



Near Field Communication (NFC) Tag-based System with Machine Learning in Retail Marketing

Authors

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Abstract

In today's brick-and-mortar stores, it is no longer enough for retailers to have the best products on the shelves or offer attention-grabbing discounts. Customers are now in search of seamless retail experiences. This calls on business owners to make better use of emerging innovations.

Near Field Communication (NFC), a short-range wireless technology capable of two-way communication, has long been applied for contactless payment transactions through compatible devices. However, we believe it has a lot more to offer.

NFC tag-based systems, in conjunction with machine learning (ML), can provide customers with detailed information about items/services, offer access to helpful product demos and even address any questions or queries they may have.

Retailers can track customer purchase history for valuable insights into shopping patterns and product popularity in their various stores. Not only could this aid them in creating more targeted (and successful) marketing campaigns, but it also enables them to coordinate the supply to match the demand.

Here, we explain how the NFC tag-based system operates, detail its alternative uses throughout the customer's buying journey, and explain exactly how NFC with ML could revolutionize retail by allowing for a more engaging and personalized shopping experience.

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Introduction

Poised at the brink of a new retail age, Retail 2.0, brick and mortar stores need to adapt to the fact that the shopping journey has irreversibly altered. Customers feel more empowered to go after exactly what they want than ever before.

The result of this is that retailers need now need to cater to a hyper-aware audience who demands more – multi-channel shopping access, greater convenience when purchasing, community features, brand authenticity, and environmental sustainability, among other things.

An ongoing conversation among experts is about how retail has become the latest customer acquisition tool. People often visit stores not to make a purchase but to see, touch, and try new products. The showroom experience matters, and this is what retailers now need to focus on.

A standout trend of Retail 2.0 is a thirst for meaningful experiences. These days stores live and die on their ability to effectively integrate the latest technology trends that help to make shopping more convenient and more enjoyable than ever before. NFC manages to do both.

NFC is a set of communication protocols that enables two electronic devices to communicate with one another. While you have likely come across NFC in the form of contactless payment using smartphone wallets like Apple and Android Pay, to our mind, it is an underutilized technology with many potential retail applications.

To date, just a few forward-thinking companies have started to explore NFC's uses for improved marketing opportunities and for wowing their customers:

- Kentucky Fried Chicken (KFC) launched NFC-based campaigns to aid customers with locating their closest outlet.
- Adidas placed NFC tags on their shoes so customers could browse details of the products directly on their phones.
- Toyota's flagship brand Lexus leveraged NFC technology in print advertisements by including tags that directed customers to a demo app.

What's clear is that both customers and retailers could benefit from NFC technology. It provides the former with a better shopping experience while allowing the latter to collate valuable data – the fuel of the future.

The accumulation and conversion of this data offers excellent insights into pre-purchase, in-store, and post-purchase shopping behaviors that can not only elevate customer experiences to the next level but also provide us a glimpse into the future of retail.

Retail Marketing Intelligence System 2.0

The NFC system consists of tags that are attached to products, advertisements, billboards, or any other dedicated space in a store. These tags then communicate with either an NFC reader or smartphone directing customers to a dedicated URL with more information on the products or services.

Not only does this boost the customer experience, but it also helps retailers to better understand and fulfill the needs of their customers. NFC moves the shopping experience away from more traditional but less effective retail and marketing methods towards something more convenient and effective for all.

