NFC and QR Code Enabled Smart Exhibition System

Submitted By

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NFC and QR Code Enabled Smart Exhibition System

Major Project

Submitted in partial fulfillment of the requirements

for the degree of

Master of Technology in Computer Science and Engineering

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Certificate

This is to certify that the major project entitled **"NFC and QR Code Enabled Smart Exhibition System"** submitted by **Parth H. Jain (Roll No: 15MCEN08)**, towards the partial fulfillment of the requirements for the award of degree of Master of Technology in Computer Science and Engineering (Networking Technologies) of Nirma University, Ahmedabad, is the record of work carried out by him under my supervision and guidance. In my opinion, the submitted work has reached a level required for being accepted for examination. The results embodied in this major project, to the best of my knowledge, haven't been submitted to any other university or institution for award of any degree or diploma.

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Statement of Originality

I, **Parth Jain**, Roll. No. **15MCEN08**, give undertaking that the Major Project entitled "**NFC and QR Code Enabled Smart Exihibition System**" submitted by me, towards the partial fulfillment of the requirements for the degree of Master of Technology in **Computer Science & Engineering(Networking Technologies)** of Institute of Technology, Nirma University, Ahmedabad, contains no material that has been awarded for any degree or diploma in any university or school in any territory to the best of my knowledge. It is the original work carried out by me and I give assurance that no attempt of plagiarism has been made.It contains no material that is previously published or written, except where reference has been made. I understand that in the event of any similarity found subsequently with any published work or any dissertation work elsewhere; it will result in severe disciplinary action.

_____

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- Parth Jain

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Abstract

Use of mobile phone is increasing nowadays. With the evolution of the 'Information and Communication Technology' (ICT), there are different technologies available for accessing data. NFC and QR code is very useful technology nowadays. These technologies differ from each other and mainly useful for small size content sharing and automation.

In the exhibition, different videos related to exhibit item is displayed. If a visitor wants to acquire an idea about the exhibit, then the visitor has to wait for the video to start. In this work, framework based on NFC and QR code is proposed. Which helps visitor to get content related to exhibition system. This framework can help visitor to easily access exhibit content through local network available at exhibition. When visitor want to get video then, visitor can initiate connection to connect network using NFC and QR code. This will automatically stream video to visitor's phone after connecting the network. Framework is also beneficial to exhibitor to manage videos, and transferring data securely to visitor.

Abbreviations

Wi-Fi	Wireless-Fidelity.
NDEF	NFC Data Exchange Format.
NFC	Near Field Communication.
NFCIP	NFC interface and protocol
QR Code	Quick-Response Code.
RFID	Radio Frequency Identification.

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Chapter 1

Introduction

According to Wikipedia[1], in a most general sense, an organized presentation and display of a selection of the item is called 'exhibition'. In exhibition different items are displayed calls exhibit. It can include many exhibit items like art in the most of the museums, small galleries, and also there are history museums and also some focused exhibition.

In this, exhibits are displayed and the information of the exhibits are given to visitors using the posters, videos, and images shown on displays near the exhibits. In this work, our main aim is to give automate the content or information delivery method for exhibit using NFC and QR code technology.

1.1 What is NFC?

NFC means Near Field Communication. It is a short-range wireless technology useful for making communication between two devices. We can say that is a newer version of RFID, But still, it is more differ From RFID.
Based on the power it has two types [2] :-

- Active Type: The device has its own power for working. For example, NFC-enabled mobile phone like Sony Xperia z. This is very useful for beaming using mobile phone.
- Passive Type: This device doesnt have its own power. For working the device uses another device's power. For example NFC tag example. Mifare classic tag, Felica tag.

1.2 Work with the NFC technology

As shown above NFC has two type.in one type device has it's own power. Here in the system, one device is called 'Initiator' which uses a magnetic field to create radio wave and when the 'Target' will be detected. Then the target device can transfer some amount of data using that magnetic field to the 'initiator' device. The 'initiator' is always active means it has its own power, whereas 'Target' may work in both active and passive mode Generally the distance between two devices should be less than 4 inches or up-to 10 cm to communicate with each other.

Here the figure below gives basic idea about how the basic NFC work.

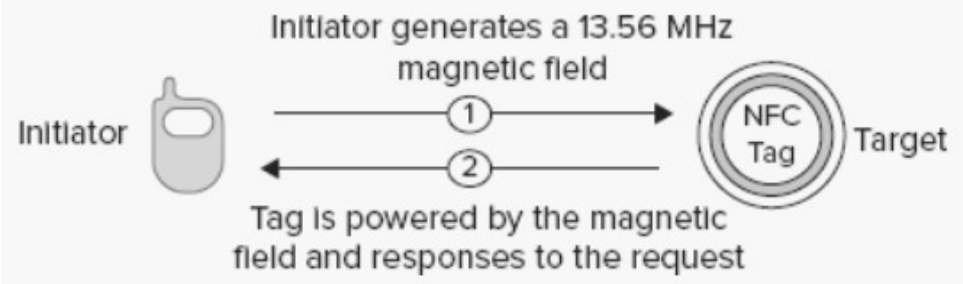

Figure 1.1: NFC Basic Work

1.3 What is QR code?

Quick Response code (QR code) is the 2D 'barcode' Developed by Denso-Wave Corporation at japan for inventory automation system.This name was given because of its complex structure of 2D barcode.

We need a special application for scanning the QR Code. Google has its own API for making QR code scanner, so there are many applications available which use the QR code. There are many cases where QR code can be useful:

- Payment:For making the payment QR code can be used. Example Paytm.
- Advertising: QR codes are used for 'Advertisement' purpose. If the user scans QR code than it redirects to the site related to the object. This is also called object hyper-linking.
- Security: In the security domain QR code also used for encryption.

Figure 1.2: QR code[3]

- Tracking the object: For tracking the object QR code is used. By scanning the QR code of the object the details about the location can be tracked with the software setup.

- Automation: Automation means minimize human intervention and get the work done. In this type of applications user just have to scan the QR code user do not have to manually enter all data.

1.4 Problem Statement

In this work, we want to do automation of information/content delivery in the exhibition system. At the simple exhibition, a visitor comes to the area and see the different 'exhibit' available. They can get knowledge about the particular 'exhibit' by the videos displayed there. If the video has already started than visitor has to wait for the time when it starts again. So this framework is all about if it can be possible that video will be streamed to the visitor's phone and the visitor can see it and all thing can be done in an easy way. But here the main problem is that

- Connect the visitor's phone to the local server using WiFi.

- Pass the link of the particular video to the visitor.

1.5 Thesis Overview

Following work is done and described in thesis.

- Different technologies are available for sharing data, But we need automation. Different kind of literature have been studied which is described in **Chapter 2**.

- In **Chapter 3**, idea about how the framework will be work is discussed. System flow for visitor and exhibitor is discussed.
- In **Chapter 4** is Implementation. In this chapter different technologies and tools is discussed, using which framework is developed. In this chapter also some programming related stuff for framework is discussed.
- In **Chapter 5** results means how the framework automates and how it helps in exhibition automation is discussed.
- At last **Chapter 6** conclusion of full work is discussed.

Chapter 2

Literature Survey

2.1 Introduction

The exhibition is the place where visitor can receive information about the exhibit item. There are many technology used in exhibition nowadays like NFC, QR code, Beacon. In papers some of the work done for Indoor Navigation system of the Exhibition. It is found that, many systems have been made using NFC and QR code, but in exhibition this is not widely used for information sharing role.

For implementing the framework, a survey from different papers has done. Some of the best Application scenario, which can motivate and give the ideas for making framework are as below.These applications and architectures are discussed as below chapters

2.2 NFC and QR code Related Papers

1. An NFC-based O2O Service Model in Exhibition-space [4]

Technology Used: NFC, Beacon

Summary of Paper: In this paper author gives idea about O2O based exhibition using the NFC and Beacon Technology. Using the beacon technology when visitor comes near the exhibit item and if visitor has the app then they can get small sized beacon message related to exhibit. In this author described how NBOS platform helpful to visitors as well exhibitor for promoting advertisement related to sponsors of exhibition place. By this exhibitor can create some revenue values.

Problem with System: User has to connect WiFi manually to get data at exhibition place. More beacons comes to visitors phone can be treated as spam.

2. Excavate and Learn: Enhance Visitor's Experience with Touch and NFC [5]

Technology used: NFC, Android.

Summary of Paper: In this paper author described innovative museum installation using NFC. The architecture of the system is given in Figure. In a paper given an idea for Archaeology related Exhibitions.

