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Intelligent Retail: Transforming Operations with Business AI

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Abstract **- The integration of Artificial Intelligence (AI) into store operations is transforming the retail landscape, offering innovative solutions to long-standing challenges. This paper explores how AI-driven technologies enhance efficiency, accuracy, and customer experience in retail environments. By leveraging AI for inventory management, demand forecasting, and real-time analytics, businesses can optimize stock levels, reduce waste, and prevent stockouts. AI-powered tools such as computer vision and natural language processing enable personalized customer interactions and improve in-store experiences. Additionally, automation in workforce management and supply chain coordination streamlines operations, reduces costs, and ensures seamless service delivery. Case studies and industry insights are presented to highlight measurable outcomes, including improved decision-making, reduced operational costs, and enhanced profitability. The study concludes by emphasizing AI's potential to redefine store operations and offering strategies for its effective implementation in a competitive retail market.**

Keywords - Artifical intelligence in Retail, Store Operations Optimization, AI driven solutions, Inventory management, Real Time Analytics

I. INTRODUCTION

Store operations refers to the day-to-day activities and processes involved in running a retail store efficiently and effectively. It encompasses all the tasks and responsibilities necessary to ensure the store meets its goals, including providing excellent customer service, managing inventory, and maintaining an organized and safe environment for customers and employees. The major aspect of the operations is to Tracking stock levels, replenishing inventory, and preventing stockouts or overstock situation., Displaying products attractively to encourage sales, Scheduling shifts, training employees, and supervising daily tasks. However more than often Retailers struggle to set up a proper inventory management solution. It can result in missed sales, bad customer experience, stockout situation, increase in shrinkage etc. this list could be endless. This article delves into these challenges to understand the key areas of improvement and identify opportunities to define a strategic roadmap for leveraging technology and innovative solutions to enhance store operations and overall efficiency.

II. PROBLEM STATEMENT

Inventory management at retail stores involves the systematic process of ordering, storing, tracking, and controlling stock to efficiently meet customer demand while minimizing costs. Effective inventory management ensures that the right products are available at the right time and in the correct quantity, preventing both overstocking and stockouts.

A. Inventory Management at the Back room of the Store

When goods are delivered by the warehouse, distribution center, or vendor, they are typically stored in the back of the store before being moved to the shop floor.

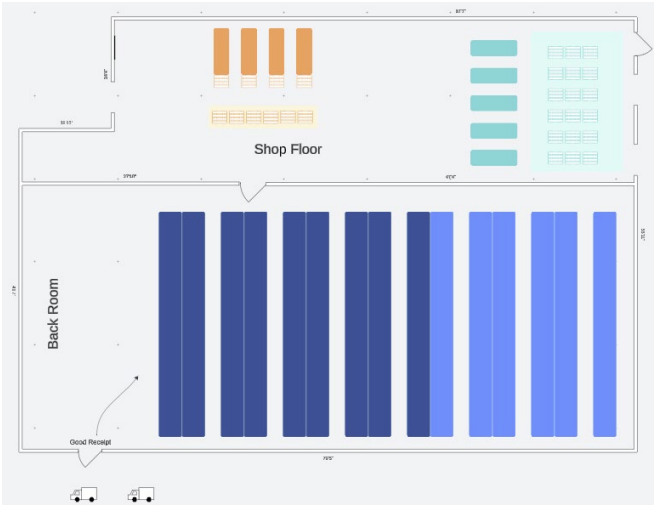

Figure 1: Store Layout

However, this transfer doesn't occur immediately, as overloading the shop floor with inventory can create a cluttered display, negatively affecting the store's appearance and making it inconvenient for customers to locate products. Conversely, delaying the transfer for too long can result in empty shelves, leading to missed sales opportunities and over stock of unsaleable inventory. The transfer of the inventory from the back of the store to the front are usually a manual process and heavily dependent on the schedule of the shifts, training of the employees, frequency of the supervisor's daily store walk through task and efficient storing system in the back of the store. Sometimes the store associate has no visibility on the availability of a specific product unless the shipments are unboxed or a through manual search is conducted. This all can lead to a bad customer experience and more inefficient store.

