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Android App for Local Railway Ticketing Using GPS Validation

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Abstract: One of the biggest challenges in the current ticketing facility is "QUEUE" in buying our suburban railway tickets. In this fast growing world of technology we still stand in the queue or buy with oyster & octopus cards for our suburban tickets, which is more frustrating at times to stand in the queue or if we forget our cards. Android Suburban Railway (ASR) ticketing is mainly to buy the suburban tickets which is the most challenging when compared to booking the long journey tickets through 'M-ticket' which fails with suburban(local travel) tickets.

The ASR ticket system can be bought with just a smart phone application, where you can carry your suburban railway tickets in your smart phone as a QR (Quick Response) code. It uses the smart phones "GPS" facility to validate and delete your ticket automatically after a specific interval of time once the user reaches the destination. User's ticket information is stored in a CLOUD database for security purpose which is missing in the present suburban system. Also the ticket checker is provided with a checker application to search for the user's ticket with the ticket number in the cloud database for checking purposes.

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Keywords: *ASR ticketing, GPS Validation, Cloud Database, QR- Code format of ticket*

Introduction

In the past decades, there has been much advancement in the field of technology. Considering railway department, e-ticket facility was introduced, wherein users could browse through an official website and book their long journey tickets which can be printed out after confirmation to show it to the checker when needed. A few months later a new technology called M-ticketing (mobile-ticketing) was introduced where customers messaged to a web- portal using their mobile phones after which a complete web page was downloaded to their phones where user could do the same booking process as in the e-ticketing facility. Also the use of oyster and octopus cards has become mandatory in foreign countries during travel. But if user forgot to carry the travel cards along with and stand in the queue for local suburban tickets, the user could suffer.

Android Suburban Railway (ASR) ticketing is primarily to buy suburban tickets which just a smart phone application, where you can carry your ASR ticket in your smart phone as QR-code(Quick-Response). It uses the smartphone's "GPS" Facility to validate and delete your ticket automatically after specific interval of time once the user reaches the destination. Ticket information is stored in a cloud database for security purpose which is missing in the present suburban system. On the other side, the ticket checker has a checker application to search and validate the user's ticket information which is been stored in the cloud database.

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1. Increasing Importance Of An Android Phone

Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android hasa large community of developers writing applications("Apps") that extend the functionality of devices SQLite is an ACID-compliant embedded relational database management contained in a small C-programming library. Application framework enables re-use and replacement of components.

- Dalvik virtual machine is optimized for mobile devices.
- Integrated Browser is based on the open source Web Kit engine.
- Optimized graphics are powered by a custom 2D graphics library; 3D graphics is based on the penGL ES 1.0 specification(hardware acceleration optional) .
- SQLite used for structured data storage.
- Media support is done for common audio, video and image formats(MPEG,PNG,GIF,JPG).
- Hardware dependent GSM telephony.
- Hardware dependent Bluetooth,3G,Wi-Fi,EDGE.
- Hardware dependent Camera, GPS, Compass and accelerometer.
- A rich development environment enabling device emulator, tools for debugging, memory and performance profiling, and a plug-in for the Eclipse IDE.

3.1 SQLite

SQLite implements most of the SQL standard, that uses a dynamically and weak typed SQL syntax that does not guarantee the domain integrity. SQLite operations can be multitasked, though writes can only be performed sequentially. The source code for SQLite is in the public domain. SQLite has many buildings to programming languages. It is the most widely used database, the most widely deployed database engine.

3.2 Present System

Android Cloud to Device Messaging (C2DM) is a service that helps developers to send data from servers to their applications on Android devices. This service provides a simple and lightweight mechanism that servers can use to tell mobile applications to contact the server directly, to fetch updated application or user data. The C2DM service handles all aspects of queuing messages and delivery to the target application running on target device.

A QR code is a type of matrix-barcode (or 2-D code). The code consists of black modules arranged in a square pattern on a white background. The information encoded can be made up of four standardized modes of data (numeric, alphanumeric, Kanji, byte/binary).

Encryption:

An android app manages encryption and decryption of QR codes using DES Algorithm (56 bits), Japanese immigration use encrypted QR codes when placing visas in passports.

