

Android Application for Suburban Railway Ticketing System(SRTS)

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Abstract- This paper presents the implementation of an Android App and an Arduino controlled QR code displaying system that can be used for Suburban Railway Ticketing. This paper describes use of QR code for ticketing and steps used for storing QR codes in the Arduino UNO. The user can use the app to book ticket and inbuilt wallet for payment but it is compulsory for the user to scan the QR code, displayed on one of the Arduino controlled systems fixed at the station, using the same app. The QR code contains information about the Source and some other validation details which is encrypted using Vigenère cipher. The QR code on the system changes every 5 minutes. Each QR code is encrypted using different key. The app contains the key and the QR code data is decrypted in app itself and it fetches source station from the decrypted text and calculates fare. Finally the app generates a ticket and stores in the database. The App uses Google Vision API for scanning QR code and PayPal payment gateway to add money to wallet.

Index Terms— Arduino UNO, QR code, PayPal, Vigenère cipher, Google Vision API.

I. INTRODUCTION

Mumbai locals are rightly called the lifeline of the city, with almost all of the city's inhabitants relying on them to get to work or other destinations at some point in time. Many of them rely on these services on a daily basis. This is why Mumbai Suburban Railways operates over 2,300 train services every single day. But people need to wait in long queues for buying tickets even if they are getting late. This is one of the inconveniences people face because of the current local train ticketing system that is manual operating computer systems by the operators for printing of tickets. The use of electronic equipment like computers, printing machines, paper & ink are the major and most important resources required for paper ticketing systems. Besides, the use of electrical equipment's like ceiling fans, tube lights, and air conditioners have proved to be a costly affair. Besides time consumption and cost, these systems seek a lot of maintenance and repairs on a regular basis.

II. DRAWBACKS

Due to increasing population the main cause of problem is standing in a long queue to buy the ticket ,this cause a big

time loss and along with that the use of paper for ticket is one of the reason for the imbalance in the environment. This project is aimed for user to buy ticket in an efficient manner with the help of a mobile application.

III. WORKING

WORKING OF QR CODE DISPLAY

QR code calculation problem

The Arduino UNO has very low memory for storage (2KB approx.) and very low processing power. To generate a QR code on Arduino itself would take so much time. So the solution is to store these QR codes in Arduino.

QR code Storage Problem

We used 21 X 21 block QR code with L-level error correction. To make the QR codes that occupy least space, each block of QR code is scaled down to one pixel. So the generated QR code image is 21px X 21px. The QR code image is a black and white image so each pixel is either WHITE or BLACK. So programmatically, each pixel is either true (WHITE) or false (BLACK) but a Boolean datatype takes 1 byte of storage. So one QR code will take $21 \times 21 = 441$ bytes. But it is too large for Arduino memory as we won't be able to store more than 4 QR codes.

The Solution for the Storage Problem

The solution is to store each group of 8 pixels into a short variable. So the memory occupied will be $441/8 = 55 + 1(\text{remainder}) = 56$ bytes. So the complete QR code can be stored in an array of 56 elements of type short int. This enables us to store approximately 30 QR codes into the Arduino.

Displaying QR code

The system uses a TFT LCD shield for Arduino as a display for displaying QR code. The display uses raster scan to update its pixels and is a 240px wide and 320px long 2.4 inches 18-bit colored LCD. As the QR code used is Black and White, scaling of image does not reduce its quality. The steps to display require

1. Converting first short int value in the array to its equivalent 8 bit binary representation. Every bit represents one pixel.

2. Plotting all 8 pixel scaled to a fixed size on to the screen.
3. Repeating the same steps for all remaining 55 short int elements in the array to display one QR code.

WORKING OF ANDROID APPLICATION

1. The user needs to download the app from play store.
2. Register him/her on the app. If already created an account he/she has to login using registered email and password. The login, registrations and user sessions are automatically managed by Google Firebase.
3. The Home Fragment is the default view for the user when he/she logs in. It also has buttons to navigate to past bookings, wallet and settings as well as option to book new ticket and change account information.
4. Users' home screen displays his/her name and currently valid tickets.
5. Bookings Fragment displays all tickets booked previously.
6. Wallet Fragment shows wallet balance and previous transactions. It contains an option to add money to wallet. This part of app uses PayPal payment gateway to accept payment and add money to wallet.
7. Settings fragment has logout button and application version information.
8. Book Ticket option on the Home Fragment redirects user to new activity where he/she fills Destination, Number of adults and children, and Trip Type that is Single or Return. Now on next it goes to QR scanning activity and now user has to scan the QR code from the QR Display System fixed on wall or column of the station. After scanning the app validates the QR code and fetches Source station and calculates the Fare of the journey and displays the complete information for verifying. Now the user has to complete the payment within 3 minutes. So it is mandatory for a User to maintain a minimum balance in the wallet. Our own wallet helps for faster transaction as no third party is involved. After successful transaction the ticket will be generated and will be displayed on the Home Fragment as well as Booking Fragment. The tickets will be valid for a certain amount of time and then their status will change from Active to Inactive.
9. Account Setting option on the Home Fragment will feature all user account related options like changing the Display Name, etc.

