FROST & SULLIVAN

Frictionless Payments Enabled by the Internet of Things

FROST & SULLIVAN VISUAL WHITEPAPER

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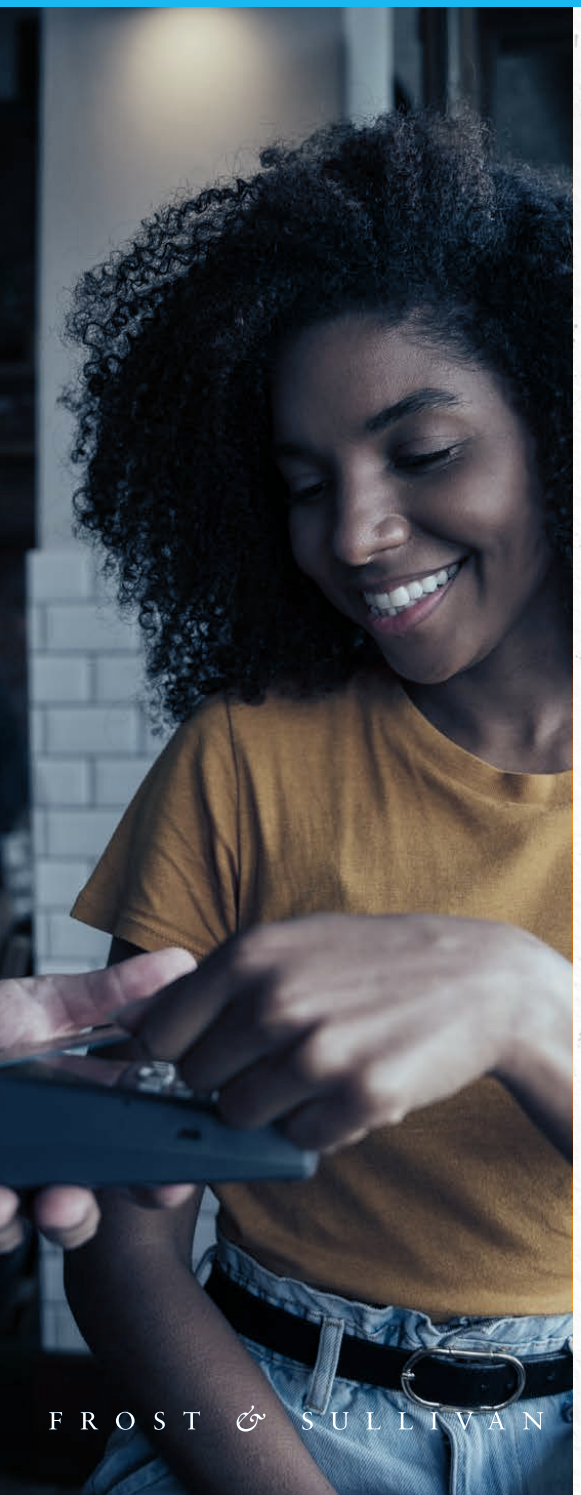


The Catalyst That Changed the Retail Industry

In March 2020, the world shut down as the COVID-19 pandemic disrupted life. The retail industry felt the effects of the pandemic as they had to adopt **different business models** in reaction to lockdowns, including delivery services, in-store pickup, BOPIS (buy online, pick up in-store), digital payments, and much more.

The payments industry has had to make significant changes to payment processing to enable retailers to embrace these different business models, including substantially increasing **eCommerce sales** and bolstering **digital payments infrastructure**. While the payments industry has reacted admirably and rapidly to the pandemic, another revolution is underway that demands an even faster response.

Consumers are increasingly frustrated with long checkout lines and self-checkout procedures and are looking for a frictionless payment alternative. Retailers lose an estimated **$40 billion** a year from customers abandoning their cart. The use of Internet of Things (IoT) devices to enable frictionless payments—payments via voice assistants, scan-and-go devices, and even vehicles—can help reverse these losses. It is incumbent upon payment processors, banks, and central banks to develop infrastructure that simplifies payments from a host of different devices.

