

IoT based Indian Railway Ticket Booking and Authentication System-A Smart Approach

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Abstract- In this rapidly changing digital world, the use of android application is also increasing and which makes day-to-day tasks more efficient and secure. Considering the problems occurring during the railway journey right from booking ticket to passenger verification and during journey also we are trying to improve the digitization of ticket booking and verification process of railway using smart devices available around us.

We prepared a system which will overcome all the problem through an app in which QR (Quick Response) code will be generated where ticket information will be stored in encrypted form, user has to scan the QR code from smart phone which will act as QR scanner at the railway station. All the details of the passenger will be directly sent to Railway Central Database. QR code scanner will be installed at entrance of train coach after the scanning of QR-code passenger's ticket information will be verified. This app can also track the location of passenger in real-time and the app will only be able to track a passenger as long as that passenger is traveling in the train maintaining the privacy. Before real time implementation we also surveyed or reviewed many papers related to smart ticket booking and authentication systems using QR code, biometrics and IoT device like (GPS and GSM module). This IoT-based smart approach is to create an environment which is hassle-free and user-friendly for visitors as well as for passengers and also booking and verification problem will be easier and reduced to a large extent.

Keywords — *Arduino, Biometric, IoT: Internet of Things, GPS and GSM module, QR Code*

I. INTRODUCTION

In terms of cell phone usage, we Indians are among top in ranking but when it comes to the management of large-scale bodies like Indian Railway we often faced difficulties. Since the world is rapidly advancing towards digitization and the use of android application makes day-to-day tasks more efficient and secure. At railway stations also this smart systems can be used to solve all difficulties facing today.

In Railways, problems related to crowd management at railway ticket counter, proper storage of information regarding current location of the travelling passenger. In spite of having vacant seats, people travel without reservation. Often it happens that, by taking someone else ticket which is verified by that person's ID, some other individual is able to travel. Sometimes three or more people travel together by using only a single person's ID. This motivated us to solve this problem by creating a smart railway ticket booking and authentication system based on IoT[1].

II. LITERATURE SURVEY

A short literature survey is done which help us to move further in this direction. For literature survey, number of works from different researcher is reviewed and prepare and mention in the Table 1 below.

Table 1. Literature Survey.

Authors	Paper Title	Proposed Algorithm
Kirti Dhiman, Er. CK Raina	IoT Based Ticket checking system	QR code is creation for purchasing the ticket and authenticated with QR code for verification using mobile number

Mr.Godson Michael D’silva, Mr.Anoop Kunjumon Scariah, Mr.lukose Roy Pannapara, Ms. Jessica John Joseph	Smart ticketing system for railways in smart cities using software as a service architecture	AWS cloud based service using AWS IoT and RFID. Effective and can be monitored easily using cloud service and also reduces the man powers.
R. Vijaysanthi, S. N. Radha, M. Jaya shree, N. V. Sindhujaa	Fingerprint authentication using Raspberry Pi based on IoT.	Biometric verification using GT-511C3 and Raspberry-Pi.
Ms.M.Gowthami, MR.P.Karthikeyan, P.Kishore, R.Arun Aravinth	Train ticket inspection and validation using Biometric	user has to register their details like their name mobile no. and finger prints. user will reserve their ticket and get ticket ID.
Nitu Mujumdar, Pooja Shinde, Karishma Thigale, Sanjay Agrawal	Application of smart phone QR code and fingerprint for anti-counterfeiting	Generation of 2D and barcode on the ticket for authentication.

