RETAIL DIGITAL TRANSFORMATION
A LEAP TO NEXT GEN RETAIL
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There is a widely held view that pure-play e-commerce presence is disrupting the retail space so radically, bringing competitive pressure to retailers. However, the reality is quite different. There are several other challenges retailers encounter, as depicted below:

Consumers’ buying behavior and lifestyle choices are changing, and it is high time for retailers to adopt digital transformation. With the digitization of the retail industry, there are many ways for retailers to provide a seamless experience to customers between online and in-store. The ultimate aim of a retailer is to convert a visitor to a customer. The key to achieving this goal is to take the customer experience to the next level, be it online or in-store, in addition to bringing efficiencies in retail operations.
Retail Digital Transformation is about bringing the next wave of innovation with technological advancements for improved customer experience along with greater agility and efficiency across retail operations.

There are multiple game-changing technologies below that retailers can adopt to transform the retail industry:

- Omnichannel support and sales
- Connected Retail through IoT
- Immersive Customer experience through AR/VR
- Business Intelligence on consumer data using big data Analytics
- Enhanced Supply Chain using Blockchain
- Drone / Autonomous Delivery through Robotics
- Computer Vision through AI /ML
- Experiential retail through Indoor positioning
- Personalized products through 3D printing

Figure 2: Retail Digital Transformation technologies
Below are some use cases for retailers to reimagine what the future retail environment will look like after adopting these retail digital transformation technologies:

<table>
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<tr>
<th>Use Case</th>
<th>Description</th>
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| Omnichannel support and sales                                           | • Seamless transitioning between various sales channels including in-store experiences, m-commerce, e-commerce to provide a smooth transition between online and in-store experiences  
  • Gaining customer loyalty by analyzing the customer purchases, interest etc, and providing customers with personalized content offers adjusted to their preferences and needs, to improve customer experience |
| Computer Vision through AI /ML                                            | • Customizing offers based on facial recognition from the images of cameras installed at the store, The backend system determines the customer gender and the age of the customer, applies ML algorithm & identifies shopping patterns monetize hot zones with personalized coupons  
  • Theft detection and billing fraud alerts by correlating the image recognition output and billing entries  
  • Automated billing using video cameras and computer vision systems |
| Connected retail through IoT                                              | • Smart Shelves to optimize shelf inventory, manage stock and determine the efficacy of store displays  
  • To monetize key customer insights, understand in-store shopper behavior and optimize floor navigation paths  
  • Real time alerts to supporting staff on sections needing assistance  
  • Generate store Heat maps, Reduce store energy costs through IoT sensors |
| Immersive customer experience through AR/VR                              | • Enhance customer confidence in products using Smart mirrors/MR devices to virtually try clothes/cosmetics  
  • Smart apps/AR devices to visualize how a particular product like furniture/decor will look in customer’s home/office  
  • Kiosks in store or mobile application - to know offers, product reviews, product availability, indoor map |
| Business intelligence on consumer data using big Data Analytics          | • Comprehensive analysis the retailer to measure the time customers spend in specific areas, frequency of customer visits  
  • and the footfall capture/success rate of each campaign  
  • Queue Management and Service Time improvement |
| Enhanced Supply Chain using Blockchain                                   | • By connecting all supply chain players with Blockchain, it can help increase shipment visibility, decrease delays and reduce frauds  
  • However, fragmentation can be a challenge here were all supply chain players are not connected with the same ledger in Blockchain |
| Personalized products through 3D printing                                | • Design and produce personalized and customized products as per customer needs  
  • Speed factories with 3D printing and computerized knitting can speed up the production |
| Drone / Autonomous delivery through robotics                             | • In house and warehouse robots with advanced sensory capabilities to work along with humans  
  • Handling and cleaning of hazardous waste  
  • Picking, packing and stock delivery |

Figure 3: Realization of Digital technologies in Retail

With various use cases been listed in Figure 3 for future Retail market, the next section of the paper will provide details about Smart Shelves which is at the leading position in Gartner Hyper Cycle of Retail technologies, 2019 [1]

Digitizing the physical retail store with Smart Shelves based on the Internet of Things (IoT) is a conduit to bring digital experience into the physical store. Smart Shelf is an asset to retailers for getting in-store insights and real-time store monitoring and control. Smart Shelves provide plenty of features:

- Real-time stock information & inventory management
- Low stock alerts to minimize out of stock situations and lost sales opportunities
- Correct product positioning & alerts if products are displaced
- Real-time shelf tags updates
- Effective and customized product information display
- Optimized store performance and enhanced customer service
There are a variety of implementations of Smart Shelves with advanced capabilities and benefits:

- **Weight sensors built-in or installed on the shelves**: These weights sensors notify the backend about the change in item quantity if an item is picked up the shelf. This helps in inventory management.

