NFC Based System for Smart City

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Abstract- In the era of information technology everyone tries to find simple way to make their job as much as easy without any workload. Everyone knows the condition of Indian railway system, traveling via railway is one of the most tedious things in the world. Similarly, in money transfer lot of paper work or account holder needs to have online banking knowledge. There are multiple accounts of one user and we have to remember their various codes and password for their further banking operations .So we are designing a system which overcomes the workload of Ticket checker as well as passenger or user .We use NFC base technology for developing proposed system, in which with the help of NFC enable phone, ticket checker can check the correctness of passenger ticket, on the other side we will create the Android application which gives simple way to passenger to view train schedule and book the ticket. In this Android application we will create database where all the information about passenger will be store. This application can be used in places like car parking and restaurant. At parking user will enter pin and will select parking hour from drop down and parking amount will get deducted from account. Thus we are proposing a new way for money transfer from one NFC mobile to another NFC Device.

KEYWORDS- Aerial surveillance, dynamic Bayesian networks (DBNs), vehicle detection

1. INTRODUCTION

Today, various public transport agencies in Europe, United States, and Japan have implemented the use of NFC-enabled mobile phones. NFC is used in the reference of transport ticketing in gateless systems to enable a normal start-up program. Other trials do retail contactless payment cards to the ticketing options. Multiple applications, along with online payment and over-the-air ticketing, have also been enabled by the phone.

NFC is a wireless short-range communication technology that enables simple and intuitive two-way interactions between NFC devices. With NFC technology, consumers can do contactless transactions, access digital data and connect NFC-enabled devices with a single tap

NFC requires close proximity by design and it offers instantaneous connectivity, which provides an intuitive user experience that can be readily applied to the transmit environment.

Within the improvement of technology, problems in banking transaction have been overcomes by integration customer's accounts to the internet. It can be seen from the existence of I-Banking and M-Banking as main features of banking services. The ability to do transaction anytime and anywhere isn't only good for Bank's management, but also several service providers and sellers also make use of banking features to chain an amount of transactions

happened. Proven by viral development of online shops that take benefits from payment feature to shop's bank account.

The ability to form fast transaction can be done almost border less with the existence of e-Money feature. Take an example from a private bank in Indonesia, this particular bank has deployed a card embedded with a particular device which can be detected using radio signal that intended to replace small denomination and increase the speed of transaction. This particular development of technology is not only used by banking sector. Google Inc., in 2011, launched Google Wallet feature as the substitution of credit card which essentially works as combination of credit card and certain equipment that can be detected through radio signal located within a cell phone.

The NFC technology implementation directed for quick transaction such as supermarket payment or ticketing payment. NFC implementation as transportation ticketing will be largely beneficial for reducing queue line in counter, reducing robbery cases as well as prohibited ticket trading which arrive in this country. Train is commonly used by people. Every day, train station establishes large number of transactions. Furthermore, self-hold ticket has become another particular problem from the passenger side. By simplifying the ticketing process and exchanging ticket physical form to virtual one, then the development will not have limited only for payment transaction. This particular technology can be implemented as one of the way to substitute current ticketing.

This study will be focused in application of NFC technology as transaction tool for transportation system, particular in train so that the passengers can easily perform the ticketing payment. Furthermore, ticket transform can be done through the NFC technology application. User can also book a parking lot and pay restaurant bill using NFC technology.

2. RELATED WORK

NFC applications have been deployed in transport programs in a number of countries, including a variety of ecosystem players and transport modes. Following are few successful programs.

London – Transport Ticketing on NFC Mobile Phones In London 2007, a trial of NFC for mobile transport ticketing and payments was carried out in London. A collaboration that involved the transport supremacy Transport for London (TfL), phone provider O2, Nokia, Barclaycard, and Visa, it was conducted to test user demand for having payment cards normally carried in a wallet. This trial was a large-scale customer research and feedback project implemented to understand a series of customer experiences enabled by NFC. For TfL, it was main to obtain specific understanding of user' use of mobile handsets for transport as a potential option to Oyster cards. The project involved 500 O2 users, who were given Nokia handsets with NFC functions.
NFC applications were used:

O2 - Participants could use their NFC mobiles to tap and gain entry into the Blue room at The O2 Arena –the exclusive bar for O2 users and guests at the venue.

Oyster – The trial mobile were all enabled with Oyster functionality, which permit each user to use the handset in place of an "adult" Oyster card to load "pay as you go" money and pay for travel ticket on the Tube, buses and trams across the city. Each trial user was given £50 in free credit.

