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**Deepjyoti Koley**  
School of Computer Science  
and Engineering, Vellore  
Institute of Technology,  
Chennai, Tamil Nadu, India

## Role of internet of things and robots in retail sector: A useful overview and analysis

**Deepjyoti Koley**

### Abstract

Recently robots have become good research areas in the Internet of Things (IoT) and retail. The retail sector is lagging behind as technology is strongly developed in every sector as more technology is not used in retail stores. Retail robots promise to free workers from routine tasks, perhaps giving humans more time for customer interaction. But that is just the beginning of what robots do. The real advantage of retail robots is the ability to get more nuclear data about the products on the shelves and about customer purchase models, which increases efficiency and accuracy in inventory management. In Internet-of-Things (IoT) it is important to use retail robots as data-collectors, which collect vast amounts of analyzed data in the cloud or on the edge as a complex network of connected devices, objects and sensors. Considered the best. Combined with the advanced capabilities of computing AI and machine learning, IoT guarantees to change the way we live, work, trade and buy the goods and services we want and need. The key to all of this is that the robot moves freely, bringing data from user touch points in the store corridors to the data management system in the cloud. This paper discusses the connectivity issue of all physical devices such as sensors and efficiently binds the robot, providing a fast and hassle-free shopping experience for the customer. The Internet of Things has a good context for improving communication between customer and brand. IoT sensors can track customer habits and share insights with the marketing team.

The content team can create segment-specific personalized content that helps the buyer find the product he is looking for, get tips and advice, or provide it to a friend in the store. This greatly increases the reach of stores and makes them unique than other stores.

**Keywords:** Retail shop, internet of things, robots, cloud computing, deep data learning, customer, digitalization

### 1. Introduction

The use of the Internet of Things (IoT) was initially unpredictable in retail, but these days it has become a way to gain competition from the world's leading retailers. The Internet of Things in retailing is the physical marketing facilities and products and the connection between the virtual world of retailers and consumers. Although technologies already exist to track products through the supply chain and how consumers are using products such as RFID, the Internet of Things refers to consumer convenience throughout the process, prioritizing ease of purchase. High level sharing. There are many concerns regarding the storage of large amounts of data, as well as user security and privacy issues. The question is whether consumers will soon be shopping in shelf-free stores without products with virtual displays and touchscreen options, allowing customers to choose products that are packed and ready when they exit the store. Or to go further, the customer will be delivered to the home and wait for them before entering the home. The Internet of Things supports such a future collection concept.

The development of new retail technologies empowers that the last decade is regarded as the era of electronic retail, while it will continue to dominate the development of technology in traditional retail in the times to come. We have seen the birth of e-commerce by amazon in 2002. Nowadays everyone buy/sell in online platform through this site. They become a trusted middleman. Technological progress in e-commerce has reached a saturation level. But in retail stores, there is a huge scope of research into digitizing it with the help of robots and IoT and perhaps pull the crowd back to physical stores which have been in decline since the rise of e-commerce<sup>[1, 2]</sup>.

With the advent of new technologies, better sensors, better Internet connections, ease of communication, and mobile devices, they have made the Internet a thing in retail use, and have also brought opportunities to improve business and personal shopping experiences

**Correspondence**  
**Deepjyoti Koley**  
School of Computer Science  
and Engineering, Vellore  
Institute of Technology,  
Chennai, Tamil Nadu, India

The aim and purpose of this analysis is to present an opportunity for retailers to develop a vastly improved ecosystem that connects the physical and digital worlds that allow bidirectional real-time interactions with consumers inside and outside the store. This opportunity has been created because of advances in Internet of Things and Robotics. The Internet of Things offers retailers new opportunities by connecting each consumer to a retail store and the activities that are carried out in the shopping process by connecting to the Internet and combining physics and physical science. Virtual World. Digitization is becoming a growing trend in retail which has always been a labor intensive sector, and today the human workforce is increasingly being replaced by technology.

There are many ways in which the retail industry can make use of IoT technology. Currently, the sensors are being used to monitor customer satisfaction, provide supply chain insights, and monitor food safety and track assets. Retailers can use IoT technology to enhance customer satisfaction. IoT sensors connected to a dashboard or set of color-coded buttons allow stores to collect customer feedback immediately after the shopping experience. This data provides real-time shopper satisfaction insights that can improve in-store customer experience [3, 4].