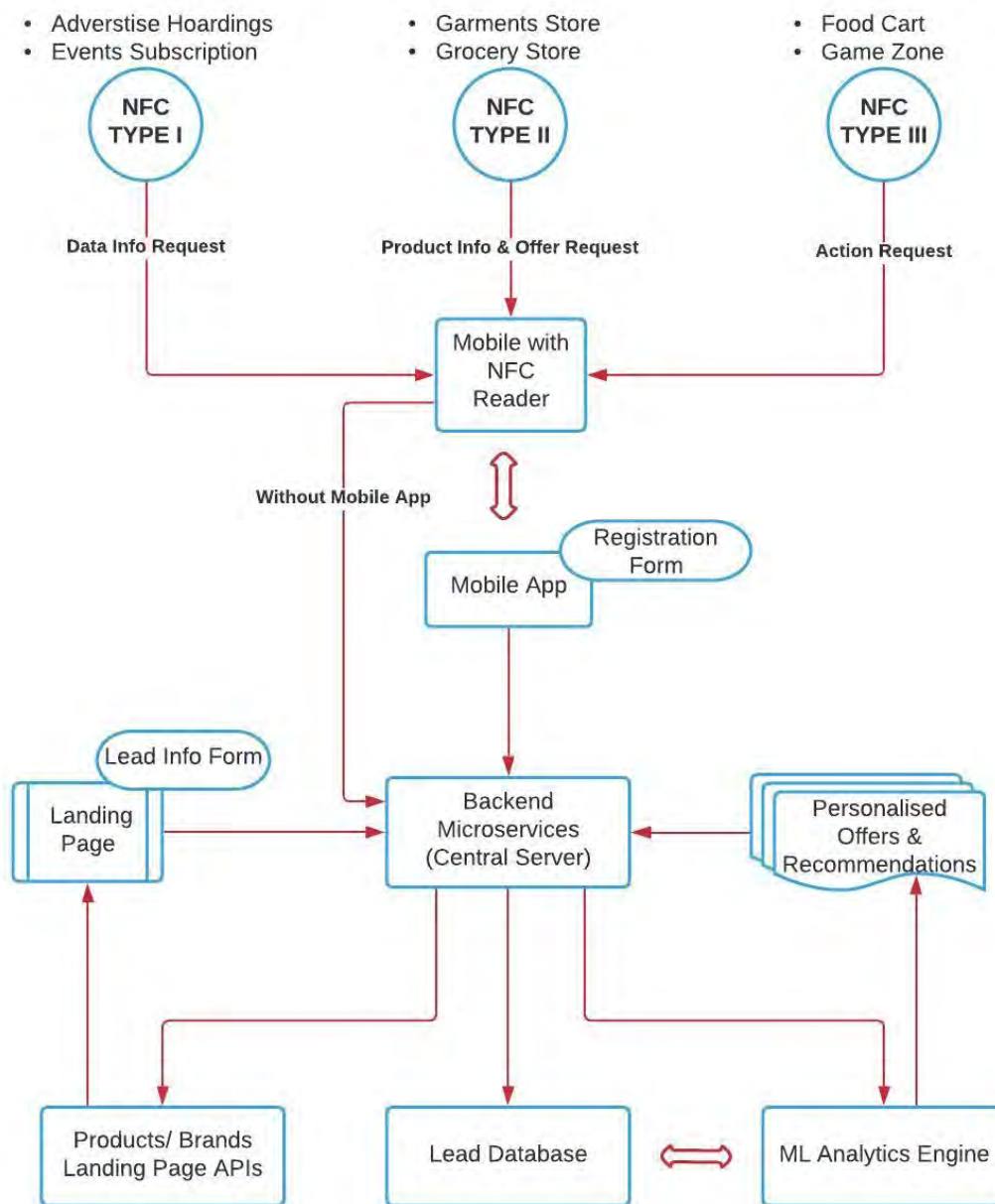


Fig.1: Retail Marketing System 2.0

Components

This innovative design makes use of communication technology across the various sub-systems and components of NFC – many of which are unseen.

The above diagram illustrates the architecture of our NFC-based Retail Marketing System 2.0.

1. NFC tags

NFC tags are passive electronic devices that transfer information to an active receiving device such as a smartphone through magnetic induction. These tags operate without a power supply of their own and so rely on the device being within range to activate them.

A typical NFC tag can store a URL up to 40 characters long. This is written and locked in using an NFC-enabled smartphone with lock/unlock privileges. There are three different types of tag:

NFC Type-1: Mounted onto digital billboards or kiosks in multiplexes, stadiums, markets, retail stores, or any other place a customer might easily access them, these tags store information in the form of a URL that does one of the following:

- a. Directs the user to a landing page where they can access product, event, or brand information.
- b. Prompts the user to register for a product, service, or event.
- c. Allows the user to log into the store's website.