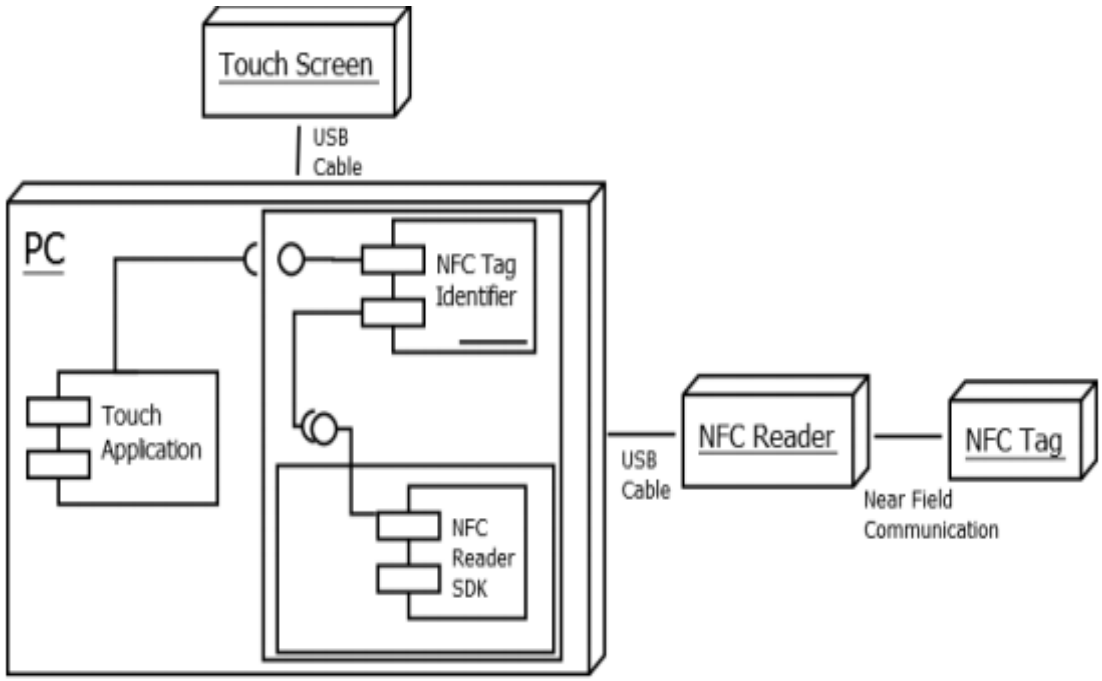

Figure 2.1: Excavate and Learn System

In the Exhibition, the visitor can choose objects, pick them up can understand some activities related to archaeology like observation, deduction, and analysis. After this, they can touch their phone to NFC tag so some quiz related to the object is now available for the visitor. In this way, visitors can Learn and enjoy the exhibition.

Problem in System: In this paper author described purely NFC based architecture. If visitor doesn't have NFC enabled mobile phone then they can just see the exhibit. They can not become part of learning process in exhibition.

3. A New Simple Wi-Fi Direct Connection Method using NFC on Remote Control and DTV [6]

Technology Used: NFC, Bluetooth, Wi-Fi Direct.

Summary of Paper: In this proposed architecture authors gave the idea that how

Bluetooth, Wi-Fi direct and NFC all can use together for making a connection with different devices. They discussed how the NFC-enabled phone can connect to the Smart TV using Remote control which contains Bluetooth and NFC chip. In this architecture, the author described the two-way connection for 'MiraCast' application.

1. Smart Phone to Smart TV
2. Smart TV to smart phone.

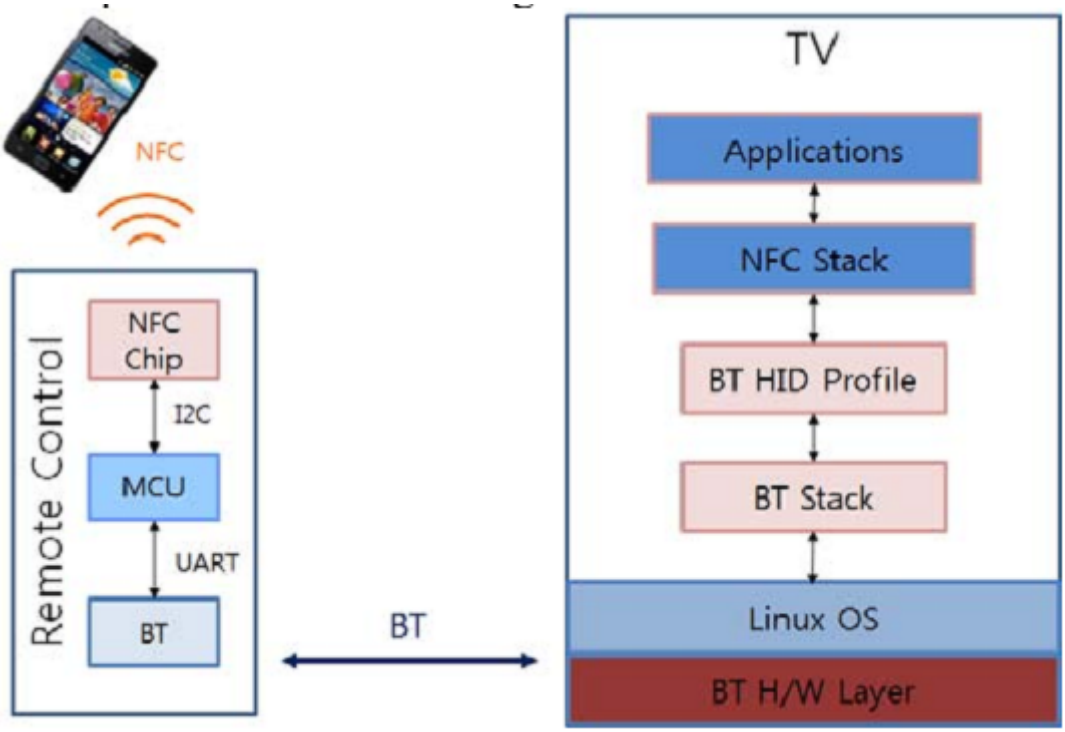

Figure 2.2: Mobile to Smart TV Connection using NFC

Here in both direction mainly MAC address and Channel Information is used to make NDEF message.

Motivation from paper: This paper gives an idea about how different devices can be connected using the NFC.

4. Interaction between small size device and large screen in public space[7]

Technology Used: QR code, Local Server system.

Summary of Paper: In this paper, the idea of the use of the large screen in public space is given. For interaction and connection to the local server, QR code is used by the application.

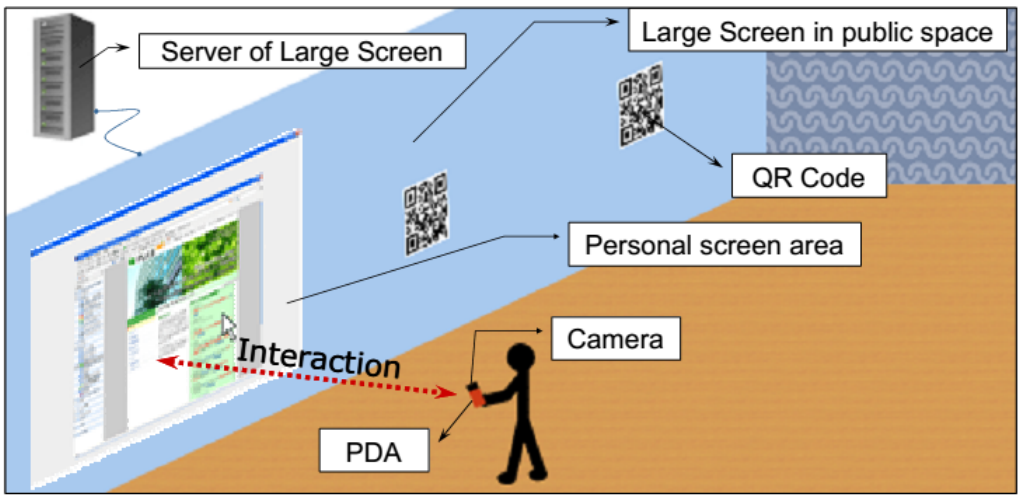

Figure 2.3: Use of Large screen area using QR code

By this user can use large screen instead of small sized PDA screen for their work. At last, the user has to pay for the usage of the large screen according to the usage hour.

Motivation from paper: This paper gives ideas about how QR code can useful for our application and for sharing the data.

5. Development of an indoor navigation system using NFC technology[8]

Technology used:NFC, MapServer

Summary of Paper: In the paper, Author proposed the idea for an application for indoor navigation using the NFC technology. The user can get the details about their place by interacting with the application proposed in the system.

