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Next Generation Smart Transaction Touch Points

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***Abstract*— In a rapidly evolving world financial transactions opportunities have become inseparably linked with advanced Information Technology. This paper presents the integration of a NFC (Near Field Communication) enabled mobile wallet with a NFC enabled payment card as a next generation smart transaction. The objective of the research is to provide customers of a financial institute/bank with a mobile application to perform banking transactions while enabling merchant payments through a NFC enabled SMART card. This solution introduces a new local initiative for enabling NFC based mobile payments which will promote the acceptance and adoption of NFC technology in Sri Lanka. This in turn will provide flexibility, mobility and control to consumers who use cashless payment mechanisms.**

Our solution will also address the problem of merchants and banks needing to generate and process paperwork, as receipts and promotions are delivered to the customer digitally. The uniqueness of this research is the integration of NFC enabled card and the mobile wallet, which has not been offered by any existing mobile wallet vendors in the market and eliminating transaction fees currently paid to international merchants. This solution will enable local economic growth and at the same time promote greener initiatives while encouraging the general public to utilize and obtain the advantages of the latest technology advancements.

This paper elaborates the research carried out with respect to NFC and mobile wallets, and present the design and the features of our Next Generation Touch Points Solution.

***Keywords*— Mobile Wallet, NFC, Green Banking**

I. Introduction

Mobile communication technology is a field that has been facing rapid growth and expansion in recent years. The basic mobile phone, which was initially used as a mechanism for giving and receiving calls and messages, has now developed far beyond, into a device that enables users to conduct business on the go, set up meetings, connect to social networks, access entertainment media, plan and organize events, and capture special moments in pictures and videos, all at their fingertips [1]. Along with the development in mobile communication, technologies such as Bluetooth connectivity and Near Field Communication (NFC) have also emerged as essential mechanisms for data sharing [1].

With said advancements in mobile communication and information technology, and the ever-increasing complexity in consumer needs, the requirement to perform business and service transactions over the mobile phone has become a necessity. This has in turn given rise to numerous mCommerce platforms being developed and launched. The move towards a cashless society [2], where consumers are more willing to use payment cards and mobile wallets for performing their day-to-day transactions is another factor that has had a positive impact upon the development of mCommerce. mWallets [3] are an emerging payment vehicle that enable paperless and touch transactions. It is carrier neutral and compatible with any mobile model.

The need for mobile wallets is heightened by the fact that societies are now more focused on greener initiatives. Without digital media and mobile channels, merchants would be required to generate vast amounts of paperwork in the form of fliers, posters, banners and leaflets to spread awareness of their products among the general public. Added to this are the high setup and maintenance costs associated with setting up bank branches, including the resources required for the operation of the branch, such as energy, staff and space.

This paper first introduces the technologies used for our research and its current use. Then we present our solution together with the system architecture. We define the problem scope and show how the Next Generation Touch Points Solution overcomes said issues. The unique features of the Solution are highlighted before presenting our concluding remarks.

II. Research Study

A. Near Field Communication (NFC)

Near field communication (NFC) is a set of standards for smartphones and similar devices to establish radio communication with each other by touching them together or bringing them into proximity, usually no more than a few centimetres [4]. It is a high frequency wireless communication technology that enables exchange of data between devices. NFC is an upgrade of the existing RFID standard. It combines the interface of a smartcard and a reader into a single device.

The NFC technology enables contactless transactions, data exchange, and simplified setup of complex communications such as Wi-Fi. This technology enables users to seamlessly share content between NFC enabled devices, make mobile payments, use as an electronic travelling ticket.

NFC provides the advantage of speedy set-up over Bluetooth. While Bluetooth connectivity needs to be established manually, a NFC connection between devices can be set up under $1/10^{th}$ of a second. NFC can even operate when one of the devices is not powered by a battery (e.g. on a phone that is switched off, contactless smart credit cards, etc.).

NFC also provides higher security compared to Bluetooth, due to the shorter range required for operation. To use NFC, the two devices must be within 4cm [5] of each other, which limits the possibility of third party interference [6]. The customer's account information and transaction details are stored in a secure area of a NFC enabled phone, called the "Secure Element". The Secure Element is a smart chip that stores and securely manages

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sensitive information separately from the rest of the device's components. The Secure Element (SE) is a secure microprocessor that provides transaction authentication and security, and secure memory for storing payment applications [3].

