Android Application for Ticket Booking and Ticket Checking in Suburban Railways

Subarnarekha Ghosal, Shalini Chaturvedi, Akshay Taywade and N. Jaisankar*

SCSE, VIT University, Vellore, Tamil Nadu, India; subarnarekha.ghosal2013@vit.ac.in, shalini.chaturvedi2013@vit.ac.in, akshay.taywade2013@vit.ac.in, njaisankar@vit.ac.in

Abstract

Technological development has resulted in a boundary free digital world. This development has resulted in transaction through virtual money instead of real ones. One of the most popular forms of online trading is E-ticketing. Android Phones can reduce the trouble of the customers to stand in queue and book the tickets. With the advent of the smart cards the overhead of waiting for ticket was reduced but the user should always remember to carry the card with him. Moreover one has to pay attention that it is not misplaced or stolen. After that came E-Ticketing where passengers have to carry a SMS or a printout of the ticket booked online. But that required laptops or desktop for booking. Thus came into front the use of smart phone application where carrying a smart phone will do all the work. Thus the introduction of smart phone application overcomes all the drawbacks of the earlier systems. This paper deals with the development and implementation of smart phone application which is more effective and simple than current ticketing system. The "Android Suburban Ticket (ASR)" can be bought easily anytime, anywhere and ticket will be present in the customer's phone in the form of "Quick Response Code". GPS facility is used for validation of the ticket at the source and deletion at the destination. The information for each user is stored in a CLOUD database for security purpose which is unavailable in the current suburban railway system. Also the ticket checker is provided with an application to search for the user's ticket with the ticket number in the cloud database for checking purposes.

Keywords: Android, Android Suburban Ticket (ASR), Cloud Database, Mysql, Quick Response Code

1. Introduction

In the fast forward world of technology everyone is running behind time. Thus the main motivation of technology is to produce a time and cost efficient product. Even in the railway department online ticket booking or e-ticketing was introduced for facilitating the users to book ticket on internet via a governmental website. The printout of the ticket may be used for validation. Later M-ticketing (Mobile ticketing) was introduced which sends user messages of tickets for validation purposes after booking the tickets through online ticket portals. In foreign countries Oyster and Octopus cards are compulsory for travelling but that also has the risk of damage or loss and people also have the overhead of remembering to carry the same always while travelling. That is where the e-ticketing and m-ticketing come to scene. But this facility was never implemented in suburban railways. This paper presents methods of implementation of the same in suburban railways. In the year 2011 Google introduced this facility in Android Phones.

Android Suburban Railway (ASR) ticketing is basically a way of buying tickets for suburban railway which is an extremely challenging task. ASR ticketing is a simple application which enables users to buy tickets in an efficient manner, with the help of a smart application. They can also carry tickets in form of a Quick Response (QR) which is actually an application containing the details of the ticket in an encrypted form. GPS facility is used for automatic checking, validation and deletion of tickets at desired points in the journey. The information about a particular user is stored in cloud database for continuous and easy availability anywhere and everywhere. The information about the tickets and routes are also stored

in cloud database and are retrieved when required. The information is transferred in a secured manner as QR code and is received by the user in the form of a personal SMS. A checker application is also present to search the user's ticket information by giving the ticket number as the input.

The increase in the number of mobile phones and the mobile phone users on one hand is shrinking the world itself and on the other hand is resulting in the manufacture of more number of phones with ever new technologies and facilities. Starting from the earlier hand set to the advent of mobile sets these are inevitable to our daily lives. In today's world mobile phones have become pervasive devices, which is used as Camera, Music Player, Web Browser, for playing games etc. Thus for combining all these features within a single device have emerged several new ideas and technologies. One of these new technologies is Android Phones. Android is basically an operating system incorporated in mobile phones now-a-days.

Android is a software heap and has Linux Kernel which combines operating system along with middle ware and key applications. Android SDK is the provider of all the android tools required to develop an application mainly using JAVA since it is platform independent. Developers use personalized versions of Java for the same.

