

RETAILER PREPAREDNESS FOR CASHIERLESS STORES

Abstract

Retail as an organized industry revolutionized in the 18th and 19th centuries with the rise of small convenience stores converting to big department stores. The advent of shopping malls and e-commerce websites helped reach out to a wide variety of shoppers. There is a paradigm shift in the focus of retailers from just selling products to offering enriched experiences to shoppers. Product marketing, personalized recommendations, omnichannel mode of customer reachability, contactless shopping, 24x7 availability, insights and feedback are now being prioritized.

In this paper, the authors will focus on frictionless shopping and will present a comprehensive study on how retailers can approach the provisioning of such cashierless stores.

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Frictionless Shopping

Brick-and-mortar stores rule a substantial chunk of the retail industry. However, dark stores, robot-powered packaging, and autonomous drone-based deliveries of products to the doorstep are boosting the online shopping experience of customers while staying at home. Physical stores are in dire need to upscale their outlets with digital innovation, automation, and experience to keep them steady in the race.

There is a need to transform mere shopping in stores into a leisurely and joyful journey with an enriched experience. The effort and time spent by shoppers in navigating through the store, searching and figuring out product price offers and standing in long checkout queues need to be reduced. Moreover, overall store management also affects the shopper experience indirectly. Even now, there

are multiple shops which run in silos and are not well integrated with the retailer's backend or the product supply chain. This often leads to poor inventory management, which in turn affects the shopper's experience. Advanced technologies available today can help achieve frictionless stores.

Tech Trends Reshaping Retail Industry

As per a recent article published by [EY](#), the top technologies driving experiential retail are:

Artificial Intelligence - Providing personalized recommendations, offers and pricing, predictive shopping insights and recommend in-store inventory positioning/layout

Internet of Things - Anonymous and non-invasive collection of humongous data from stores empowers machine learning and AI-driven analytics that enrich the shopping experience as well as help retailers support the shopper journey better

Biometric Recognition - Helps establish shopper identity which is critical to personalization.

AR, VR, and Metaverse - Provides an immersive experience like virtual tryouts and fitting room, training of retail staff, collaboration across outlets, etc.

Multiple retailers and technology providers have collaborated in providing experiential retail at various levels such as Amazon Go and Just Walk Out, Walmart Sam's club, Kroger, Grabango, Zippin, AiFi, and Standard Cognition, to name a few of them. Here are a few innovations that they already offer:

Cashierless checkout - Shoppers can pick up their items and leave without waiting in a queue for billing.

Beacon-powered smart shelves - Enhanced inventory management with beacons tracking the inventory on the shelves

Electronic shelf labels - Centrally controlled seamless product pricing display and updates

In-store navigation - Interactive map of the store helps shoppers navigate and provides precise location of desired products

Location-based advertisements and offers - Proximity-driven trigger of special promotional offers to shoppers

These innovations can co-exist in any store. Based on shop location, target product range, and intended shopper experience, retailers get to decide which technologies need to be brought in. Technical feasibility, business viability, and operating regulations are to be factored into these retailer decisions as well.



Ideal Targets for Cashierless Stores

A cashierless store supports seamless pickup of items, automated billing, and frictionless checkout for shoppers. The article, [Future Of Autonomous Retail Store](#), describes the need and scope for

innovation, the challenges and the trends around such retail outlet automation.

The setup of autonomous stores demands significant capital investment and time. To ensure the return on investment is best, it

is necessary to carefully select the target stores as well as the target products. The following diagram lists a few of the factors that make a store a potential candidate for cashierless technology.