B. Replenishment to the Shop Floor

If a customer cannot find a product on the shelves, store associates often need to physically check the back of the store for stock availability. The default response is often that the product is unavailable, even when stock may exist. If the shipment were just received and the store has not yet opened the boxes, there are no visibility at the store associate level on the products. Throughout the day, store associates must monitor the shop floor to identify empty or nearly empty shelves. They then manually communicate with back-store associates to replenish inventory, a process that can be time-consuming and prone to errors.

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Figure 2 : Shop Floor

C. *Product search*

It often happens when a customer reaches to the store and intends to buy a product specifically only to find that the store is out of stock. Most of the retailers has their apps where the product can be searched store by store. Often this is frustrating and time consuming. If the particular item is not available corresponding similar items are not suggested to help the customers to find an alternative. Sometimes the suggestions are very different than the original item.

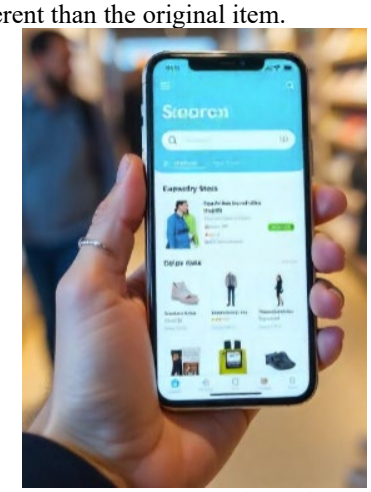

Figure 3: a representation of the usual Store app

III. SOLUTION APPROACH

A. *Master data Set up*

In a store setup implementation of a WMS kind of system is an overhaul on the IT cost and infrastructure. Moreover, the stores associates are more focused on the shop floor assisting the customer rather than performing extensive steps needed to main the operations of a WMS system. The solution approach aims at providing a solution which is lead, automated and driven by business AI.

The first step of the solution should start with Master data.

1. Article Dimensions – each article should be tagged with its dimension.
2. Every Article needs to be assigned to its Bin location for both back of the Store and Front of the store. This step could be part of the data creation process.
3. Shelf Master – Based on the store layout, every shelf, whether located at the front or the back of the store, must be appropriately labeled and organized with a clear nomenclature system. This could be a derivative from the planogram.

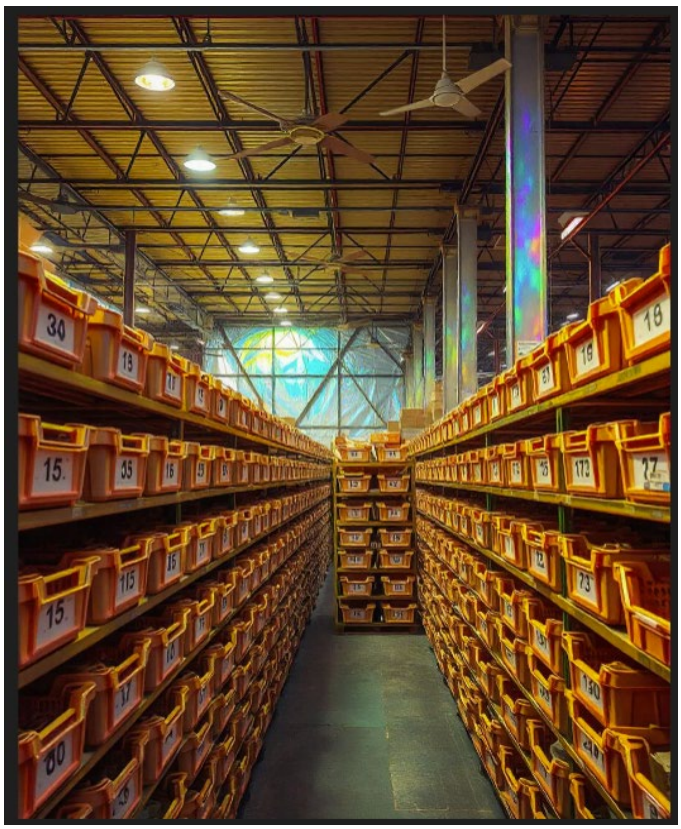

Figure 4: a representation of the back of the store layout.

