

# Internet of Things (IoT) For E-Commerce - A Study

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**ABSTRACT:** The most important application of Internet is E-commerce which is a typical format of information service. Since the lifestyle of the consumers is changing and becoming more adaptive to online shopping, it has becoming crucial for the experts in this industry to hold and update the technologies to provide services that can lead to customer satisfaction. In information technology, IoT is the new revolution after internet and mobile network. IoT-enabled devices uses internet to exchange data with each other thus, helping retail and e-commerce businesses to efficiently carry on their operations. In this study the applications of IoT in e-commerce businesses has been discussed. Also this paper explains the way in which the Internet of Things can be is integrated with E-Commerce.

**KEYWORDS:** E-Commerce, Internet of Things.

## I. INTRODUCTION

E-Commerce or Electronic Commerce refers to the type of business model which involves transferring of information across the internet. That is a customer makes online shopping, online payments, online transactions between merchants and a variety of business activities, trading activities, trading activities, financial activities and other integrated services. Without any barriers of time and distance e-commerce allows consumers to electronically exchange goods and services. E-commerce is currently one of the most important aspects emerging on the Internet. As mobile devices became more popular, there is a rapid increase in the adoption rate of internet in recent years, a large number of online shoppers have witnessed a steady growth. Since more and more businesses move sections of their operations onto the Internet the boundaries between "conventional" and "electronic" commerce blurred. E-commerce has evolved over the years like any digital technology or consumer-based purchasing market. With the rise of sites such as Facebook, Twitter and Pinterest, social media has become an important driver of e-commerce. Recent survey shows that the e-commerce sales will reach \$27 trillion by 2020.

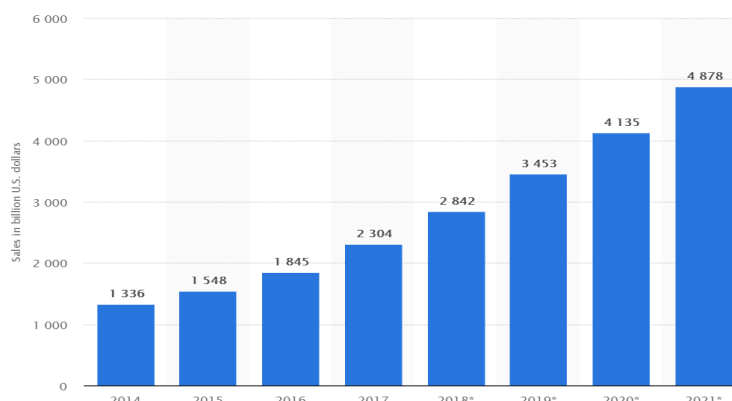


Fig 1.1: E-Commerce sales worldwide from 2014-2021

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IoT devices will help e-commerce businesses streamline their operations. In broader terms IoT refers to the connection of devices with internet so that those devices can exchange data within themselves. It blurs the gap between physical world and computer-based systems resulting in improved efficiency, accuracy and economic benefit. IoT with its amazing efficiency and simplicity has augmented the growth of e-commerce sector and has impacted millions of lives. IoT is driving innovation and new opportunities by bringing every object, consumer and activity into the digital realm. The leading businesses are making similar changes within their enterprises by digitizing every employee, process, product and service. The back-end of business management has seen the greatest impact from IoT. Internet connected devices have drastically improved the entire supply chain process—from inventory management to delivery. This technology allows inventory management to occur in real time reducing person-hours all while providing more accurate information. The growth of connected devices coupled with improved, less-expensive technology platforms and adoption of common standards would increase the rapid growth of IoT-enabled capabilities across industries.

### **II. RELATED WORK**

The author of [1] analysed the development of IoT enabled services in e-commerce. The key technical issues of Things development, e-commerce security measures and configuration structures have been discussed in this paper. The paper concluded that the IoT technology is still in early stage and it is not mature. So it requires long term focus and improvement in IoT technology. The author listed out certain areas where the telecom operators and system integrators should work. i) The sensor and real time communication network should be strengthened. The cloud computing services should be accelerated in areas such as finance, online payment, manufacturing industry etc., ii) There has to be an improvement in network security, system stability and data protection. A security should be built stronger since all the transactions would take place through internet. iii) The IoT technology and industry solution programs need to be developed in related-party of e-commerce industry chain.