NFC Type-2: Placed on products or service information boards around the store, these tags provide customers with either:

- a. Product/service details.
- b. Product/service demonstrations.
- c. Personalized offers related to the product/service.

NFC Type-3: Also placed on products or service information boards, these tags assist with purchases and other experiences by allowing users to:

- a. Add the product to a virtual cart simply by tapping on it.
- b. Make use of services such as game zones and movie theaters.
- c. Pay for products or services directly through their smartphone.

2. NFC Reader Devices (Smartphones with NFC Capabilities)

As outlined above, an NFC reader device is necessary for the user to interact with the tag. Luckily these days, many smartphones are NFC-enabled, so all the user has to do is tap or scan the tag to experience all the magic of NFC.

3. Smartphone Applications

Certain apps can also interact with NFC tags via these inbuilt NFC capabilities in smartphones. The apps work in a way similar to e-commerce ones but with NFC support. The main features are:

- a. They let users keep track of products and services added to their virtual cart, as well as their purchase history, wishlist, payments, etc.
- b. They allow users to purchase products online when they are not available in the store.
- c. They enable users to view customer reviews of products and services they are interested in. Retailers can also send out personalized offers, discounts, upcoming sales, etc.

4. Landing Pages

After scanning the NFC tags, customers most often will be directed to a landing page that supports them with their shopping experience. This space is also a great place for retailers to advertise.

Business owners can create their own page with relevant product details and/or registration forms. This is great for those that don't have a website. Those that do can use it as a link there.

While the specific information provided on the website or landing page will vary depending on the type of retailer, having customers complete a quick user details form before accessing the content is highly recommended for recording and keeping track of non-registered visitors.

5. Back-end Microservices (Central Server)

A centralized component that integrates everything into a single system, back-end microservices, handles all requests that come from customers scanning the NFC tags. This central server carries out necessary functions via service calls and prompts back to the user via the application.

So, let's say a request for registration to an event is made. The back-end microservices fire up the relevant service (the registration form) and send it in the form of a response to the user. Once they submit their details, the document comes back to the server, and details are stored in the lead database via a database service call.

If, on the other hand, the request is for product details, the back-end microservices fetch the required information or send the respective product link back to the user with any special offers from the retailer.

6. Lead Database

The lead database is where customer information such as personal details, purchase history, utilized special offers, past online activities, upcoming registered events, opted-in services, and more is stored.

The lead database is then responsible for sending the data on to the ML engine, which uses it to provide insights into customer behavior. All of this helps to make the system even smarter and more reliable.

7. ML Analytics Engine

One of the most vital parts of the system as it supports retailers in tailoring their service offerings specifically to their customers' needs, the ML analytics engine is used to make sense of all stored data.

Depending on the specifics of the company in question, data on brand popularity among different demographics, seasonal sales for specific brands, customer retention ratios, geographical product demand, and more can be measured. The engine also offers lead probability distribution based on store layout and store location from past data.

8. Recommendations and Offers Engine

Distinct from the analytics engine, the recommendations and offers engine helps retailers convert leads by sending special offers out to customers via messages or push notifications. It is also responsible for detecting the optimum time for sending out these offers based on past trends so that the advertising is even more effective.

Sequence Diagram

The following diagram shows the interaction of a typical customer with our application in different scenarios. It describes the complete flow with requests and responses from each component within the system.

Here we have detailed five scenarios to help you better understand the process:

Scenario 1: The user comes across an interesting product and wants to learn more about it.

Scenario 2: The user wants to know if there are any special offers on a specific item.

Scenario 3: The user would like to book an appointment for a service.

Scenario 4: The user places an order or adds a product/service to their cart either online or in-store.

Scenario 5: The user registers for an event or subscribes to a program.