B. Mobile Wallets

Mobile wallets are payment services operated under financial regulations and performed via mobile devices. Mobile wallets enable customers to transact with merchants without using cash, cheques or credit/debit cards. This payment system can store credit card, loyalty card, gift card and sales promotion details.

In Sri Lanka, mobile wallets have mainly been deployed as a means of extending financial services to the unbanked and under-banked areas of the country. Mobile wallets enable consumers to maintain money balances without having to open up bank accounts. The money balances are maintained in their mobile phone accounts. Mobile wallets are used as a mechanism for expanding the banking reach, especially in to rural areas where the community may not be knowledgeable about banking services [7]. Mobile wallets can be especially supportive towards self-employed individuals, farmers, business owners, etc.

NFC is used with mobile wallets mostly in paying for purchases made in physical stores. A consumer using a special mobile phone equipped with a smartcard waves his/her phone near a reader module. The payment could be deducted from a pre-paid account or charged to a mobile or bank account directly.

Fig. 1 below depicts the growth in mobile penetration in Sri Lanka, which indicates that the potential for the acceptance of the NFC SMART Solution is favourable.

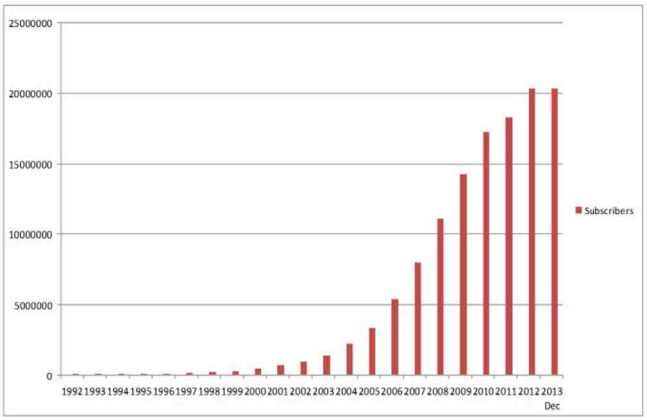

Fig. 1: Mobile Penetration Growth in Sri Lanka (Source – TRC)

The credit and debit card usage in Sri Lanka has shown a significant increase in the past 3 years, as shown in Fig. 2 and Fig. 3. These statistics is an indication that consumers now prefer to use cards in place of cash to carry out their transactions, due to convenience and the added advantage of security [8].

Said developments in the communication and payments arenas favourably contribute towards the acceptance of the NFC SMART Card system.

III. Similar Solutions

While there are existing NFC based payment solutions in the market, there are no systems that combine a NFC enabled card with a mobile application that bring a wider set of services to the customer. Some of the leading existing NFC based mobile wallets include Isis Mobile Wallet, Google Wallet and Vodafone SmartPass [4, 9, 10]. All of these solutions support NFC based mobile payments through the mobile wallet application on smart phones. However, none of these systems combine a NFC card with the mobile wallet to facilitate banking transactions and merchant payments [11].

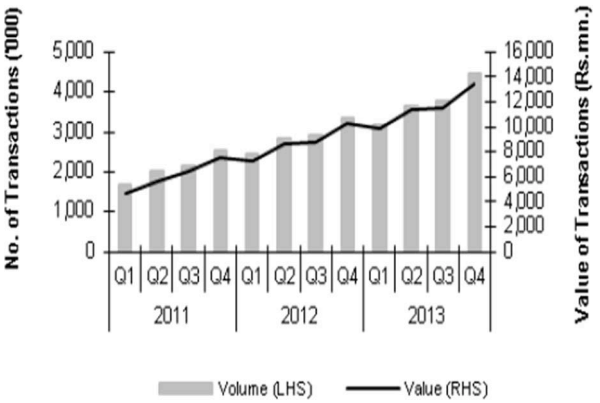

Fig. 2: Debit Card Usage (Source – CBSL)