Barclaycard payments – participants were given £200 prepaid to make low-value payments. In addition to making payments, they were able to use their NFC-phones to check available balance and locate neighborhood retailers that accepted contactless payments. This application was provided through the Credit card scheme, along with standards for contactless payments. Key findings of the research were that users maintained high levels of interest and satisfaction throughout the trial and that the main user benefits were convenience, ease of use, and status.

San Francisco – In 2008, the contactless payment option provider ViVOtech enabled the BART (Bay Area Rapid Transit) NFC mobile payment in San Francisco. In an association with Sprint the project enabled hundreds of commuters to ride BART just by tapping their NFC mobile phones at the doors to gain access to the stations. The design was the first in the US to combine mobile-enabled transportation with mobile payments at merchant, by allowing users to use their phones to pay for food at Jack in the Box locations around the Sale Area. In addition, the trial featured targeted promotions to users via Smart Posters at BART transit stations that helped drive traffic to providers. The design was a major success, enabling several thousand mobile-enabled BART trips and foods at Jack in the Box, with a very extreme rate of Over-the-Air (OTA) top-up of both BART and Jack in the prepaid accounts. ViVOtech developed its award-winning mobile wallet, OTA provisioning contactless payment readers in stores.

2.1. Comparison to Other Technologies:

2.1.1. Benefits of NFC Phones vs. Paper Magnetic Stripe Tickets

Paper tickets can wear out with use if they are repeatedly inserted into readers. Tapping an NFC enabled phone at a contactless reader need no moving parts that could wear out. An NFC-enabled phone is more reliable and more convenient than a paper ticket, so the user will get through the gate quickly and more reliably. Tickets stored in phones are not as much to be lost than paper tickets.

Studies have repeatedly shown that people are less likely to depart from home without their phones than without their wallets. Putting a ticket within a phone means fewer lost trains or buses due to long lines and no more buying one-time tickets because of a forgotten ticket.

Obtaining a ticket is much more appropriate, because it can be sent electronically to the NFC-enabled phone. Users do not require visiting a ticket office or line up for a ticket machine.

2.1.2. Benefits of NFC-enabled Phones vs. Contactless Cards

Contactless smart cards can hold electronic tickets because of that, they give some, but not all, of the same user benefits as NFC-phones in replacing paper tickets.

An NFC phone can hold more than one ticket from more than one transport operator. Thus, along with their wallets, user can manage all their tickets in their phones, along with similar items like payment cards. With contactless smart cards, a user must carry several different physical cards in a physical wallet.

A user can easily select which application to use from a menu display application set on the phone. With contactless smart cards, a user would have to physically remove the chosen card from a wallet, pocket use it, and then run the risk of missing the ticket.

Smart cards stored in an NFC phone are less manageable to "collision." If a contactless ticket card is kept in the wallet as another contactless card, such as a smart card or identity card, and the wallet is tapped to the reader can't recognize which one to read and the fence won't open.

Using their NFC-enabled phones, user can manage their smart cards and tickets anywhere at any time. tickets can be renewed over the air; there is no need to physically visit a ticket office and this can be done while a user is walking from the parking lot to the train station or bus stop.

2.1.3. Benefits of NFC-enabled Phones vs. Online Ticketing:

Online portals provide consumers with the convenience purchasing travel tickets in the agreeable of their own homes from their PC. Electronic tickets can be picked up from a designated ticket office, ticket machine, entry gate, can be downloaded to the PC and printed out as (for example) 2-D barcodes. The benefits to users of using NFC phones instead of computers are:

By sending the electronic tickets to their NFC phones that can read and show the ticket details, users are immediately assured that they are correct tickets. They don't require waiting until they start their travel for that confirmation.

NFC phones give us simple, fast access to web services and information. By using the phone as an alternative of the PC, tickets can be managed from the phone, anywhere and at any time.

E-tickets mean that people don't have to take paper tickets from the PC, do not have to remember to bring the tickets, and can't lose them. By using their NFC phones as part of their traveling, consumers can derive further benefits, such as:

Obtaining information of specific Attraction to the consumer by touching an NFC -enabled phone to a smart poster and being automatically directed to the respective internet page or website

Receiving special offers and information about seller and retailers in or near the station or airport

2.1.4. Benefits of NFC phones vs. Barcodes

Benefits associated with NFC phones are:

Two-dimensional barcodes are easy to transfer to a phone but can often be conflicting to read. The phone must be held at just the right angle and a required for repeated tries can cause delays. NFC phones can be read in a short,

broader range, avoiding that problem. In a busy station barcode readers get dusty, and not clearly seen by the reader.

