Secure NFC Based Loyalty Management System with Payment Module

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Abstract-Now a days, Customer loyalty system that uses bar code based or magnetic strip cards have earned popularity in market. But currently customer needs to carry the cards they acquired to get the facility of loyalty program provided by the merchant. So the idea is to have one medium which will allow customer to have multiple loyalty cards virtually (e.g. in only one NFC smart card or NFC enabled mobile phone). In our general and market research, it found that NFC technology can contribute to abridge or simplify daily activities like mobile payment or transactions. NFC is a short-range radio technology. NFC transmission range is so short, NFC-based transactions are inherently secure and shortly. If person wants to purchase something than he/she needs to carry credit card or debit card also. The paper includes instant use of loyalty points collected by customer(user) in previous visit. The customer can redeem those loyalty points and also can make payment with the same mobile application. The solution may accomplish that if customer is loyal and has access to loyalty card or mobile phone then he/she can take advantage of services provided by merchant and also increase in repeat purchase of customer for merchants which may increase business relation among the payment organization, loyalty associations and card owner.

Keyword--- NFC, Loyalty, smart cards, mobile payment

I. INTRODUCTION

Due to global and economical climax, every civilians wants to save money and to get more benefits and better services in cheaper price. Because of this, many companies mainly focuses on attracting customers (customer satisfaction)as they(customers) are users of their products and their reviews matters a lot for success of their product. So, Customer loyalty is the key part of any company which concentrate on the behavior and need of their customers.

Loyalty is the best tool for such companies which wants repetition in purchase of their products by customer. To increase customer loyalty, Great attention is given to marketing and customer facility to retain existing customers. Organizations hire loyalty programs which recompense customers for recurrence business. Current loyalty systems needs some upgradation. In this paper, to form true loyalty and improve relationship between customers and merchants, a system is described.

Near Field Communication (NFC) technology is a short range, high frequency and standards-based wireless communication technology that allows data to be swapped between devices. NFC operates at 13.56 MHz and transfers data at up to 424 Kbits/second. NFC has three operating modes i.e. card emulation, reader-writer and peer-to-peer operating modes. Using any of these operating modes, communication or data transfer between devices like an NFC enabled mobile phone, an NFC reader, an RFID/NFC tags. NFC also provides feature is that mobile phones are capable to behave like an RFID/NFC tags. This capability of NFC generates many prospects for inventive facilities. The maximum range in which NFC work is 10 centimeter. NFC

offers users services like payment, loyalty, transport, culture etc. NFC inventors instruct the usage of secure element to make payment and other application secure. This element is used to store private and delicate data like a credit card pin.

RFID/NFC cards are being used in variety of application like home automation, transport, e-payment, etc. RFID/NFC cards data can be an ID for data access or in a reduced and set of field. These cards does not need data structure optimization. Usage of these cards by the applications which desires to have fast and secure transactions. The popularity of cards depends on its ability to provide secure usage of multiple application through single card.

In current circumstances, the customer needs to carry lots of cards data, counting loyalty cards, membership card, debit cards, credit cards, etc. This paper provides solution that all data of all these card can be stored into one device by installing application on NFC/RFID card suitably. Merging this application with payment applications can provide simplicity, mobility and availability of using loyalty rewards can obtain customer satisfaction and loyalty.

The goal of this paper is to present set of techniques to reduce the efforts require from merchant to handle loyalty reward programs, customer satisfaction and to provide secure money transaction.

Introduced features of NFC technology and loyalty card rewards in introduction section with brief definition of loyalty programs.

II.   RELATED WORK

NFC technology permits to store and manage delicate and commercial data, so NFC must provide secure atmosphere to users. In survey, it has found the solution for traditional bar code based cards in customer loyalty system. The solution is to replace those bar code and magnetic strip cards with NFC smart cards or NFC- enable mobile phone and that system is capable to hold multiple virtual loyalty cards[1].

Many application based on NFC has been already built to simplify and to increase the standard of living of civilian like WingBonus [5], SCDM[4]. WingBonus is used to manage vouchers and all kind of coupons using NFC. The use of NFC and its mobile application offers easy way for storage, management and acquisition[5]. NFC Technology also used for customer's identification[7]. After which users can get and check coupon information from their respective mobile phones. Future extension of this system can be involvement of location from account. In this case, it can recommend stores that are located in near place where the customer can use that coupons.