IoT is a complex ecosystem that integrates information technology (IT) with operations technology (OT) to generate data that can be analyzed to increase revenues and improve business productivity. In retail, IoT devices such as sensors, cameras, ATMs, and payment devices have been used for decades to help retailers reduce inventory losses. IoT can also help retailers perform forensics to ensure that the person that purchased a product is the one that is making returns. Frost & Sullivan estimates that there were **30.4 billion** IoT devices in service in 2021. This is expected to grow to **73.8 billion** devices by 2026 at a CAGR of 16%.

The National Retail Federation estimates that retailers lost close to **$94.5 billion** in 2021 to theft. This equates to 1.4% of total retail sales. Since the start of the pandemic, retailers have embraced technologies such as artificial intelligence (AI)-based video analytics, license plate recognition, autonomous security robots, and self-locking display cases to mitigate losses.

In this visual white paper, Frost & Sullivan will focus on this emerging segment within the payments market of using IoT devices to enable a secure and frictionless infrastructure for retail payments.

Retailers That Are Outperforming the Sector Are Improving End-to-End Customer Experience (And Increasing Loyalty) With Frictionless Retail

Omnichannel Experiences

Omnichannel experiences involve merging digital interactions with in-store engagement to deliver seamless brand experiences.

Frictionless Checkouts/ Payments

Customers are becoming more loyal to retailers that offer frictionless checkouts. New checkout models in retail (smart carts, scan-and-go, contactless checkouts, BOPIS, BNPL, IoT payments) will decrease the dependency on a singular point of sale (PoS).

Frictionless Fulfillment Models

New shipping/delivery models, such as drop shipping, Warehouse-as-a-service (WaaS), and micro-warehousing, are enabling significantly faster delivery times and allowing better integration of inventory-level data between online and offline channels.

Frictionless Returns

Delivering against customer expectations is more costly than absorbing return costs. The rising pressure from giants such as Amazon will push businesses to reevaluate their return models.

Eliminating Points of Friction to Support Frictionless Retail

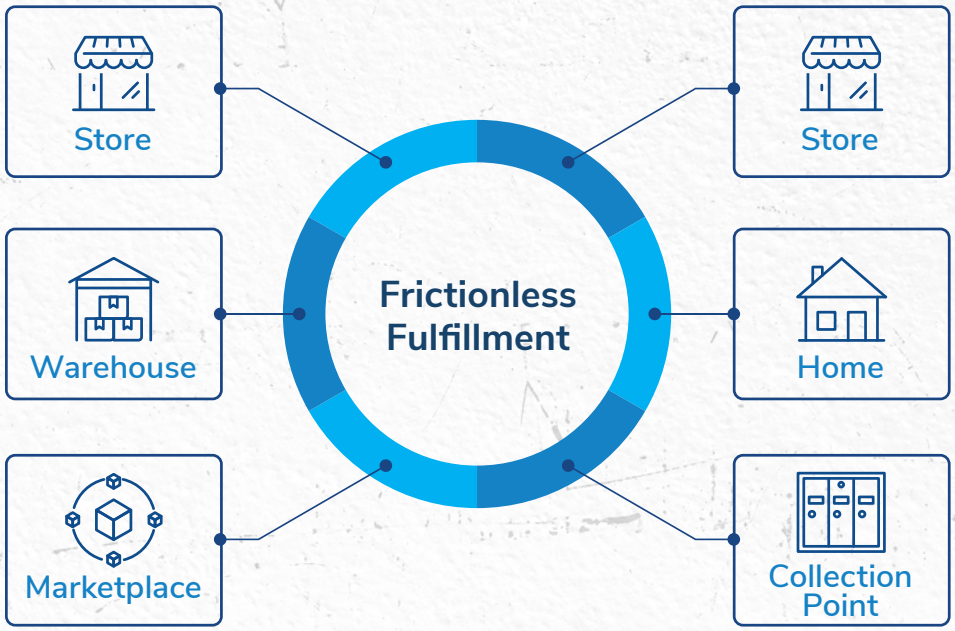
Frost & Sullivan estimates that long checkout lines and fraudulent returns cost retailers **$270 billion** annually, directly impacting profitability. New payment methods will enable retailers to refocus employees on value-added activities that improve overall employee productivity, increase customer satisfaction, and improve customer loyalty.