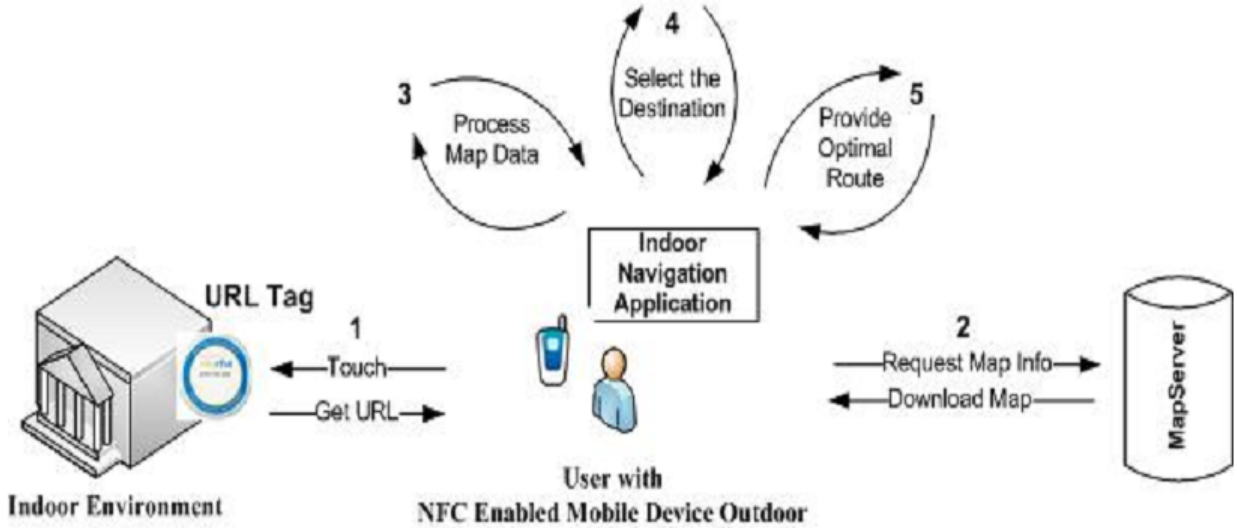

Figure 2.4: Indoor navigation system using NFC

Here application is connected with the *MapServer* from which the application get detailed data about user location and give an idea about how the user can move toward the destination in the indoor area.

Motivation from paper: This architecture gives the idea that NFC tag can be helpful for connecting local server, here the limitation is that there is processing time needed on MapServer for calculating the shortest path.

6. A User Interaction Model for NFC Enabled Applications[9]

Technology/Hardware used: NFC, Motorola E680, MSP430, Philips PN531

Summary of Paper: In this paper, the author gives an idea about how the NFC device can interact with the real world.

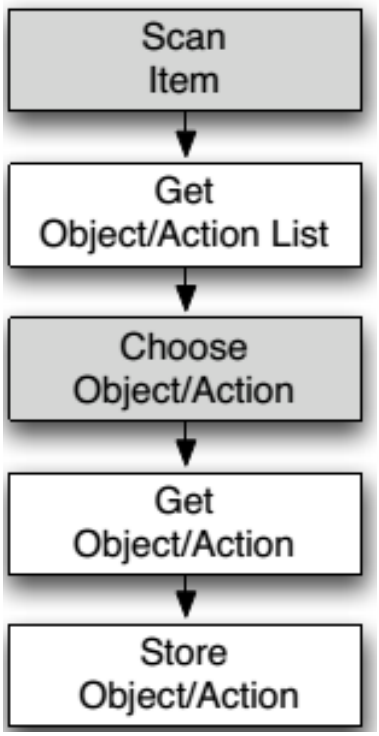

Figure 2.5: User Interaction Model 1 using NFC

Here in the figure above gray boxes actions are done by the user. For this model, the author gave an example of the smart movie poster. If in public area like mall there is smart movie poster with embedded NFC sticker, a person can tap the phone to the poster and can get details about a movie like a poster, trails and also can book the tickets for the movie. This all things can store in the mobile phone which can be shared by the other users.

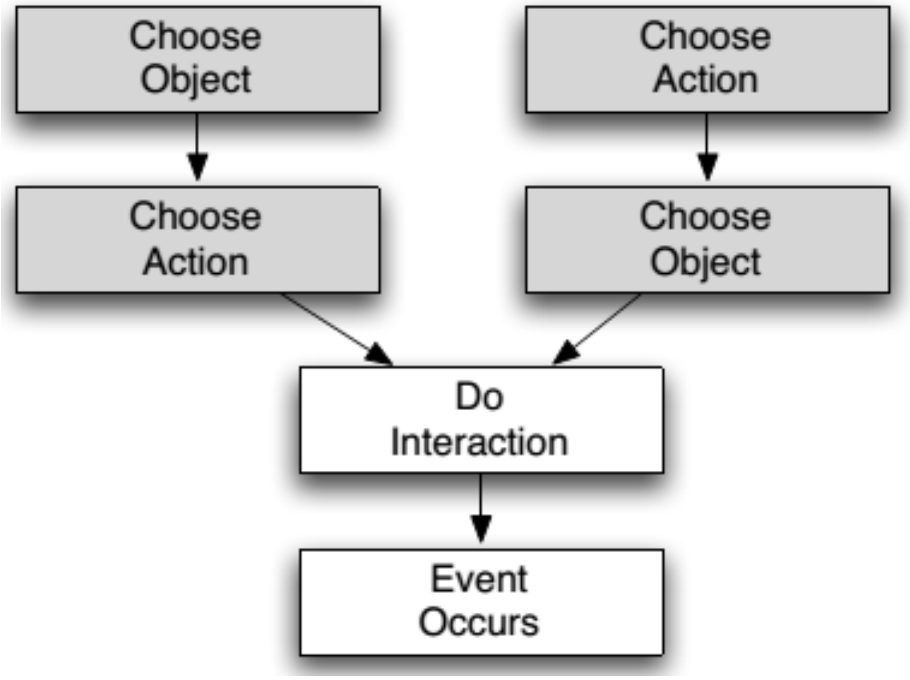

Figure 2.6: User Interaction Model 2 using NFC

For this author gives another interaction model which can work in active peer-peer mode which is as above.

7. Managing NFC Payment Applications through Cloud Computing [10]

Technology Used: Cloud, JAVA, NFC.

Figure 2.7: Fujitsu Cloud Based Project

Summary of Paper: In this paper, the author gives an idea about Fujitsu cloud-based project. Here for the different scenario like museum, school and conference room, the data is different. All the data is stored in the cloud. For all different places, there are different applications which interact with the cloud. They have given the idea like

ongoing the conference room there is NFC tag and user have the NFC-enabled device. If the user taps the phone to the tag the data will be automatically downloaded to the phone. At last, when the user goes out the conference room the data will be deleted automatically.

Motivation from paper: This paper gives us the idea that we can also use the cloud as our option of data server and also it can be beneficial for but it costs more.

8. Exchange of contact data between mobile phones using NFCIP [11]

Technology used: NFC, NFCIP in active mode.

Summary of Paper: In this paper, the proposed architecture is as above. In the paper, the author gives an idea about transmitting small data like contact details from one phone to another phone. For this, they gave an idea about the application names 'VisiExchange'.