In the year 2003, Android Technology was first invented by Rich Miner, Andy Rubin, Chris White and Nick Sears in California, USA. Later Open Hand Alliance led by Google got hold of that technology in 2005. With the ever growing technology several modified version have also been released. To extend the functionality of the mobile devices applications known as "apps" are being developed by large group of developers for Android. Third party sites and online stores like "Android Market" run by Google, enable downloading Android apps. By October of the year 2011 more than "400,000" apps were available and more than 10 million applications were downloaded by December of the same year.

This application used SQLite as a database which is present in the C programming library. It is basically a relational database management system which follows ACID properties and applies weakly typed and dynamic sql syntax to implement the SQLite, thereby no guarantee of domain integrity is assured. Unlike other database management systems, SQLite is an innate part of the system rather than applying a separate application for client. Due to presence of the local database application software, it is a preference for databases in embedded

systems. The clients access the Cloud database from the clouds and the database of the server of the provider can place the demands through internet. It is alternatively known as DataBase-as-a-Service (DBaaS). For better results in case of availability, effective resource allocation etc cloud database uses cloud computing. It can be traditional like MySQL or professional like SQL Server. Xeround's MySQL uses the cloud resource in a very efficient manner, which guarantees scalability, efficiency and availability of the system.

Some advantages of Cloud database are accessibility, low investment, automated failure recovery, automated scaling, better performance and maintainability. But some drawbacks include security and privacy and loss of critical data in the case of any disaster.

Android Cloud to Device Messaging Framework (C2DM)[1] instructs the application to contact server directly to receive updated data of user or application. This service not only incorporates all kind of messages about queuing but also the delivery to the target application on the target device. Being designed for the automotive industry first a QR code is basically a barcode in matrix format known as matrix-barcode. The comparatively large storage and reliability it is becoming popular beyond its field. A set of black modules arranged on a white background constitutes this code. The encoded information may be numeric, alphanumeric, Kanji, byte/binary and so on.

2. Literature Survey

Recently, the handheld devices are gaining major importance since these devices allows one to pay and book tickets in a secured manner through the mobile devices which are Bluetooth enabled. Digital signature ensures security of e-ticketing and e-payment to some extent[1]. There are mainly two security issues related with all the ticketing systems. One is validation and the other is ticket checking. The problems arising due to these security issues are many and various. One of them is the e-payment.

To deal with these problems a new protocol has been given in the previous papers itself[2]. This protocol aims at providing high level security. Security was offered but the performance of the system. E-ticketing is one of the most popular trading services since it does not involve any paper work for e-ticketing in transport system. With the emergence of new technology, came the digital era. It provided the concept of money in the place of real one for all trades and transactions as well.

Then evolved Mobile Ticket or m-ticket. The concept of virtual money is supported by existing Near Field Communication (NFC) device. Mobile ticket for public transport application can be purchased using this NFC technology as explained by Biader Ceipidor U. et al[3].

Then was derived the concept of smart phones which may be considered as a platform for validating the tickets using low cost ticketing device[4]. Interoperability and elasticity are ensured by the integration of android mobile with the cloud environment.

The cloud platform automatically configures and remembers the user information, and thereby validates the tickets[5]. The smartphones however are accompanied by shortage of data storage, battery and computation capability of the phones. For overcoming this problem cloud based virtual environment can be used to store data with complete security along with Android Emulator[6].

The pressure and time of computation can be reduced with the incorporation of a virtual server in the mobile device[4]. Thus with the introduction of Android devices M-ticket concept was introduced which removes the burden of passengers to stand in queues to book the tickets. Security is ensured by the use of QR (Quick Response) code. GPS is used for automatic validation and deletion of ticket information during the required points in the journey. All information about the users is stored in cloud database in encoded form thereby ensuring constant availability and security[6].