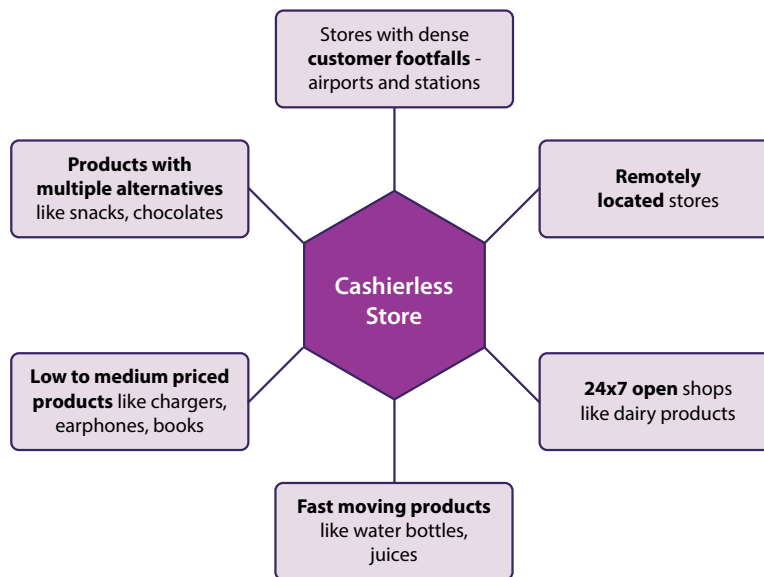


Figure 1: Ideal targets for cashierless store

Stages of Cashierless Store Journey

Before elaborating on how to set up a cashierless store, it is important to understand how this cashierless shop runs and operates differentials from a brick-and-mortar store.

Shoppers will be recognized uniquely once inside the store. Shopper identification can be without using facial recognition,

keeping shopper privacy intact. Shopper tracking was done earlier as well, in the form of security cameras, but only from a surveillance point of view to avoid thefts. Unique identification here is for maintaining a separate virtual cart per shopper on the fly and having an updated list of exact product types and quantities picked by them. This leads to a pre-

requisite, i.e., shoppers being uniquely identified at the point of entry to the store, and a consequence, which is potentially 0 second checkout with billing being taken care of by an attached payment method to the shopper's identity.

The following diagram lists several ways in which shopper identification, tracking and automated billing can be achieved.

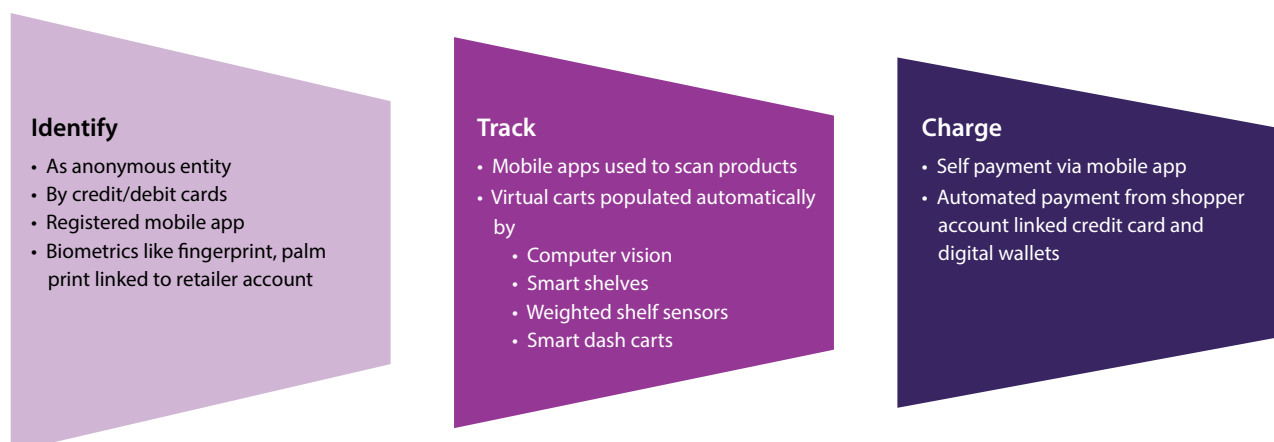


Figure 2. Stages of cashierless store journey

Frictionless Store Technology Provider and Retailer Integration

Retailers use multiple management systems and solutions to handle their backend systems and processes efficiently. Here are the major software contributing to this:

- Point of Sales (PoS) hardware and software systems for offline and online stores for payment processing and sales tracking. In-store PoS, mobile PoS, self-service PoS, integrated POS, and cloud-based PoS are some of the variants available.
- IoT systems in retail to make stores smarter and more autonomous and to improve overall customer experience.
- Customer resource management platforms for storing customer details,

their behavior, their interactions, and grievances with customer services.

