new lighting technology. LED industrial lighting consumes a fraction of the electricity required to run conventional lamps, and when combined with warehouse management systems using sensors and timers, becomes even more economical.

12.13 IS THAT WAREHOUSES BECOME BIGGER OR SMALLER?

So now, you have an idea of what the warehouse operation of 2030 might look like, the opportunity that technology may impact the very existence of warehouses.

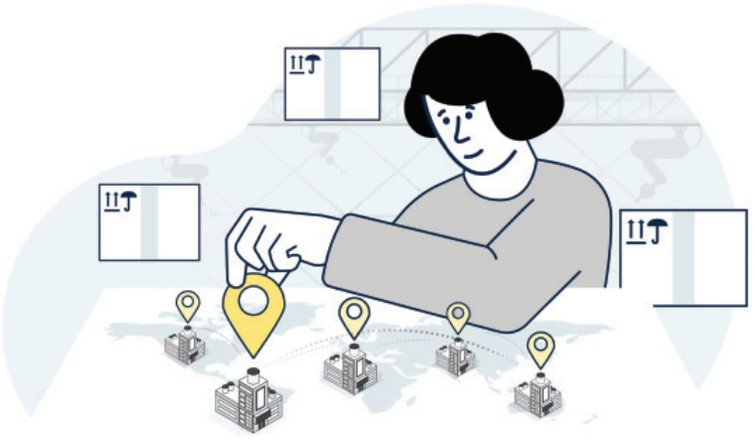

Fig. 12.6: Warehouses Grow or Shrink

In today's dynamic, omnichannel, fulfilment economy, associated consumers want to buy anywhere, fulfil anywhere, and return anywhere. To meet this need, businesses need the capability to respond quickly with warehouse management software that optimises fulfilmentabilities.

In moving to the cloud, Warehouse Management Systems can meet the associated customer with a connected fulfilment solution that offers real time visibility, scalability, and market responsiveness.

12.14 GREEN WAREHOUSING

Environmental perception and ecology are not new in industrial systems and supply chains. The term and arena "Industrial ecology" is now almost 40 years old, disturbed with tracking the movements and stocks of substance and material, particularly those whose cycles are profoundly influenced by industrial activities, as the basis for dropping the impact of the production progression on the environment.

Green warehousing is a comparatively new approach which executes greening into warehouses and distribution facilities.

A few elements which are regularly used in everyday usage by the Warehouse management systems are

1. Implementation of paperless warehouse management system (WMS),
2. Using an energy efficient lightening,
3. Using doors with sensor which automatically close,
4. Using wind turbines or/and solar energy,

5. Using ventilators to push hot air from the top to the bottom of a warehouse,
6. Using sensors for lightening so the light is turned on only in the passage/ area where needed,
7. Using building materials which are better insulator,
8. Using equipment with less carbon emission and less energy consumption,
9. Using returnable/recyclable containers and packaging materials,
10. Forklift fleet improvements, etc

12.15 TECHNOLOGIES USED IN WAREHOUSE ACTIVITIES TO HANDLE THE INVENTORY

The warehouse activities and association with the identified technologies,

Activities	Described Technologies
Material ordering and buffer replenishment	1. Barcode 2. Vision system and image processing 3. Sensor networks 4. IoT 5. RFID 6. GPS 7. AI 8. QR code
Packaging	1. Vision systems and image processing 2. AGV and mobile robots 3. Industrial robot 4. IoT 5. RFID 6. AR 7. Smart glass
Warehousing	1. Vision systems and image processing 2. AGV and mobile robots 3. Industrial robot 4. Digital twin 5. Sensor networks 6. Smart glass 7. Smart gloves 8. Smartwatches 9. Drone 10. AI 11. IoT 12. RFID 13. QR code 14. AR 15. Barcode

INTEXT QUESTIONS 12.3

Fill up the blanks

1. The vast developments and technology influence the ..... tasks been replaced with automatic/mechanised systems.
2. ..... is a comparatively new approach that executes new technology into warehouses and distribution facilities.
3. WMSis the process created to support the warehouse activities ..... for people to operate,

WHAT YOU HAVE LEARNT

Software is the system's brain – it keeps records of all the individual SKUs, their quantities and their storage locations as they go through, move within and leave the warehouse or distribution centre.

Many operations use several transportation systems differing on the volume and weight of the inventory or loads being relocated.

- Pallet Jacks
- Fixed Transport Systems
- Lift Trucks
- Hand Trucks and Carts
- Autonomous Mobile Robots
- Automatic Guided Vehicles

Automatic Identification and Data Capture (AICD) Systems: These technologies predictably collect data from an object and transfer it into a computer system without any manual data entry. This guaranteed data accuracy and improved operator productivity in order picking environments.

The few components of WMS are Paperwork and data entry.

(a) Picking efficiency
(b) Task Interleaving
(c) Scanning Technologies
(d) Warehouse Automation

Warehouse technology has replaced data entry processes, allowing data to be entered directly into digital storage and reducing the range of errors caused by **readability problems, lost paperwork, and other concerns that** arise from the translation of handwritten data into electronic bits and bytes.

Automated warehouses certainly seem to be the ultimate in modern distribution centres, needing very few people to operate, offering high levels of productivity (because as well as being fast, they can operate 24/7/365), and offsetting some of the power they use by operating in an unheated or un-cooled environment, with little if any need for artificial lighting

TERMINAL EXERCISE

1. What is the role of a robotic warehouse?
2. Explain the benefits of Automated Warehouses.
3. What do you understand by the term Inventory picking technology?
4. Identifying the different types of the Inventory picking technology
5. Distinguish between the different types of Inventory Picking types for different Inventories.
6. What do you understand by Warehouse Management System. Explain the usage of Technology in WMS?

ANSWER TO INTEXT QUESTIONS

12.1

1. Inventory Management Software
2. Horizontal Carousel Modules

12.2

1. Automatic Identification and Data Capture (AICD) Systems
2. Light Directed and Voice Directed
3. Warehouse management system

12.3

1. Labour-intensive
2. Green warehousing
3. Quicker

Notes

GLOSSARY

- **Pallet Jacks:** These manually used forked vehicles move a single pallet load pile up at floor level.
- **Barcode:** A barcode, consisting of bars and spaces, is a machine-readable representation of numerals and characters.
- **QR code:** QR – which stands for "quick response" – code is basically a barcode on steroids. While the barcode holds information horizontally, the QR code does so both horizontally and vertically
- **IoT:** The Internet of Things (IoT) describes the network of physical objects – "things" – that are embedded with sensors, software, and other technologies.
- **Smart glass:** "Smart glasses" refers to a device that brings with suitable technology a computer screen/display in front of a person´s eyes.
- **Mobile robots**: A mobile robot is a machine controlled by software that use sensors and other technology to identify its surroundings and move around its environment.