This smart phone application for ticket booking may be used for any kind of transportation system such as bus, railways, airways etc. It has been first implemented in airways, then in railways for long distances and lastly in buses. In case of Android railway ticket (AR)[7], which came into existence, QR[2] was used. In this paper, online ticketing system was introduced for Suburban Railway System.

The Android application known as the Android Application for Suburban Railways not only uses all the above features but it uses another application for ticket checking. GPS is used for the validation of tickets. It saves a large amount of energy. Ticket checker holds the ticket number in CLOUD database[8]. This concept is clearly described and implemented in this project.

3. Proposed Model

The current ticketing system of suburban railway system works manually and is quite time consuming. People may carry android or oyster cards as substitute, but if that is misplaced somehow or if anyone forgets to produce it at the right place these are of no use. The main objective for this project is developing an android application so that passengers can book the tickets online directly from their smart phones and a received message to their own phones is enough for travelling a desired distance. Thus the process of standing in lines to book the tickets and after that carrying the tickets is curdled. The Android Suburban Railway System thus carries a Quick Response Code (QR)[2] in the form of a SMS. GPS is used to validate the ticket when the user reaches the station and deletes the ticket automatically after the destination is reached. For security reasons the information about every user is stored in CLOUD which is to be accessed for each ticket booking for validation purpose. As pointed out by Agostinho Baia et al.[5], "This change of paradigm benefits from the fact that cloud ticketing services can be accessed through the Internet and they can be elastically grown or shrunk, providing easier scalability and high availability". There are two modes of ticket payment. Firstly a customer can pay by cash and secondly he can pay by token, an inbuilt account in the cloud itself. In the paper by Surya Michrandi Nasution et al., in 2011[1], Google Wallet launched by Google combines credit cards and the requirements of detecting radio signals on the phones. The steps for using this app are as follows (Figure 1).

3.1 Features

3.1.1 Login/Register

This is the first and foremost procedure to know the user's information. If the user is using this application for the first time he has to give some of his basic information like name, address, date of birth etc [Figure 5]. When a user has already registered first he has to enter the user name and password that he will already receive. All these information are stored and can be accessed from the local SQLite base[9] as well as the Cloud Database. These informations are necessary during the creation of QR code also.

3.1.2 Buying the Ticket

For booking the tickets we have to fill certain details like Route, Amount, No. of Persons and way (single/both). Then generate ticket options have to be selected for generating a ticket. Then payment mode has to be selected. There is an option where you can store the credit card information the next time you use this site. This facility is known as token payment. Thus the user chooses between card and token payment [Figure 6].
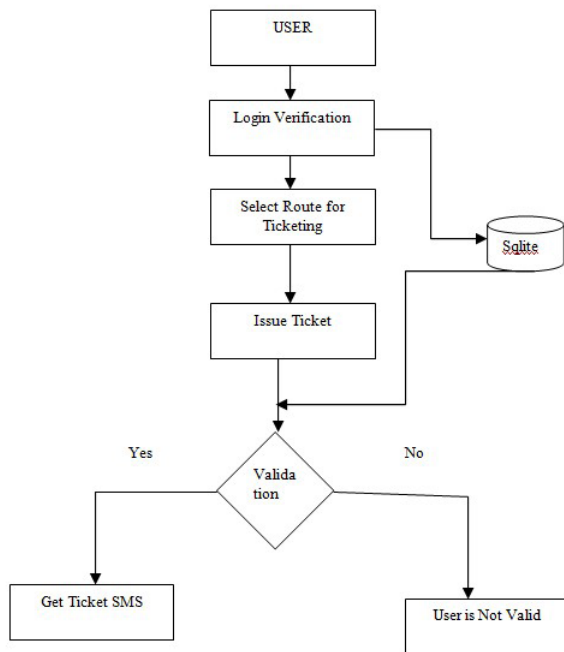
Figure 1. Flow of the processes in case of Android Ticket Booking.