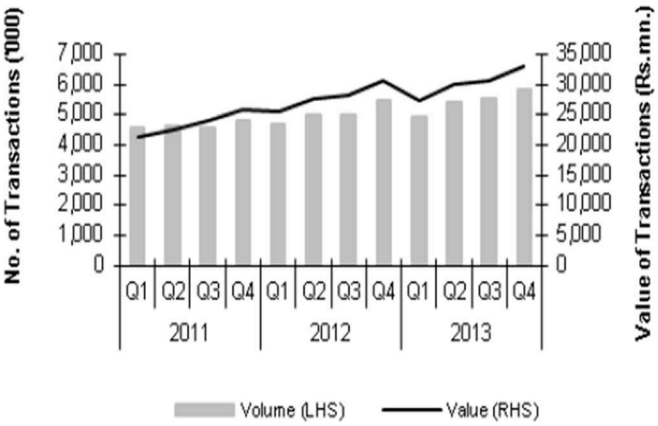

Fig. 3: Credit Card Usage (Source – CBSL)

Vodafone SmartPass [12] offers a payment card with their solution, but this card is not NFC enabled and is provided to be used at merchant locations where NFC has not been adopted.

Google offers a debit card with their Google Wallet [10]. This card is not NFC enabled, and is used for accessing the Google Wallet balance at ATMs, shopping online or at physical merchants. In other words, the Google Wallet card is basically another debit card that can be used where MasterCard payments are accepted.

The uniqueness of our NFC SMART Card solution is the combination of the NFC card with the mobile wallet.

IV. Background of the System

The proposed NFC SMART card solution provides the major benefit of being the first initiative taken towards NFC mobile payments through a local solution. While all other solutions in the market have been in existence for some time, the availability and adaption levels differ from

country to country. The deployment of a local NFC based mobile payment solution would promote a more familiar and approachable service, ensuring that the solution is readily accepted.

Our NFC SMART Solution provides mobile commerce solutions with comprehensive integration between banking functions, advertising, customer relationships, merchant networks and media. The solution provides banks with the tools to connect customers to merchants and other utility and service providers remotely, near store through geo-fencing and in-store using NFC. This enforces customers with a richer and better shopping and banking experience, while enabling merchants to have cost efficient and optimized mechanisms for promotions and payment acceptance [13].

Combining a NFC enabled card along with the NFC mobile application provides several benefits. As is the case with almost all smart phones in use today, battery power is a critical factor. Due to constant use, connecting to the internet and the number of applications running on the phone, running out of battery power is an issue that all smart phone users face [9]. The customer's phone malfunctioning would also pose a problem if he is unable to perform the NFC transaction once he approaches the cashier at a particular merchant. To address these issues, we propose the NFC enabled SMART card would be an ideal solution.

Having a NFC enabled SMART card that can be topped up via the mobile wallet can be useful in situations where the consumer prefers to use the card as a supplementary card. For example, the consumer may want to let his/her spouse/child use the SMART card while he/she is in control of the funds available in the card through the mobile application.

V. System Overview

Proposed solution is a suite of products for the next generation mobile transactions processing and payment management industry. It is an enterprise m-Commerce solution that enables organizations to provide m-Banking, m-Wallet and m-Money for the banked and un-banked customer on a single platform [14].

Our solution combines a comprehensive m-Wallet application with a NFC based card, which will provide consumers with flexibility and convenience for carrying out merchant payments, fund transfers, top-ups, receiving information on the merchant deals, coupons and promotions, etc. The m-Wallet application and the NFC card will be synchronized through the bank's Card Management System at the time of initiating the payment, ensuring that the customer's available balance is updated in both the application and the card.

A common platform will be maintained for SMART cards and M-wallet. Customers of the Commercial banks will have the ability register to obtain this SMART NFC card or M-wallet through appointed banks branches or any other partners within the said eco System. The solution provides flexibility for any bank to join this eco system, which would enable the growth of the overall banking industry in Sri Lanka. Such a networked eco system provides flexibility and mobility to customers. The SMART card solution will be mainly catering to all the layers of the socioeconomic pyramid, focusing on the middle and bottom layers, based on KYC and AML procedures [2].

