

Near Field Communication Based College Canteen

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Abstract: - In this paper, we put forth an effective and user friendly Near Field based communication (NFC) based Restaurant system for College Canteen. NFC is the technology currently trending which uses radio communication to communicate between two NFC enabled devices to send contact information, images, make payments, etc. within a short period of time. Using this potential of NFC, the students who order food in canteen have no longer to wait for placing the order instead she/he can directly order the food from her/his table.

Keywords: - NFC, NFC-enabled Smartphones, NFC Tag, NFC Card, QR code.

I. INTRODUCTION

The processes of ordering food in many college canteens comprise of several steps beginning after the students enter the canteen. After reading the menu, students would have to go to the counter to place the order, which will be fully occupied by the students and then wait for the food to get ready. Such a process has at least two demerits, one is ordering must be done in the counter and secondly, the student must struggle in the crowd to place the order. While the canteen is one of the business sectors in college with high competition, removal or reduction of such demerits will be of great benefit to the college owner in terms of promoting efficiency and reducing service cost. In the proposed system, we are planning to use the NFC reader/writer. The smart menu consists of QR Code and NFC Contact-less Sticker. The student scans the QR and tap on NFC card by his/her NFC-enabled Smartphone using NFC Read Application. If both are verified, the student gets the food menu into their Smartphone. They can select the food which is displayed on their mobile screen. Now, when they confirm, the order will be displayed in the NFC-enabled device. Once confirmed, the information will go to the Chef (inside the kitchen) and the Cashier. Now the chef prepares the food which is served to the student. Finally, when the student leaves, he pays the total amount manually to the cashier. The proposed solution tries to overcome the mentioned limitations by making use of the versatile nature of Smartphone and the upcoming NFC technology to implement the service automation for the restaurant. The result can reduce cost with canteen perspective and time in student's perspective.

II. RELATED WORK

A. Current Food Ordering Process:

1. Full Service Canteen: Current food ordering process used in most full-service canteens starts with the student checking out the paper-based menu, and then waiting in the line to inform in the counter to place the order. This process typically requires the students to be seated in the canteen and to place the order in the crowded counter.

2. Automatic Food Ordering System: In order to enhance student experience and reduce service costs, few restaurants have invested in the automatic service system. The automatic system takes the food order from students ranged in various forms, but mostly consists of an electronic device with a screen that shows the menu and accepts user input for placing the order [2]. The proposed solution provides alternative ordering option to students and is beneficial to currently existing process in various ways portrayed in following figure 1.

B. Related Technology

1. Android Smartphone device: The proposed solution's prototype is advanced on an Android Smartphone device. Whereas, as a commercially graded solution, it will be needed to support NFC based android Smartphones from manufacturers such as Microsoft, Nokia, Apple, and Blackberry.

2. NFC: The Near Field Communication (NFC) is the communication technology which enables transmission of data between electronic devices within a short-range developed by Sony and NXP. Major manufacturers of Smartphones are inculcating the NFC technology into their Smartphone devices and Tablets including HTC, Samsung, Nokia, Google, and Motorola; as for example. The 3 Means of Application of NFC are sectioned as follows:

- Card Emulation: It Enables NFC devices to work as contact less cards. It includes NFC-enabled mobile phones which are used for making payments and transit.
- Reader/Writer: It Enables NFC devices to work as Reader/Writer and interact with NFC tags. It consists of NFC-enabled mobile phones which are used to read “Smart Posters”.
- Peer-to-Peer: it Enables NFC devices to interact with each another. It connects NFC-enabled printers or laptops or for sharing photos between a TV and camera.

The NFC technology uses the radio communication on the frequency 13.56 MHz, according to the ISO18092 standard. The Smart Poster consists of the paper based poster with the NFC tag attached on it. This tag normally contains wide information regarding the contents present in the poster. As the NFC tag attached in the smart poster is capable of short-range wireless communication, when a user places the NFC enabled device near the tag (usually less than 4cm), the device is then able to detect the presence of the tag, read information from it, and then the device will carry out required actions accordingly. Even though the tag can contain any data, the NFC Forum has put forth a standard named NFC Data Exchange Format (NDEF), which is to be used as a standard format of data stored within the tag. This proposed solution will make use of Smart Poster which contains data in the NDEF form with e NFC tag attached to it. These posters can be place in crowded area to attract the student’s attention easily. In canteens, to obtain the pre-order, students can touch the poster with their NFC-enabled Smartphone device. By the means of NDEF standard, the Smartphone device can be setup to automatically verify the PIN in the particular application installed to handle the data read[1]. If the user has not installed the particular application, the canteen can provide this application to the student or keep a NFC tag which redirects the student to the website of the canteen to download the application.

