

Application of NFC Technology for Cashless Payment System in Canteen

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Abstract - In a campus community, mostly is younger people and stay in University hostel without cooking facilities then have to get from canteen for foods and beverages. In office hour with limited break time either breakfast or lunch everyone is rushing to get food and crowded situation are happen. One of the issues is payment system use manually (cash) and queue at the cashier to pay foods, sometime need to wait a few minute until to get the turn. Cashless payment such as token or credit system is implementing in some of restaurant and food courts but does not applicable in University canteen that most of customers are students with small transaction, only a few dollars and cents. Nowadays, mobile phone or smart phone is not a luxury thing and most of student carries it for phone call, message, email, or browsing internet. Most of smart phone also embedded with Near Field Communication (NFC) reader inside the phone, thus by using this phone with NFC enable to do payment system at the canteen. The credit is deducted from mobile phone balance for pre-paid system or billed in monthly for postpaid and this system have working together to the cellular phone operator. Confirmation on payment system is shows whether customer approve payment or not then a notification is sent to user. With this system be able to overcome several issues such as queue at cashier for payment and risk of student to carry cash money while buying foods.

Keywords: NFC, Canteen, Smart phone, Cashless

I. Introduction

The story of payment system is done hundred or thousand years before century such as barter of material between traders to exchange they need. Conventional payment system is done for long time since before century; introduction of notes in trading system is preferred method to do transaction in trading. Lately, the use of notes or cash money in trader transaction made inconvenience especially for large volume of transaction. Recently, cashless payment system is more valuable in some transaction such as used credit (debit) card, online transaction, online banking payment system, used token or dummy cash. Another cashless payment system is used NFC technology as media to read identity of owner instead of using card, NFC system is embedded in most of latest smart phone the by using this media can be done for transaction or payment method. The use NFC technology as payment system is done in some of outlet that working together with banking system [1].

Introduction of cashless payment system in campus or academic institution is one of idea to implement in this era. Student, lecturer or staff can order and pay use cashless for food at outlet or canteen. Nowadays, busy student and rushing for many studies and assignment made limited time to have foods including paying the foods at cashier. Canteen staff and management system get benefits just provide reader or point of sales for cashless transaction and all the money is going direct to banking system. Used technology in the transaction is required in this era for some reason such as safety for cashier staff and avoid for miss transaction. Cashless payment system can be benefits for all partier business owner, worker and customer that do not need to bring cash money because of much risky. Cashless in canteen system is a system with cost effective solution for Universities or Colleges or anywhere with cash payment system that requiring cashless payment. With centralize account balances stored in a central PC which allows cards or other cashless payment system to block instantly in the event of any loss or damage cards used. Cashless payment system can be used with card, smart cards or other contact less media such as RFID and NFC technology. Cashless payment system is easy to use, secure and costs effective also have some benefits include:

- Simple and reduced administration staff.
- Better planning, control and management in the campus cantenn.
- Savings through better cash flow management (pre-paid system).
- Fast and efficient payment process, quicker service, shorter queues.
- Safety by reduced cash handling, better reporting and reduced cash shrinkage.
- Improved school security by minimizing cash on the campus.
- Reduced student and parent complaints by offering an excellent quality service.
- Provides value added functions such as event planning.

II. Related Work

The use of NFC technology is done in various applications in communication, payment system and others function. Several previous works related to the NFC technology and application as wrote in [2]. Auhtor discussed on the recent emergence of Near Field Communication (NFC) technology enabled to smart phones in security. Evaluation of the feasibility software-based relay attack current mobile contactless payment system. Possibility and threat potential of the attack and provide several possible workarounds. The evolution of mobile modern used Radio Frequency (RF) and capabilities of Near Field Communication (NFC) for payment system is eaborated in [3]. Mobile NFC cashless payments systems are able to enhance shopping experience, but the security is one of the concerns. It allows the user of mobile to point of sale (POS) cashless payment services. Another preivous work is contactless payment system in shopping complex, implementation of contactless payment systems are based on same infrastructure that exists for the payment cards with magnetic strips and does not require additional investments by the firm and financial institutions, other than upgrading the existing POS terminals [4]. Near Field Communication (NFC) technology is a contactless smartcard communication into mobile devices, such as mobile phones. In order to overcome this problem, the cantactless payment model based on NFC, tokenization technique to support the privacy of cantactless payment, and MD authentication technique for fasten cantactless payment in aspect of information of technology [5]. Mobile payment system (m-payment) refers to one of type electronic payment; used mobile devices to get better result, m-payments have to use a plethora of sophisticated technologies, including SMS, NFC, and software applicaions. The heterogeneity of m-payment systems and current economic models is an important challenge for their diffusion in the future years [6].