As NFC is popular for safe and secure communication, it can be used for money transaction or e-payment also. There are many application developed for mobile payment merging NFC with different other technologies like Bluetooth[2], wireless

GSM networking[13]. A peer to peer based application is described that demonstrate usage for money transfer between mobile phones using NFC and Bluetooth Technologies[2]. NFC users can even pay theirs bills without credit card[6]. Usage of NFC/RFID cards can reduce costs and improve quality of service[15]. Implementation of Smart Shopping system based on NFC technology is already done[6],In this paper, system includes technical support of mobile applications, and users will be able to conduct a series of actions like product searching, pre-ordering and online payment on the mobile app. With NFC users can even pay the bills without credit card which would simplify the purchasing process[6].

In a paper by Nour El Madhoun, FouadGuenane, Guy Pujolle, the risks are entailed by the vulnerabilities of EMV and particularly in the case of NFC payment. Hence, in order to overcome EMV weaknesses, a new security procedure based on an online communication with a trusted thing is proposed[8]. Another papershows the NFC mobile payment via NFC-Micro SD technology advances the higher reception, using willingness and loyalty of the partners and user. It also makes the value chain as the collaborative solution[10].

Such papers already proposed which describes a framework using NFC for the full management of mobile coupons. Security voucher is granted by the system by synchronizing procedures and secure encryption algorithm[14].

From all such system, it can predict that NFC has great potential to simplify and safe human's life. Future of this is "ideally" smart environments.

III.   SYSTEM OVERVIEW

The idea behind the system is that customers can replace all their loyalty cards with one NFC intermediate. The NFC medium is nothing but the NFC card or NFC empowered phone. Customers are always carry their phone with them.This should be well approved by customers Since they are affected with paper vouchers and plastic loyalty cards now days.
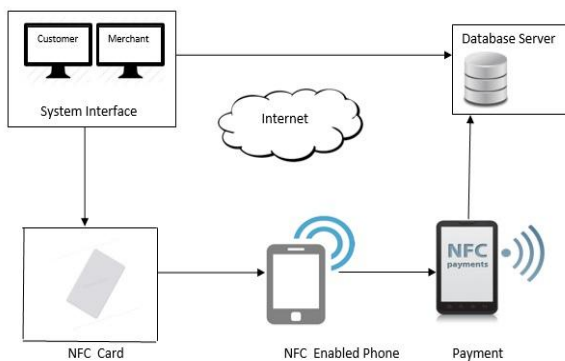
A. System Interface:

Fig.1. Architecture of Loyalty Management System

Fig. 1 shows the architecture of Loyalty management system. System describes how loyalty program is managed and online payment service.

1.Customer Interface:

Service provider will provide a NFC tag to customer which will include customer details. When customer will tap the card to NFC enable device, it will read the cards and display the details on device screen and according to available loyalty points customer can use them.

Payment mode will provide customer facility to make there payment online without carrying their payment cards.

2.Merchant Interface:

Merchant operator can read as well as write the card used by customer. Updation of cards details are done by merchant operator. Merchant have access to the points balance and history of their customer and other marketing information of their customers. Different graphs and other apparatus are available. e.g., a graph that shows the quantity of customers that visited the store during the earlier period.

B. Database Server:

Database operator will monitor the database. All the data is stored in central database. Database will store the data of customer. The customer standard is only used for classification. The data is available by the online interface. All operations(processing of data) are performed on backend. Which enables efficient updating of data. When there are multiple branches of store,all data is already centralized.

C. NFC card:

NFC card will store customer details like its unique ID and other cards detailswhich will be used for payment.

D. NFC enabled Phone:

NFC enabled phone is mobile phone or smart phone which contain the NFC feature in it. Using this device operator can read the information of customer. Tap the NFC enabled phone on NFC tag and operator will get the all information of the customers mobile phone can be used as virtual.

E. Payment Module:

Payment module is used to make payments. It will ask user to make the mobile payment. There will be different option to make the online payment.

F. Use case:

1) Customer will log in to his account using given id and password and check available loyalty rewards with him/her.

2) Next page will be displayed where user will enter the bill amount and customer can use loyalty rewards according to the validity of the rewards. Discounts are also deducted from the bill and final bill is generated.

3) Then system will ask to make payment which can be done online or offline. For online payment user does not need to carry payment cards as payment cards details are written on NFC empowered cards.

4) Customer will read the details form the card, enter the password and make the payment done.

5) Customer will collect the loyalty points for the shopping using NFC enabled device and the points are displayed when they select the option view collected points.

6) Logout

IV.   SYSTEM UPSHOTS

A. Customer's Application:

Here customer who is already registered will login. After logging in,customer will be able to see rewards collected by him/her. Then the shopping bill amount will be entered and the pop up will be displayed of whether to use the rewards or not? If customer want to use the rearwards they will select the option yes and proceed with how many rewards to use. Usage of the rewards will depend upon the validity of the rewards. Rewards will be redeemed from the customers account and final bill will be generated. Then customer can pay the bill online using various facilities provided by our application.