Retailers are using IoT technology to track lost shopping carts and baskets. Tracking these assets can reduce the cost for stores to replace them. It is expensive for retailers to replace shopping carts. By placing sensors on properties such as shopping carts, retailers can track them to their exact location and receive status updates and alerts if they are damaged. Tracking devices, installed on carts and baskets, work inside and outside the home and can last for months or years without changing the battery. These sensors help retailers improve the customer experience by ensuring that shoppers always have access to adequate shopping carts and carts.

As robots move from warehouses to stores, the inclusion of artificial intelligence (AI) in them allows retailers to dramatically change their customer interactions. Basic sensor-based robot customers can bring what they are looking for, while the AI-led robot can provide personalized product recommendations. The robot's 'advice' is always driven by analytical insights by combining customers' age and location data with their purchase history.

The paper Humanoid Robots, powered by AI, is a good example of how the combination of AI and robotics can improve customer engagement and experience. The robot can be pre-programmed to chat with customers, answer their questions and provide directions. Robots like Pepper can use their robotic hands to pick up items that customers choose through the touch screens in the store. They can help retailers by saving store space by keeping items vertical. Clothing outlets can also use robots to quickly deliver items to customers in the dressing room through the store's mobile app. Customers can order and pay for whatever they take before leaving the dressing room. Retailers can use these methods to gain customer intelligence in-store and in-store promotional activities to optimize product assortment.

Sensor features look to analyze customer count, path-tracking, behavior, attention span and emotions. The customer scoring system finds disgruntled customers and uses their feedback to take corrective action. Dedicated marketing intelligence units today process huge data and adopt IoT components such as 3D sensors that track

customer travel to the store. Probabilities and statistics are the model for deeper insights that enable better.

Innovative applications and implications of robotics in the retail industry offer incredible potential and opportunities. Welcome robots, robots that track, monitor and analyze customer travels, and operational robots - such innovations are committed to providing significant benefits to customers and retailers.

Robots may have limitations in the manipulation and performance of complex ideas and reactions that require a high level of instinctive or creative skill. However, these are innovations for the future with improvements in AI and deep learning technology. However, for now, retail has shifted to robotics facial and voice recognition features, advanced responses, explanations and responses.

## 2. Efficient ways to implement iot and robots

Scanning and payment for products is done remotely until the customer leaves the store with the goods. Thanks to the sensor, there is no need to scan each product individually in the cash register. The product reads the sensor after exiting the packaging store, which sends the signal to the application on the user's mobile phone and makes the payment.

### Virtual product zone

Provides infinite product shelf to retailers and convenience and variety to customers

### Experience zone

Without using trial rooms, customer can conveniently try on multiple products virtually;

### Virtual simulation of retail theatre

Without using trial rooms, customer can conveniently try on multiple products virtually;

### Physical product on display

Customers can scan the tags of physical merchandise and use the experience zone to virtually try them on themselves;

### Prototypic zone

Customers can customize the products (shape, size, design, colours, fit, etc.) according to their needs.

In addition, there will be sensors on each shelf that will keep track of the items. When a particular item is almost out of stock, the sensor will send a signal to the store owner to refill the stock. It will also store the data in the cloud, which can later be used to analyze customer buying patterns and which items are selling fast and which are not selling at all.

3D printing technology allows stores to create their products on demand. In addition, many products can be printed locally, reducing transportation, warehousing and logistics costs. Plus, virtual reality profoundly transforms and expands the shopping experience from home or in stores. Consumers will be able to explore products in the virtual world before buying.

There will be a robot to speak to the customer or accomplish physically using a touch screen – where to find the things they need inside the store. Buyers can also ask the robot some basic customer service questions that would otherwise need to be addressed by a human worker. The robot also performs real-time inventory tracking as it moves through the aisles. The information the bot gathers while operating is

supposed to help identify buying patterns at the location, so that the retailer can not only re-supply its shelves but also understand which merchandise Moves more quickly, and what day of the week or season.

Another robot is specifically focused on monitoring inventory levels and pricing products within stores. Tally uses visual recognition software to identify when a product's inventory is low as well as whether the price associated with the item is accurate.