A customer can visit a merchant and pay for his purchases using the NFC enabled SMART card. The merchant will be using a NFC enabled POS device for accepting this payment. The amount paid will be deducted from the available balance of the customer's card, and the same amount will be updated in the customer's mWallet account. The customer can transfer funds from mWallet to mWallet using the mobile application. When a customer is travelling, merchants registered with this solution who are in the vicinity where the customer is in can push messages containing information regarding promotions and deals, as well as coupons which the customer can use, using geo-fencing technology [15]. These messages will be displayed in the mWallet application of the customer.

The available balances of the mWallet and the NFC card will be synchronized by the Card Management System of the bank/financial institute. mWallet accounts will be maintained in the bank's switch, and therefore will not manipulate accounts at Core Banking level.

The NFC SMART Solution's application server will provide administrators with the ability to configure settings as required. The solution can be highly parameterized to suit the respective bank's requirement. Comprehensive audit trails and reporting mechanisms can be developed in order to enable investigations and decision making.

This solution has already been accepted by National Development Bank PLC and proposals are under consideration by People's Bank. We are currently in the process of obtaining Central Bank approval to launch the solution by next year. The infrastructure layout is shown in Fig. 4 below.

The scope of the NFC SMART Solution is shown in Fig. 5. The Solution encompasses console management, customer interaction through the mobile app, searching facilities, deals, offers and promotions, geo-pushing features and merchant payments [16]. This broad scope enables providing a gamut of services to consumers.

A. Product Expectations

The NFC SMART card enables fund transfers between mWallets using the mobile application. The transferred fund amount will be updated in the mobile wallet and the SMART card simultaneously.

Consumers can perform merchant payments using the SMART card. The merchant must have a NFC enabled POS device for accepting the payment [17].

The solution provides geo-fencing capabilities where the mobile application will update the current location of the customer continuously. Merchants would be notified of

customers who are in their proximity, and said merchants will then be able to push deals and coupons to customers using geo-fencing and augmented reality solution [7].

The NFC SMART Card solution enables transaction limit security. For transactions exceeding a certain cap limit (e.g. Rs. 1000/=) a 4 digit PIN/security code will be required to authorize the payment.