If customer is visiting for the first time then customer needs to register and get their id and passwords with the NFC card holding their credential details. Then the rewards are transfer to customers account and next time when customer visit again he/she can use the rewards and other facilities. In our application customer can view discount and offers which are offered by the service provider.
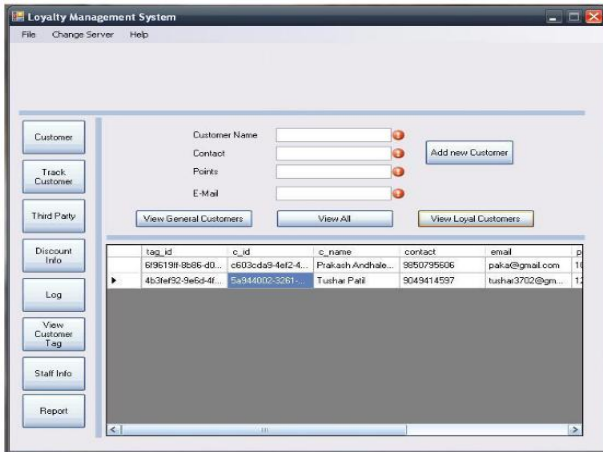

Fig. 2. Registration of new loyal customer at backend

Fig. 2 shows form of new loyal customer registration. Different options are available like customer information, discount information , report generation, etc.

B. Service Provider's Application:

Using this application service provider will be able to register new customers ,track customers, display and edit discounts and offers currently in trend, generate log files,view and edit information of staff and generate report. Service provider is responsible for handling the loyalty program. They will provide rewards to customer using NFC empowered device.

Customer when visits the shop for the first time and buys some products, service provider give them loyalty points depending on their terms and condition, which can be used when the customer visits the shop for the next time.
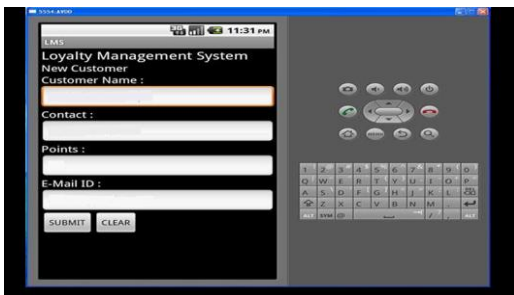

Fig.3.New Loyal Customer Registration Form

Fig. 2 and Fig. 3 shows how customer can log in to their account after getting their id and password.

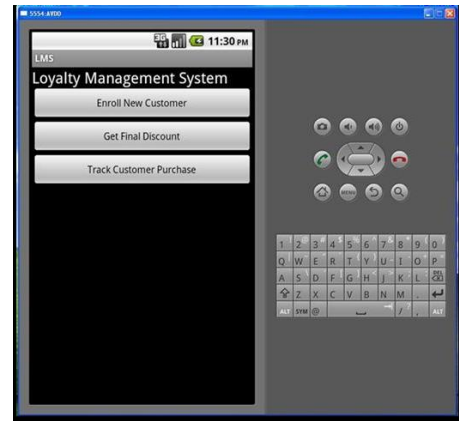If customer is regular then they just need to log and come to end with further process.

Fig. 4. Activities Related to Customer performed by service provider

Fig. 4 shows page which belongs to merchant's application and various activities performed by them.

Merchants are people who are responsible for handling the loyalty program. They are permitted to enroll new customers and provide them their id and password. They also provide NFC card which encloses their details. Whenever customer visits again they just need to carry a single card instead of bunch of cards.

They are also responsible for handling discounts and offers provide by them so that customer can view discounts and offers and take the gain of it.

Customer can be tracked be analyzing his/her pervious shop list and accordingly place the products and present the offers.
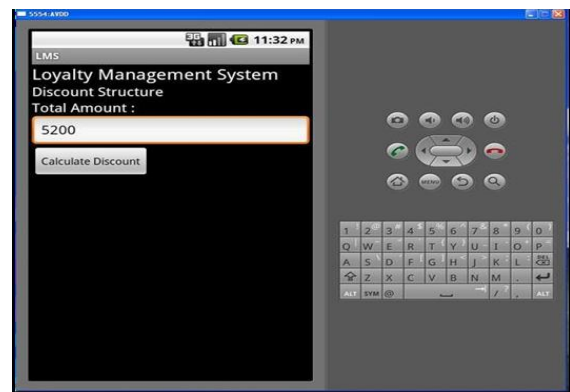

Fig. 5. Calculate Flat discount

Fig. 5 and Fig. 6 shows calculation of final amount to be paid by customer after withholding discounts and deducting the rewards.