B. *Goods Receipt process*

Once the good receipt transaction is processed, the articles should be put away to an empty bin at the back of the store. The solution has to provide an intelligent and automated way to help the users identify the location of the empty bin.

AI bots can check availability of empty bins based on the master data assignment. This can trigger an immediate worklist item for

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the store associate. The associate can login into the App and identify the bin where the products have to be stacked. Once the work is finished, the associate can complete the worklist items.

If the designated bins are all filled, Machine learning capabilities can enhance the operations by identifying what would be other bins where the products can be stored. This will help the back store associates to stack the inventory in a proper sequence.

Similarly, any goods issue posted should also update the bin quantity. This would the job of the AI agents to maintain the posting.

C. Replenishment process

Automatic agents with machine Learning capabilities can be deployed to schedule the replenishment to the front of the store with a predefined business logic. The agent can monitor the real time sales numbers and can automatically determine the emptiness of the shelf. If it falls the below reorder number or minimum shelf capacity number, The agent can trigger a pick list to the back store associates to transfer the required inventory to the shelves. It can identify the exact bin to pick from and the target shelves to place it. In case any excess inventory in the back is unavailable it can trigger a purchasing request for the store manager or the buyer to perform a purchasing step.

This could be fully automation process working in autopilot mode.

The picking request would be generate by leveraging wave picking concept thus optimizing man power utilization and routing to highlight if additional machinery like forklift has to be used.

D. Enhance customer service

The solution set can be deeply integrated with generative AI capabilities to able to help further support customer service and aid in upselling process. Generative AI would be able to investigate the data structure to provide accurate and specific information about the availability of the product. It can investigate the back store racks or within the incoming shipment to appropriately guide the store associates on the location.

If inventory is unavailable, it can suggest alternatives product by leveraging the attributes of the out-of-stock product thus helping in upselling. It would provide the best possible match by levering data science, or it can suggest if any of the nearby store have inventory. If agreed with the customer to buy, it can trigger a reservation request to the target store thus securing the product with minimal human intervention.

This could be done via a kiosk Aswell where the customer can place the request themselves.

The same process can also be integrated with the consumer facing store app thus optimizing the search more suiting towards the correct information.

E. Business AI

There are various formats of Retail stores with varying degree of complexity in store operations. One common factor is unreliability of workforce, and the major motivation of the store associates is focused on the customer service and sales rather than performing transactions in the system. The more automated and guided process the better possibilities of maintaining the integrity of the system the more efficient and welcoming the acceptance of the solution. Business AI can help in this aspect.

- Information scraper agents can be deployed to collect necessary information from the transactions occurring in the system.
- Vector DB updater can create embeddings from the selected information and upload into Vector DB.
- Chatbot UI can allow users to perform transactions over voiceover which can use LLM to covert them to trigger to agents to perform the transactions.

This would be an automatic and guided process reducing the burden of store associates and transferring the redundant and labor-intensive work on to AI agents.

Agents would also be deployed to identify frauds and Exceptions which can be reported and notified to the Store Manager in situation where either further information are needed to complete the tasks, anomaly is detected, or additional business inputs are needed.

In case of fraud or exceptions are identified, an early alert can be communicated to the Manager for further investigation. This could also trigger cycle count request.

Store Manager at the beginning of the day would have all the information needed to better plans the shift and work force management.

F. Challenges

Some of the challenges in implementing the solutions could be as below.

- Standardized store layout – Each Retail store might have different square footage or different layout. The dimensions of the shelves could be different. The region, city where the store is located can vary based on the real estate availability.
- Product dimensions – Not all products might have a standardized dimension. Produce is a very good example.
- Placement of Stock in the back of the store – There could be instances where the shipments after receiving are not stocked as per the guidelines. The racks and shelves are not available or are in shortage.

The shelves or racks might not standardized dimensions across all the stores

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