Paper [2] talked about the E-commerce logistics in supply chain management from a practice perspective. Due to the fast development and large influence of E-commerce, logistics has been greatly changed compared with several decades ago. This paper highlighted the logistics models and supporting techniques which have improved the E-commerce logistics significantly [2]. Worldwide implementations such as North America, Europe, and Asia Pacific are reported. Typical e-commerce companies have been reviewed in this paper aiming to get the opportunities and future perspectives which may be used for guiding practitioners and academia when contemplating Ecommerce logistics and supply chain management in the near future. For the practice view of E-commerce logistics, the IT technology plays an essential role in improving the efficiency and effectiveness of supply chain management. Future technologies like Internet of Things (IoT), Big Data Analytics, and Cloud Computing would be possibly adopted to enhance the E-commerce logistics in terms of system level, operational level, and decision-making level that may be real-time and intelligent in the next decade.

The authors of paper [3] proposed an architecture for IoT enabled e-commerce services. It consisted on three layers namely perception layer, network layer and service layer. The authors described the working of IoT in e-commerce. They have taken e-commerce as an application scenario and explained how IoT works in that case.

### **III. BENEFITS OF IoT IN E-COMMERCE**

IoT-enabled devices uses internet to exchange data with each other, helping retail and e-commerce businesses to carry out their operations effectively. By 2020 the retail spend on the Internet of Things is expected to reach \$2.5 billion. More than 70% of the retailers are ready to adopt the Internet of Things to improve their consumer experiences worldwide. The IoT movement offers e-commerce businesses and retailers opportunities in the following critical areas: inventory management, logistics, customer experience, marketing opportunities, the supply chain, and new channels and revenue streams.

#### **A) INVENTORY MANAGEMENT**

IoT devices will help ecommerce businesses streamline their operations. For example, the tracking and handling of inventory will become easier with the movements of connected products now traceable in real time. Such data can be used to notify business owners of low and slow-moving stock. With the help of IoT, it becomes easy to keep track of inventory. IoT sensors and RFID tags make management of inventory in real-time possible, streamlining the entire

flow. They improve the monitoring and tracking of inventory items, reducing human errors in reordering items. Information like product type, manufacturer's name, the expiry date of the items and their batch IDs can be automatically stored in the system without human intervention. Smart shelves are useful in reducing customer dissatisfaction due to out of the stock products. They can track the number of products that have been sold and can place automatic orders as soon as the stock reaches reorder level. IoT not only helps in optimizing inventory and reducing shortage but also eliminating over-stock of items in the warehouses. Temperature-monitoring sensors can be used to check the optimum temperature for perishable products and send alerts whenever needed. There can also be sensors that examine the forklifts in the warehouse for predictive maintenance to reduce the loss of productivity.

### **B) LOGISTICS**

By integrating IoT with e-commerce logistics, tracking stock in the warehouse or customers and their interest list can be made easier. Radio Frequency Identification (RFID) and Global Positioning System (GPS) technologies allow tracking every stage of an item's journey, reporting how fast it's traveling, who the driver is, or even the weather. This information can be used to automate much of the shipping process, and ensure there are no missing shipments or unforeseen delays. Here IoT technology can be used to enhance the customer experience by updating the delivery status of the item they have purchased like sending automated messages informing customers of the status of their package. For example, a text shall be sent to the customer a couple of days before the item will arrive, and then another couple of hours before, so they won't have to worry about missing the delivery. The sensors can be included according to the needs. A supermarket delivering frozen goods might want to include temperature sensors to ensure the package is staying cool, and to alert the driver to take action if it's getting too warm. IoT ensures the smooth and continuous flow of goods from one location to another as the success of any e-commerce business relies on seamless and uninterrupted supply chain management. IoT allows tracking of items from their production until consumption. With IoT-enabled detectors, retailers can easily manage the route and speed of their shipped products too. Radio frequency identification (RFID) and global positioning system (GPS) techniques help merchants recognize a product in transit and deliver particular information about its location, temperature and much more.

### **C) CUSTOMER EXPERIENCE**

The Internet of Things connects e-commerce businesses with customers like never before. For example, warranty and malfunction data can be automatically sent back to retailers to ensure a swift response - sometimes before the user is even aware a problem exists. Every experience is becoming a digital experience and these experiences are combined together called the "Internet of Me," which describes an interconnected environment in which businesses are building products and services to be designed for, created for, and specifically centered on the individual. IoT enables e-commerce businesses to differentiate themselves from their competitors in front of their clients. For example, Walmart uses IoT to get insights about the products which are popular on social media. This innovative technology allows retailers to deliver a comprehensive shopping experience to customers with a high-level of personalization, leading to clients' satisfaction and engagement. The location-based beacon technology allows retailers to interact directly with customers as they enter the online store.

IoT can help in personalized advertising for e-commerce businesses to target a specific group of customers. It can recognize shopping patterns in search trends and online browsing, enabling businesses to sell targeted products to their customers. IoT will allow tailoring products, services and offers to customers' choice. With more data available to marketers about consumer behaviour, it will become possible to attract customers and influence their purchase decisions. IoT also improves customer service, helping report issues even before they are noticed. This helps the businesses to smoothen the customer experience by anticipating possible complaints, leading to easy and prompt resolution. A customer may search from the list of items provided in the e-commerce sites and they can purchase their favourites. Every customer has certain shopping pattern base on what they are looking in the sites. On studying such shopping patterns of a customer via search trends and online browsing, IoT helps vendors sell targeted merchandise to their customers. By that way sellers can focus on the needs and requirements of their customers in a better way.