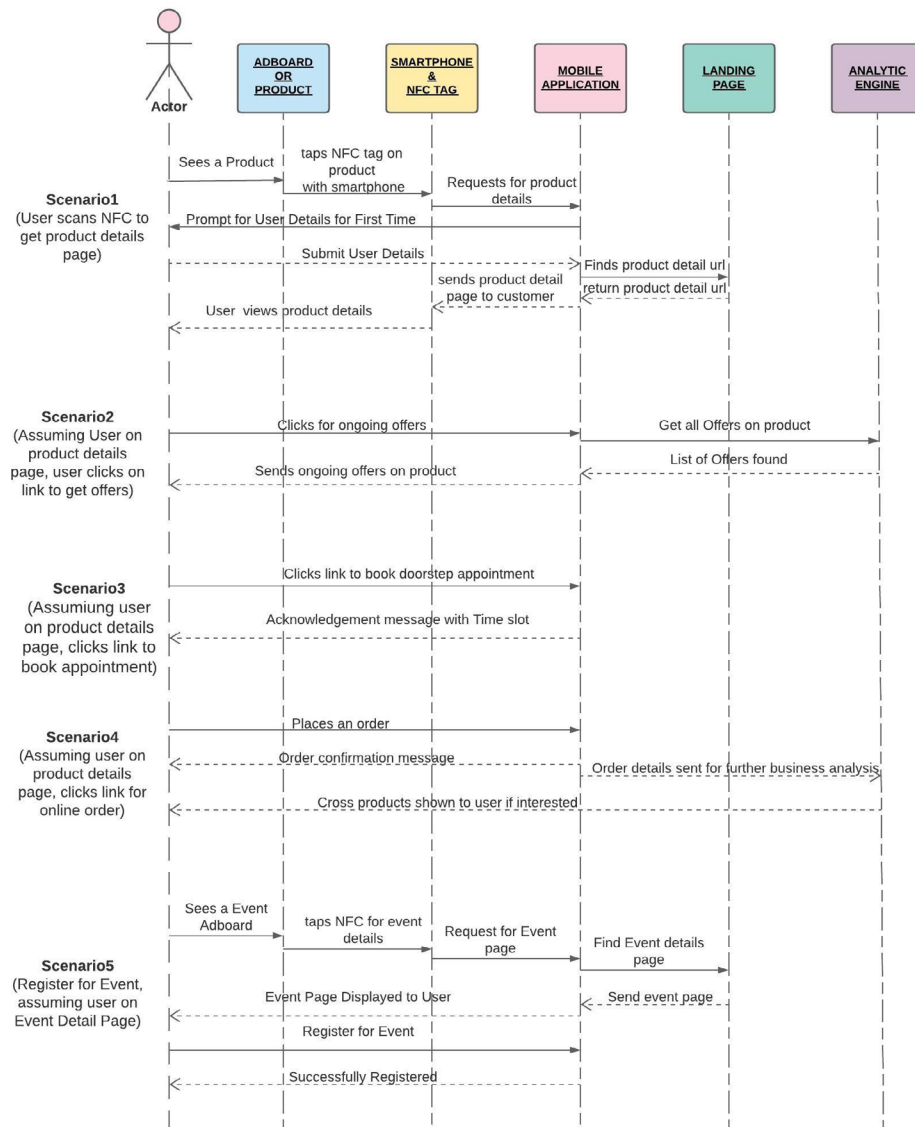


Fig.2: Retail Marketing System Sequence Diagram

Use Cases in Customer Purchase Journey

Our proposed marketing intelligence solution strives to convert leads to business across each stage of the customer's shopping journey – pre-purchase, in-store, and post-purchase.

a. Pre-Purchase

Today's consumers are smart, savvy, and well-prepared. Before purchasing a product, they will often spend time online researching, reading reviews, comparing prices, and seeking out special offers. This is the ideal time to reach out to them, gain their trust, and provide them with incentives to visit your store.

Scenario 1:

Potential customer 'Bob' comes across product 'P.' Bob likes the product but doesn't know its name. This makes it difficult for him to search for it online. However, product P has an NFC tag, and so all Bob has to do is tap it with his smartphone to find out more. He is directed to a site where he can see the product's details and check out reviews from other customers. Bob registers his interest by submitting his details, and retailers can reach out by providing nearby store details and information on any applicable discounts.