3.1.3 Validation for Pin Code

The generated Quick Response is received by the user. The user can validate the pin number or password of the user's card after the user processes the request for payment through his account. If the validation is successful the user's information including journey details are received are saved in the cloud database and the railway database (MySQL). In response to this the ticket number, time of buying are recorded and the credit balance are displayed.

3.1.4 Generation of the QR Code

After the creation of ticket number[10] and the time of buying the ticket from the above mentioned step, QR code is generated from the API engine named Google Chart [Figure 7]. Thus in response a QR code is generated as a HTTP Response against the request sent earlier.

3.1.5 Validating the Ticket with the help of GPS

When user books a ticket the geographic locations of the source and destination, type of ticket, the date of booking the tickets etc are stored in the SQLite database. It automatically validates the current location of the user and expires the ticket as soon as the destination is reached. Thus it acts like a ticket checker.

3.1.6 QR reader checks the QR Code

This mainly used to retrieve the information from the QR code for validating the details of the journey including its date [Figure 8].

3.1.7 Database Checking

This is a backup plan in case the user's mobile device is damaged or shows any problem. In this case directly the ticket database can be checked by the user with the ticket number to get detailed information[11] about the journey.

3.2 Architectural Design of the System

3.2.1 Hardware Requirements

Hard Disk (80 GB), Processor (Pentium 4), Mother Board (Intel dual or quad core), Device (Smart Phones), Speed (3-4 GHz), RAM (1GB).

3.2.2 Software Requirements

IDE (Eclipse INDIGO), Language (Java), Operating System (Windows XP, 7, 8), Supporting Device (AVD for Android SDK), Version of Android (SDK 2.2 to 4.1), Database (SQLite, Cloud).

3.2.2.1 Android SDK

Android SDK or Android Software Development Kit is a package which includes a set of libraries, a debugger, documentation, a QEMU based handset emulator, tutorials, sample code and many more. Recently Linux, certain versions of Mac OS and almost all versions of Windows after Windows XP are also supporting this kit. It is most suitable
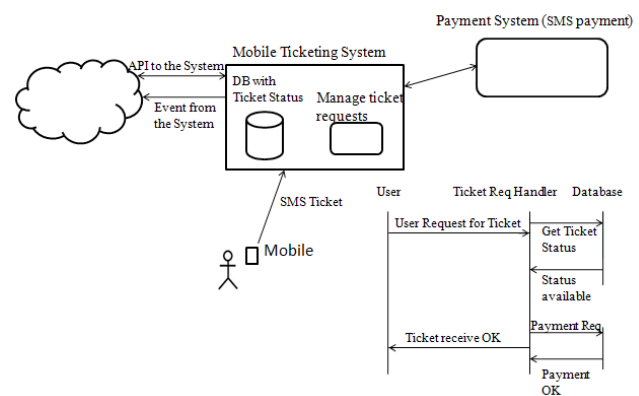

Figure 2. Use case and sequence diagram for ticket booking and checking.

Android Development Tools (ADT). In addition to this, developers edit Java or XML files with the help of any text editor. The android project needs to be created first. Later it has to be compiled and run. Command line tools like JDK or Apache Ant may be used for the same purpose. Android SDK is developing with each new version of android but each android SDK supports the older version of Android also. Thus the latest version of Android can support tools from older versions also depending on certain compatibility issues. The .apk file is a package of all android applications. This .apk file is stored under the app folder which is a portion of data folder on the Android OS. The .dex files and other resource files are stored in the .apk folder.

A few more features of this Android Applications include:

• Android Open Accessory Development Kit

USB hardware is allowed to connect with the android device through Android Open Accessory support which is a part of Android 3.1. The external USB hardware communicates with the device in a special mode called "accessory" mode.

• App Inventor for android applications

Based on Open Blocks Java Library at MIT a web based environment was developed mainly for visualization. It was mainly built to facilitate the learners in this field. It provide access to Accelerometer, GPS[12], Orientation data and other phone functions including test messaging and web services such as Amazon, Twitter etc.

• Native development kit

System.loadLibrary can load Java code from the native classes under the Virtual Machine named Dalvik VM.