Error correction:

Codeword's are 8-bits long and use the Reed-Solomon error correction algorithm consisting of four error correction levels. The higher is the error correction level, the less is it's storage capacity. The approximate error correction capability at each of the four levels are as follows:

Level L
Level M
Level Q
Level H

7% of codeword's can be restored.
15% of codeword's can be restored.
25% of codeword's can be restored.
30% of codeword's can be restored.

Due to the design of the codes and the use of 8-bit codeword's, an individual code block cannot exceed 255 codeword's in length. Therefore, the larger QR symbols contain much more data and therefore it is necessary to break the message up into multiple blocks. The QR specification defines the block sizes so that no more than 15 errors can be corrected within each block. This limits the complexity of certain steps in the decoding algorithm. The Code blocks are then interleaved together, making it less.

4. System Design

4.1 Individual Details

The installation of application starts from personal information. It gathers the customer information such as first name, last name, date of birth, city, state etc., and all this information will be stored into user mobile's, SQLite database. So whenever user buys the ticket this information is also sent to database. This process is basically used for security purpose and QR generation.

4.2 Ticket Buying

First the user selects source point, destination point, class, no. of child and adult tickets, ticket type is also choose by user like return or single etc. Then the user surf through the list of options to prefer either credit buy option or coupon buy it simplifies the buy process by remembering the credit card details. Once the user prefer any of these options the application moves on to the pin code validation module.

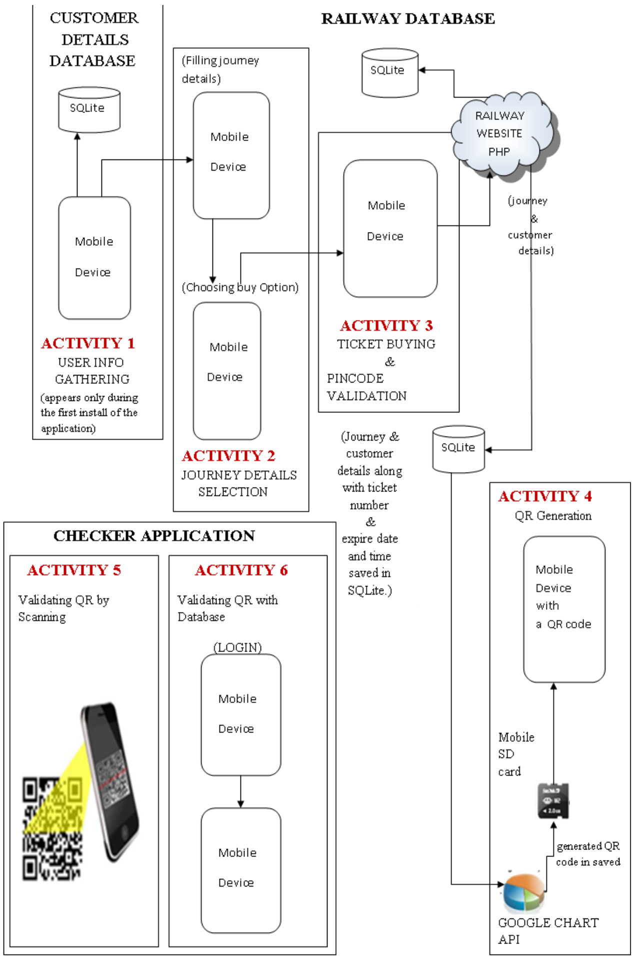
CUSTOMER DETAILS DATABASE
SQLite
Mobile Device
ACTIVITY 1
USER INFO GATHERING
(appears only during the first install of the application)
RAILWAY DATABASE
(Filling journey details)
Mobile Device
(Choosing buy Option)
Mobile Device
ACTIVITY 2
JOURNEY DETAILS SELECTION
SQLite
RAILWAY WEBSITE PHP
Mobile Device
(journey & customer details)
ACTIVITY 3
TICKET BUYING & PINCODE VALIDATION
(Journey & customer details along with ticket number & expire date and time saved in SQLite.)
SQLite
ACTIVITY 4
QR Generation
Mobile Device with a QR code
Mobile SD card
generated QR code in saved
GOOGLE CHART API
CHECKER APPLICATION
ACTIVITY 5
Validating QR by Scanning
ACTIVITY 6
Validating QR with Database
(LOGIN)
Mobile Device
Mobile Device

Figure 1: System Architecture

4.3 Pin Code Justification:

When the customer press the buy button a PHP code in the railway server validates the pin number and passwords, if it is triumphant it saves both journey details and customer info in the server's MYSQL database. After this ticket number and time of buying is generated by PHP code and balance credit value is displayed.