- **Shelves equipped with wide angle low light HD cameras**: Using computer vision technology, the images from cameras are computer vision technology, the images from cameras are interpreted to determine the product that’s been picked up by the user and finalize the purchase. This helps in inventory management and automated billing.

- **Shelves with digital displays to avoid traditional paper price tags**: Price tags, discounts and product information are all displayed in real time on the digital screens installed on the shelves. This also allows the visual presentation of shelf planogram.

- **Shelves installed with RFID readers and products installed with RFID tags**: The RFID reader consistently notifies the backend system about the existing items and their movements by scanning the RFID tagged items on the shelf. This helps to track product positioning and inventory management.

- **Shelves equipped with light sensors**: All shelves have light sensors that detect the light level above them and distinguishes the products. This helps to detect the location of products on the shelf to avoid wrong positioning and inventory management.

Figure 4: Smart Shelf Implementations
Smart Shelf solution is dependent on a variety of factors like the size of the retail outlet, level of current digitalization of the outlet, remote connectivity requirement, retailer budget and much more.

For instance, the Smart Shelf solution for an already established retail outlet may vary from the solution that will be implemented in an under-construction retail outlet installing Smart Shelves.

An approach to deal with “Real time Inventory Management” challenge in a supermart sized retailer is by designing a Smart Shelf solution based on the Internet of Things (IoT) along with computer vision technology, as shown in fig 5. The key aspects of this approach are listed below:
• Weight sensors deployed on shelves send the weight of the shelf at regular interval to WSN which further sends this information to the Edge Cloud
• Low light HD cameras deployed above the shelves continuously feed the images of the items placed on shelves to Edge Cloud
• Temperature controller deployed on refrigerators or the shelves of perishable items, sends the temperature notification at regular interval to the Edge Cloud
• The EDGE Cloud, deployed inside the retail outlet, creates Image recognition algorithm for the objects placed on the shelves and does continuous modeling for object detection
• The Edge Cloud analyzes the information received and generate alerts/notifications on the devices connected with it:

**Low Stock (or) Bad Product positioning alert:**

• The total weight of the shelf is configured in the algorithm according to the number of items planned to be on that shelf
• When Edge Cloud detects a change in weight (reason can be someone picking up an item from the shelf or putting it back), it analyzes the camera feed from cameras deployed on that Smart Shelf and correlates the output of the algorithms:
• The Edge Cloud does object recognition from the images coming from the camera. If the algorithm identifies the planned type of items that are placed on the specific shelf, the algorithm generates notification about the decrease/increase of the quantity of the item.

• If the object recognition algorithm identifies that some other item is kept on the shelf; then it generates notification about wrong product positioning.

• If the algorithm detects the number of items on the Smart Shelf is less than the threshold; it generates an alert of low stock.
Temperature control notification

- The algorithm loaded in WSN (shown in Fig.5) is configured according to the planned temperature of the refrigerator
- When the Edge Cloud detects a change in temperature of the refrigerator, it generates a notification to the temperature controller to control the temperature
- Based on this notification, the temperature controller adjusts the temperature of the shelf/refrigerator

IoT Cloud

Storage & Business Intelligence

- IoT Cloud stores the WSN data, computer vision data received from the Edge Cloud
- Based on the data received from the Edge Cloud, it does retail analytics for inventory management

Remote connectivity to devices

- A mobile or laptop connects with the IoT Cloud remotely (outside retail outlet) to receive emergency alerts and view, daily stock and analytics reports
Retailers are now re-strategizing their in-store offerings to keep apace in a digital-first world. The major benefit of physical stores is an opportunity to provide a visual and sensory experience to customers that cannot be replicated in online retail. Innovative technologies like Smart Shelves empower retailers to deliver enriching customer experience along with optimizing and automating the store operations. With multiple smart retail technologies evolving and rapid technological advancements, retailers must choose the right technologies that can transform the business wisely. Business growth will depend on the retailer’s ability to develop a Digital Strategy and execute at the right time, gaining a competitive advantage.

With an extensive portfolio of IP and services, and years of experience in Engineering, Product development services and innovation, Altran is built on strong pillars – “frog, Lohika, Tessella, Aricent and Altran,” and can help retailers to strategize, conceptualize and execute their digital transformation journey.

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Altran ranks as the undisputed global leader in Engineering and R&D services. The company offers clients an unmatched value proposition to address their transformation and innovation needs. Altran works alongside its clients, from initial concept through industrialization, to invent the products and services of tomorrow. For over 35 years, the company has provided expertise in Automotive, Aeronautics, Space, Defense & Naval, Rail, Infra & Transport, Energy, Industrial & Consumer, Life Sciences, Communications, Semiconductor & Electronics, Software & Internet, Finance & Public Sector. The Aricent acquisition extends this leadership to semiconductors, digital experience and design innovation. Altran generated revenues of €2.9 billion in 2018, with some 47,000 employees in more than 30 countries.