Although NFC technology is contactless chip cards (ISO/IEC 14443) that known for over ten years, the implementation of mobile phones and payment system using NFC technology is rather rare. From a technical point of view, there are no issues to used NFC technology in payment system. The concept is implementation of a technically and commercially feasible system with minimum impact on the current infrastructure. Hence, the integration costs involve in the NFC ecosystem is lower will be more attractive [7]. Mobile commerce applications became the most popular platform, an indication that NFC technology represents to the potential and tremendous business leading for the retail companies, shopping complex transaction application process integrated with NFC technology based on smart phones. Shopping application system designed on the merchant sides, by leveraging the use of mobiledevices that already has NFC technology [8]. In this paper propose a new solution for the contactless payment and cashless payment system using NFC technology that most of its

embedeed in smart phones, application in campus canteen for student payment. Vitual money used for the payment is different to the currently using which is NFC technology is used for replacing credit/debit card but in this system cash is from mobile credit for the pre-paid system and billed to the post-paid system. Every transaction in canteen will deduct from the mobile credit then working together with telecommunication operator is required to facilitate this propose system.

III. Basic Concept of NFC Technology

Near field communication (NFC) technology is a set of ideas that enables mobile devices such as smart phones, tablets and other devices to establish communication system with each others by using radio frequency (RF) devices to bring into a satern of gap or distance typically more or less 10 cm. All mobile devices that NFC enabled can be provided with dedicated applicatioss including mobile readers as the traditional dedicated infrastructure that specifies a particular standard for ticket, payment system and access control. NFC peers can be connecting to all other devices which NFC enable that acts as a server for any action (or reconfiguration). The memory of NFC chips/tags typically can store data (currently between 96 and 4,096 bytes of memory) and are mostly is read-only, but may be rewritable. NFC tags can be programmed or encoded by the manufacturers or industry while production with specifications number provided by the NFC association. Philips semiconductors which is became NXP semiconductors in 2006 and Sony were vendor with promoting the NFC technology and preparation the key standards, which is includes the definition of four distinct types of chips that provide different communication data rate and capabilities in terms of memory, flexibility, security, write endurance and data retention. The assosiation also promotes NFC technology and certifies device compliance and if it fits the criteria for being considered a personal area network. NFC technology is specified in ISO/IEC 18092 [9] and is a short-range wireless communication interface with data exchange rates up to 424 kbps and working at operating frequency of 13.56 MHz. NFC offers three main operation modes for various types of applications, card 120 (smart card/RFID) emulation mode, card reader mode and peer-to-peer mode. NFC is an extension of the ISO/IEC 14443 Type A specifications [10-11] and NFC is therefore compatible with these systems. ISO/IEC 21481 describes extended services for NFC, which includes the possible use of existing ISO 14443 Type B and ISO/IEC 15693 [12-13] products. Figure 1 shows how a basic concept of NFC technology working with a tag powered by reader in this case powered by a mobile phone which send energy then tag chip send back data/information.