NFC ticketing is also faster and smarter. There is no need to open an application to find the 2d barcode.

NFC phones are two-way devices, enabling the user to both send and receive information, while 2d barcodes are read-only.

3. PROPOSED APPROACH

The design has identified three basic use cases for NFC: connection, access, and transactions. All have application in transport. For example, an NFC phone can connect with an NFC -enabled booth to download a ticket, or the ticket can be sent directly to an NFC phone over the air (OTA). The phone can then tap a reader to rescue that ticket and gain access.

Tags may be of particular interest to transport officer, as they can be included in posters, products, maps, etc., to give transport service-related information. These low-priced tags can be included in smart posters and can contain an information or automatic links to pertinent data and transport service websites. Examples of information that can be accessed and activities that can be started by tapping a tag with an NFC phone include:
• Transport schedule
• Links to weather report website
• Location-relevant map
• Next bus arrival time
• Taxi services
•Phone-to-phone transfer of destination addresses.
• Emergency calls
Let's look at some ways in which NFC can improve the traveller's experience.
Before the journey:

Jack is planning a day trip to London to visit some museums. He has checked the fares online with his mobile phone, purchased his train ticket, reserved his seat, and downloaded the ticket to his phone. The ticket also includes a one-day parking pass at his local station.

While waiting for the train, jack remembers that he has a loyalty card stored in her phone because he is a frequent traveler. This enables his to touch a reader on the door to enter the executive station to wait for the train. There are smart posters on the walls of the lounge, and he taps her phone on one to download alternative return timetables in case he runs late. One of the museums he plans to visit is advertising a decreases admission fee, and she taps poster to download the discount coupon and store it in her phone. He also taps to opt in to promotions from stores and restaurants in the neighborhood, and he instantly receives token in her phone. With these waiting-room posters, the retailers have an opportunity to using NFC to pay for parking
During the journey:

Jack uses his phone to tap a reader, redeem his ticket, and board the train. He holds his phone out and displays his ticket and reservation to the conductor, who asks if he would like to purchase a newspaper for the journey. Jack taps the conductor's handheld reader with his phone to pay for the paper. A colleague he hasn't seen in some time sits

down next to his. They tap their NFC -enabled phones together to exchange information.

The journey ends pleasantly, and jack hails a taxi. He pays the driver by touching his phone to the reader in the cab and receives a virtual ticket in return, which he stores in his receipts folder in the phone. At the first museum, jack redeems his discount coupon when he pays his admission fee with his phone. While he is visiting the second museum, however, he receives an SMS saying his return train has been retard. He checks the other times in the schedule he downloaded that morning in the station and requests a new seat reservation, which is sent to his and stored on his phone.
After the journey:

Jack has spent a pleasant day, and the delay on his return trip was not long. He knows that each time he used his phone to pay that day, he received receipts in return. He checks his phone when he gets home and sees receipts stored for the train fare. He taps the phone to his NFC -enabled pc and transfers the receipts to her company expense report.
Benefits of NFC for transport:

Mobile phones are network-connected and have easy-to-use sound and text interfaces. They give us anytime-anywhere access to information and applications are easy to download over the air. When these features are combined with NFC, travelers can experience a new, intuitive, and rewarding experiences on their NFC enabled mobile phones.

Benefits for travelers:

From the traveler's perspective, NFC-phones have great benefits over paper tickets. Tickets stored digitally in phones are constitutionally more durable, less likely to be lost, and are appreciate to be more environmentally friendly than older versions. They are even more appropriate than plastic cards, with no groping in a wallet for the right card. NFC phones can carry multiple payment applications, allowing the traveler to choose which method to use credit, debit, travel passes, or prepaid tickets. Updates are easy and can be done OTA, avoiding a trip to the bank or other point of sale. Travelers can tap information tags embedded in posters to download train information on nearby attractions, upgrade the passenger's travel experience as well. A simple tap also gives fast access to Internet services and rich information. NFC can also be included into readers to enable services such as lease bicycles or opening storage lockers.

Benefits for Transport Operators:

Existing programs have shown an increase in traveler simplification because easy and contactless ticketing and payment solutions. In closed gate systems, outcome has increased and bus boarding times have improved.

Transport operators can also beneficial from overcoming operating and maintenance costs by cutting

down on the use of ticket machines, paper tickets, ticket collectors, and even ticket sellers. Paper tickets require production, storage, and distribution. Kiosks require maintenance, and costs for all of these processes can be high. User service issues with lost paper tickets are costly, and environmentally unfriendly paper tickets can be unfavorable to a transport operator's image.