Eliminating Points of Friction

Smart Shelves
- Dynamic and accurate pricing
- Out-of-stock management
- Efficient product pickup

IoT Sensors
- Freshness monitoring
- Asset monitoring
- Warehouse optimization

Computer Vision
- Inventory tracking
- Foot traffic monitoring
- Frictionless checkout



Location Intelligence
- Geofencing
- Flexible and precision shipping
- In-store navigation

Drones/Robots
- Last-mile delivery
- Warehouse automation
- Surveillance

Checkout
- Biometrics for pre-fulfilment authentication
- Automated product recognition
- Loss prevention

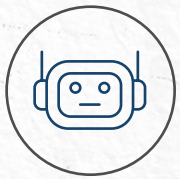
Emerging Payments Models

In-app Payments	QR Code Payments	Biometrics	Scan-and-go
Virtual Assistant Payments	IoT Payments	In-vehicle Payments	Digital Currency Payments

Eliminating Points of Friction to Support Frictionless Retail

In the United States, Frost & Sullivan estimates that **4.2 million** retail establishments account for over **252 million** IoT devices in 2022. This number grew significantly during the pandemic and is expected to grow at over **25%** annually over the next 5 years.

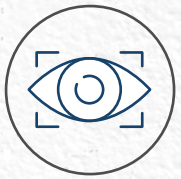
Smart Shelves:
SES-imagotag uses electronic shelf labels to allow retailers to automate low-value tasks, eliminate pricing errors, manage inventory, and improve customer experience.



Service Robots:
Aldebaran Plato supports the hospitality industry with food deliveries and serving and bussing tables. The robot uses sensors, depth cameras, and lidar to create environment maps, enable autonomous navigation, and avoid obstacles.

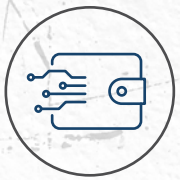
Smart Carts:
Caper uses smart shopping carts with built-in sensors. Customers scan items and place them in the cart while a screen on the cart keeps track of purchases and interacts with shoppers.

Digital Kiosks:
Elo kiosks are deployed in over 80 countries across a wide range of vertical markets, including self-service kiosks at over 7,000 Taco Bell locations across the United States.



AI and Edge Compute:
Amazon Go uses camera sensors, deep learning, and Edge computing to enable frictionless retail, allowing customers to walk in, walk out of stores.

Computer Vision:
Juganu uses computer vision, AI, and cameras to create a digital map of the retail store to help optimize store operations and improve customers experience. The solution is designed to provide retailers with advanced customer analytics and prevent losses.



Digital Wallets:
Digital wallets are accepted by more than **75%** of merchants globally, and **20%** of consumers use wallets for in-store payments.

Biometric Payments:
Amazon One uses palmprint recognition to enable a frictionless shopping experience. With biometrics, Amazon enables secure check-in/out and payment with complete touchless interaction.