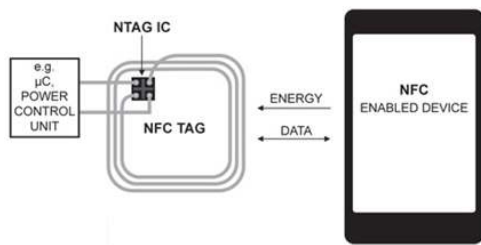


Figure 1. Basic concept of NFC technology



Figure 2. A canteen with long queue to do payment at cashier

IV. NFC Payment System at Canteen

Academic institution is the place of students to get knowledge then most of them busy with studies and assignments. Limited time and some of the Universities does not provide cooking facilities for student then have to get foods or beverages in canteen or food court. During lunch or dinner time food court are busy to serve food and beverage thus queue is happen while paying the foods. Cashless payment system is alternative solutions for this issue and safety for student instead to bring cash money for having foods. Use of cashless payment is not limited to student and can be apply for others such as lecturer (teacher), staff, or visitor. Nowadays, cashless payment system is most popular using credit or debit card, token that some of method need to pay at centralize cashier then get a card as transaction media to food stall, coupon system that issue on the ceiling price with no balance and similar to bring note cash, online booking or payment the issue is unable to change foods while in the restaurant or food court, and bond or debit system which is similar to conventional method that cashier need to record everything in log book then will pay in the end of week or month. Information technology with mobile devices such as smart phones or tablet that has more capability and feature embedeed in the system to do many task, beside that mobile equipments very practical to use because easy to bring anyware. Today, most of mobile devices are available with Near Field Communication (NFC), user by using application software very easily to scan and do the transaction also others task with contactless system. Figure 2 shows an example canteen in the campus with long queue to do payment or transaction at cashier with manual cash payment system. Some of students very rushing to attend class or do activities then can not spend much time in the canteen. Cashless payment system is able to utilize information technology for daily life that more benefit, efficient, safety and to control cash flow for the students. Another significant benefits is all the transaction were recorder then student can review what foods or beverages that they having before.

4.1 Payment System Design

Propose cashless payment system using NFC technology in this paper is different to the others current cashless payment system such as credit card or coupon system, in this payment system used smart phone as media that assume most of the phones is NFC enable. The credit in this payment system is deducted from mobile phone credit for pre-paid and billed in monthly bill for post-paid system. Most of student in the campus assume is younger age that unemployment yet that still subsidize money from parents. Thus, mobile phone used is mostly pre-paid voucher, if they want to pay foods in the canteen just tap mobile phone then application shows credit balance, total payment and balance after deducted. In case of not enough credit to pay then, screen on mobile phone shows alert not enough credit "please top-up". In the canteen of cashier, there is NFC reader to read mobile phone with keypad in order cashier to key total money need to pay. Implementation of cashless payment system gives much impact to the customer (student) and canteen or bussinees player. Cashlees payment system architecture diagram as shown in Figure 3, every transaction to canteen or cashier mush have NFC system and payment applications that downloaded in smart phone. Cashier shows how much need to pay to customer through cashier system and by tapping smartphone to do payment, once cantacting then system checking the balance via mobile network and payment applications shows current balance also the amount to need pay then actual balance deducted, options is shows wheter to accept or reject. Smart phone communicate to mobile operator management system and database via cellular network that now covered most of area including in house of campus. Every transactions made is recorded by operator system and update to applications software for customer information and notification. In case of shortage balance while payment, there is alert that shows not enough credit balance please top up, or customer can reduce the amount to match in order to get payment done. For post-paid mobile system, bill is issue according operator regulation and while payment there is alert wheter accept payment or not. For the canteen or merchant, all transactions is recorded into cashier system (PC) that can be claim to the operator, including customer mobile number used and detail. Security is one of the concerns in this system, all transaction is

using NFC technology to communicate between smart phones to merchant system, and instead of customer losing their phone then can be report immediately to block the applications also mobile number to be use by others people.



Figure 3. Architecture cashless payment system diagram

4.2 Cashless Payment System Application

Application of cashless payment system is widely used worldwide in shopping complex, transportation and trading transaction, most of method is using card or cheque in the transaction. The use of NFC technology as payment media is applied for some banking system to replace their credit/debit card. Nowadays, the smart phone is more important beside for phone call and more than that can do many things such as email, text messaging, take picture and even to do payment transaction with most of smart phone embedded with NFC chip. In this proposing payment system is working together with mobile or cellular operator then credit is deducted from cellular credit for pre-paid and billed for post-paid. Figure 4 shows an example how payment is done by tapping smart phone to merchant NFC reader then applications software shows the confirmation and payment details.



Figure 4. Example of cashless payment system done

Proposed system is targeting for student in campus or school, with cashless payment to avoid bringing cash money and the important is to control their budget. Security reason another consideration to propose this system, student very risk to carry cash money sometime is missing and misplace. Today, mobile phone also very important to the student and most of them carrying it because with smart phone can do many task for student and the price keep going down.

V. Conclusion

A payment system used NFC technology at campus canteen is proposed for effective transaction and security for student to bring cash money to buy foods or beverages. Beside for security, NFC payment system (cashless) is able to overcome some issues such as long queue at cashier waiting for payment. System used smart phone with NFC technology enable that currently most of phone have it, payment method is deducted from mobile phone credit for prepaid and billed for post-paid. In order to top-up credit for pre-paid system have to use mobile phone operator (provider) and this system working together between operators to canteen. By using this system to avoid security issues for some of student that worries to bring cash money to do transaction or buying foods. Security in transaction is doing by confirmation or approve sign is appear before done any transaction then a notification is send to user. The system can be expanding to the school canteen that most of student is out of control and youngest age.

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