IoT devices enable the retailers to collect consumer data including their habits and behaviors. On average, a retailer employing IoT technology may be able to aggregate a higher amount of consumer data than their competitors, and they can use that data to engage with their customers. Retailers aren't limited to mining data from their own customers. Walmart has already begun implementing IoT technology to analyze social media data, and see what products are trending. With that information, they can effectively market to specific segments of their customer base. The retailer

knows the shopping histories, habits, and preferences of their customers and can create marketing campaigns at almost the individual level.



Fig 3.1: Customer Data

#### **D) SUPPLY CHAIN MANAGEMENT**

An interrupted and efficient supply chain management is crucial to carry on operations of e-commerce businesses successfully. IoT ensures that goods move from one place to another smoothly. It enables tracking of goods right from the production stage to delivery.

The "Industrial Internet" describes how companies are using cloud, mobile, big data and other technologies to improve operational efficiencies and foster innovation. It has been estimated that by 2030, the combination of the Industrial Internet and IoT devices could add more than \$14 trillion to the global economy. Data can be sent directly from the products to the retailer, helping to identify issues or malfunctions perhaps before the customer is even aware of them. Data visualization technologies help the employees to track products across the supply chain quickly. These data visualization technologies can even be extended to customers allowing them to track the items they have purchased, for example, where a custom order is in the production and distribution process. This technology even allows the managers to adjust pricing in real-time, using Internet-enabled smart tags to lower prices on promotional or low-turnover items or increase pricing on higher-demand items. A fully integrated pricing system would be developed and this helps retailers to improve synchronization of prices between the shelves and the registers and also across channels, to verify prices are consistent online and brick and mortar stores. The supply chain can be integrated with other IoT devices which further improve store operations and help reduce cost. Since sensors are used to automate many of the functions such as tracking inventory or changing prices on individual items, it gives sales associates more time to spend interacting with customers further improving the in-store experience.

#### **E) MARKETING**

There are many surveys that profess the importance of mobile phones to the purchasing process. But as long as mobile sites don't deliver what user wants, it's clear that most people would go to their main computer to make any final decisions. The Internet of Things detect devices that belong to the same individual, allowing to market to the individual rather than the device, while still offering the correct ads for the platform. In fact, customer data is one of the core uses of IoT for e-commerce — improving everything from personalization to segmentation.

The prevalence of IoT devices in society enables businesses to gain a greater insight into their customers' behaviour than ever before. The daily routines of target demographics, their shopping histories, product preferences and buying habits can all be tracked and used to tailor more relevant marketing campaigns. This is why, as consumers, we're starting to see an increased amount of 'personalized' advertising sent our way. IoT devices contain all the information of its customers. These devices can also provide GPS locations in case of loss or theft. General Electric is probably the

best example of a company fully utilizing this technology to the benefit of both them and their customers. They have a complete suite of "smart" appliances.

#### **F) REVENUE STREAMS**

The true power of the Internet of Things is that it creates opportunities for retailers to develop new revenue streams or, in some cases, build entirely new channels. Home appliances, cosmetics, home and vehicle security, clothing, comfort products, even health and wellness products are all becoming part of the Internet of Things ecosystem. Retailers in home improvement or consumer electronics sectors not only can drive more sales of these connected devices. Home Depot already stocks more than 600 "smart" products in its stores. By becoming an integration platform, retailers start taking further advantage of the wide array of connected products.

#### **G) DYNAMIC PRICING**

Before IoT started to catch on, out pricing the competition meant constantly monitoring their promotions and marketing tactics, developing counter-campaigns and using every tactic in your arsenal to draw attention to your brand as the better choice. Businesses now have the option to skip this tedious process and beat the competition from moment to moment by using dynamic pricing models. Instead of coming up with a future sale to outshine your competitors, dynamic pricing with IoT allows you to update the prices on your e-commerce platform and even in your brick-and-mortar stores in real time to ensure you're always offering the best deals and providing a unified experience across platforms. Dynamic pricing can also communicate greater value by responding to demand and setting prices to reflect what consumers are willing to pay for the perceived worth of a product or service.