4.4 QR Code Generation:

Once the PHP code generate the ticket number and time of buy details saved in the MySQL database are sent to Google Chart API engine in order to generate the QR code. All the individual particulars and ticket information are transformed into QR codes and sent back to the user mobile as HTTP response and saved in the application recollection.

4.5. GPS Ticket Justification:

GPS plays the job of the checker, where when the user buys the ticket, the source geopoints , destination geopoints, ticket-type , termination time and date are stored in a mobile SQLite database. This facility checks the user's current location in accordance with the destination geopoints, after which the ticket type is checked and therefore the ticket is deleted if two is single or updated if type is return.

4.6. Examining QR code with QR Reader

In this part, checker will have QR code reader and inspect the QR code with the application with the purpose of authenticate the code and validate the journey tickets, particularly the time and date of the ticket.

4.7. Read-through With Database:

If suppose the user's display is being damaged and not able to examine the QR code because of other reasons like battery collapse, the user can use another infallible option to check the ticket by probing the ticket database with user's ticket number for justification purposes.

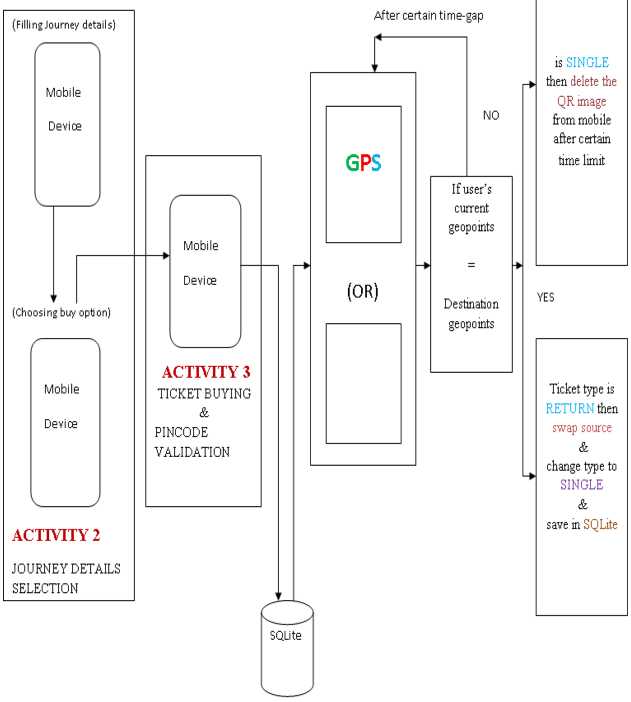
(Filling Journey details)
Mobile Device
(Choosing buy option)
Mobile Device
ACTIVITY 2
JOURNEY DETAILS SELECTION
Mobile Device
ACTIVITY 3
TICKET BUYING & PINCODE VALIDATION
GPS
(OR)
After certain time-gap
NO
If user's current geopoints = Destination geopoints
YES
is SINGLE then delete the QR image from mobile after certain time limit
Ticket type is RETURN then swap source & change type to SINGLE & save in SQLite
SQLite

Figure 2: Ticket Validation Process

5. Conclusion

In this paper we have presented a mobile ticket application developed for android 1.5 using Java, SQLite ,SQL and PHP on server side which can alter the approach people procure their tickets in future. This kind of ticketing application can be useful to any kind of transport system. This android app is one of its kind and finds massive application to buy suburban railway tickets through android mobile and also this app save huge effort for the ticket checkers by GPS justification of tickets and also moving from manual ticket examination process to digital examination process by just scanning with their own android mobile to authenticate the ticket. Hence a huge problem of issuing local train tickets has been solved with this new application.

Knowing at what time the trains will be available will also relieve the user to allot his time accordingly to arrive at the station, so in this project GPS will be used here to find the location of the user and close by train stations to display the train arrival timings. Still further improvement modification can be a dynamic display of train locations by fitting GPS devices in trains to show its location in the Google-map display which is obtainable in this application. Also as a station level safety we can have hardware devices to authenticate the QR codes prior to the user enters or leaves the station, where the user can have right to use towards platform after being validated by the hardware device.

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