• Hyper Next Android Creator

Novice programmers can get a lot of help to create Android apps with the help of Hyper Next Android Creator (HAC). HAC is basically a software development system.

3.2.2.2 SQLite

SQLite is a relational database which is quite popular specially is client server environment. It is used by a wide range of OS, browser or even Embedded Systems[1368]. It guarantees integrity amongst domains and thus used as the local database of our project.

3.2.2.3 Cloud Database

The Android service namely Cloud to Device Messaging (C2DM) is used for request and response between the server and the applications. This service has simple ways

by which the servers use to communicate with the mobile phones mainly for fetching user data.

3.2.2.4 QR Code

The Quick Response (QR) code first used in automotive industry has now become popular due to its large storage capacity and extremely less response time [Figure 3]. Here QR code is used to store user information in encoded form. As pointed out by Sadaf Shaikh et al.[4], this QR code can be used to transfer between mobiles and can be shown to the ticket checker for validation [Figure 7].

3.3 Feasibility Check

This finds out the strength, weakness of the existing system, the scopes of the existing system [Figure 4], threats faced by the system, availability of the resources and so on. Feasibility studies are carried out before implementing the project.
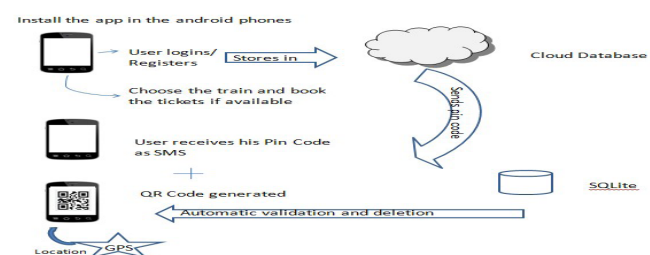

Figure 3. A typical QR.

Figure 4. Dataflow diagram of ticket generation.

3.3.1 Economic Feasibility

Most of the technologies utilized in this project are available freely. Thus the implementation of this project is economically feasible.

3.3.2 Technical Feasibility

The proposed system is technically feasible also since minimal changes on the existing system may result in this new system.

3.3.3 Operational Feasibility

This study is to check the level of acceptance of the system to the user. This should be user acceptable as it provides feature to help the user to utilize time in lieu of a negligible amount of money.

4. Results and Discussion

The use of online ticketing application in the android phones will reduce the tension of daily passengers to stand in long queues and book the tickets. E-ticketing aims at reducing expenditure and increasing the QoS[1]. M-ticketing is a system where mobile users can book, pay, retrieve and validate tickets through ant portable devices such as mobile phones. These were earlier implemented in airlines and then in railway for long journey. But the need of E-Ticketing for daily passenger was always overlooked. In this paper an android application for ticket booking has been proposed and implemented. This application has ample useful features to make it popular in the market within a few years. Firstly all the user information are stored and retrieved in an encoded manner with the help of QR providing the maximum security for the customers. Moreover, all the user information is stored in Cloud Database and is retrieved from the same place which provides continuous access of the user ticket information. Thus an application installed in the smart phone is serves the purpose of booking a local ticket as well as validating the tickets. It also automatically deletes the tickets after the completion of the journey. The information for the current station is retrieved by the GPS facility also present in this application. Payment can be done through credit cards and if it is not possible to carry the card always a token can be made which stores details of the card in a secured manner thereby enabling automatic payment through it.

All required facilities for booking a suburban railway ticket are present in this application. It also provides

the required security. Thus this application will become popular sooner than later. The following reasons make this application better than any other application.