III. NEAR FIELD COMMUNICATION

NFC [3] [4], is an instinctive easy and technology that allows users to use their Smartphones for special purposes. NFC tags or contact-less reader [5] can share and link to information such as web pages, databases, social media and all other sorts of information. As described earlier, NFC can work in 3 modes and they are NFC reader/writer, NFC peer-to-peer and NFC card emulation. NFC tag is shown in the figure 1

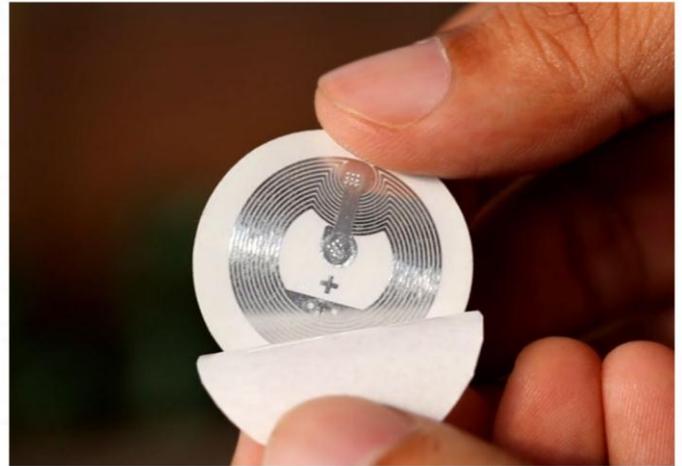


Figure 1. NFC tags

NFC is starting to evolve into scanning the NFC tags in the places to get the Travel information, making payment, exchange money for a ticket simultaneously, etc. All of these actions does the same procedure, that is they induce an action based on the user placing their NFC enabled phone (or any other NFC device) near the object that the user wants to read or interact with. Thus, NFC acts as a bridge those gaps between both the virtual and physical world. There is a virtual reaction by bringing two devices near each other. NFC uses electromagnetic induction between 2 devices operating within globally available unlicensed radio frequency ISM band of 13.56 MHz on ISO/IEC 18000-3 air interfaces at rates ranging from 106 to 424Kbps. This act of communication between two devices is called as ‘Tap-in’ and the electrical communication is called ‘Inductive Coupling’. In order to obtain the information embedded within the tag, the user has to scan/tap the NFC Tag/Reader via a Smartphone. As compared to NFC setup, Wi-Fi and Bluetooth do not have this ease in set up. So, the key feature of NFC is automatically getting the data on to user phone’s screen without user accessing it. In more technological terms, NFC defines the way two products communicate with each other. NFC is a short-range wireless RFID technology [6] (1-4cm. realistically, 10cm. theoretically), which uses low speeds (106-414 kbps) and a low friction setup (no discovery and no pairing), which permits two devices to automatically start communicating when they are close to one another. NFC uses passive targets with/without batteries and random devices that may/may not be powered, so-called tags or stickers, sometimes NFC contact less reader. NFC Tags/Readers are essentially “targets” that “want” to be touched by NFC devices like mobile. These can contain information, applications or services. NFC is coming to many phones and handset manufacturers like HTC, Nexus, Samsung, Sony and Blackberry have been pushing the

deployment of the technology [7]. The various applications of NFC is shown in the figure below

IV. THE PROPOSED SYSTEM

A. Service Scenario:

The proposed system comprises of 2 components, NFC-enabled Smartphone and NFC Smart Menu which consists of QR code and NFC card. The service scenario is described below:

Step 1: The Students need to have or download NFC Read Application.

Step 2: The Students need to register himself by providing their information such as Name, Phone no., E-Mail id, etc.