Source: Qualcomm; Statista; Frost & Sullivan

Frictionless IoT Payments

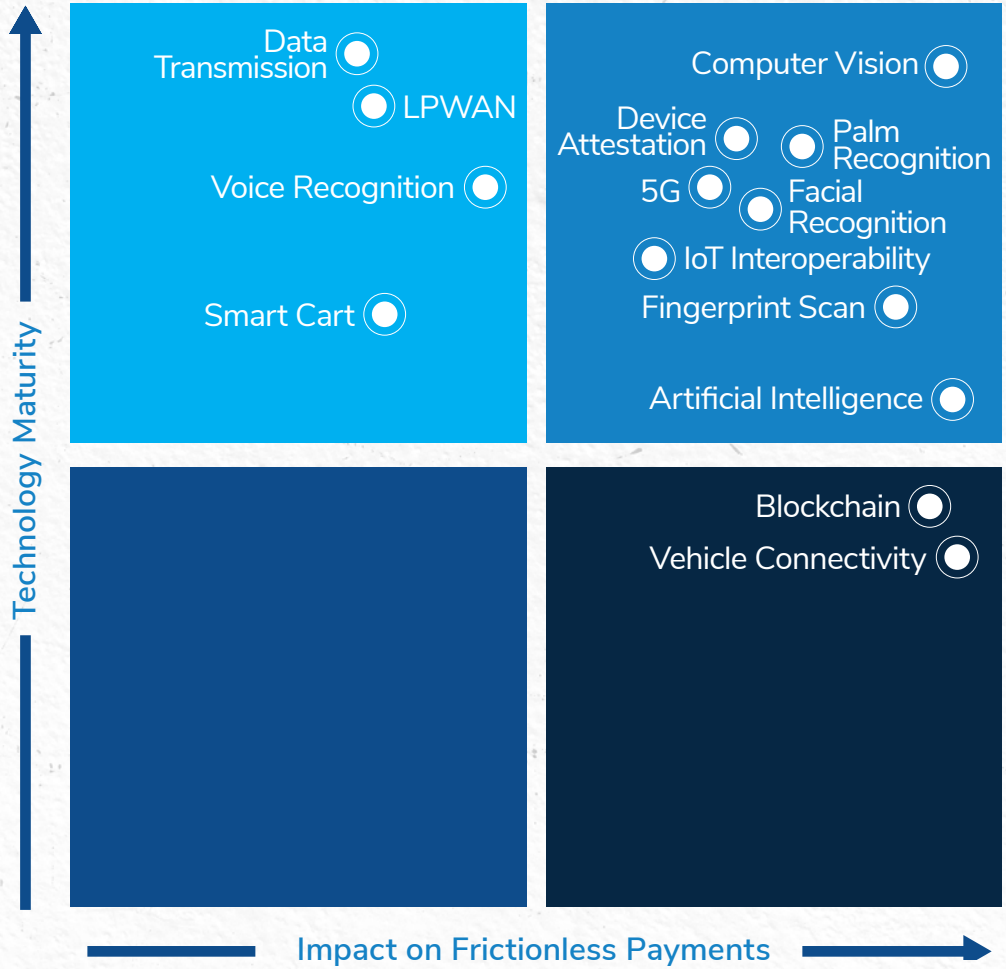
As the demand for frictionless retail increases among consumers, retailers must continue to adopt **innovative and secure payment technologies.**

The retail industry is struggling with an **inability to find labor** and be staffed up for busy periods. It is imperative that the retail associates focus on more valuable aspects of enhancing the customer experience rather than the mundane tasks of scanning products at checkout.

In addition to focusing on self-checkouts and digital wallets, retailers must also use more **advanced technologies to capture payment** information from a large variety of devices installed in stores.

Additionally, retailers must ensure that the consumer has the **same experience** in-store and online to increase loyalty and revenues per visit (both online and in-store). Consumers do not have to wait in lines during online shopping, so why do they need to wait in lines in-store?

It is imperative that retailers trial new modalities, such as **biometric authentication and IoT payments**, that offer seamless, frictionless, and highly secure payment options.