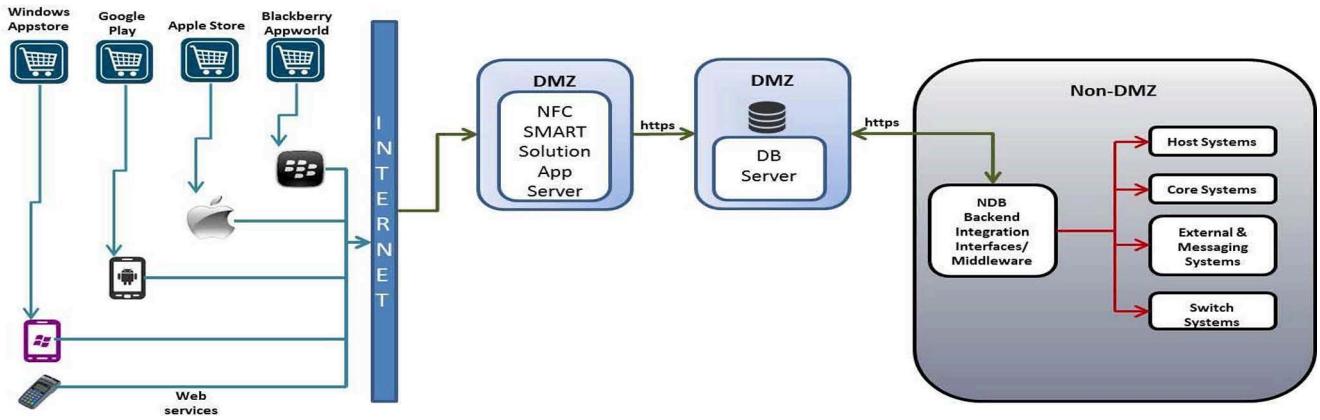

Fig. 4 Infrastructure Diagram

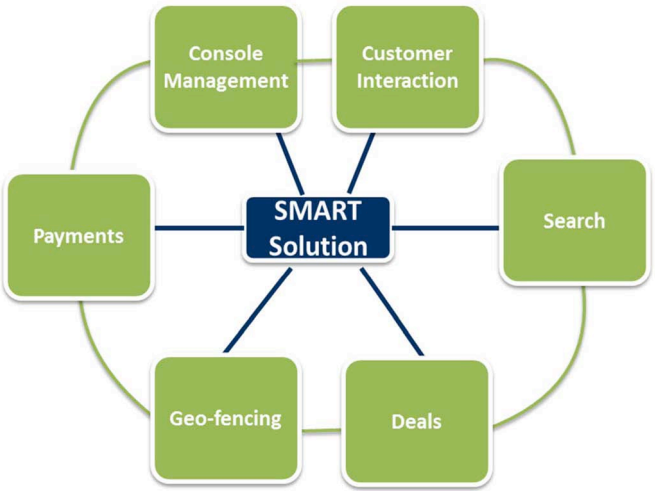

Fig. 5: Scope

Customer purchasing trend/pattern recognition can be facilitated through the solution. Merchants can use the Merchants' console for monitoring buying patterns and to carry out promotions and deals based on customer purchasing behaviour [18].

The NFC solution is designed to support banking functions, merchant payments and marketing and promotional services. Time to market is optimized with the availability of a pre-integrated eco-system of merchant and utility partners and the usage of APIs for integration readiness. It is a future safe solution with a modular and extendable architecture to enable easy deployment, and provide full 360° mCommerce solutions [2].

Security features can be built in to the system, where a customer needs to enter a passcode to access his mWallet. The same passcode or a different transaction passcode can be used for authorizing each transaction. The mobile application can be configured to disable itself if the user enters the passcode incorrectly three times [3]. Multi-factor authentication mechanisms can be incorporated, along with session time-outs. The mobile device will not retain any transaction or personal data.

Managing of registering/de-registering of merchants, hot list management, account activation/deactivation, etc. can also be provided, where the bank can configure merchant categories and risk profiles.

Fees and limits can be assigned per customer group. Fees can be assigned based on fixed amounts or percentages.

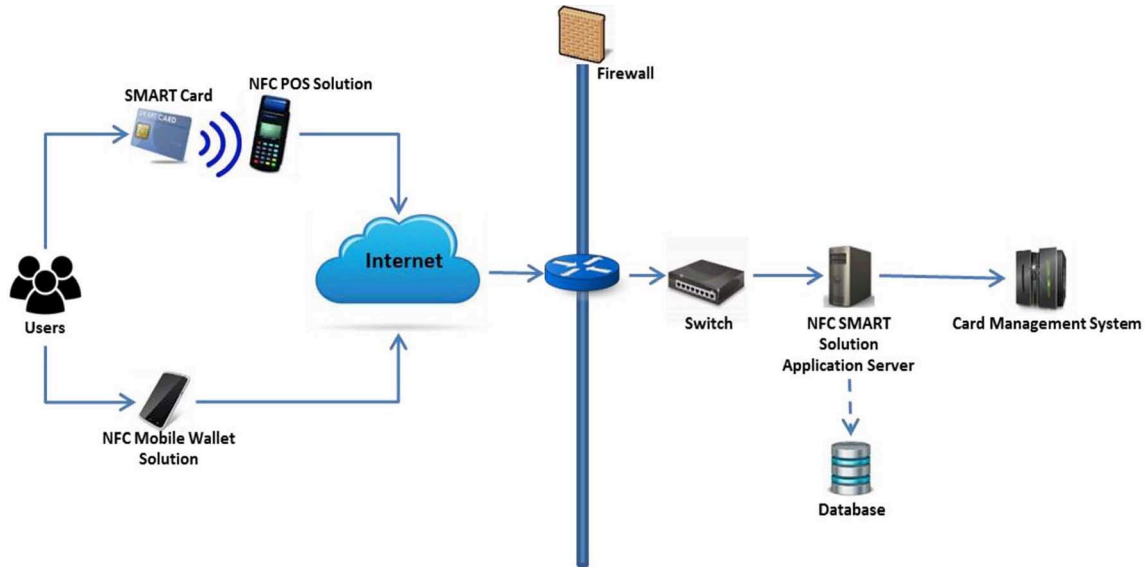

Fig. 6: Architecture Diagram

The commission will be shared among the partners such as banks, telecommunication service providers and any other registered merchants based on transactions.

