Shopping using NFC

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ABSTRACT

The traditional system currently implemented for shopping at a retail store has been in place for a long time. However, it has its fair share of disadvantages associated with it. It requires the retail store to keep the products to be sold, ready on shelves to be picked up by the customer. This consumes a lot of space which gets overcrowded during sales and other offer periods. In addition to consumption of space, it also takes a lot of time for the cashier to scan the products and generate a bill which results in subsequent delay for other customers waiting in the queue. There is a need to find solutions to these problems and make shopping at a store a convenient option for users. To overcome these problems, we propose to use NFC (Near Field Communications) technology and improve the user's shopping experience. NFC is a groundbreaking technology that works for short-range communication. NFC tags are available that can magnetically store data. To implement the system NFC tags will be placed in front of every product which can be scanned by the consumer's mobile that must have NFC enabled. The tag can be placed in front of a sample product or an image depicting the product. The user must be connected to the internet to make use of this application. As soon as the consumer scans the tag all the details about the product will be added in the user's cart. This will reduce the load on the cashier to scan every product to generate a bill, making the system more efficient and easy to use. There will be an android application for consumers. The store manager/admin will have the responsibility to manage (add/remove) products available for consumers to shop. A store admin can manipulate the data stored in the NFC tag. Admin will have a desktop website at his/her disposal to add information about the products available. Once the consumer registers for the shopping application he/she has to verify their account at admin's desk. The admin has to add images, details, price, etc. of the product to be viewed by their consumers on their mobile application after the tag is scanned. This system will reduce the workforce required to maintain the products on the shelf. Hence the system will be cost effective and efficient for the store and convenient for the users.

Keywords— NFC, NFC shopping, NFC tags

1. OVERVIEW

In the traditional shopping spaces, people need to carry around baskets all over the shopping mall and get the products they need and add them to their baskets. All the products in your basket are then billed at the exit counter. So there's a long queue for checkouts and payments at the exit counter. This extra overhead in shopping takes a lot of time and thus require extra manpower at the desk to handle large crowds. This overhead can be reduced by introducing a user-friendly hassle free Android-based M-commerce system. In recent years, the use of smartphones has increased rapidly. Mobile phone manufacturers are rapidly adding new features to make cell-phone smarter [1]. One such feature is the integration of NFC technology in smartphones. NFC is a form of short-range wireless communication. It involves a sender and receiver. NFC communicates either by a modulated electric field, or a modulated magnetic field, but not by radio waves. Present and anticipated applications include contactless transactions, data exchange, and simplified setup of more complex communications such as Wi-Fi Communication [2].

2. NFC

NFC stands for "Near Field Communication" and, as the name implies, it enables short-range communication between compatible devices. This requires at least one transmitting device, and another to receive the signal. A range of devices can use the NFC standard and will be considered either passive or active. Passive NFC devices include tags, and other small transmitters, that can send information to other NFC devices

without the need for a power source of their own. However, they don't really process any information sent from other sources, and can't connect to other passive components. These often take the form of interactive signs on walls or advertisements.

Active devices are able to both send and receive data and can communicate with each other as well as with passive devices. Smartphones n=by far are the most common form of active NFC device. Public transport card readers and touch payment terminals are also an example of technology [3].

2.1 Working of NFC
The major difference between NFC and Bluetooth/Wi-Fi is that the former can be used to induce electric currents within passive components as well as to send data. This means that passive devices don't require their own power supply to send data to other devices. They can instead be powered by the electromagnetic field produced by an active NFC component when it comes in range.

The transmission frequency for data across NFC is 13.56 MHz you can send data at either 106, 212, or 424 kbps. That is quick enough for a range of data transfers — from contact details to swapping pictures and music.

To determine what information will be exchanged between devices. The NFC standard currently has three distinct modes of operation. Perhaps the most common use is in smartphones which is the peer-to-peer model. This allows two NFC-enabled devices to exchange various pieces of information between each other. In this mode, both devices switch between active when sending data and passive when receiving.

Read/write mode, on the other hand, is a one-way data transmission mode. The active device, possibly your smartphone, links up with another device in order to read information from it. NFC advert tags use this mode.

The final mode of operation is card emulation. The NFC device can function as a smart or contactless credit card and make payments or tap into public transport systems [4].
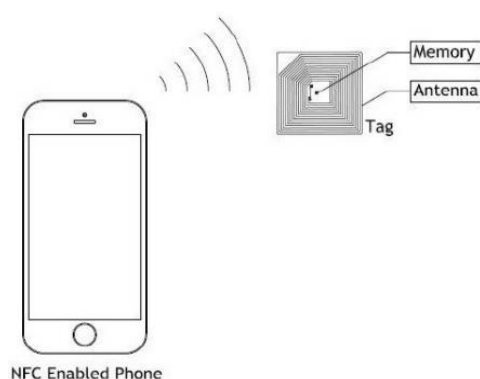

Fig. 1: Working of NFC

2.2 NFC communication modes
NFC devices support two communication modes.
- **Active:** In this mode, the target and the initiator devices have power supplies and can communicate with one another by alternate signal transmission.
- **Passive:** In this mode, the initiator device generates radio signals and the target device gets powered by this electromagnetic field. The target device responds to the initiator by modulating the existing electromagnetic field [4].