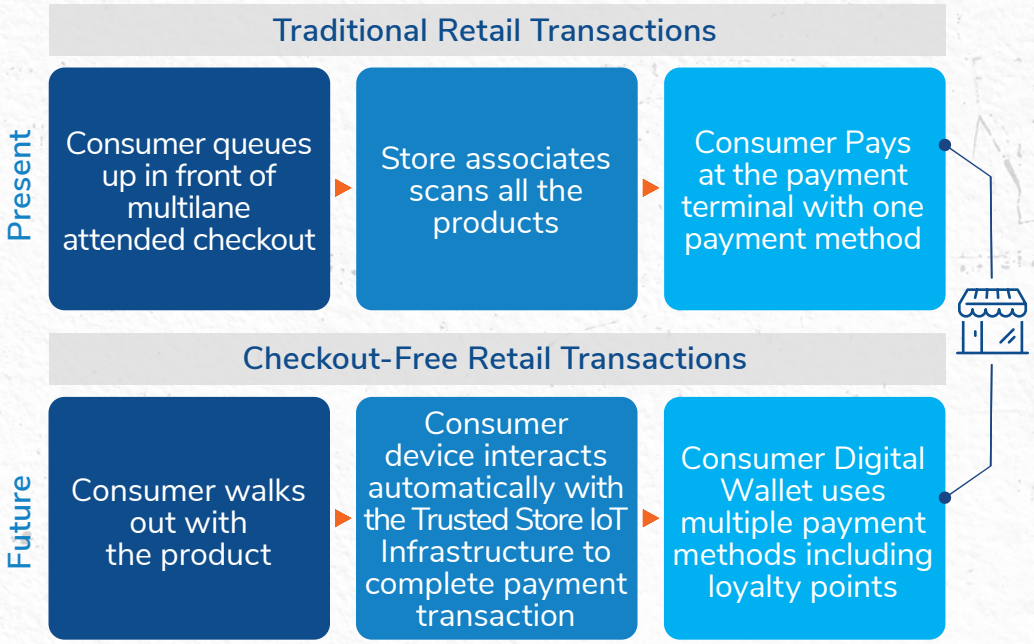


The IoT Infrastructure Will Increase Payment Security and Reduce Costs for Retailers

In 2021, it was estimated that eCommerce payment fraud amounted to over **$20 billion** in the United States. Mitigation and prevention methods cost businesses an **additional $20 billion**. Most of these costs are attributed to "card not present" transactions. The use of existing IoT infrastructure can help retailers reduce these costs and improve their profitability.

The Future of Frictionless Checkouts

In addition to smart shelves, digital wallets, kiosks, and sensors, checkout-free retail options (stationary and mobile self-checkout) are becoming increasingly adopted as a retail checkout option. This is resulting in increased eCommerce transactions in-store.



Benefits for Retailers

- Reuse of existing IoT devices for payments
- Less reliance on dedicated payment devices
- Autonomous user identification and device attestation add security to the payment flow
- Total cost of payment transaction reduced due to less fraud
- Increased digitization of payments in-store results in additional data analytics for retailers

Source: RBC; Frost & Sullivan

Use Cases for IoT Frictionless Payments

There are currently more than **4 IoT devices** in service for every human on the planet. This number will increase to over **9 devices per human** in the next 5 years.

Technology and payment providers must develop an ecosystem to enable IoT devices to make and collect payments in a highly secure manner. This ecosystem is imperative to enable a frictionless shopper experience.