- Inventory management software for a single view of existing stock, their expiry, projected stock, their sales, etc.
- Retail space planning software to plan store layout and product placement on shelves.
- Retail facility management software to keep the stores smart and up to date via regular or surprise compliance inspections to maintain health and infrastructure safety standards.
- Enterprise resource planning software for smooth interaction and seamless data sharing between departments like inventory management, finance, HR, etc.

- Employee management software to manage employee shifts, holidays and leaves, and other notifications.

Frictionless store technology providers can be defined as companies that provide the platform, required hardware and necessary support to set up an autonomous store.

Frictionless store technology providers target the PoS and IoT systems in retail stores. Retailers may opt for one or more technologies to deploy in their autonomous stores. The following diagram lists various components involved in a shopper's journey through a frictionless store.

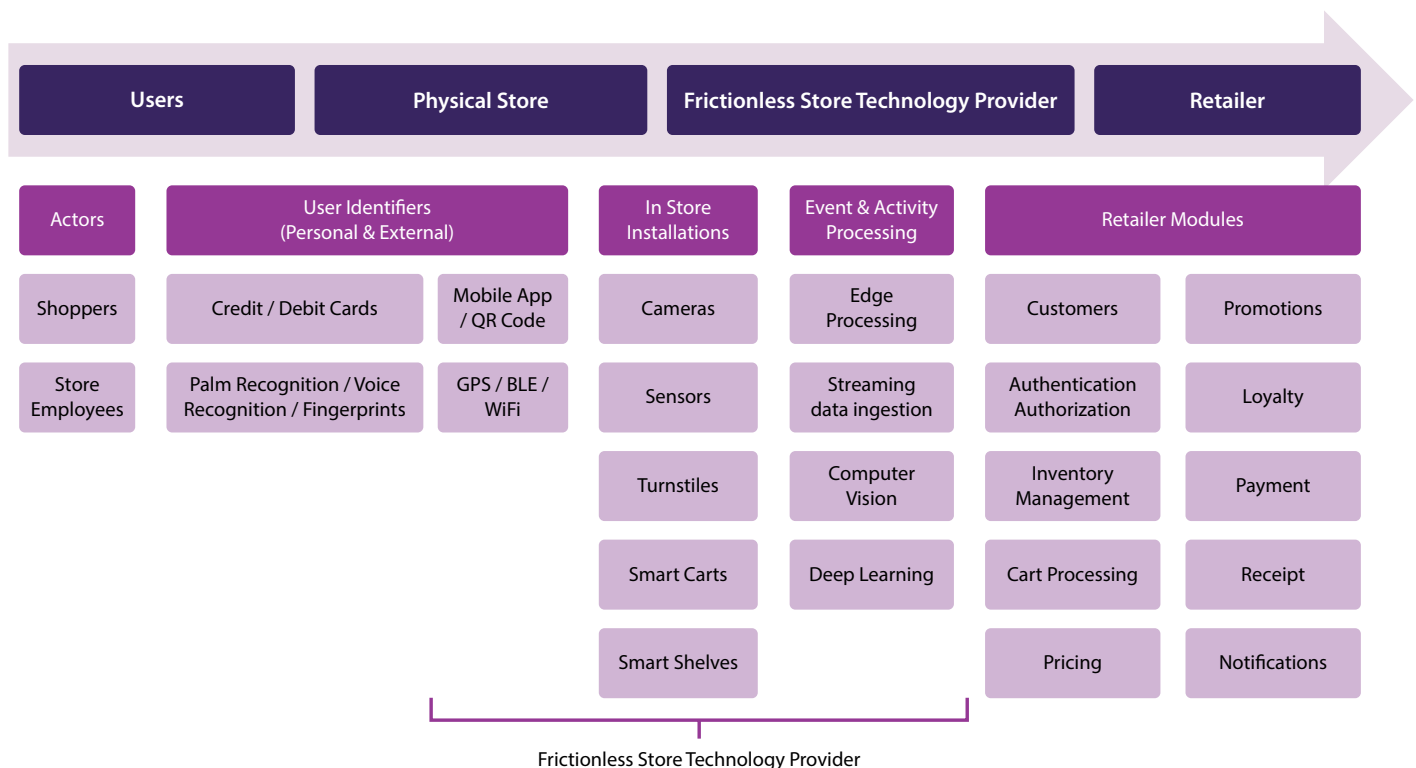


Figure 3. Components of frictionless stores