The solution will allow customers to set limits on how the card can be used. Daily limits, per transaction limits, etc. can be defined by the customer.

Fig. 6 depicts the architecture of the solution.

Security features are provided through secure login using PIN validation.

The table 1 shows the separate functionalities of the NFC mobile wallet and SMART card.

TABLE 1
NFC SMART CARD FUNCTIONS

NFC SMART Card	NFC Mobile Wallet
Merchant payments	Fund transfer
Loyalty points collection and redemption	Card top-up
Utility bill payments	Merchant Deals
Student identification card	Geo-fencing services
Transport Payments	Coupons
SME Payments	Personalised Discounts

VI. BENEFITS OF THE SOLUTION

The main benefit that can be gained through the NFC enabled SMART card solution is the contribution towards the growth of the national economy. It enables going forward with the Mahinda Chinthana vision for Sri Lanka to be an advanced technological hub in the South Asian region while enabling significant economic growth through rapid development of the banking industry. Development in the banking industry is achieved through expanding the bank's reach towards the under-banked areas of the country [19]. Achieving effective sustainable growth and cost reduction through enabling paperless operations which leads the way to creating awareness of greener initiatives is another advantage.

The benefits for the bank include receipt of a fee based income generated through transaction fees from merchants and convenience fees received for fund transfers. The solution also enables the bank to use the latest technology to reach out to a wider customer base by mobilizing bank-led mobile and NFC based financial transactions. This will strengthen the bank's presence in all parts of the island and will thereby encourage growth of the bank's image [9]. The solution enables the bank to achieve cost reductions in the long term and to contribute towards a greener society.

The NFC enabled SMART card solution enables the bank's consumers to perform transaction and conduct business on the go while providing security and convenience [20]. This mobility and flexibility is enhanced through the coupling of the mobile application with the NFC SMART card which provides consumers with a payment option that is convenient to them. Through using this system, consumers can perform financial transactions without handling cash, thereby eliminating risks of loss and theft. The solution gives access to various deals and coupons offered by merchants with the geo-fencing technology and consumers can use the mobile app to accept such offers. The solution also gives better control if being used as a subsidiary payment mechanism by parents/employers [21]. As consumers use only the amount that is loaded in to the NFC card, monthly fees, overdraft fees, purchase fees, etc. that are applicable to other card payments can be avoided.

From a merchant perspective the solution provides them the ability to tap in to a wider customer base. Using the mobile app, merchants can push promotions, deals and other offers to consumers, which would provide building of brand loyalty. Merchants can personalize these offers and promotions based on customer location and buying behaviours [22]. Through an efficient merchant dashboard, merchants can identify customer preferences, trends and patterns. The solution provides the ability to activate referral programs to help existing or new brands to develop [15].

The table 2 displays the cost savings that can be achieved through for channel listed by using the NFC SMART Solution.

TABLE 2
CHANNEL COST ANALYSIS
(Source: HNB AR – 2013, BOC AR – 2013)

Channel	Cost
Branch counter	Rs. 90-110
ATM	Rs. 48-52
Internet	Rs. 20-22
Mobile	Rs. 14-16

VII. TECHNICAL REQUIREMENTS

The NFC Mobile Wallet application and the NFC enabled SMART card will be linked via the bank's switch through a Middleware. The mWallet accounts will be maintained in the bank's switch and synchronization of the card and the mWallet application will be handled through the Card Management System. The Middleware will handle the interfacing between the switch, mobile application and the Card Management System via ISO 8583 message formats. The integrations will require minimal changes to the existing infrastructure of the bank [23].

The Next Generation SMART Touch Points solution can be deployed on Windows 7 OS and has the capability to support other operating systems as required by the facilitating bank. It can also be configured for Oracle, MySQL and DB2 database management systems.

The security model of the solution covers both the mobile and the Middleware components. Content submission over the entire system, i.e., mobile devices, POS devices and the bank will incorporate end to end encryption using 3DES. All web portals will be using HTTPS. Internal servers will communicate using SSL and self-signed PKI certificates, while all external access via SSL will use PKIs signed by 3rd parties. Two factor authentication mechanisms will be in place for customer authentication [2].