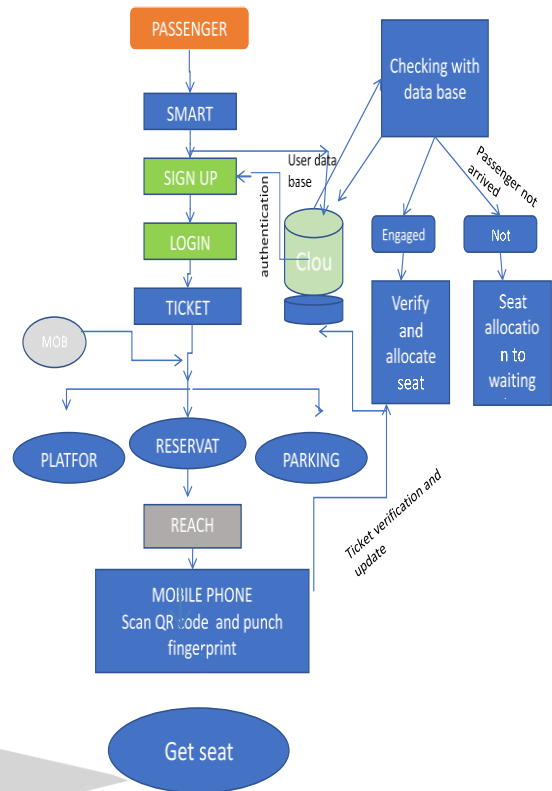


Fig. 1. System Flow Chart

III. SYSTEM ARCHITECTURE

We prepared a system as shown in fig 1. System Flow Chart which will overcome the problem of authentication at railway station through an app on which QR (Quick Response)[1,2] code will be generated in which ticket information will be stored in encrypted form and detailed information is stored in the cloud[2] database, which can be easily verified through android application.

User has to scan the QR code from smart phone (which will act as QR scanner) at the railway station. The biometric data of user will also be captured using the android app[At entrance of train coach QR code scanner will be installed; after the scanning of QR-code user’s ticket information will be verified. After verification of biometric[3] data (using the android app), user’s identity will be verified. This application-based approach is to create a user-friendly and hassle-free environment for visitors and also for passenger

In this Smart system, there is sign in page for user who will issue the ticket for first time through our App using email sign in; his Aadhar-card (UIDAI) number and mobile number is mandatory for identification purpose, after the login to the system, reservation ticket booking and verification options will be displayed[4,7]. After selection of ticket payment gateway will be displayed. After completing payment and biometric data capture QR code will be generated and the information in QR code will be saved in database. In QR code user's with user ticket information will be stored.

At the entrance of train coach and parking QR code scanner will be installed for scanning QR code generated ticket. Users have to scan and verify ticket with the help of QR code scanner. The information stored in QR code is verified with the information in database. If the ticket is validated[6,7] successfully then user can enter railway platform. But at the time of start journey the user must scan QR code and punch thumb on biometric finger print scanner. If this input data matches with the data in the cloud database then the ticket is validated successfully and the user can board the train and start the journey. At the outset of his journey the app will start tracking his location and update it on cloud database[8].

IV. DEVICE MECHANISM

The mobile device will be connected to a biometric device (Mantra MFS 100) via USB. After the user opens the ‘Smart Railway QR’ app, the user is presented with a splash screen and then a login screen, asking him the sign-in using personal

account. The user needs sign-in only once. Post that, a dashboard screen will be displayed showing two options: - (i) Generate QR Code and (ii) Verify Passenger.

While booking tickets the user has to select the ‘Generate QR Code’ option, which will take him to a form for filling his journey details. All the fields in the form will be mandatory to fill. After filling the form, the user will be taken to the biometric fingerprint capture screen, where the user’s thumb impression will be captured by the biometric device and stored. Post the fingerprint capture, the user will be taken to the payment gateway screen (PayUMoney), for payment of the ticket amount (the user can pay using any mode, Debit Card, UPI etc)[9].

Once the user completes the payment, a QR code will be generated for him/her on the next screen. This QR code will contain the PNR of the passenger. ‘Zxing’ library will be used by the app to generate QR code. The user will have the option to save the QR code in the internal storage of his mobile device, by tapping on the ‘Save’ button. The passenger details, along with the PNR, will be stored on the Amazon RDS database[10,11].

Once the fingerprint is verified, the TT will then have to enable the Bluetooth on the device, in order to search for the Bluetooth device; a list of devices will be displayed on the app screen. TT will select the ‘HC-05’ device option from the list as shown in fig. 3(b), and the app will now be connected to the Arduino setup via Bluetooth. The Arduino setup will consist of HC-05 Bluetooth module, an LCD display and the Arduino UNO microcontroller. After the Bluetooth connection is successful, a scanner (also implemented using Zxing Library) will open up on the app, asking for a QR code as shown in fig. 3(c).