There are multiple interaction points and data exchanges that happen between the technology provider and retailer in the autonomous store. Broadly, these interactions surround the following two scenarios:

Shopper authentication and authorization: Unlike brick-and-mortar stores, shopper entry and exit from autonomous stores are monitored and must be approved by the retailer.

Shopping cart processing: Though

every action of the shopper, like picking a product or keeping it back on the shelf, is tracked, however at the end of their journey through the store, the shopping cart needs to be processed, and cashless payment must be made.

Setup of Cashierless Store

There are multiple steps for building an operational frictionless store. Here, the focus is on automated checkout stores than the self-checkout variant.

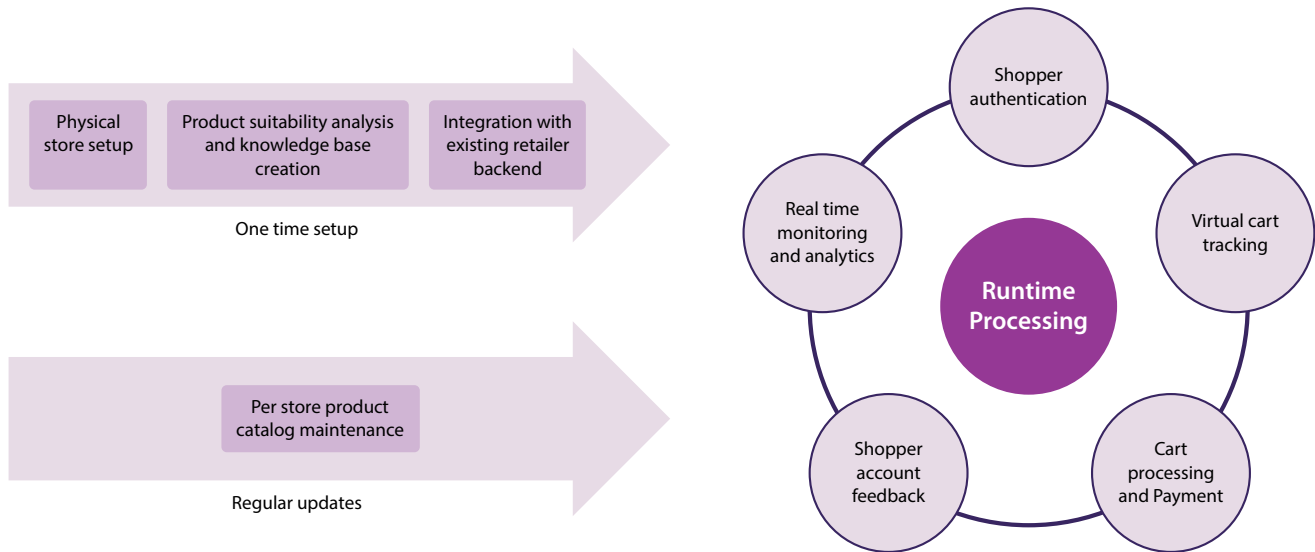


Figure 4. Phases of an operational cashierless store

1. Physical Store Setup

The store layout needs to be analyzed for the best placement of the sensors, cameras, and turnstiles. The arrangement of shelves with embedded sensors or beacons must be outlined carefully. Afterwards, overhead cameras, entry/exit turnstiles and smart shelves are installed in the shop.