- It overcomes the difficulty of passengers standing in a queue to book their tickets for passenger trains.
- It enables customer to buy tickets online, anywhere and anytime.
- For payment of the ticket the user has two facilities. Other than credit cards the payment can also be made through token systems. Thus credit cards also are not required during booking tickets.
- The user of this application can carry the QR code generated after booking the tickets on their phone itself. Thus they don't have the overhead of carrying any smart card or a print out of the ticket.
- Due to encryption by QR code, security is maintained.
- User's information is present in the Cloud Database and thus the system can access it anywhere.
- The ticketing information is present in the local database SQLite. It is used accessed to validate tickets.
- This application uses GPS facility for updating the source, current and destination stations. The tickets are automatically updated at the source station and deleted after the destination station is reached.
- Additional ticket checker information is also available which checks the status of the ticket booked.
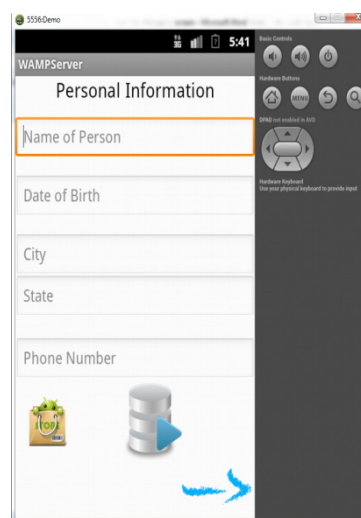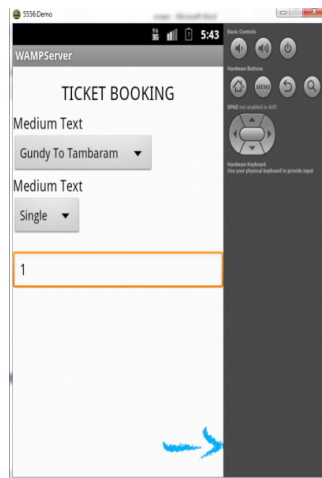

Figure 5. Login to user account.

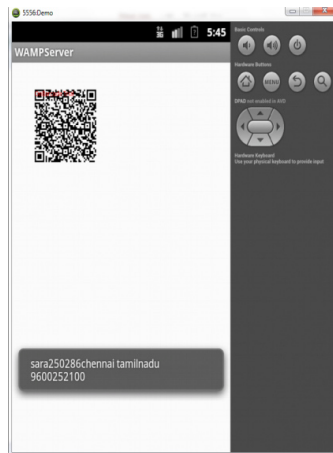**Figure 6.** Ticket generation.

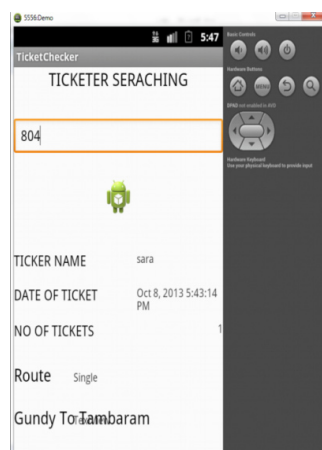**Figure 7.** QR ID generated.

Figure 8. Ticket validation.-

Figure 5 describes the page where an existing user can login and a new user can create a new account with the sign up option. Whereas, Figure 6 displays the page where user has to enter the details for the journey and generate a ticket if available.

Figure 7 is the verification page where user has to enter the details of the ticket to generate the QR Code. QR code is received by the user to their phone through SMS. Figure 8 shows the Validation of the ticket which is done through a number generated as ticket code.

5. Conclusion

This paper gives the idea of a mobile ticket application on android phones developed by Android 1.5. The platform independent language java is used for the implementation. Along with that SQLite and Cloud Database are used as databases for user and ticket information respectively. PHP is also used as a development framework. All these things taken together can change the total concept of buying tickets in the coming days. This application can be modified according to any kind of transport system. But this is defined exclusively for sub urban railways. This android application reduces the manual work of both ticket bookers and ticket checkers. It is basically the transition from a manual to digital system for ticket booking of as well as ticket checking of suburban railways. QR code used for user validation ensures security of the system. Automatically available train time allows the user to book tickets according to his convenience; this work is performed in this project by GPS. Thus the problem associated with local train ticket booking as almost ceased.

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