### 3. Beneficial result of robots in retail store

- Attracting customers' attention: Since retail robots are a new invention, customers are eager to see them in action. In our opinion it is considered a "toy" advantage, which helps drive adoption and promotion, but is sufficient to make retail robots the industry standard in businesses such as McDonald's, Lowes, Wal-Mart <sup>[4]</sup>, etc.
- Improve storage space utilization: Robots in the warehouse allow the use of narrow aisles and on the shop floor, they allow the use of vertical space not available to human sales personnel.
- Inventory Tracking: Robots can quickly locate lost items to avoid losing sales.
- Guiding customers on campus: From airports to hotels to warehouses in and out, customers always need help finding the product or location they are going to. This task requires very little in terms of robot agility or efficiency and looks like a viable short-term application in the retail environment and outside.
- Retrieving products for customers: Robots can quickly access items stored behind glass so that the customer does not have to wait for free staff (i.e. Best Buy Chloe robot).

### 4. Examples of such trial

- Sawyer, Active8's collaborative robot, with its embedded Vision system, offers excellent e-commerce ordering, co-packing and handling.
- Tally, Tory, Skylog and Stockbot are robots in the retail industry that find applications in inventory, stock taking and monitoring.
- Retailer Hointer is a fully automated store in Seattle. Customers can scan a clothing item using their smartphone (only one item from each category is on display) and provide the size and color they like. Robots can go to the fitting room to give them the clothes they like. These can change shape and color with the help of robots. Upon completion, they can check their purchases using a self-service kiosk.
- AWM's Smart Shelf is equipped with edge display and high-definition optical sensors to display information that transmits data about product prices and inventory levels. It can also identify user age, gender and ethnicity to provide more specific display content.
- Phlonomics counting system and retail analytics technology can help retailers determine the right staff levels for different dates and times, improve marketing strategies, measure traffic flow, improve customer service and much more.
- Engage 3's Competitive Intelligence platform helps retailers determine pricing strategy by providing competitive pricing data and product integration capabilities as well as machine-learning-based analytics, all within a single dashboard.
- Caper Lab manufactures a smart self-checkout cart based

on Amazon-Go's AI, sensor and image recognition technology. Customers simply pick up the item from the shelves, scan the barcode of the item, drop it into the cart and pay directly to the cart once the purchase is complete. No need for app, no change of cash, no waiting.

- Locus Robotics creates autonomous mobile robots that optimize warehouse operations by reducing labor costs and improving order fulfillment speed and accuracy, without interrupting all ongoing warehouse operations.
- Digital Lumens provides software, product and system integration through its cloud-based intelligence platform Site Works, which allows connected LED lighting and IoT sensors. It offers lighting and a low carbon footprint for a tenth of the cost.

### 5. Cloud computing

Compared to traditional retailers, cloud computing and data analytics in the cloud allow retailers to make more data-based decisions and develop innovative marketing strategies.

Cloud data platforms provide marketers with a single source of comprehensive data from multiple sources, allowing retailers to plan targeted marketing campaigns and create customized offers to enhance customer experience, deliver delivery value and reach business goals. Will help to gain.

Inventory management is very challenging for distributors to manage, manage and monitor their inventory. However, real-time tracking and monitoring with the help of cloud can prevent duplicate data from affecting our business processes. Here are some benefits of using the cloud for inventory management.

Tracking stocks and insights: Overstocking or understocking that affects our profitability is the ultimate budget killer. The cloud can help solve this problem by tracking the list at all stages without the limitations of traditional systems.

Remote Warehouse Management: Switching to cloud software gives us offsite access to our inventory locations, live inventory volumes, our distribution center locations and more.

Maintaining a Supply Chain in the Cloud: Tracking inventory manually can take a long time, but with inventory in the cloud, our inventory management, order placement and requirements will be automated.

POS Updates: Real-time inventory updates (integration between POS and back-office) from back-office systems to POS.

### 6. Walmart digitalising retail stores aggressively

Walmart is "aggressively" upgrading its infrastructure, upgrading more than 50,000 servers, allowing the store to take advantage of the latest hardware and software. The company upgraded 2,000 stores to 1 gigabit fiber connection per second. This allows them to implement machine learning and data workloads such as computer vision and augmented reality that require a lot of bandwidth in their stores.