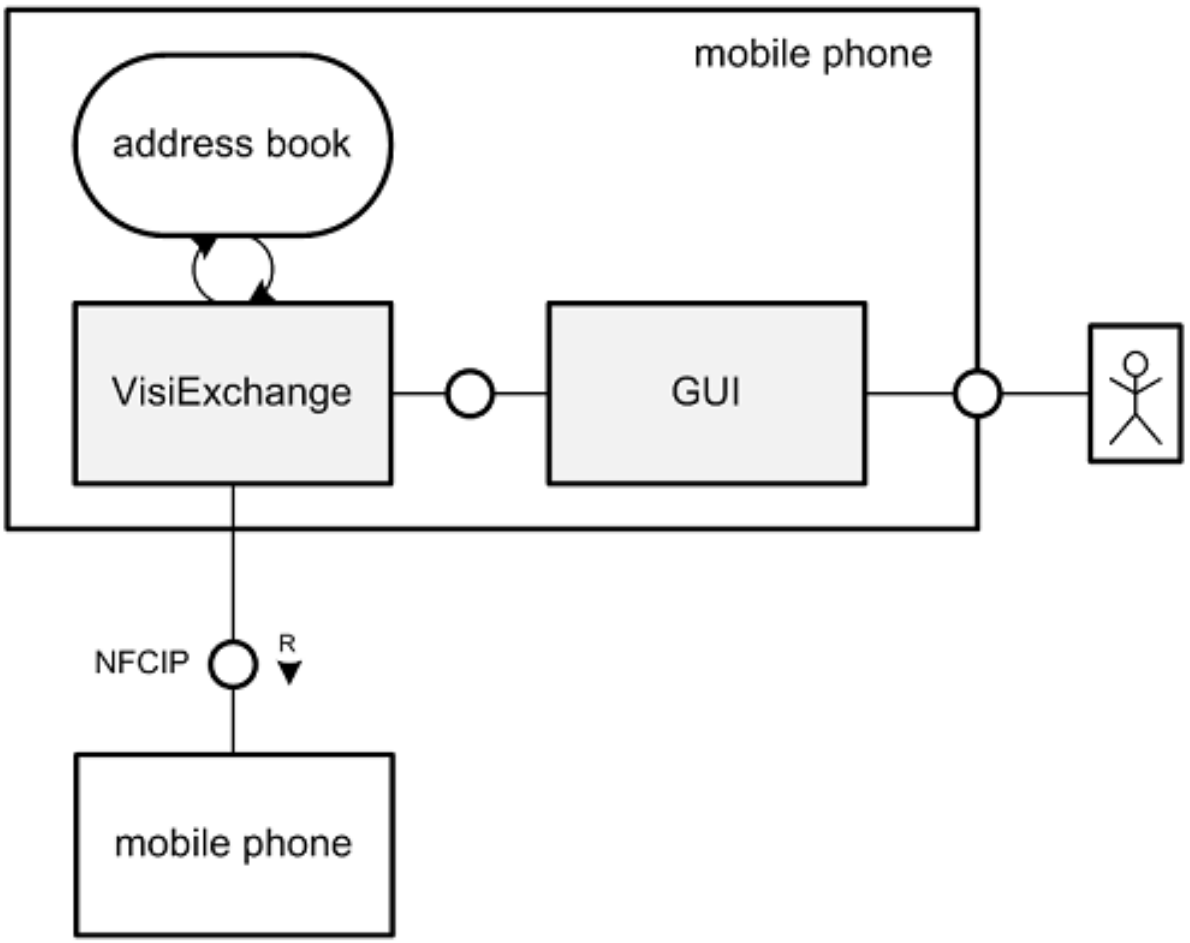

Figure 2.8: VisiExchange Application

Here mainly NFCIP is used for exchange information from one phone to another phone. Main modules of the system are:

- Make virtual contact list from main contact list
- Share to another user.

Motivation from paper: This paper gives an idea how the NFC can be useful for exchange small size data using NDEF.

9. Use of NFC and QR code Identification in an Electronic Ticket System for Public [12]

Technology used: QR code, NFC

Summary of Paper: In this paper author proposed system for making reservation and payment using the NFC and QR code. The application download the ticket after reservation made using the QR code or NFC tag and then it is stored on the phone, which can be checked by the checker using QR code scanner or NFC reader utility.

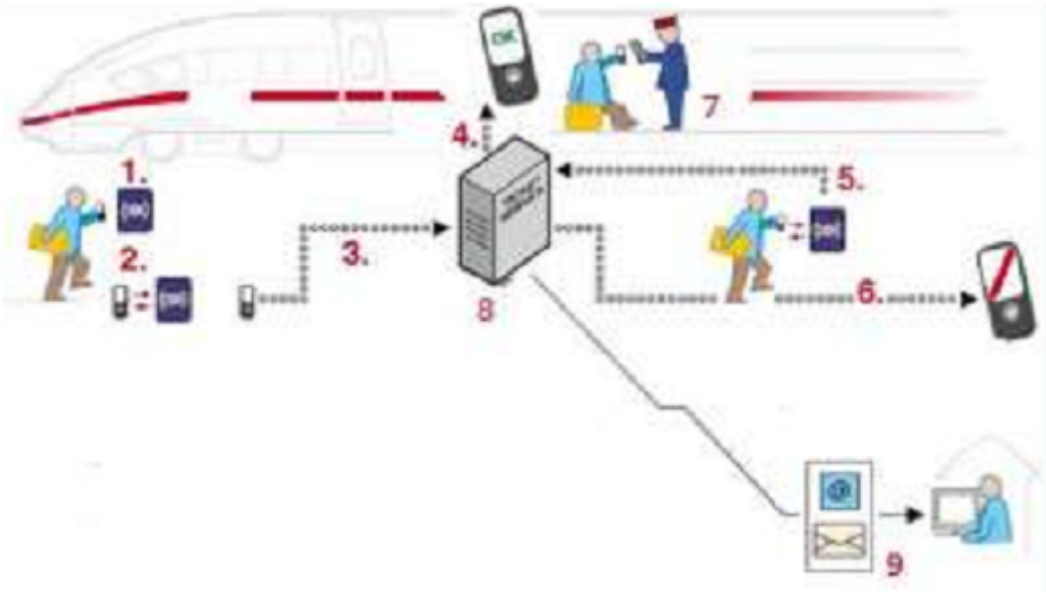

Figure 2.9: Electronic ticketing using NFC and QR code

Here main modules are:

1. Ticket verification
2. Fare calculation

Motivation from architecture: This paper motivates us that the automation can be done in our system using the NFC and QR code by making our own application for sharing data.

2.3 Comparison between the Different Technologies

There are many wireless technologies now day available.As output, we can make a comparison between different technologies.

	NFC	RFID	QR code	Beacon
Standard	ISO 14443		ISO/IEC18004	
Range	up to 10 cm, proximity based	upto 3 m		up to 70 m and adjustable with help of Signal power
Complexity	Low	Low	Low	Hi
Power	Low	Low	No power needed	high compare to other technologies
Working mode	Active,Passive	Passive	Passive	Active always
Use Cases	Pay, get Access, initiate service, Easy Setup, Automation	tracking object	Automation , security,object tracking, object hyper-linking	Mobile marketing, indoor navigation

Table 2.1: Comparison between difference Technology [13][14][15]

Table above describe comparison between different technologies. By this we can consider the range, as shown NFC is short range while RFID and beacon is long range.But in framework, video will be sent only if visitor want it. So, NFC and QR code is enough technology for framework development.NFC is newer version of RFID. API is available for NFC for Development.

Beacon is quite differ than NFC and QR code.Beacon need 'Bluetooth Low Energy'(BLE) devices, which uses Bluetooth version 4.0. All newly coming devices are beacon software compatible. But all BLE(Bluetooth Low Energy) devices need more power than the passive type NFC. No doubt, Beacon is small sized signal but uses more

power. More signal comes to the visitor can consider as spam . For small size exhibition it becomes complex. So, NFC and QR code is best available option for framework.

2.4 Summary

In this chapter, survey from different literature is done. Comparison between different technologies is done. At the end of chapter it is concluded that, for develop this system why NFC and QR code is best.

Chapter 3

Proposed Approach

3.1 Introduction

In this chapter, approach for automate the exhibition system is discussed. In coming part 'Exhibitor System Flow' is discussed. In second part Visitor System Flow is discussed. Here in this how system at visitor part work is discussed.

3.2 Exhibitor System Flow

Main work of Exhibitor is to manage videos and manage related QR code and NFC for exhibition. System flow is as discussed below.