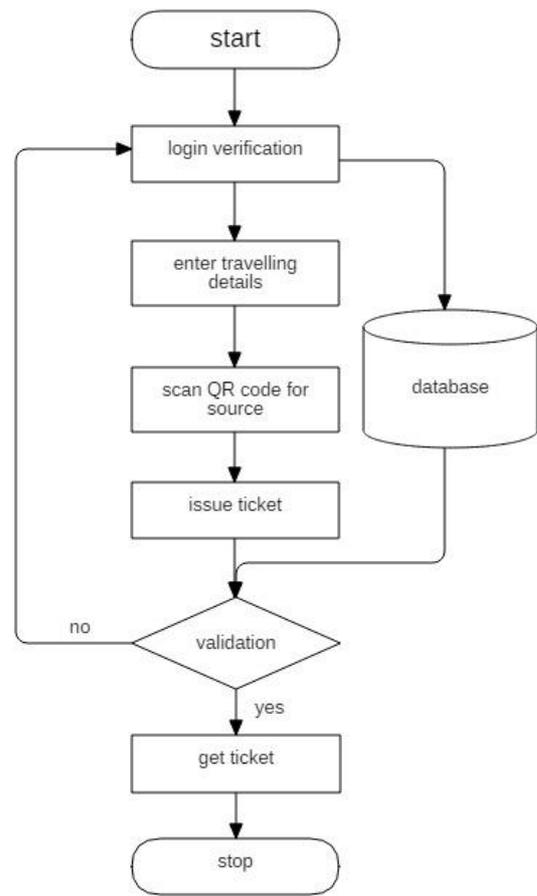


Fig. FLOWCHART

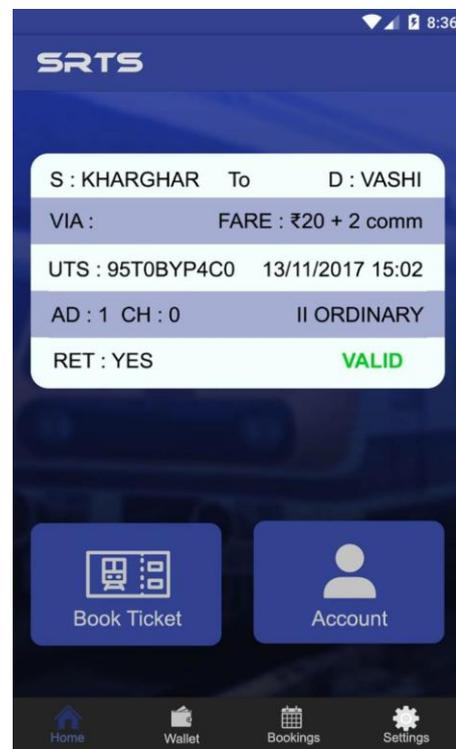


Fig. Screenshot 1



Fig. Screenshot 2

IV. ADVANTAGES

1. Saves Paper and Ink
2. The need of more and more operators to print tickets.
3. The system works on very low power as compared to Computers and Printers.
4. Reduced Maintenance cost.
5. Saves lot of time which they used to waste in waiting in queues for ticket.
6. Space required is less than adding a new ticket counter.
7. The system is scalable as it can be scaled by just adding one more QR Display System.
8. Low cost device.
9. By increasing display size, the extra space can be used to display ads which can also generate revenue.

V. HARDWARE AND SOFTWARE REQUIREMENTS

HARDWARE

- Minimum Intel I3 is required
- Minimum of 4 GB RAM is required and the RAM above this size would be recommended.
- 80 GB HDD and above
- Android smartphone.
- Arduino UNO
- TFT LCD display

SOFTWARE

- Android Studio
- Arduino IDE

- JAVA
- Python
- Database(Google Firebase)

VI. CONCLUSION

In Conclusion we can conclude that “Suburban Railway Ticketing System (SRTS)” has potential to be used in future markets. Due to the project being based on mobile platform it has quite the potential to be used widely. Also this project can help reduce the problems faced by passengers and will make their life more efficient. This application also benefits towards maintaining the eco-friendly environment by eliminating paper based ticketing system.

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