Once the bill is generated of the purchased products customer enter the bill amount into the field where total amount is to be entered. Then discount is calculated and the pop up will be raised which will ask customer a choice to use their rewards. If customer wills to use the rewards then rewards will be deducted from the customer's account and then final bill will be generated which is amount to be paid by the customer.

Customer can pay the bill online as systemis providing facility of paying bills online without carrying the payment cards by storing their cards details on NFC card provided to them. Customer needs to read the card using their NFC empowered devices and read the details form their and continue with the transaction.
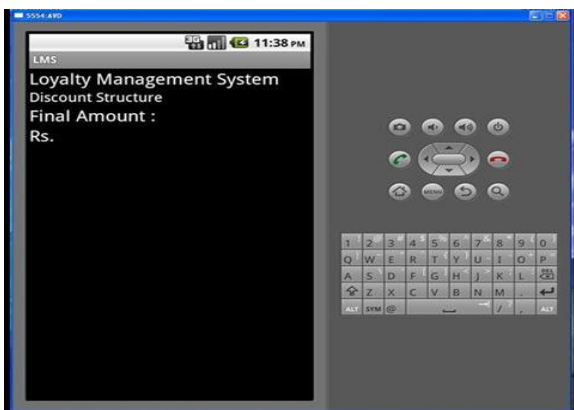

Fig. 6. Final Bill Generation Including Discount

V.   SECURITY AND PRIVACY

Several security levels were enforced in the system. Foremost, all communication between website users and terminals is encrypted using SSL. Then Web pages or web services require authentication (anticipate the public pages). Eventually, each user or terminal is restricted to perceive only the grade-appropriate data. The system should proscribe data duplication regarding points. This is acquire by securing the back end, all data is stored there. Considering the privacy, access to customers personal data and loyalty which is restricted to merchants of stores where customers have any type of loyalty cardvirtually. By visiting a store, a customer elect that store and repeatedly come for purchase then a virtual loyalty card is generated and given to the customer, giving the merchant of that store access to that customers information.

Torah exist that defend the customers privacy and that should not be neglected. Self-assurance agreements between merchants and the system administrators have to be done. Those point the loyalty and sales information of the stores which should not be vended to third-party system by the systems administrators.

VI.   INTERVIEWS

6 interviews were held in 5 different stores which contains small shops to globalized shops which have many branches across the world. The current loyalty intermediate vary from normal cards to barcode cards.

The existing loyalty system is widely accepted by all the distributors and stores. Review of NFC technology usage is quite similar. The NFC use in the traditional loyalty system find useful and easy to use by the merchants. As everyone is fanatic about online platform, the customer and merchant interfaces provided by system found complete and well understood.

The use of website were appraised by all the interviewees. The interviewees have desires for some more specific information related to customers concerning their likings. The interviewees liked the concept of providing offers using marketing data on website as it takes down their efforts. The smaller shopkeepers raise question that if they have found the integration of social media for the same system comfortable and cost efficient then why they will use this system? But using system NFC based will bind them with the loyal customer and provide them tracking of the customer and analyze requirement by the customers.

For large and small stores, the customer information is very much gentle subject. Even interviewees also agreed that customer secrecy must not be overlooked.

VII.   PERFORMANCE ANALYSIS

To improve performance, very first describe system in measurable terms. When a performance analysis get conducted, the major activities that represent its progress is identified by observing performers. Following are some aspects on which performance of the system depends:

A.   Robustness:

The system should be robust enough to handle any sort of exceptional condition or errors like network failure, data server crash etc.

B.   Portability:

The system is used from various points situated at different geographical distance from each other. Therefore, System

should portable enough at every access points.

C. Flexible:

As the system have two application i.e. the mobile application and the desktop application. Hence, It should be flexible enough to work on both.

D. Reusability:

Modules can be effectively reused in this system.

E. Hardware integrity:

The system works by combining hardware and software. So, Hardware should be properly synchronized and integrated in order to execute system efficiently.

VIII.   CONCLUSION

This paper burrow various features of NFC based loyalty management system with payment module to empower customer to roam with weightless wallets and customer also need to worry less about which points to use where as these points can be used globally. To collect the loyalty rewards customer will collect the same using their NFC enable mobile phone. Customer needs to carry only single NFC card which will contain the credential details of the customer and the card will be highly secured.

This application is proposed because some network operators wanted to break down the act of credit transfer. It is developed in Android operating system which facilitates with real-time communication, high reliability, convenience of installation of application and maintenance with high efficiency. It also includes secured transaction of data between payment gateway and the application which is installed on customers mobile. Block diagram explains the accessory of the system in detail.

For future research application will be developed which can be easily ported to any other operating system with NFC support. It will also include study of business impacts with NFC support.

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