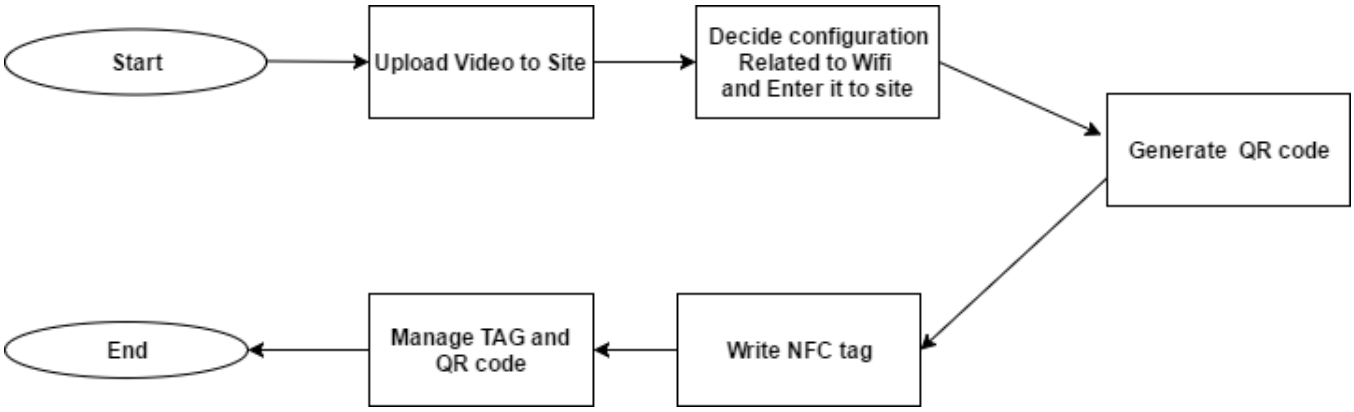

Figure 3.1: Exhibitor System Flow

3.3 Visitor System Flow

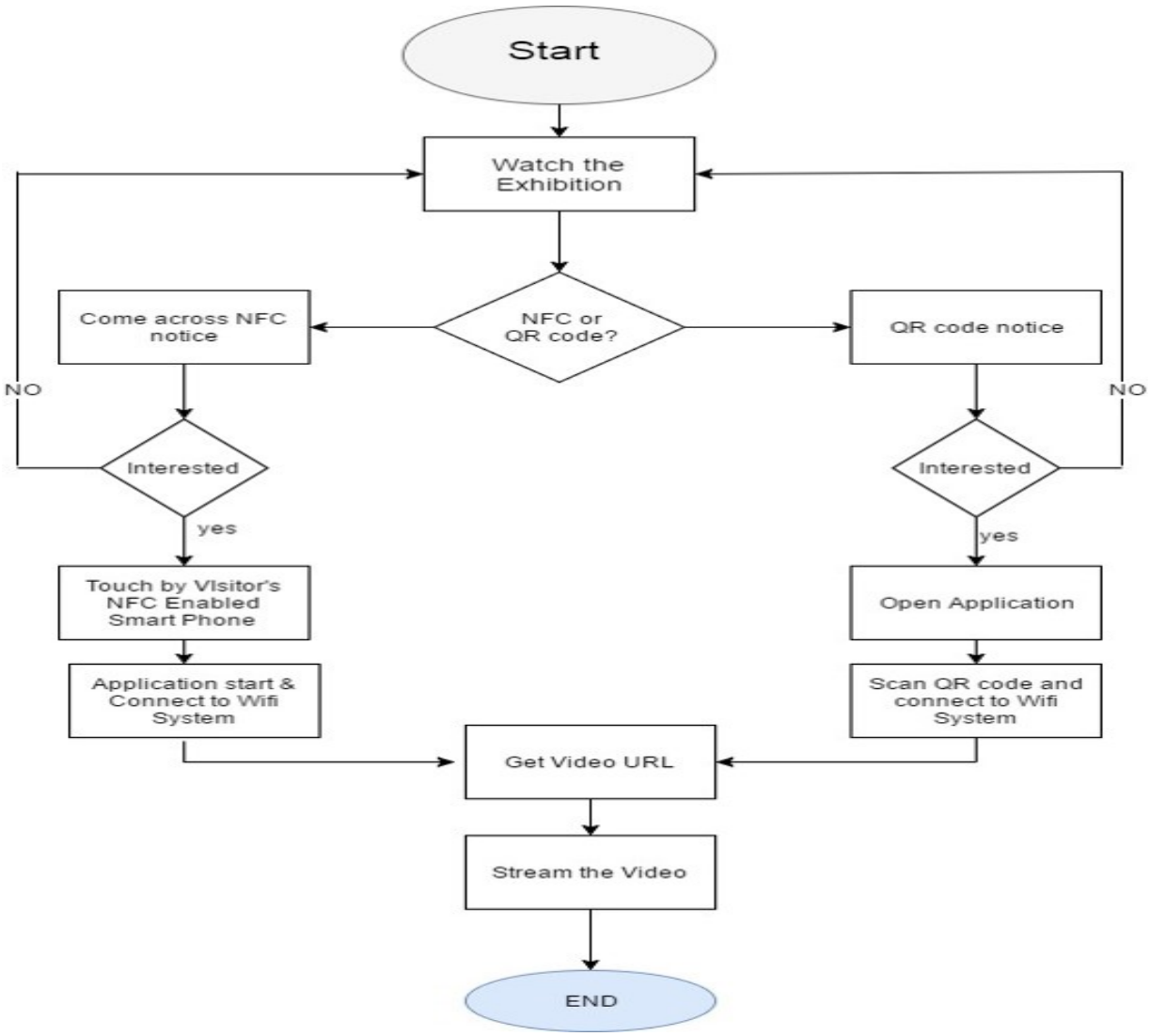

Figure 3.2: Visitor System Flow

Mobile phones are ubiquitous devices. Nowadays, majority of them are smart-phones. People are accustomed to using a mobile phone in various activity like obtain information, surfing the internet and use different applications.

As found from different kinds of literature, there are many wireless technologies like Bluetooth, WiFi, NFC for sharing the data.For automation purpose technology like NFC, QR code, iBeacon technologies are useful.By the comparison, we can get the idea that how NFC and QR code are best for us.

There is no doubt that the number of NFC-enabled phones is increasing nowadays, but if the visitor does not have the NFC-enabled phone then they can simply use QR

code for this. As we defined our problem there are mainly two modules in our system

1. **Connecting to the local Network:** NFC and QR code can be useful to connect to WiFi.We can store WiFi credentials to the QR code and NFC tag.if visitor has NFC enabled phone then by tapping the tag visitor can connect to the local network. Otherwise, By using the application user can scan the QR code and get connected to the local network using WiFi.

2. **Fetch the video to the visitors mobile phone and stream it:** After connecting to the local network there is need of fetching and stream video to the mobile phone.If the user has NFC enabled phone, then automatically video URL will be fetched through NFC and it will be streamed, else it will be done after QR code scanning automatically.

3.4 Summary

In this chapter System Flow for Exhibitor and visitor is discussed. Here the main advantage of using NFC and QR code will be that, here less interaction of user is needed and that is just for tap the tag/scan the QR code. By this visitor will be connected to WiFi system at Exhibition place and stream the video for getting information related to exhibit. These all work is done in secure and automate manner.

Chapter 4

Implementation

4.1 Introduction

In this chapter different technology and tools needed for implement the framework is discussed. Main work of the system is to develop framework which can automate visitor and exhibitor module using NFC and QR code. So, here in this chapter NFC and QR code related programming stuff is discussed.

4.2 Tools and Technology

4.2.1 Hardware tools

Different hardware tools are available for write NFC tag, like 'Nfcboard from ADAFruit', 'NXP PN532','NXP PN531' and others. For writing purpose this boards are used. But, we can also write tag using the NFC-enabled phone too. Using the phone for writing the tag can decrease the cost.

- **NFC Enabled mobile phone:** NFC can be useful during testing and framework development.Different phones are available nowadays,which are NFC enable.The list of different NFC enabled phone is available on the **'nfcworld.com'**[16].For this work Sony Xperia-Z is used for NFC module.

- **NFC tag:** As mentioned in above part of work, there are different type of NFC tags available to use. Difference between them is as in below table.[2]. For this work NFC type-2 tag is used.

Tag	Standard	Configuration	Memory
Type-1	ISO 14443 A	Tag is Read/write capable. Also Can make Read-only	96 byte
Type-2	ISO 14443 A	Tag is Read/write capable. Also Can make Read-only	48 bytes-2 KB
Type-3	Sony Felica, JIS X-63194	Tag is Preconfigured. Can make it read and re-writeable or Read-only	Basic 2 KB. Upto 1 Mbyte
Type-4	ISO 14443A, ISO 14443B	Tag is Preconfigured. Can make it read and re-writeable or Read-only	32 Kbyte

Table 4.1: NFC tag types

4.2.2 Software tools

Android Studio: Android is a free and open source for application development.For this, we can use Android studio.It is Easy to use. We made our framework at visitor side using different API's. In the frame work, task for connecting wifi for video transmission at the exhibition place is employed. For that some some of the programming related to NFC to wifi handover is done [17][18][19]

For developing framework, NFC API and Google chart based Zxing Api is used

4.3 Developing Server

For developing local server, WAMP is used. WAMP used to create server,which can work with different technologies like MySql, php,etc. For making the system, Php is used to create site on server. This can be useful to exhibitor. Using this exhibitor can upload videos to local server, manage it, manage settings regarding local server details and generate QR code.