#### **H) PROMOTIONS**

Flexibility in pricing also extends to the individual customer experience. Today's IoT technologies include "smart" shelf tags, also called "e-tags," installed in stores to provide targeted promotions to customers based on their past buying habits. Using data regarding what a customer has purchased both in-store and online, these tags use location-based signals to light up and attract attention to items the individual is most likely to want to buy. Your business can use "smart" technology to deliver special promotions via push notifications. Purchases from those customers — both in-store and online — can be more easily tracked. With a clearer picture of customer behavior, it's easier than ever to deliver the smooth omnichannel experience consumers desire.

### **IV. IoT IMPLEMENTATION FOR E-COMMERCE**

The future of e-commerce will be towards the development of diversification and convenient, the competition will become more intense. If IoT technology is used in various aspects of e-commerce, then the efficiency of it will be increased for a greater extent. Its operating costs will be reduced, customer experience will be improved. IoT is combined with e-commerce and a new IoT e-commerce system has been formulated (Han and Li, 2012).



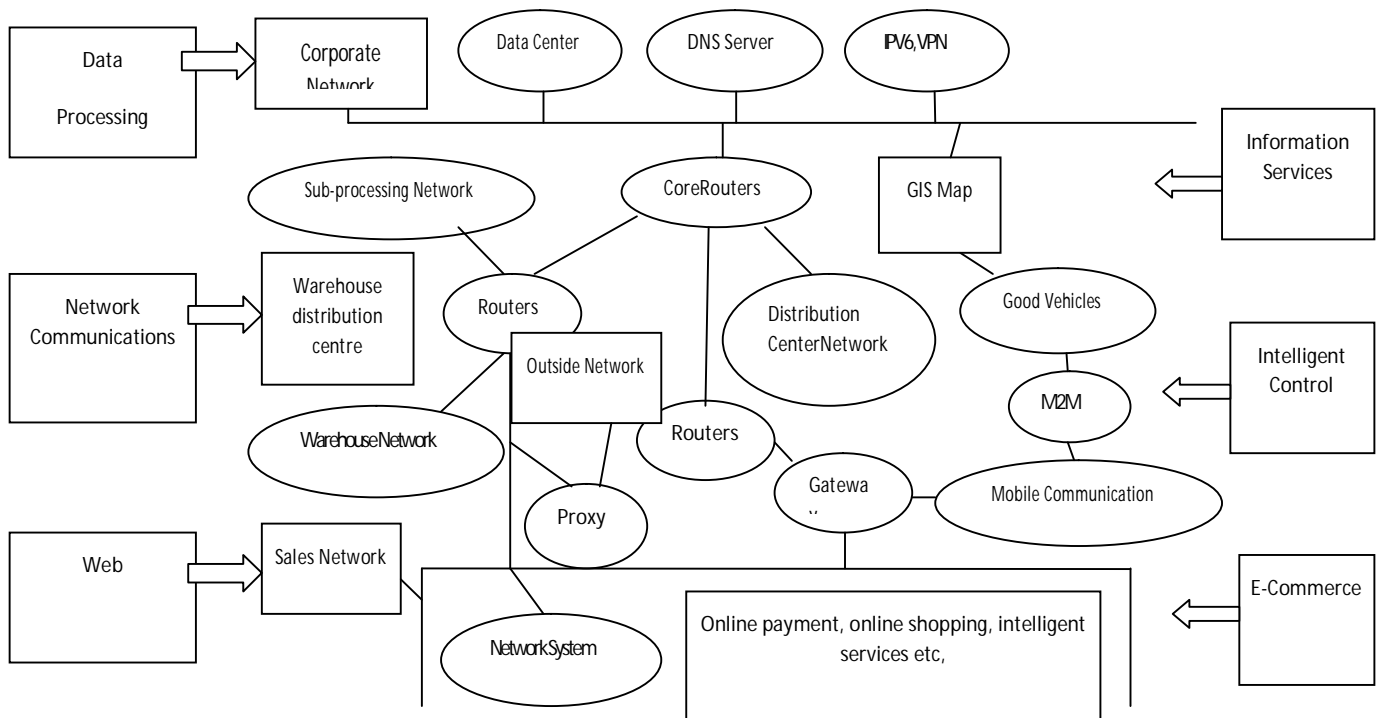


Fig 4.1: IoT e-Commerce System

## V. CONCLUSION

The IoT technology is going to expand drastically over the next few years with an estimated 30 billion IoT devices in use by 2020. This growth is going to have a tremendous impact on e-commerce retailers and online shoppers. If IoT technology has been utilized in businesses, it will result in massive benefits for both their customers and their bottom line. For developers and designers, the fundamental essence of work lies in innovation. Without innovation, there is no existence in an industry that grows changes, forms, and reforms faster than any other. A great user experience is essential for ecommerce websites, but in the near future, when the IoT becomes even more prevalent, web developers will have to work on ways to harness the increased data on offer. This will eventually lead to more intelligent, perceptive websites which are capable of offering personalized browsing experiences.

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