Recently, Infosys was also granted a patent by the Indian and European patent offices for store design layouts.

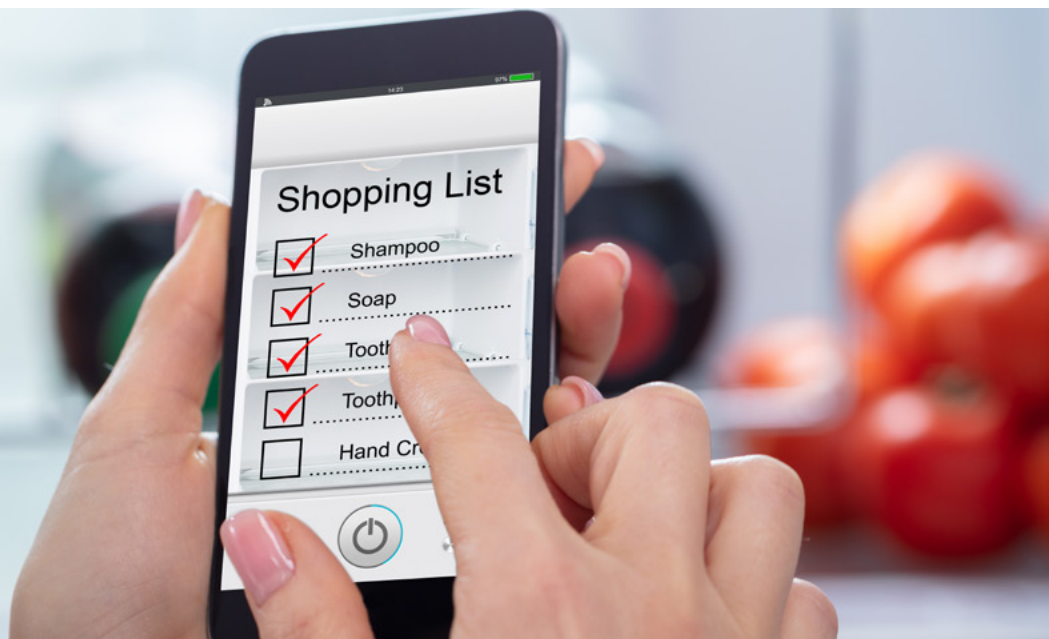
2. Product Analysis

The products to be sold in the store are also reviewed to ensure their shapes and sizes conform to the standards of computer vision technology. A knowledge base is created after scanning the product from different angles with 360-degree cameras and is used to train computer vision algorithms.

3. Add/Update Product Catalog

Along with a knowledge base created from

various products, a store-specific product list is also kept. This narrows down the scope of products for the computer vision technology, which tracks and identifies items picked by shoppers or returned to the shelf by them. This catalog may vary across stores belonging to the same retailer. This product catalog is kept up to date by the store managers or associates for the proper functioning of the computer vision algorithms.





4. Integration with Existing Technology

- Enhance the existing retailer mobile app to generate QR, which can identify the user uniquely without using facial recognition. This will enable shoppers to scan and enter the stores.
- Shopper authentication on entry to autonomous stores needs added checks to the basic identity check.
 - The shopper should have an active and valid payment gateway (card or wallet) registered.
 - Shopper accounts should be flagged for non-payment of earlier dues or any other fraudulent transactions. This is important to ensure seamless payment at end of the shopping trip.

- Enable personalized cart processing. Added discounts and promotions can be applied for new or repeat customers, as we experience when shopping online via E-commerce portals. Two people in the same store, at the same time, buying equivalent items may pay differently based on their past purchase history.