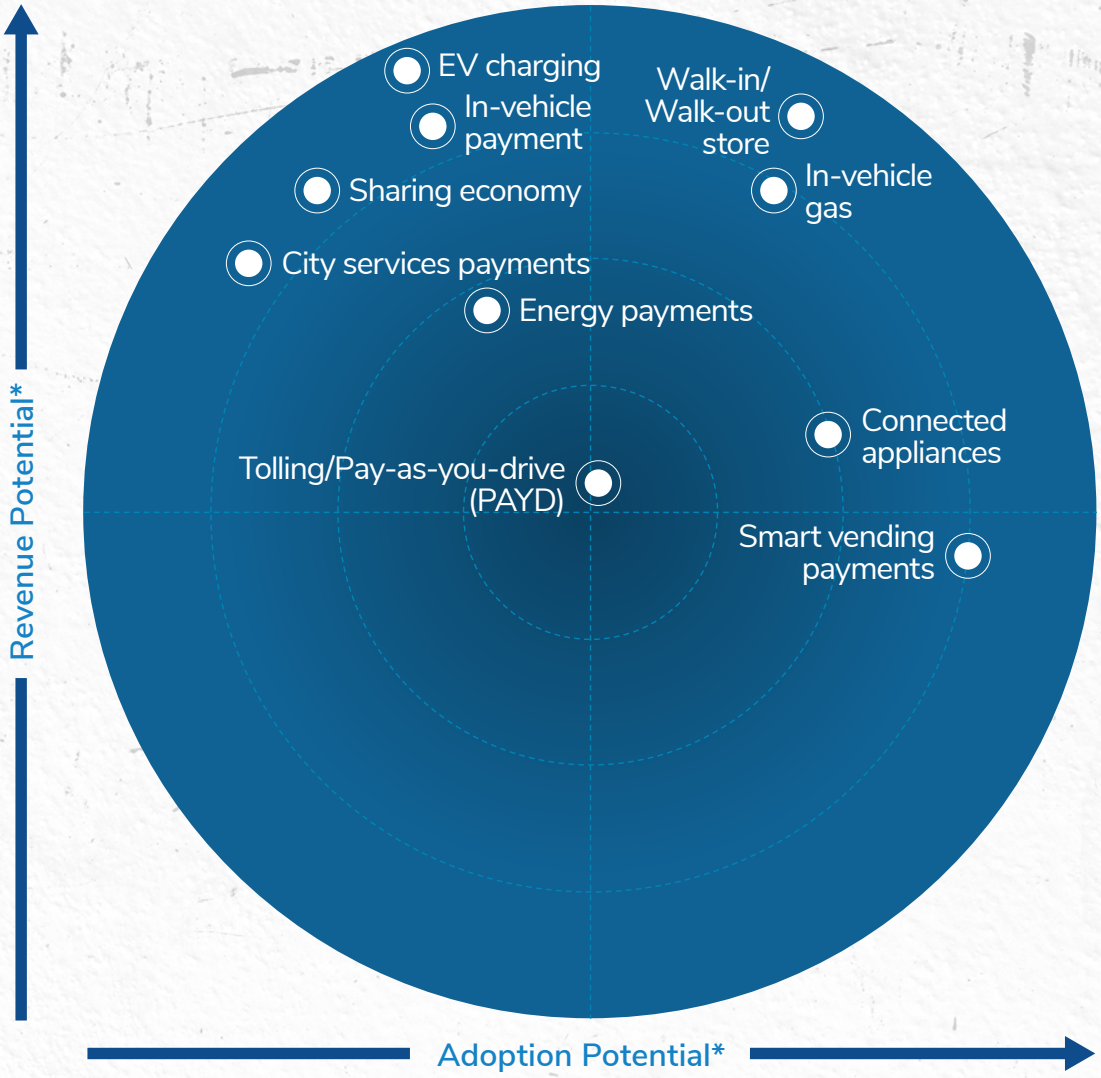
As a shopper, the temptation is high to abandon brick-and-mortar shopping experiences for online experiences. By creating seamless omnichannel experiences and enabling frictionless customer experiences across both channels, retailers can earn loyalty from their customers.

The use of IoT devices to both make and collect payments can help retailers retain the growing segment of Gen Z and Gen Alpha shoppers that have grown up in the age of the Internet.

The following graphic is a visual representation of the revenue versus adoption potential of different types of services that frictionless payment solutions could impact.

> "In the waves of global energy transition, the automotive industry is undergoing massive transformation, driving disruptive business models to emerge. New opportunities are arriving for many key stakeholders in the ecosystem including car makers, retailers, payment providers, banks, and technology providers, to offer the best customer services. EV charging is a promising use case where secure and frictionless payments help drive revenue, reduce cost and increase satisfaction. As a global leader in PayTech, Worldline connects over 1.1 Million merchants across the globe, who daily entrust us with all their payment transactions. We are convinced that IoT-driven payments are the real game changer."
>
> —Dr. Minh LeHead of Connected Vehicle & IoT Service Offerings, Worldline

Use Cases for IoT Frictionless Payments



* Potential in the next 5 years

Securing Payment Transactions with Biometric Technology

Frictionless customer experiences are at the core of the retail industry's payment system evolution. Payment providers are looking to make transactions seamless and adaptable to digital transformation processes, allowing payments to be integrated across all channels.

eCommerce websites and retailers use biometric authentication solutions (facial recognition, for example) to power automatic checkouts. Retailers will be able to capture customer data in stores (which they currently capture online) and offer customized engagements and personalized product offerings.

There is a need for an industry-wide ecosystem that includes payment service providers, IoT vendors and service providers, and digital ID and security system companies to include biometric authentication in their payment platforms to create seamless customer service experiences and transform their offerings. Amazon, for example, is testing a biometric solution that will allow customers to pay by scanning their palms. The system will link a user's palm image to a payment card.

