AUTOMATED STORAGE SYSTEM FOR SMART LOGISTICS

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Abstract - *In this paper, it discusses the automated storage system for small scale goods in e-commerce sectors like Flipkart and Amazon. In developing countries like India, online purchase is increasing exponentially and for proper delivery of products purchased through online stores which are delivering the goods at customer end is also a time bound process. Sometimes it may lead to misplacement and cancellation of products due to longer delivery time. So to reduce the time taken for delivering or returning the goods to the appropriate location and to reduce the manpower, an automated Vertical Lift Module (VLM) system is used nearer to the customer location. This VLM stores the goods. Sensors, Barcode scanner, Security System and special Software program are used to automate the system. A Human and Machine Interface (HMI) screen is present outside the module to communicate with the machine. When VLM is operated each time a tray is stored, the height of the product on the tray is scanned and stores it using the least amount of space required for maximum storage density. By this, we can save manpower and transportation cost.*

Key Words: Vertical Lift Module, Sensors, Barcode Scanners, HMI screen, Security System.

1. INTRODUCTION

1.1 Introduction to Automated Storage Systems

Living in the 21st century, the competition in e-commerce is increasing day by day. In such a fast-growing environment to sustain the vying and to meet the customer satisfaction the setting up of an effective stock management system is required. The conventional ways of storing the stock are Rack Systems, Shelving, and Bins, Storage Drawers. In the rack systems, the loads are stacked vertically without the need for loads themselves to provide support. In Shelving and bins, horizontal platforms are present to store the load which also includes boxes/bins to holds the loose items. The drawer modules are used to reduce the problem in shelving and bins where the shelf may be far or away from eyesight. Here, the pulling of drawer allows the contents to be seen readily. These traditional methods require a human worker to access the item in storage. The automated storage systems reduce the amount of human intervention to operate the system. In highly automated systems, the load/stocks are entered and retrieved using computer control.

The main objective for automating storage systems is to improve stock rotation, customer service, safety in storage function, reduce labour cost and to improve security and reduce pilferage. The Vertical Lift Module (VLM) uses the principle of a center aisle to access the loads vertically. The VLM is operated each time a tray is stored, the height of the product on the tray is scanned and stores it using the least amount of space required for maximum storage density. The sensors are used for placing the loads properly on the platform and for retrieving the loads whenever required. The Computer control permits the physical operation of the storage and retrieval system to be integrated for keeping the record of the products placed in the storage system. The scanner barcode is used to provide the end-user the validation to procure the product from the place of storage system.

Sensors:

A sensor is a device that senses the change in physical parameters. The sensors are used for accurate measurements and for detecting the errors or deviations from the desired output. The sensors utilized in ASRS are LINARIX Linear Sensor and IXARC Rotary Encoder for the correct positioning of the merchandise.

Fig - 1: LINARIX Linear Sensor

Fig - 2: IXARC Rotary Encoder

Barcode Scanners:

The barcode scanners are also called as a point of scale scanners. It is an optical scanner used to read the printed barcodes. The barcode readers contain a decoder circuitry

that analyzes the data of the product using the sensor and gives the content to the output port. The scanner used for barcode reading has a hands free scanning using a stand for support.

Fig - 3: Barcode Scanner

HMI Screen:

Human Machine Interface (HMI) is an interface or dashboard that connects an individual to a machine. It is a high-resolution touch screen display. HMI displays are the panel mounted devices with a responsive touch screen for operator inputs. They display graphics and allow easy selection of options.

Fig - 4: HMI Screen

Vertical Lift Module (VLM):

A Vertical Lift Module (VLM) is an indoor system that consists of two columns of trays with an inserter/extractor within the center.

Fig - 5: Vertical Lift Module Type System

The VLM then optimizes the tray height and stores it using the smallest amount of space required for maximum storage density.

2. LITERATURE SURVEY

The purpose of this literature survey is to provide the information about the Automate Storage and Retrieval Systems used in different fields/sectors to the readers.

2.1 Automatic Storage System used in Agricultural Field to store grains developed by Skyway Grain System Inc, Alberta:

The automated storage systems are being used to store agricultural products. The agricultural products like grains (Wheat, Paddy) are stored in cold storage. Skyway has designed a grain handling system. When there is a need to move a wet harvest, bucket elevators, grain dryers, chain conveyors and grain pumps provide the ability to move products within the grain system and in-load and out-load products to trucks or rail cars. The growth in technology has made the advancement also in warehouses where agricultural products are stored. The usage of multi-storied racks has reduced the floor space and is yielding high efficiency and high storage capacity. The real-time monitoring of the grains stored is done using grain temperature sensors, moisture sensors, humidity sensors, etc. These sensors are used for maintaining the product quality and for preventing defects.

2.2 Automatic Storage Systems used in Heaven Hill Distillery:

Heaven Hill is an American company that produces distilled spirits. With significant growth in acquisitions, it was quickly running out of space for storing finished goods on-site. Heaven Hill historically operated with fully manual processes that were not as efficient as the company grew. So, it decided to look for a fully automated solution that would increase warehouse storage capacity and scale as the company expanded its bottling facility. With the help of Westfalia, Heaven Hill installed tandem storage and retrieval machines and one fully automated layer picker. It increased the company's storage capacity by 40%. By automating previously manual processes, Heaven Hill is shipping products 400% faster than before and able to cut down dock times by 49%.

3. METHODOLOGY

The lapses in delivery of products purchased through online mode are due to improper storage systems near the delivery stations. The products will be delivered in a different location i.e., City/Town from that shipped. The sellers sell them from different localities using the warehouses and also self shipping. The consignments after getting shipped are first delivered at the facility center and from there they are put into cargo for delivering them to consumers according to the delivery location.

Fig - 6: Materials Stored in Racks with manual storage and Pick up

The products get stored in the warehouses for one–two days in the warehouse before sending them into cargo or at the delivery station before delivering to the consumer. There the misplacement or shipping the products into different tote bags may happen due to manual errors. This leads to the late delivery of products which can be reduced by using this Vertical Lift Module type Automatic Storage and Retrieval System. Using this system the products are stored into different trays and are stored into the Automatic Storage system where they are stored vertically in racks. The special

barcodes are to be assigned to the products that are to be stored. For retrieval, the products are to be retrieved and can be stored into to tote bags automatically according to the delivery location. The transporter just picks the bags and delivers it according to the location.

In this system, the barcode scanners can be used to detect the product which is given a unique identification number. Using this number the consumer can also come to collect the product stored at the facility center if it is nearby or if he/she is not present at specified address. In this, the customer has an option to collect the product from the warehouse in hand or to be door delivered.

If the consumer chooses to collect from the facility centers or the special warehouses where the product will be stored, he must scan the barcode of the product at the barcode scanner and the special Human Machine Interface (HMI) screen present outside the prescribed desk communicates with the customer about the product details. After verification the product comes out automatically from the storage module. From there the product is shifted onto the conveyor belt which comes to the desk where double verification is done using the special identification number and also the details verified. If the product is cash on delivery product, then the consumer can pay the amount at the desk using different payment modes like cash or digital money wallets.

Fig - 7: VLM type Storage System with Security Features

4. CONCLUSION

As technology is growing day by day the ease of handling products has also increased. The usage of the Vertical Lift Modules for storing the products reduces the size of the warehouse and also increases the storage capacity. By automating storage racks using barcode scanners for delivering the products out of the storehouses the errors involving in pickup and misplacement of products reduces.

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