Scenario 2:

Bob sees a digital billboard advertising a special offer on a piece of jewelry that he would like to buy for his partner. However, he is unable to get to the store to take advantage of the offer. Luckily, the billboard has an NFC tag attached, which, when scanned, directs Bob to a landing page where he can schedule an appointment by selecting a suitable date and time and inputting details of the kinds of pieces he would like to view. The retailer can then send someone out to Bob, enabling him to purchase the one he wants.

In both the above scenarios, the NFC tag translates to an actual sale rather than simply a lead demonstrating how our proposed solution caters not just to customers but to retailers too.

b. In-Store

While customers are in the store, retailers have ample opportunities to engage them by enhancing their shopping experience, advertising offers or discounts on products and services, and even supporting them with purchasing decisions.

The NFC tag-based system can take care of all of this, making a retailer's work that much easier.

Engaging Consumers with Smart Offers:

Special offers appeal to most customers. However, retailers might not always be in a position to offer them to each one. NFC can help distribute these in fun, innovative and interactive ways. For instance, retailers might choose to have smart offer kiosks with inbuilt NFC tags.

Smart offers are designed in such a way that they can present a 10% discount coupon to, for instance, every 10th customer to tap on the tag, and 'better luck next time to everyone else. This simple idea can attract customers who hope to try their luck with a discount rather than paying the full retail value elsewhere.

Confirming Product Integrity:

No one wants products that have been damaged or tampered with in some way. Product integrity is a crucial part of a retailer's reputation and is essential for both customer satisfaction and trust.

Installed NFC tags can provide evidence that a product has or is being tampered with by setting off an alarm or sending a notification to the system. The NFC tags for these damaged products would automatically be deactivated to prevent customers from purchasing them.

Building Relationship with Customers:

The key to effective digital marketing is presenting the right offer to the right audience at the right time.

Once retailers have collected customer details, e.g., if they opt into a mailing list or loyalty program, they can send them special offers via NFC tags.

Supporting Chatbot Conversations:

Traditionally, support and assistance were provided in-store by sales advisors who approached customers individually. The issue with this is that due to the ratio of advisors to customers, people would frequently be left waiting for long periods to have their questions answered.

As Chatbots can be used on websites for addressing quick queries, so too can they be used in-store via NFC technology. Placing handy 'Have a question?' tags around the store that customers can interact with means that assistance is readily available to anyone with a smartphone.

Optimized Inventory:

Space in retail stores is often quite limited, meaning that large amounts of inventory can't be kept in-store. Customers can be left frustrated by not being able to find a product they want in the right size or color. This can mean the retailer losing business.

One way around this, using NFC technology, is to place tags on products that redirect customers to the store website. Here they can either purchase the item and have it delivered direct to their store or put in an order for collection depending on the specific services on offer.

c. Post-Purchase

The purchasing journey doesn't end when the sale is complete. Retailers can continue to provide support and derive data that can be used to generate leads and further business.

Value-Added Product Delivery:

The set up of products at home can be made more interactive to support customers and add value to the shopping experience using NFC.

Scenario 3:

Bob has brought his newly purchased item, in this case a washing machine, home. He finds an NFC tag on the package that offers support with the installation. On scanning it, he is directed to a video tutorial explaining the steps as well as the different features of the device in detail. There is also a message thanking him for shopping at this particular store. Bob is satisfied with his purchase and pleased with the additional support. He decides to go back to the same store for similar items in the future.

Supporting Reorders:

Some products need to be regularly replaced or refilled. Retailers can make use of NFC tags to encourage customers to return to their store for this.

Scenario 4:

Bob has purchased printer cartridges from a store. An NFC tag on the product allows Bob to quickly place an order for the cartridges to either be refilled or replaced as desired. Using ML, the system could even notify the retailer when Bob may be due for a refill or replacement, and they could contact him directly to remind him to stop in to the store or order online. Discount vouchers might be offered to ensure he returns to the same retailer.

Cross-selling:

When a customer purchases a product from a certain brand, chances are high that they will also buy the corresponding accessories. Retailers can place NFC tags on products that direct customers to their website, where they can check out add-on products, services, and offers.