A mobile device allows the operator to give additional services such as language settings, advertising and promotional opportunities, tourism information, direct marketing and loyalty schemes. Risk management can also be improved through the use of NFC phones for over-the-air blocking and updates to prevent fraud, general management information, and know-your-customer protections. The speed of over-the-air updates is a major benefit compared to delays that can occur when blocking contactless cards.
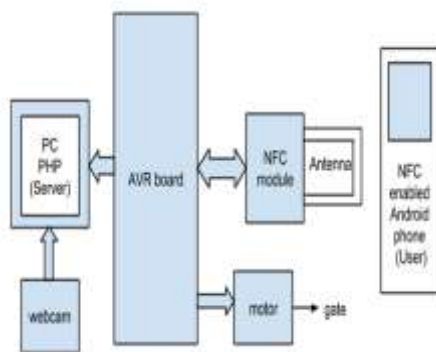
4. DETAILED APPROACH:

Fig. 1. Architecture of System.

PC: PC/laptop server, which is developed in PHP.

AVR Board: AVR controller acts as an interface between the user and the server.

NFC PN532 module: This is the NFC breakout board which decodes the information in the Android mobile of the user. Like the source and destination.

NFC enabled Android Phone: As mentioned, user with this phone taps it on the PN532 module's antenna and receives the message for tapping. If successful, balance will be deducted otherwise will tell about insufficient balance. Else error message will be displayed.

5. FLOW OF THE SYSTEM:

User: User will have NFC enabled phone. User will visit Metro station. User will enter source while entering the station and destination while exit. User will fetch pin and

amount from server at restaurant. User will fetch pin, and select timing to book a slot at parking lot.

NFC enabled Android Mobile: It will provide User Interface to the user. It will send data to other NFC module on tap with the module.

Server: Server will store user details. It will calculate fare as per source and destination received. Server will generate cost for parking lot. Server will deduct amount from user account on transaction and update the user account.

Payment gateway from NFC

- Metro--> select source and tap --> set flag as in at departure select destination and tap. Server gets source and destination and then cost deducted from his account.
- Restaurant--> enter pin and amount and tap. Random amount generated and deducted from account.
- Car parking--> enter Pin and parking hr. from drop down and background amount will get calculated and deducted from account.
1. Gate mechanism on successful
2. transaction for metro
3. User side android & server side PHP
4. Ardusino microcontroller interface with NFC-module

Mobile to mobile transaction:

- Credit transfer between two NFC Devices
- Database store entry of Transaction
- Firstly, receiver mobile tapped to sender
- Sender get information of receiver and send credit to receiver
- Sender conform OTP and Credit is transferred to receiver registered account
- Notification goes to both devices

Technology used:

• win 7/8/10, 64-bit – 40GB hardisk,1.5 GB RAM

• Jdk 1.7.0_60

• MySQL server

• Visual Studio

• Android Studio

• Android 4.0 and newer

• NFC Kit

• Arduino

6. ADVANTAGES & DISADVANTAGES

Advantages:

- It provides simple way in making payments through NFC enabled devices reduces the use of counting out the cash & credit/debit cards.
- Simple to install.
- It reduces the cost of processing paper tickets and workload of ticket checker as well as passenger gets reduced.
- It Remove all paper work with NFC enable smart phone and NFC TAG as ticket.
- It is more secure as no one can scalp.
- NFC is really fundamentally secure by propriety, of its extremely short range in order to catch your NFC signal, a hacker would need to be very close to you.
- NFC does not require line of sight. The reader can communicate with the tag through radio waves.

Disadvantages:

- Poor interaction rate can occur if the reader and receiver are not properly aligned.
- NFC technology that ultimately that allows user to be identified by a central database. This database will certainly be under attack by hacker.
- Conflict has been observed if devices such as forklifts and walkies-talkies are in the vicinity of the ticket counter.
- Require NFC embedded mobile
- Does not cover long distances

7. CONCLUSION

We aim to implement a Train Ticketing System using NFC Technology. The system is designed to generate NFC tickets, thus overcoming human effort and making the process automated. NFC tickets helps in identifying people traveling in the train providing security. The Passengers only need to carry their NFC enabled android phone and recharge their account when the balance is below the required ticket price. They are much more convenient compared to the current ticketing system as it eliminates wastage of papers.NFC technology can be used to simplify Car Parking System Multiple Credit Card can have used by one virtual card in NFC Mobile, Mobile to Mobile Credit Transfer

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