> "As a leading provider of innovative merchant services, JP Morgan is dedicated to helping merchants grow revenue and reduce costs, while improving consumers' payment experiences. We believe that privacy preserving, biometric-based payments will transform the way merchants do business—without compromising trust. Consumers have trusted us for more than 100 years to securely manage their payment and personal data and we are excited to bring the same secure experience to a faster, frictionless way of transacting."
>
> —Jean-Marc Thienpont, Managing Director Omnichannel Solutions, JP Morgan Chase & Co.

Busting Biometric Myths

Biometric technology has been used for over 2 decades in a variety of applications, ranging from security to improving user experience. The technology is not new and has been sensationalized in the media, movies, and TV shows. However, many elements have been embellished for dramatic effect, creating doubts about their efficacy, privacy, and security.

Myth 1: Biometric data can be easily stolen

Not really. Biometric data is not stored in a raw format, such as images, but as encrypted templates and metadata. This information is useless unless someone also gets access to proprietary and complex template decryption algorithms. In contrast, passwords and credit/debit card credentials are frequently stolen and used for nefarious purposes. Even if the data is stolen and decrypted, a person's face or fingerprint cannot be stolen. Anyone other than the person with the face or other defining feature will not be able to use the biometric data. Furthermore, encrypted metadata are stored in a separate database that cannot be accessed from external systems.

Myth 2: Use of biometrics is an invasion of privacy

Most reputable companies that use biometrics for authentication are extremely sensitive to invasion of privacy concerns. Every well-designed biometrics solution strips away all personal identifiable information (PII) from the encrypted metadata, and there is a firewall between these data points. This means biometric authentication data is stored separately from PII data and usually associated with a serial number. In addition, per IEEE, palm-based biometrics is unique, dependable, non-intrusive and the data captured preserves the privacy of the individual.

Myth 3: Biometric authentication is intrusive

Most people have no idea that biometric authentication has been in use for many years in a wide range of settings. Casinos use it to identify high rollers and known cheaters. Retailers use it to identify customers to create tailored experiences. Banks use it to identify customers. It is no different from using FaceID to log into your iPhone. Also, not all biometrics solutions are equal. For example, palm-based biometric authentication can be non-intrusive and happens with explicit customer consent. The customer does benefit from an improved customer experience due to the use of this technology.

The Last Word

The COVID-19 pandemic has changed the way that consumers interact with retailers. Retailers have responded by adopting new business models with BOPIS, in-store pickups, curbside pickups, and delivery. In addition, retailers are working with new payment partners to provide customers with flexible options such as BNPL models. However, these new models still present the age-old challenges of payment fraud and the need to offer more frictionless options to improve customer experience and grow a loyal customer base.

Enter IoT payment models—While IoT is not new or revolutionary, retailers have access to hundreds of IoT devices available in their stores, such as sensors, smart shelves, cameras with video analytics, computer vision, robots, and kiosks. It is estimated that there are currently over 3 billion IoT devices in service in the retail industry. This number is likely to grow exponentially over the next 5 years. With this growth, retailers have a new avenue to collect payments from customers.

The goal for consumers and retailers is to have a seamless omnichannel shopping experience that is completely frictionless. The use of IoT devices to make and collect payments goes a long way in enabling this experience, reducing costs/minimizing retailer losses, managing inventory, and growing customer loyalty.

The payments industry has operated with minimal disruption over the past 20 years as credit card payments form a bulk of transactions. However, with the use of IoT and the introduction of digital wallets, the industry has realized that disruption is here. IoT has disrupted numerous industries and changed how things are done. Various ecosystem vendors, service providers, payment processors, and regulators anticipate the wave of changes on the horizon. Change is here! The only question that remains is how quickly the industry can react.

Frictionless Payments Use Case: Electric Vehicle (EV) Charging

EV pulls up to the charging station

Driver plugs in charger to vehicle

While the vehicle is charging, vehicle communicates with the POS system to collect payment information

After charging completed, vehicle communicates with Trusted Store IoT Infrastructure to complete payment transaction

Consumer Digital Wallet uses multiple payment methods including loyalty points

Driver unplugs charger and continues trip

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