Other potential uses are available for NFC vary depending on the type of business in question and the products/services offered to the customers. Most retailers would be able to make effective use of NFC tags to generate leads, cater to loyal customers, and build better relationships with new ones throughout their entire buying journey.

NFC over other wireless technologies and QR codes

Some might question the benefits of NFC over Bluetooth, which has been widely available for many years now. There are some key technical differences between the two that give NFC the edge in certain situations.

The most significant is that NFC requires much less power making it perfect for passive devices such as advertising tags. However, this does also present some drawbacks.

Notably, the range of transmission for NFC is much shorter than for Bluetooth. Bluetooth connections can transmit data 10 meters or more from the source, whereas NFC only has a range of around 10cm. Yet this does mean faster connectivity.

Due to the use of inductive coupling and the absence of manual pairing, it takes less than a tenth of a second to establish a connection between two NFC devices. While modern Bluetooth still connects pretty fast, NFC is still better for transactions, retail marketing, etc.

QR codes are another similar form of technology that could be used in place of NFC. However, these tend to be rather cumbersome from the point of view of the customer. With a QR code they need to have a suitable app for reading these kinds of codes, then they have to open their camera, scan the QR code and hope that the picture is not too blurry for the device to read it.

In truth, it's not really about the technology; it's about the user's experience of the technology. People want to tap and go and then get on with their lives. They want something easy, simple and, above all, something that works. NFC lives up to all these and more.

NFC Cost vs Reusability

Despite the numerous benefits, examples of NFC technology applied to high volume, low margin products such as fast-moving consumer goods (FMCGs) have been limited. This is largely due to cost. However, new technologies and production processes are emerging aimed at significantly reducing the price of the key components required for manufacturing NFC tags.

Presently, individual tags generally cost between \$0.10 and \$0.60, depending on the specifications. Irrespective of the cost, NFC tags are rewritable by default which makes them reusable for multiple products and services, which can cover the investment cost of NFC for low-value products.

We recommend take away NFC tags (post-purchase journey) only be used on high-value items such as white goods, electronics, and jewelry. For services such as gaming zones and food carts, and low-value goods, NFC tags will remain in the store and can be reused as needed. This rewritable/reusable ability of NFC tags makes them more affordable and more feasible for use on all products and services in-store.

Applications

A system that can collect data and even help in inventory decision making is a boon for any retailer, marketer, or strategist. However, there are certain areas where NFC excels:

- It can be used in any store – grocery, clothes. It can even be used in shopping complexes with multiple retailers.
- One place NFC particularly shines is in the food industry, where customers can access menus using NFC tags and order directly from their tables.
- It can be used to run retail campaigns such as lucky draws and discounts for every X customer.
- Event organizers can place NFC tags on advertising boards across the city. Here users can access details of the event and even register. This means that event hosts can attract large and diverse crowds.

Future Developments

In the future we aim to develop a robust and dynamic system that no retailer will be able to deny the benefits of. At the same time, we will also focus on increasing the store's abilities to convert leads into business. Details that will need to be dealt with in making it like this include:

- Setting up an onboarding process to ensure retailers have everything in place, such as a website and product descriptions, before bringing in NFC.
- Creating standardized templates for product detail and landing pages to ensure customers have a seamless experience.
- Develop more advanced algorithms for data analytics, special offers, and recommendations to deliver greater precision.

Conclusion

The proposed Retail Marketing System 2.0 showcases the future of retail with NFC powered by machine learning. It illustrates how a two-way communication device can revolutionize the entire retail marketing industry for business owners as well as customers.

The NFC tag-based system allows brands and retailers to connect quickly, efficiently, and reliably with customers at every step of the buying journey – pre-purchase, in-store, and post-purchase.

Beyond streamlining payment transactions, NFC technology creates non-invasive opportunities for businesses to inform and convince shoppers. The promise of this increased opportunity enables companies of all sizes to acquire these hi-fidelity, customizable, off-the-shelf tags and place them strategically throughout their premises to boost in-store customer engagement.

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