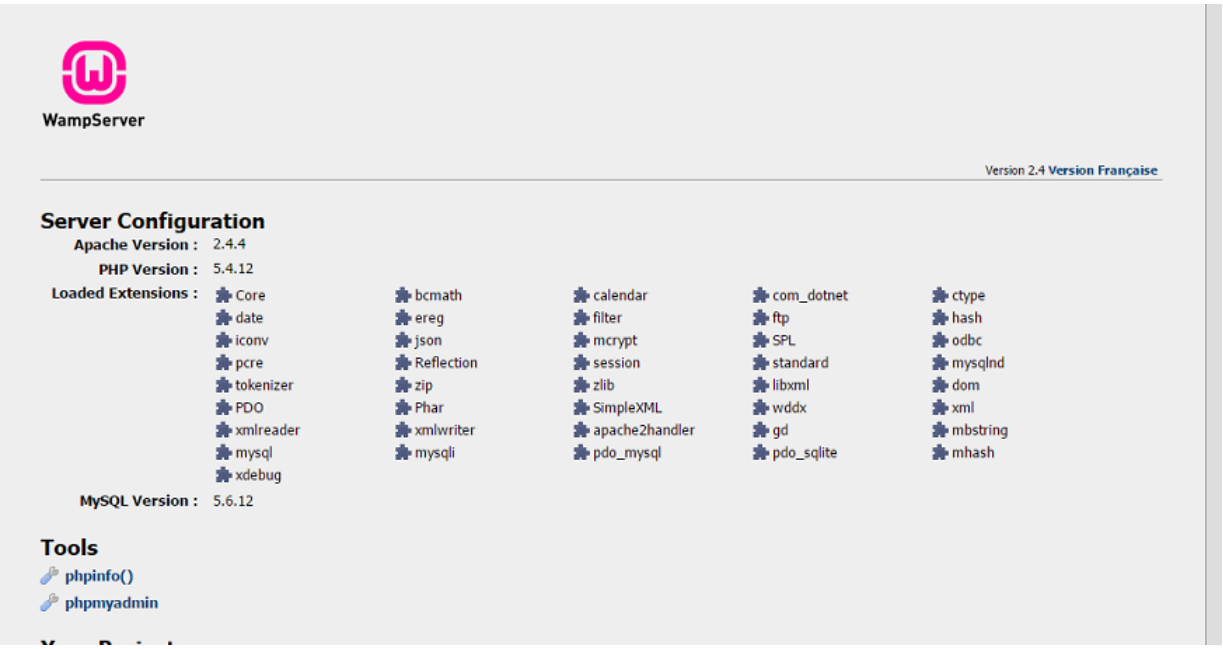

Figure 4.1: WAMP server

4.4 Development of NFC module in framework

NFC-enabled device can detect the tag if device is unlocked and NFC is enabled from setting menu.When the tag discovers,most desired activity has to handle intent without asking user what application use.Because devices scan NFC tags at a very short range, it is likely that making users manually select an activity would force them to move the device away from the tag and break the connection.

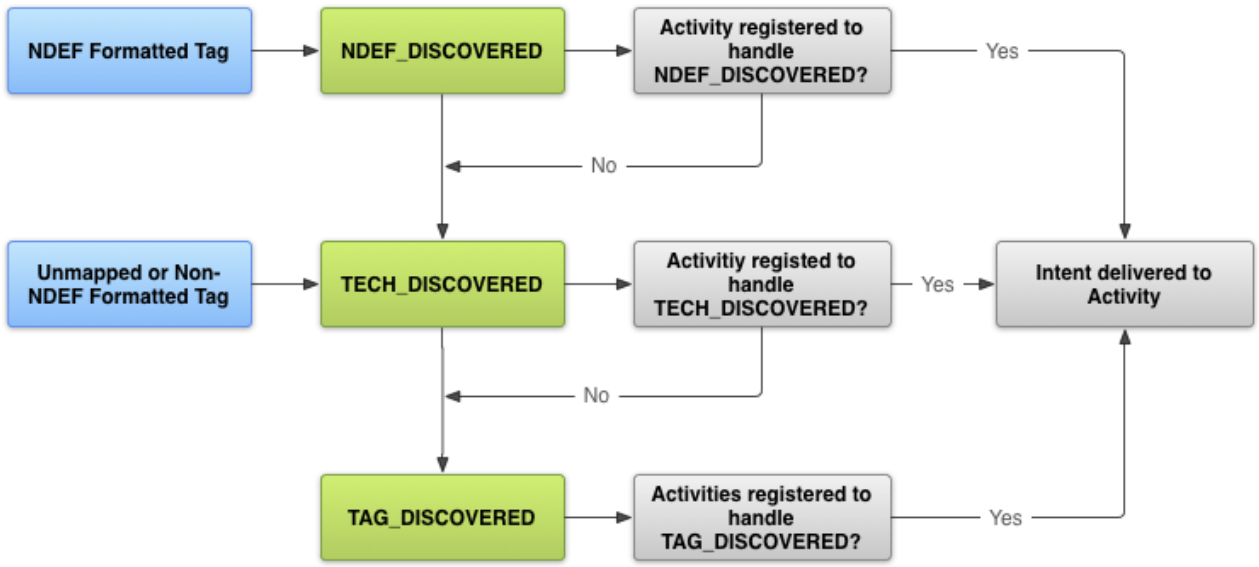

Figure 4.2: Tag Dispatch System

In framework own activity is made to handle the NFC tag detection with the own 'URI'. Above figure show how NFC tag dispatch system works. NFC API is available for android from version 2.3. It is improved and extended in version 2.3.3 and different supported technology were added into it. The NFC API is available in the android in the packages **android.nfc** and **android.nfc.tech**

The **android.nfc** package support high-level classes that allow interaction with NFC adapter of the mobile phone.It includes functions like NFC tag discovery and different functions related to NDEF data record. There are different classes available in this packages are as below.

- **NfcManager:** This is useful to obtain the NFC Adapter for the particular device if there are more NFC adapter in the particular device.
- **NfcAdapter:**This class allow direct interaction with tags using 'android activities and provides peer to peer support.
- **NdefMessage:**It is used to transmit data between the NFC enabled devices or tag and device. The 'ndef message' can contain Ndefrecord.
- **NdefRecord:** This class represents NDEF record, which is delivered in the NDEF message. Each record has its own type of data that is being carried in the record, such as text, URL and MIME type of data.
- **Tag:** it represents the tag scanned by the device. After discovering the object for the tag is created and it is enfolded to the intent of android INTENT activity.

The 'android.nfc.tech' package corresponds to different i/o operation related to NFC tag. For application development there is need of NFC API and hardware there is need to add this line to the manifest.

<uses-permission android:name="android.permission.NFC"/>

<uses-feature android:name="android.hardware.nfc" android:required = "true">

For creating the framework, URI have been made. This URI can be used only with the framework. When writing the URI to the NFC tag, firstly the URI is passed through writing framework. It firstly encapsulated to the 'Ndefmessage' using the different parameter. At writing side, we create an AAR using 'CreateApplicationRecord()'. At Visitor

side because of AAR and URI priority to our framework is given first. So, when NFC-enabled phone detects our URI from TAG the application will be opened. The message is passed from the tag as parcelable byte form.

By using the NFC API visitor module have been made. Using this NFC exhibitor can write tag and visitor can use it for get video using the NFC tag. 'enable forground dispatch' concept is used here for creating the module.

4.5 Development of QR code Scanner module in framework

Google chart API is useful for making QR code related applications. There are project names **'Zxing'** is running under the Google. The source code of this is freely available. For making our framework we used 'Zxing (Zebra crossing) project libraries. For this, we have to add dependencies to the 'build.Gradle' file by adding the line below under the dependencies.

compile 'me.dm7.barcodescanner:zxing:1.8.4'

This will download required files automatically. This library has been used for our implementation. Here from the library, mainly 'SurfaceViewer' class is used during the process of scanning. At last the **'resulthandler'** class is used. The 'handleResult()' method is invoked for getting the result. As like NFC, we require here to add permission for use camera.We can get this permission by adding this lines to the 'manifest.xml' file.

<uses-permission android:name="android.permission.CAMERA"/>

Using this library module for scanning QR code is developed. Using this module visitor can scan QR Code. By this device will be automatically connected to WiFi network without any other interaction and video will be streamed automatically to the device.

4.6 Summary

In this chapter different tools,technology and framework related NFC and 'QR code API' is discussed. Using this API modules are developed for exhibitor and visitor for automating system.

Chapter 5

Results

5.1 Introduction

This Chapter describes, how the automation will be done at exhibition place. For this work two main modules developed (1) Exhibitor module and (2) Visitor module. Both are discussed ahead in this chapter.

5.2 Exhibitor Module

At the exhibitor side exhibitor can manage video and generate QR code which contains URI for framework. This framework can be used by visitor module to get URI and which is used by framework. At exhibitor framework's working figures are as below.