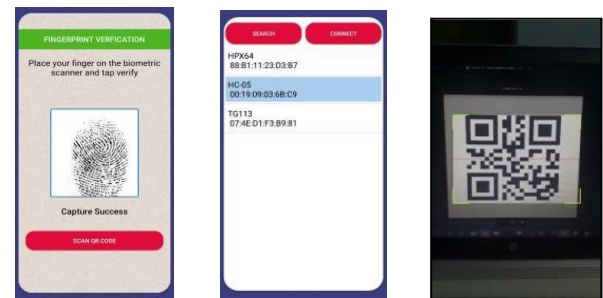


Fig. 3. (a) fingerprint verification; (b) HC-05 device; (c) QR code Scan

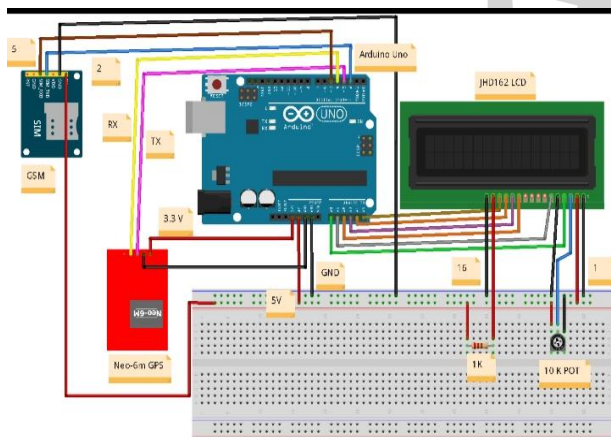


Fig 2. Circuit Diagram

Above circuit diagram consist of given below components:

- LCD Display
- Bluetooth Module
- Fingerprint Scanner
- IC2 LCD interface
- Arduino UNO
- Variable register =10 k ohm
- Register=1k ohm

A. QR Code Verification

For the verification process also, the app will be connected to a biometric device via USB. After the ‘Verify Passenger’ option is selected, the fingerprint verification screen will open up as shown in fig. 3(a), where the user will again give his/her thumb impression, which will be validated against the list of fingerprints (ISO templates) stored earlier.

Case 1:

The user scans the QR code, and the code is genuine, the app will display a message ‘Passenger Verified’ as shown in fig 4.(a), the scanner will close, and the user will be taken back to the dashboard screen shown in fig 4.(b). The app sends the relevant commands to the Arduino module via Bluetooth and the Arduino will send a command to the LCD display to display the message ‘Verified’ as shown in fig 4.(c). The authenticity of the code is checked by comparing the PNR obtained after scanning, with the list of PNR numbers stored on the Amazon RDS database.

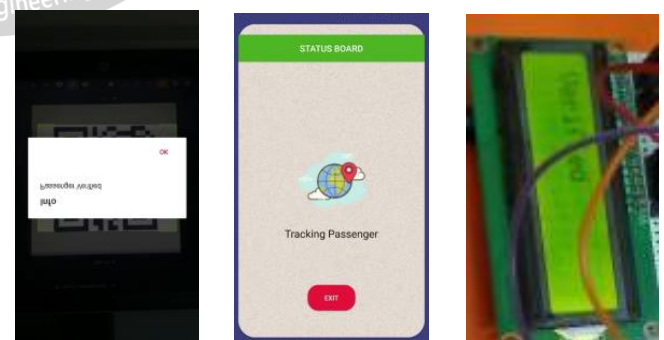


Fig.4. (a) Passenger Verified; (b) Status Board ; (c) Verified

Case 2:

The user scans the QR code, and the code is NOT genuine, the app will display a message ‘Invalid Input’ as shown in fig 5. (a) , the scanner will close, and the user will be taken back to the dashboard screen. The app sends the relevant commands to the Arduino module via Bluetooth and the

Arduino will send a command to the LCD display to display the message 'Non-Verified' shown in fig 5.(b).