3. NFC VERSUS OTHER SMALL RANGE COMMUNICATIONS
There are multiple technological solutions available for communications in a short and long range. Bluetooth and Bluetooth Low Energy are short-range communication technologies. The table below shows the difference between these short-range communication technologies.

Table 1: NFC vs. Bluetooth vs. BLE [5] [6]

Aspect	NFC	Bluetooth	Bluetooth Low Energy
Tag requires power	No	Yes	Yes
Cost of tag	US$0.10	US$5.00	US$5.00
Network standard	ISO 13157 etc.	IEEE 802.15.1 (no longer maintained)	IEEE 802.15.1 (no longer maintained)
Network type	Point-to-point	WPAN	WPAN
Range	< 20 cm	≈100 m (class 1)	≈50 m
Frequency	13.56 MHz	2.4–2.5 GHz	2.4–2.5 GHz
Bitrate	424 Kbit/s	2.1 Mbit/s	1 Mbit/s
Set-up time	< 0.1 s	< 6 s	< 0.006 s
Current consumption	< 15mA (read)	Varies with class	< 15 mA (read and transmit)

4. IMPLEMENTATION
The implementation of the system is as follows
4.1 User
The system uses Android-based mobile phones which are integrated with NFC technology. In general, the user can do the entire shopping process with the help of their Android mobile phones with a software application that reads and processes the tap to the NFC tag of the products which the user intends to purchase. The user who will visit the store for the first time will have to register on the application using their phone number and enter the details as required for shopping. The user will then receive an OTP and upon successful verification, the account will be created. This will only be a one-time process and the next time the user visits the store he/she can open the application and log in to shop.

NFC tags would be placed in front of every product in the store that will contain a unique product id. After the user has tapped on a tag, the application will fetch the information about the product based on product id from the server. The information regarding the product will be displayed on the user's Android smartphone. The user will need to be connected to the internet for the complete duration of shopping inside the store. The user will be facilitated to select the quantity of the product to be purchased. Based on the quantity of the product purchased the user will be shown the amount to be paid and they can confirm to add the product to his/her cart. The user can select multiple products by tapping on the different tags for each product and repeating the same process.

Furthermore, the user will be informed about the ongoing offers in the store through the tags itself and can avail them with a tap of their finger. The user at all times would be aware of their expenditure on the products purchased. Finally, after the user has finished with shopping he/she will select an option which will

show whether the user wants the goods to be home delivered or user will collect the product in the driveway. The user will then need to check out of the application and select a payment method. While shopper is leaving the store he/she will need to visit the admin's desk and provide the admin with their phone number. After the admin has entered the number he can view the products in the user's cart. When the cash transaction is complete between the user and the admin, a bill will be generated which can be viewed by the user in their smartphone. In addition, the admin and user can see the shopping history which will be stored in the application.
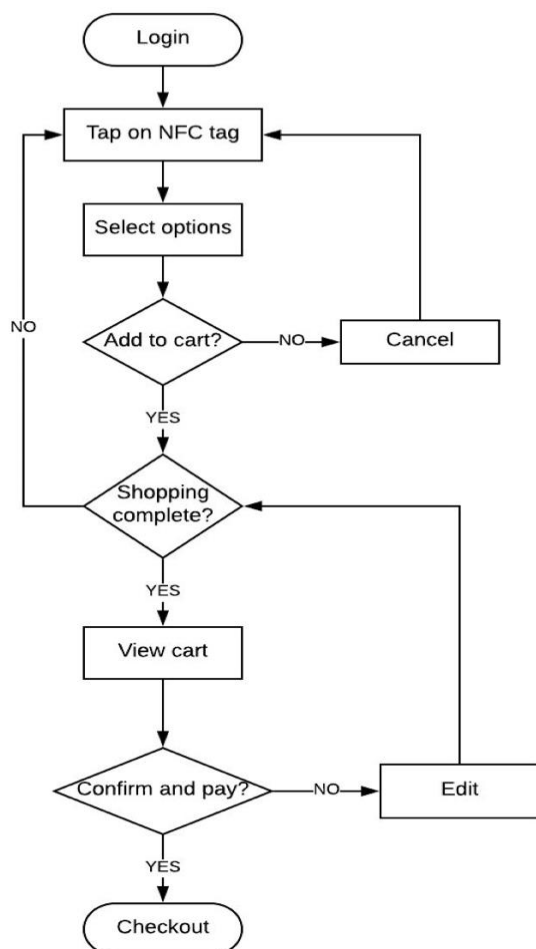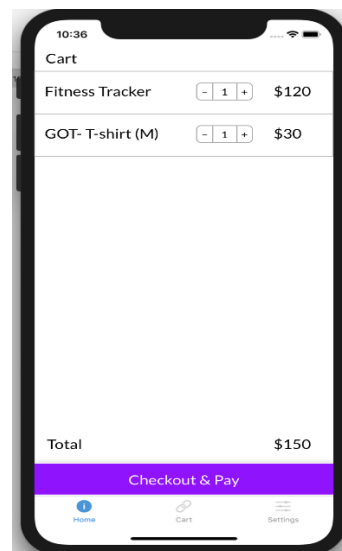