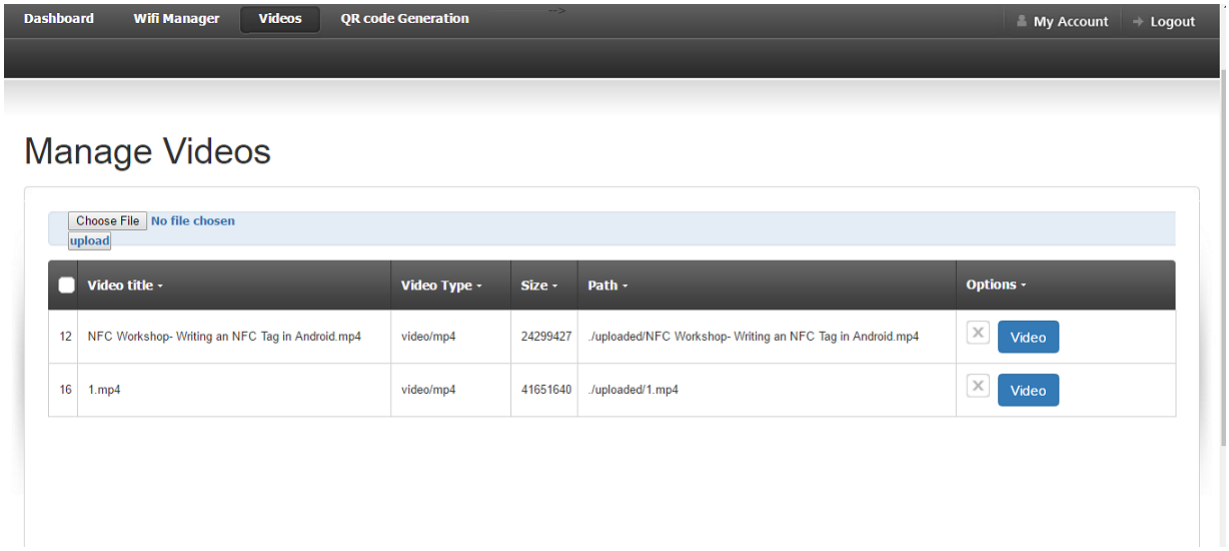

Figure 5.1: Manage videos

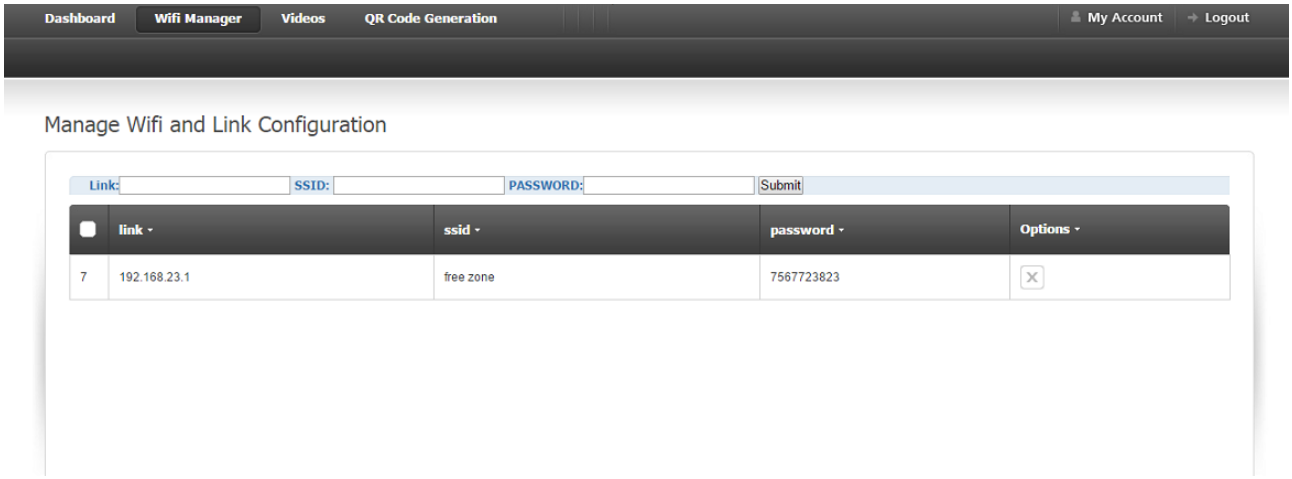

Figure 5.2: Manage wifi setting

Using this module exhibitor can upload video related to exhibit. Exhibitor can delete it and manage it using this easily.

Manage Wifi module is shown in above figure. As shown in above Figure exhibitor will enter different details like credentials, connection link. Using this module exhibitor can manage WiFi credentials used at exhibition place which is used in URI.

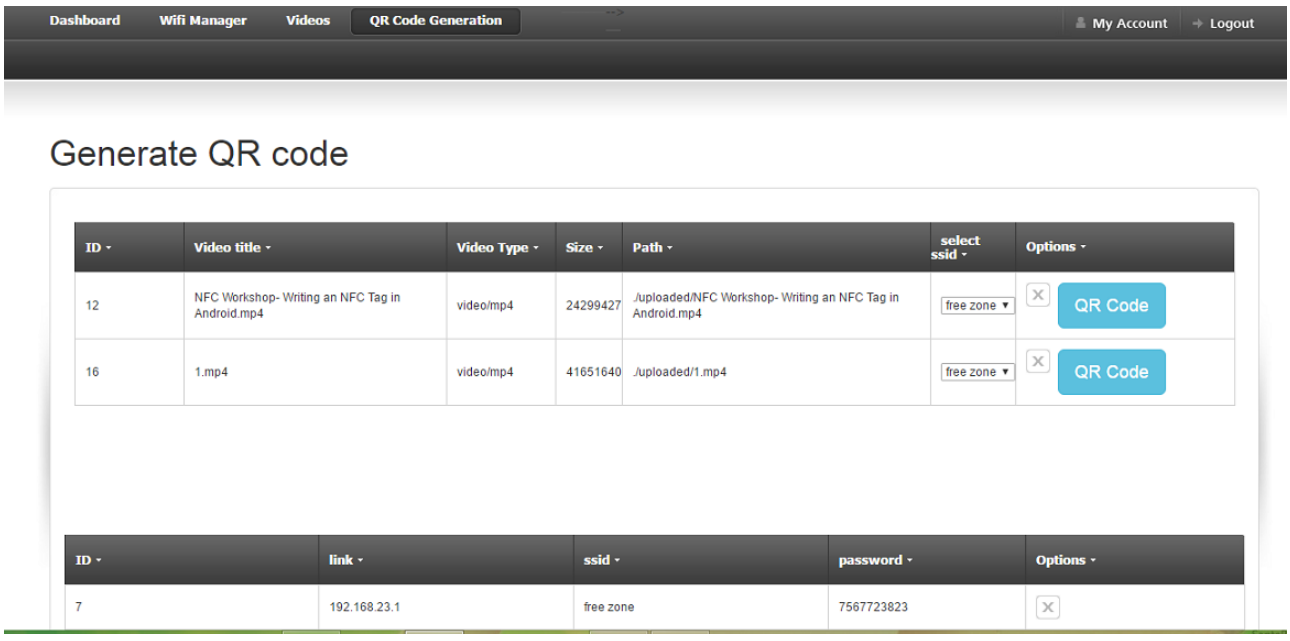

Figure 5.3: Generate QR code

At final stage exhibitor needs to generate QR code so as shown in above figure. Exhibitor can see the details, can select different URI needs and generate QR code from at, generated QR code figure is as below.

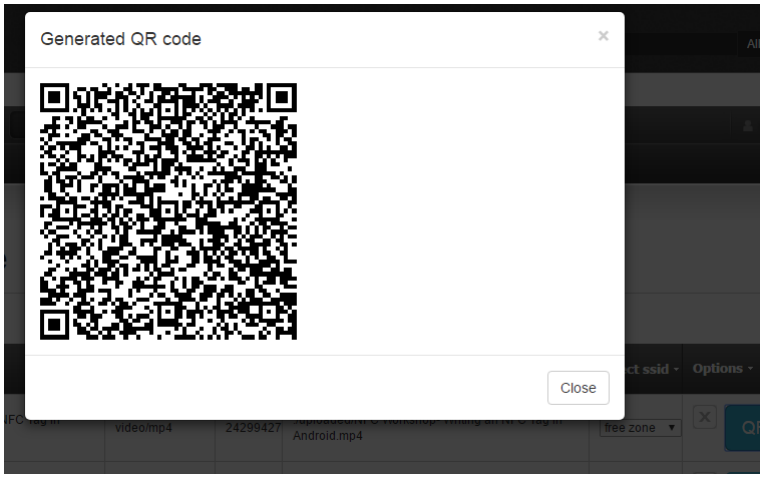

Figure 5.4: QR code generation

Figure 5.5: NFC tag Writer

The figure above shows the writer module at exhibition place used to write NFC tag. Exhibitor can use this module to write the tag which will be used at exhibition place by exhibitor. Different tag will be arranged near the exhibit as per need for visitor.

5.3 Visitor module

Using the framework, a task for connecting to the network becomes very easy and fast. IF visitor does not have NFC-enabled mobile phone then the visitor can use QR code scanning module and get connected to the local network Mainly two modules are implemented in Framework.

- Connecting the Network
- Stream the video.

If visitor has NFC enabled mobile phone like Sony Xperia-z. Then visitor just has to touch their phone to the tag. In visitor module because of AAR and URI, priority to a framework is given first. So, when NFC-enabled phone detect our URI from TAG the app will be opened after touching.Then the video will be automatically streamed using WiFi. In this way automation using NFC is done.