Walmart is also doubling the speed of transition to the cloud platform, which has become a major commitment to Microsoft. They handle 100% US e-commerce and Sams Club customer trips in a single day in the cloud. They also ended up building a data lake in the cloud and moving over 1.7 petabytes of data into it, which allows them to run very sophisticated analytics very efficiently. Finally, they

provided their cloud checkout system to approximately 23,000 point-of-sale devices. So these migrations to the cloud were really key to their modernization efforts over the past year.

### 7. Challenges faced in implementation

Despite these myriad benefits, it is an undoubted fact that any business that wants to integrate new technologies, especially AI will face some challenges:

#### New ways of working

As IT integration progresses, we are likely to see more changes in the way we work. The current trend sees robots increasingly performing manual labor activities, while "mental" work is performed by humans. But even that may be set to change as AI programs are gaining skills and are able to work effectively with data. Recent research from McKinsey & Company has shown that out of 2,000 labor activities, about 800 occupations can be automated to some degree. For society, in general, this would mean a new drive in skill building and a changing job market in the future.

However, for retailers, this means that they have to rethink both their staffing needs and their technical firepower to be able to keep up with the competition.

#### Cost of new software

For retail businesses that are just starting to introduce technology, the initial costs can seem off-putting. Typically, this means developing customized software and products to improve the business, and this can be more expensive than off-the-shelf products. In addition, companies may need to consider hiring specialists to maintain and service such systems.

While the initial roll-out of such growth comes at a price, companies should look at their long-term profits and overall impact on the business.

#### Security

Finally, retail providers will face new challenges in dealing with security. For many of these systems to work effectively, large amounts of information must be collected and stored. This means that companies will be more responsible for data security in the areas of personal privacy and the privacy of their entire businesses. Secure data collection and consent management is one aspect; Another is protection from hackers. This is necessary to protect the data from exploitation and to protect the system from being corrupted.

### 8. Disadvantages of Implementing ROBOTS in Retail sector

#### Few Disadvantages of Implementing ROBOTS in Retail sector are

- **Loss of jobs:** There will be a huge loss of jobs as very few staffs or manpower will be required to operate the automated store. Though new jobs will be created but the number will be less and those who fail to adapt to new technology will be laid off. The unemployment rate will go high.
- **Risk of privacy breach:** With the help of IOT sensors and robots, the data collected, can be analysed and a person habits can be predicted, his/her likes dislikes, usual shopping time etc. If this data gets leak and falls on wrong hand, then the privacy of customers will be at

risk.

- **Expenses of robots:** the parts of robots and sensors are very expensive, so even the salary of staffs is reduced but the maintenance cost would increase and the return on interest will remain the same.
- **Intelligence of robots:** Initially, the AI is in its developing phase, so the communication and reply to customer queries will not be as accurate as an human would reply. The skills of luring the customers to buy a particular product will be missing.

Now in the last, the researchers re recommend to refer articles on Artificial Intelligence, Machine Learning, Deep Learning, Big data, etc., <sup>[5-18]</sup> to provide better prediction and increase productivity of a business.

### 9. Conclusion

The trend of digitization is increasing in the retail sector. Further development of technologies applicable to retail stores will have an increasing impact. Electronic retailing has been an innovative retailing format with an increasing share of total retail sales, but lately retailers are not seeing further growth in electronic retailing. With the advent of new technologies, better sensors, better connections, ease of communication and mobile devices, the Internet of Things has become the technology of the future. The Internet of Things promotes the development of a multichannel approach using interactions with consumers through multiple channels. Modern retail stores involve the implementation of modern technologies and the use of the Internet to enhance the consumer's purchasing experience. The second era of digital retail is already underway, as annual IoT investments by retailers will exceed \$466 million by 2017. The Internet of Things is one of eight technologies that will have a huge impact on retailers' business in the future, along with Autonomous Vehicles (AV) / Drones, Robotics, Artificial Intelligence (AI) / Machine Learning, Augmented Reality (AR) / Virtual reality. (VR), digital traceability, 3D printing and blockchain.

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