Step 3: The Students need to tap on the QR code PIN in the application and enter his name so that he can scan the QR which is present on the table to obtain his/her PIN.

Step 4: The students need to tap on the Tap NFC in the application and tap his/her NFC-enabled Smartphones on the NFC card which is present on the table.

Step 5: The PIN which is obtained by scanning QR and the table number is encrypted and embedding within the NFC card by the canteen people before the customers enters the canteen.

Step 6: If both PIN in QR code and PIN in NFC card are validated, then the customer can see the Menu in their Smartphones from which they can select the food and confirm the order.

Step 7: The Canteen people can see the Students order in their respective system and process the order. The Students also obtain Bill to their E-Mail ID after the order is processed.

B. Smart Menu:

It will contain QR code and NFC Tag. Students Must Scan the QR code to get the Pin No Which will be in the form of Plain text to get an Access to the Service.

C. NFC Write Application:

The NFC writer application is used by the canteen employees to write into the NFC tag. The details entered by the Canteen employees are the table number and the user pin. The snapshot of write application is shown in figure 2.

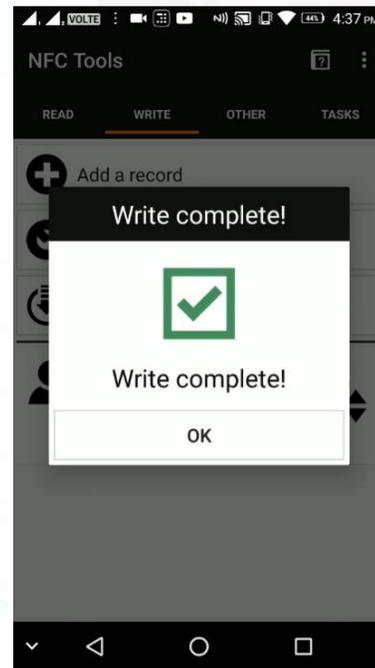


Figure 2. NFC Write Application

D. NFC Read Application:

The NFC reader application is the one which is used by the customer after they enter canteen. The snapshot of read Application is shown in figure 4. The NFC reader application is used by the customers to register their details (name, phone no., e-mail id and place) by pressing on the 'REGISTER' button. After registering, the customer scans the QR code to generate pin by providing username using 'QR CODE PIN' button. Then he/she taps the NFC card by tapping the 'TAP NFC' button. The card also contains a pin, and the application validates whether the pins are same. If the Students have checked in previously then the Pins will be same then there is No need to validate the pin again students can get direct access to the Service and Can Place the order directly. The app also gives information about the complete order and gives the total cost of all the items of the order so that the user can pay the final amount.

E. Web Application:

The Web Application has the facility for Admin and Support user login as shown in figure 5. Admin is a single person Controlling the entire Canteen and Support users are Chef, Cashier, etc. The Admin can add, remove and edit support User's details. Admin can also add, remove and edit food categories and food items. She/he can also view the order details placed by Students and obtain details about daily transaction summary. The support users can also view order details in order to process the Students order. For example, a chef can see the order details as soon as Students

place, in his/her screen which is placed in the kitchen so that chef can process the order i.e., in this case, prepare food. Support users can also clear the order placed by the Students as soon as the order is completed. In general, the web application is front-end for Canteen people.

F. Server:

The Smartphone application NFC Read App communicates with the server using wireless application protocol (WAP). The server used here is the Apache Tomcat 6.0. The web app is as the front-end for canteen people and server app is used to communicate with the Smartphone application.

G. Database:

The database is used to store almost everything. MySQL Server 5.0 is used as the SQL Server and SQLyog is the interface for the database. Here, the admin details, support user details, food category, food items, order placed by customer, order summary which included date & total amount and table details are stored in the database. The content of the database is shown in the NFC read application and web application.