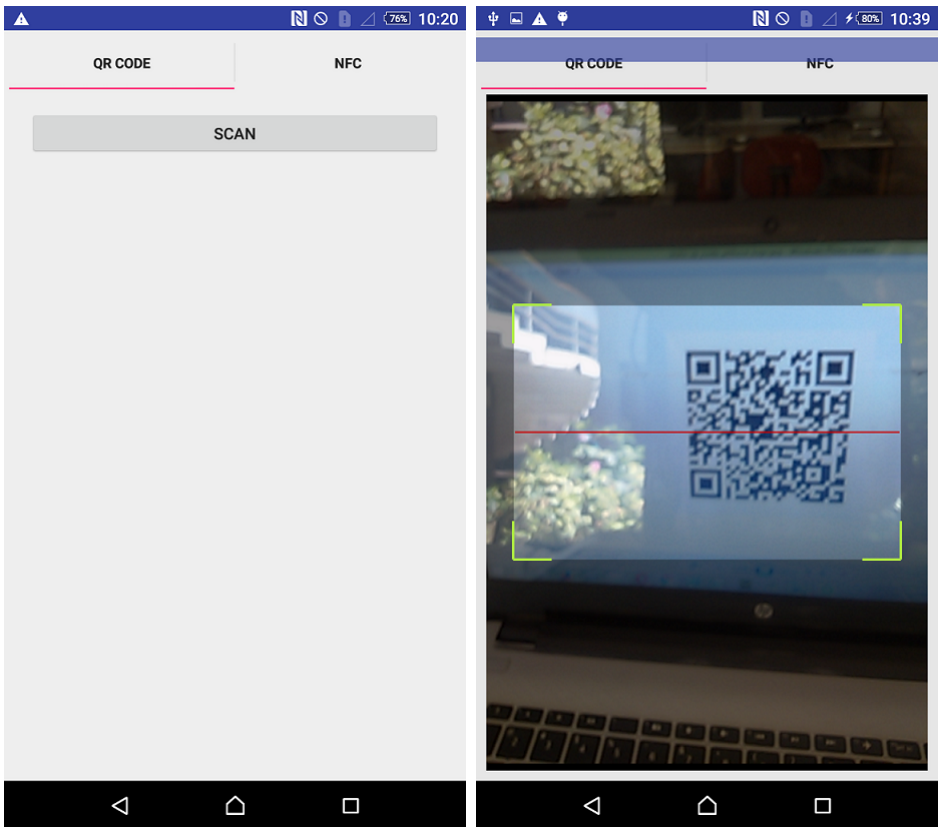

Figure 5.6: Working of QR code

Using the framework, a task for connecting to the network becomes very easy and fast.

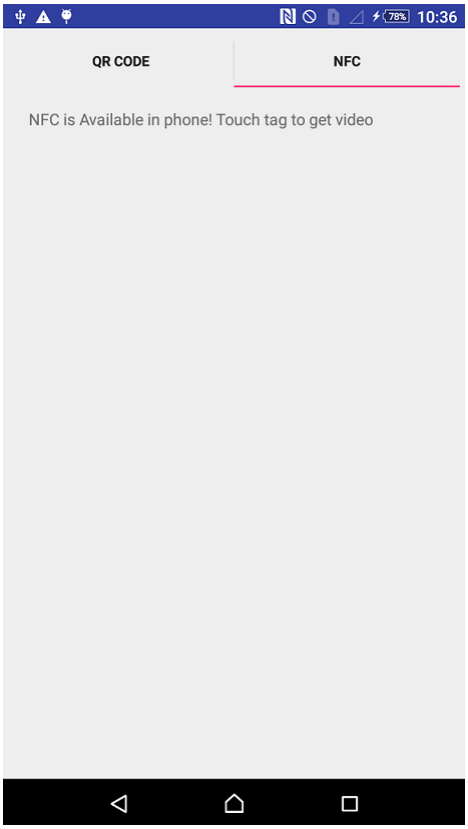

Figure 5.7: Working of NFC module

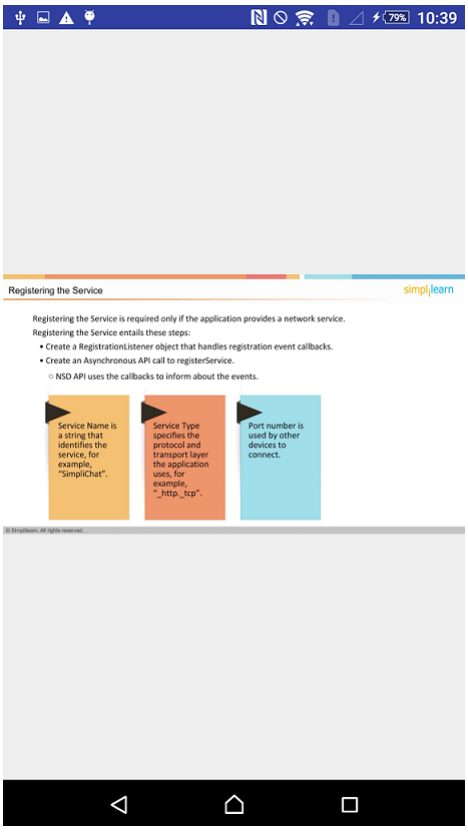

Figure 5.8: Working of NFC module

5.4 Summary

In this chapter, modules are used at exhibition is discussed in details. At exhibition place exhibitor can generate QR code and by scanning QR code they can write NFC tag.This becomes work of exhibitor fast. Using visitor module, visitor can stream video automatically by tapping tag or scanning QR code.

Chapter 6

Conclusion and Future Work

6.1 Conclusion

In this work, different kinds of literature have been studied for automating exhibition system. Among all the existing automation systems, NFC and QR code are found to be more useful. However, comparing NFC and QR code, NFC is found to be better as it avoids the manual intervention of scanning code which is required in QR code. So, using NFC the whole system can be fully automated. But, in few cases where a phone doesn't have NFC, QR code can be implemented easily. QR Code automates the exhibit system for connecting network and file transfer. This framework can provide a new user experience to the users.

6.2 Future Work

This work can facilitate a different experience to users all together by providing them an ease of access to perceive the knowledge about 'art-work' or 'exhibit' displayed at exhibition using mobile phone. Further, this framework can also be deployed at exhibition places where more video transmissions are needed in the exhibition. There is also a provision of enhancements in video transmission.

Bibliography

[1] wikipedia, "https://en.wikipedia.org/wiki/Exhibition."

[2] P. S. HALGAONKAR, S. Jain, and V. Wadhai, "Nfc: A review of technology, tags, applications and security," *IJRCCT*, vol. 2, no. 10, pp. 979–987, 2013.

[3] "https://en.wikipedia.org/wiki/qrcode."

[4] J.-Y. Lee, Y.-H. Kim, and Y. Yoon, "An nfc-based o2o service model in exhibition-space," p. 42, 2016.

[5] E. Di Rosa and F. Benente, "excavate and learn: Enhancing visitor experience with touch and nfc," vol. 2, pp. 689–692, 2013.

[6] S.-U. Yoon, S. Joshi, and S.-S. Shim, "A new simple wi-fi direct connection method using nfc on remote control and dtv," pp. 170–175, 2014.

[7] C. Jin, S. Takahashi, and J. Tanaka, "Interaction between small size device and large screen in public space," in *International Conference on Knowledge-Based and Intelligent Information and Engineering Systems*, pp. 197–204, Springer, 2006.

[8] B. Ozdenizci, K. Ok, V. Coskun, and M. N. Aydin, "Development of an indoor navigation system using nfc technology," pp. 11–14, 2011.

[9] Y. Anokwa, G. Borriello, T. Pering, and R. Want, "A user interaction model for nfc enabled applications," pp. 357–361, 2007.

[10] P. Pourghomi and G. Ghinea, "Managing nfc payment applications through cloud computing," pp. 772–777, 2012.

[11] P. Dobrigkeit, T. Flach, P. Faymonville, and J. Müller, "Exchange of contact data between mobile phones using nfcip," pp. 1–9, 2008.

[12] L. Finžgar and M. Trebar, "Use of nfc and qr code identification in an electronic ticket system for public transport," pp. 1–6, 2011.

[13] G. Vossen, S. Dillon, F. Schomm, and F. Stahl, "A classification framework for beacon applications," 2017.

[14] K. Ok, M. N. Aydin, V. Coskun, and B. Ozdenizci, "Exploring underlying values of nfc applications," in *3rd International Conference on Information and Financial Engineering IPEDR*, vol. 12, 2011.

[15] M. Vazquez-Briseno, F. I. Hirata, J. d. D. Sanchez-Lopez, E. Jimenez-Garcia, C. Navarro-Cota, and J. I. Nieto-Hipolito, "Using rfid/nfc and qr-code in mobile phones to link the physical and the digital world," *Interactive Multimedia. Dr. Ioannis Deliyannis (Ed.) InTech*, pp. 219–242, 2012.

[16] https://www.nfcworld.com/nfc-phones list, "List of nfc phones,"

[17] R. Meier, *Professional Android 4 application development.* John Wiley & Sons, 2012.

[18] D. J. Byrne, A. D. Zubiri, T. Buczek, K. P. Fernandes, and G. Pancio, "Communications system providing mobile wireless communications device application module associations for respective wireless communications formats and related methods," Jan. 22 2013. US Patent 8,358,596.

[19] T. Igoe, D. Coleman, and B. Jepson, *Beginning NFC: Near Field Communication with Arduino, Android, and PhoneGap.* " O'Reilly Media, Inc.", 2014.