Fig. 2: Shopping process

Fig. 3: User's app screenshots

4.2 Admin

An admin will be a person responsible to manage or run the store. Admin will have a website at his disposal. He/she will be responsible to manage the inventory and the store. An admin can add or remove products from the database. He will verify the user and validate the shopping credentials of the user after he/she has checked out. NFC tags can be manipulated by the admin. He will add the details of the product. Admin will keep the information about the products available and the quantity of each product. The admin can view a user's history using the phone number provided by the user while checking out.

4.3 Advantages

- The system will save a lot of customers as well as store manager's time as the need to san the barcode on each and every product purchased by the customer to generate the bill is eliminated and hence the queue at the process counter can be processed rapidly.
- It will save a lot of Store space as the trolleys needed to keep the bought items will not exist which will result in less crowding of the space. Space can be better utilized especially during festive or sale periods.
- The user will have a record of items bought which will be helpful for individuals to manage their expenses.
- The store can attract more customers by providing special benefits to regular customers who are frequent visitors to the shop and hence increase their sale as well as their profit margins.
- The store does not need to maintain all the necessary products stacked up on the shelf as only a single product of a particular type can be kept for users to feel the product and the rest can be kept in the storage room and home delivered to the customer. This will also result in the workforce required to maintain the store to be decreased.
- The efficiency of the store to handle the customers will increase.

5. COMPARISON BETWEEN CURRENT SYSTEM AND IMPLEMENTED SYSTEM

The current system for shopping at a retail store is very tedious and time-consuming. It has a few disadvantages associated with it. Below is the comparison between the current system and implemented system.
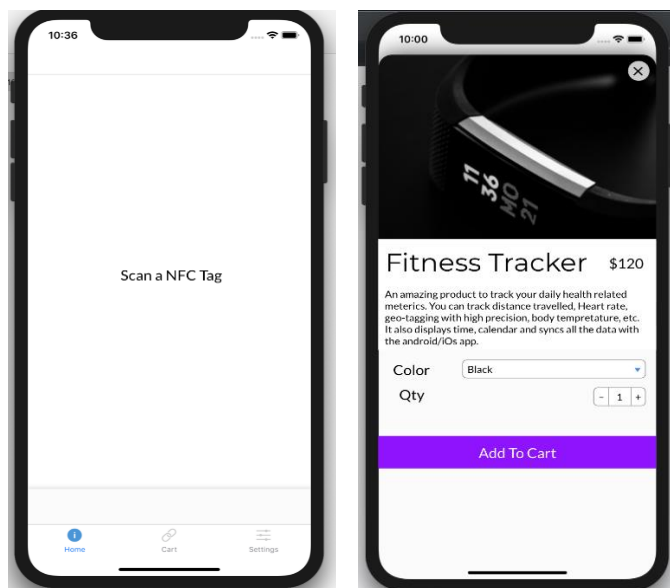
Table 2: Current system vs. implemented system

	Current System	Proposed System
Space required	The space required is more as all the products need to be stacked up	Space required is less as not all the products need to be kept on the shelves
Workforce needed	The workforce needed is more as stacking of products is required	The workforce will be reduced with the proposed system
Cost	The current system requires more investment from the store manager	The cost to run the store will be greatly reduced with the proposed system
Processing speed	Processing and scanning products in current system consume a lot of time	The need to scan each product is eliminated saving consumers as well as the manager's time
Efficiency	The efficiency of the system is less	Efficiency will be vastly increased
The condition during the offer period	During offer periods or peak season, the store is overcrowded with more people required to handle the influx of customers	The system will work equally efficiently during peak periods as it does on normal days
Maintenance of products	The shelf needs to be maintained and the customer's often pick up the product and leave somewhere else	Need to maintain shelf is eliminated as only a prototype or an image can be kept in front of each tag
Convenience	Less convenient for the user as they need to carry around a trolley in the whole store	More convenient for users as they do not need to roam around the store with baggage
Billing speed	The process of billing and scanning is time-consuming	The proposed system does not require this process to take place
Inventory management	Keeping the record of the items sold is a tedious job that needs a review at the end of each day	Inventory can be easily managed as when the user's shop, the inventory is updated instantly
Secure	Theft of products can be easily accomplished	Theft of products from inside the store is practically not possible as only a prototype or image is kept for the customers to view

6. CONCLUSION
The new system for shopping using NFC tags and NFC enabled smartphone is more reliable and convenient for both the shopper as well as the store. It is more efficient and has significant advantages over the traditional way of shopping. The system will be more into use when all the smartphones will have NFC technology.

7. ACKNOWLEDGEMENT

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