Fig.5. (a) Invalid Input; (b) Non-Verified

V. RESULTS

The 'Smart Railway QR' app, opens for the use with a splash screen and then a login screen, the user will sign-in using personal email id as shown in fig.6. The user needs sign-in only once.

The Dashboard screen will be displayed as shown in fig. 7 showing two options: - (i) Generate QR Code and (ii) Verify Passenger.

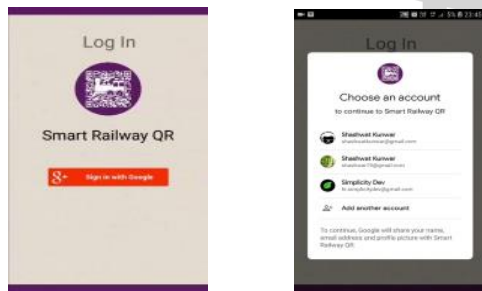


Fig. 6. (a) Smart Railway QR app Log In; (b) sign-in using personal email id

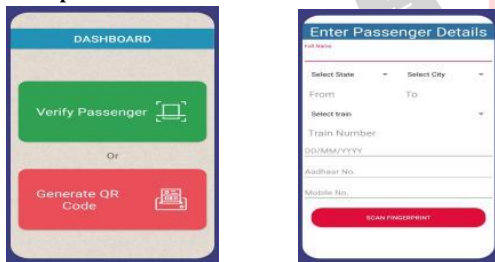


Fig. 7. (a) Dashboard screen ; b) Asking passenger details

The user will be taken to the payment gateway screen as shown in fig. 8 for payment of the ticket amount PayUMoney is used for demonstration.

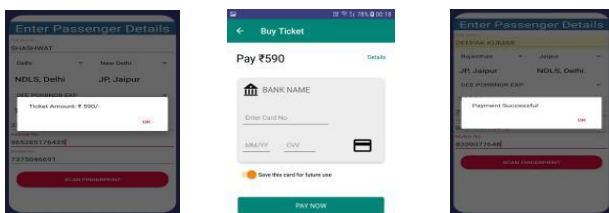


Fig. 8. (a,b,c) Payment Gateway

The user's finger impression as shown in below fig.9 will be captured by the biometric device and stored as file in the database for authentication as shown in fig 10 below.

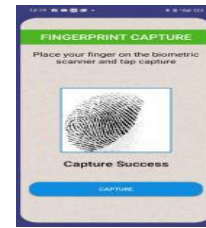


Fig. 9. Fingerprint Capture

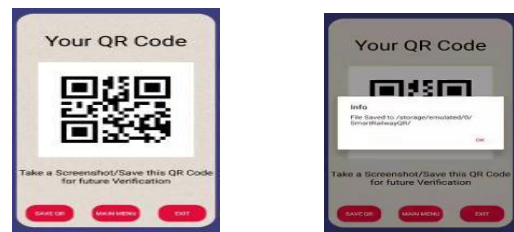


Fig. 10. (a) QR Code information ; (b) Stored in database

VI. CONCLUSION

In this paper the main investigation was to explore a system which can automate the tasks for the users. We had surveyed many papers related to biometric fingerprint scanner and mobile ticket application, so that we could develop an android application and IoT device to provide a secured travelling system by allocating seat for passenger and providing easier way of seat verification.

Biometric and QR code are used for validation of ticket at the source and GPS for suspension of passenger location update upon his arrival at the destination. The passengers are not disturbed after they have correctly verified their seats once as the location of passenger is track in real-time and the app will only be able to track a passenger as long as that passenger is traveling in the train maintaining the privacy.

VII. FUTURE PROSPECTIVE

when a user (passenger) gets down in the middle of the journey then the GPS[12] in train can track user's location and if it confirms the user has got down and left the train, then the user's remaining amount should be refunded to his/her account.

- If that seat is vacant, then it will be automatically allotted to the people having tickets in waiting. For those who would not able to travel in spite of having ticket, then the ticket of that individual will be canceled before half an hour of departure of the train from the boarding point. And the refund will be initiated to their account by deducting suitable percentage of the reservation charge.
- We can extend this concept to be used for generating parking ticket and platform ticket.

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