The Middleware security includes input validation against standard configurable validations and customer validations, SQL injection, character white listing to check against possible attacks, session fixation attack prevention, requests per session validation, remote wipe of the

application installed on the user device, anti-fraud checks, etc.

The system will include user privilege and role definition to ensure secure access to the backend applications, where bank officers can carry out configurations. Dual authorization, password storage and lockout, password inactivity expiry, password force change, session management, etc. will be incorporated as administrative security features. Audit trails and reporting features will provide comprehensive analysis and investigation methods.

In addition to client validation, server side input validation is taken care of by Validator Frame work shown in Fig. 4. Values entered in Merchant console app in each field in the form are validated by NFC application server using Field Validator, Numeric Validator, String Validator, E mail validator and additionally business specific validation without any code level change exposed in Fig. 7.

VIII. CONCLUSIONS

We strongly believe that the above described Next Generation transaction Touch points will enable banks to generate greater electronic payment volume through mWallets, NFC payments, mobile marketing and electronic loyalty programmes while encouraging greener initiatives and sustainable growth. It will encourage saving habits among the general public which will have a positive impact upon the growth of the national economy [24]. The unique combination of a NFC based mobile wallet and card provides flexibility, convenience and financial control to consumers, in addition to encouraging the use of the latest technology.

Banks and financial institutes adopting this system would receive the benefit of being in the technological forefront and thus, would be able to provide better customer through leveraging on the latest technology. Consumer education remains an area of acute interest for banks to implement use of Eco friendly financial services. Adopting Mobile based, Card base solution will reduce the physical printing money, which will have greater impact on economy growth. Green IT banking based practices in banking are critical to the future development of the nation and national progress.

In order to enable Sri Lanka to be the leading technological hub in the South Asian region, it is vital that banks and financial institutes move forward with the developments in technology. This frame work can be adopted any financial institutions, any part of the world. Due to the mission critical nature of the services provided by banks and financial institutes, this necessity is heightened further. The Next Generation SMART Transaction Touch Points Solution revolutionizes the traditional mobile wallet to reap the benefits of Near Field Communication while maintaining transaction security, flexibility and convenience to the Consumers, Merchants & Financial Institutions.

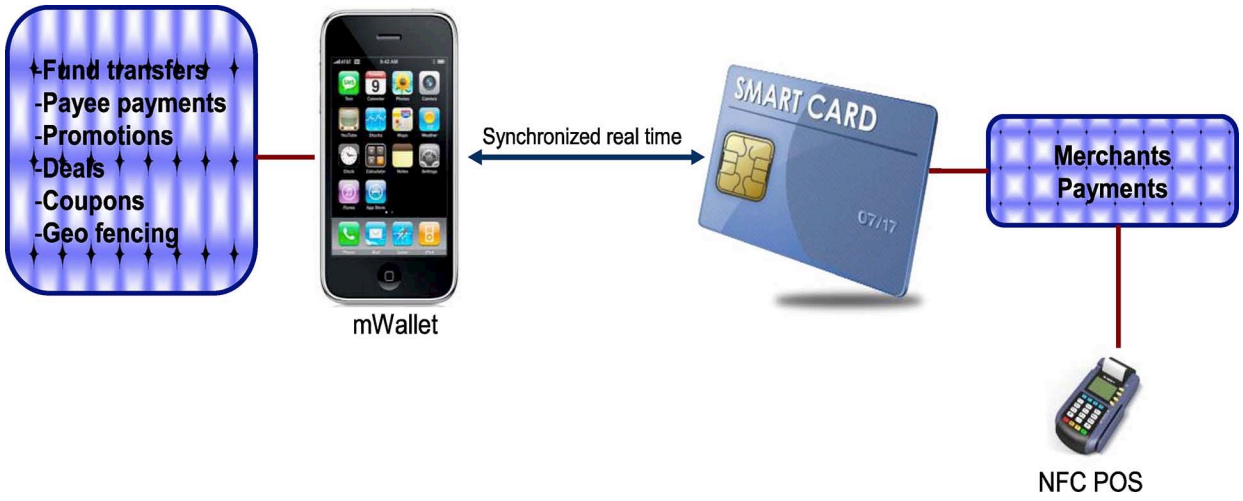

Fig. 7: NFC SMART Card Solution Components

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