V. TECHNICAL ARCHITECTURE

A. System Architecture:

The architecture of the system mainly consists of the NFC card, android application, user-server, database, admin and the support users. In his NFC-enabled Smartphone, user taps on the NFC card after which by using wireless application protocol (WAP), Smartphone application communicates with the server. The food items and the user data ordered by each Students are stored in the database. Also the details of the admin and the support users are stored. The customer can communicate with the system through the mobile application. The Student's Smartphone is connected to the server, as soon as the tap in is done. The information regarding the orders is sent from the mobile to the database which is also displayed in admin and support user's system for order processing. The architecture of the system is shown in figure 3



Figure 3. System Architecture

B. Context Analysis

By using the J2EE web application, the admin enters the details of the support users, the food items and other information. Regarding the successful input of the data into the application, the admin then gets the confirmation from the application. The support users can inquire any information regarding the orders placed by the users via the web application. The web application will then display the available information in table wise details for every user. On the student's side, they tap the NFC tag to get access to the menu in the mobile application from which they can place their orders. The orders are then passed through to the support users and the admin via the web application. After which the user gets the confirmation regarding the successful ordering of items. The context diagram of the system is as shown.

C. Data Flow

The working of the NFC Food Ordering System is quite apparent. The student first scans the QR code and gets a pin. Then, they tap on the NFC card. The menu is displayed to the customers only if both the PINs are matched. Now, the students have access to select from the various items from several categories. Once the food order is confirmed by the students, the details are sent to the web application which is continually being seen by the canteen people. Since the customer's order is stored in the database as soon as they select it, the orders are also seen by the support users and admin. The students can also view the details of the order in the NFC read app as soon as they place the order. If the PIN do not match then, the students are taken back to home screen of NFC read app by displaying that the PIN is not validated. The data flow diagram is shown in figure 4

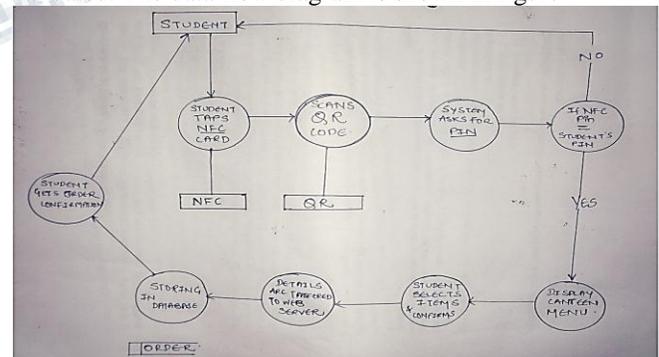


Figure 4. Data Flow Diagram

VI. RESULT

The Application is Very Convenient and easy for the Students and Canteen workers to capture pre-order transaction. It can be summarized as, Students just have to pick a phone, by placing it at the food poster then clicks confirm and should proceed with orders. The cost of the

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solution is comparatively low as compared to other alternatives. The NFC based applications are implemented in limited Smartphones. The Application can be commercially very useful only when The NFC based System is implemented in every Smartphones.

VII. FUTURE ENHANCEMENT

The solution model can be not only used in Canteens but also an extended to capture pre-order transaction or to Place actual order for other retail products and services. NFC Payment is one of the latest technologies which is setting its trend over the world. Apple Pay, Android Pay and Samsung Pay, PayPal are examples of NFC Payment Application. It completely eliminates the use of cash and credit/debit card for payment. The users just have to save their credit/debit card details once in the application. So, in order to pay, user just needs to tap on the NFC Payment machine. The transaction will be completed within a fraction of second. The Application can be extended such that, once the user gets the bill, he/she can tap on the NFC payment machine and transaction is done automatically. Thus, eliminating cash and credit/debit card.

VIII. CONCLUSION

The wide use of the Smartphones and Tablets gave us new opportunities for services sector business to increase its capability in many ways; to have more reaches to its Users, service automation can gave more efficiency, and attractiveness can be obtained by giving good quality of service experience. The upcoming NFC will reinforce its possibility and usefulness. The proposed Application provides easy, convenient and cost-effective way to capture pre-order transaction from Users. The most part of order process can be primarily done without the requirement of waiter staff assistance. The process is intuitive, User just scans the Smartphone on the smart menu, and only another touch is required to confirm the order inside the Canteen. The implementation can result in cost reduction incurred by utilization of Canteen facilities and waiter staffs; also the need to stand in a crowded environment to place the order is eliminated. Despite the shortcomings of the Application that requires NFC based Smartphone adoption. The solution employs technology that is available to the mass market; choices for implementation can be unlimited and cost effective.

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