5. Runtime Data Processing and Feedback

Multiple data exchanges can happen between the store and existing retailer backend:

- Authentication of shoppers on or before entry to the store
- Tracking products picked from the shelf or returned to the shelf by the shopper

- Cart processing and calculations
- Automated payment from cards or digital wallets linked to a shopper account
- Continuous feedback and recommendations based on shopper purchases and payments

6. Real-time Monitoring and Analytics

- Continuous monitoring of inventory refill and consumption status
- Analysis of shopper product preferences and shopping behavior
- System health status and performance monitoring
- Shoppers dwell time in a store at various times of the day on weekdays versus weekends

Challenges in Setting up Cashierless Store

Zeroing down on one or more apt technologies from the available choices is a challenge. A bigger challenge is to retrofit it in an existing shop and integrate it with the current retailer's backend. Integrating retailers with frictionless store technology providers and bringing up an autonomous store is bound to encounter challenges on these fronts:

- Frictionless store technology providers and retailers will have their own set

of APIs, data structures, authentication mechanisms and protocols. A common interface is required for handshake and data exchange between these distinct platforms.

- Not all retailers have a backend ready for receiving and processing data from a cashierless store. Retailer's backend systems may not have all such integration points available. For example, during payments from a saved card, in

any e-commerce portal, as a standard MFA process, a user is required to enter CVV or pin. However, an automated payment without any MFA should happen for a cashierless store.

Hence, a first integration feasibility check should be done with the chosen autonomous store technology. Once gaps are identified, the correct set of enhancement strategies needs to be in place.

Scope and Value Addition by Infosys

Infosys has worked towards bridging this gap between the frictionless technology providers and retailer backend systems with some custom components:

Reusable adapters: Adapters, on the one hand, can integrate with different frictionless technology providers like Amazon JWO, Grabango, Aifi, Zippin, etc. On the other hand, they can integrate with popular retail backends systems like SAP, NCR PoS, and Microsoft Dynamics. These adapters can have on-premises or cloud variants, which can be customized as per retailer requirements.

Model retailer mobile app: A standard mobile app with usual retailer-provided functionalities and frictionless store flavour-like option that can generate QR for entry or scan product bar codes for self-checkout can be built. New or small retailers can customize and utilize this if they don't have a mobile app already.

Advanced analytics: Frictionless stores give ample amounts of data that can be mined for advanced insights like new customers vs return customers, shopper product preferences, shopper movement patterns etc.

Delegating the responsibility for integrating frictionless technology with retailer backend systems to Infosys, retailers:

- Do not need to build customized modules to integrate with the frictionless technology provider
- Have the flexibility to use multiple frictionless technologies
- Can get customized analytics as per their use case, customer base, store positioning, etc.

Infosys in Cashierless Stores space

[Amazon Just Walk Out](#) is one of the innovative technologies by Amazon that provides a frictionless way to shop without the hassle of the checking out process. Through a combination of computer vision, AI, sensor fusion technology and more, a Just Walk Out enabled store allows a shopper to enter, grab the items they need and leave without having to interface with

a checkout experience.

Amazon JWO technology, if integrated with clients' existing backend systems or other e-commerce platforms, can bring multiple opportunities for clients to innovate and provide a better customer experience. This can bring new opportunities for system integrators as there is a variety of retailers with heterogeneous modes of integrating

with their backends.

Infosys is looking forward to partner with Amazon JWO to integrate it with Infosys Equinox as its retailer backend.

[Infosys Equinox](#) is an e-commerce and marketing platform that supports hyper-personalized experience across any touchpoint and channel.

Conclusion

Cashierless stores exist somewhere between traditional brick-and-mortar stores and online stores and are empowering themselves with constant digital innovation but still have their own challenges. If designed and scaled optimally, it will be well accepted and generate good revenue. To ensure this, it is important to identify the gaps - review what is existing, what can be reused and retrofitted, what needs to be upgraded and what must be built. A system with well-defined APIs and proper security measures must be assembled, which can continue to scale and evolve. Infosys, with its technological ability and domain competency, can lead retailers on a smooth journey for setting up cashierless stores.

This autonomous checkout technology, though transforming the retail industry, has the potential to go much beyond. Libraries, equipment stores in offices, medicine/chemical stores in laboratories and hospitals can also make use of this technology. The list is endless and is only limited by our imagination.

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25m ¹ Smartphone
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² Clothing
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² Restaurant
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¹ Dessert
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¹ Pizza
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