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Abstract

Transportation plays the major role in the part of humans. Nowadays, it is very difficult to manage the time and distance without vehicles. The population is increasing rapidly which leads to increase in vehicles but as the number of vehicle are increasing it leads to increase in pollution. Government are encouraging citizens to use less private vehicle and go for public transport. Public transportation (Bus Services) is the main source of travelling for inter and intra cities in India. Today in the era of Digital India and Cashless Economy, public transport needs to adopt the technology, there is a need of smart and trusted system. The major problem experienced by the passengers are getting the perfect tender for the ticket fare and waiting time. This project proposes about the Mobile app for booking the journey ticket as well as the conductor will be able to scan the booked ticket from the system provided to the conductor by depot. The mobile app will have GPS tracking facility with Maps to know the direction and route, also the application will generate the ticket in QR form and the conductor app will have scanner to scan the generated tickets. The generated ticket will also be sent to conductor with Bluetooth to validate and the SMS is sent to user with acknowledgment. The ticket is valid for 30 minutes from the successful payment receipt. This will lead to fast and paper less ticketing system.

Keywords: Transportation, eTicket, City bus service

1. Objective:

The main objective of the app is to provide a smart mode of payment for the passengers in the field of transportation. A passenger app to book the tickets by selecting the relevant source and destination with a payment option. After successful payment the ticket is generated in the form of a QR code. The QR code is then saved to the passenger device in case of network failures. The QR code is then scanned by the conductor who uses another app to verify the validity of the ticket. Every ticket id generated by the passenger app is automatically expired after a certain time making it time constraint.

2. Literature Survey:

Sanam Kazi et al. propose a system for the modern day transportation services where the user will be able to book a ticket using smartphone and then pay for it within the app itself so as to support cashless payments. The user is given a chance to book a ticket for the specifically for a bus. If the user doesn't have a smartphone he/she can book the ticket using a machine installed in the bus stop or terminal. The user is given a chance to book a particular seat in the bus if available and if it's not available the project proposes a novel algorithm to suggest a seat automatically using the algorithm. The proposed system works for people without the smartphones by suggesting to install a terminal device which can take cash deposit and print ticket. The conductor can verify the ticket using the SMS received by the user when booking the ticket digitally or for the printed ticket like in a traditional way. [1]

Luka et al. propose a system based on the NFC chips in the smartphones so as to eliminate the need to physical cash. The system uses a Metro like approach where check-in and checkout devices are installed in the bus stops. When the user enters the check-in information the phone is scanned with the NFC terminal in the check-in stand and then after the journey at the checkout counter the user taps the mobile device with the NFC counter which then generates the ticket fare which is then paid at the checkout station using cash to the administrator or using the digital payment service within the app itself. [2]

Kajal Hargunani et al. propose a system for ticket booking based on QR Codes. The system consists of buses having QR code in them for the user to scan which then redirects to a URL asking information about the source, destination and then number of tickets. The information is then sent to the server which returns the QR Code image of the ticket along with the ticket amount to be paid while verification with the conductor or via digital payment. The project also proposes a system of tracking the buses using the onboard GPS systems. The user will be able to scan the QR Code in the bus stop and the user will be able see the buses and their timings and current locations. [3]

The GPS based ticket booking and tracking system uses a smartcard to check to verify the ticket. The system includes a smartcard to be carried by the user which is issued at the bus depo. The smartcard contains information about the validity, available balance and user information. While entering the bus, if the user has a smartcard it can be swiped in the device with the conductor which then checks with the server regarding the validity and the available balance. If the criteria is satisfied the ticket is generated and the cost of the ticket is then subtracted from the balance of the smartcard in the database. [4]

Maithili Dhule proposes a NFC based booking and payment system. This system contains a NFC based check-in and checkout devices within the bus. When the user creates an account all the relevant details are saved and then when the user boards the bus, the person has to check-in with the device in the bus to start the journey process. When the user reaches the destination and while the person is exiting the bus the user has to tap the NFC enabled phone with the checkout device to initiate the checkout process and then the user is charged based on the journey. [5]

3. Requirements:

Hardware requirements:

- Android Phone
- PC

Software Requirements:

1. API:

- Maps API
- Places API
- GeoLocation API
- SMS Gateway

2. Library/SDK:

- Google Maps SDK
- Zxing(QR Code)
- BitMap Encoder(QR Code to Image)

3. Backend/Web services:

- PHP Web Service
- MySQL
- Apache 2 Web Server

Functional Requirements:

- Administrative functions :

The Depot Manager can use a Webpage to add or remove new conductor since there is no option for conductors to register from the app to prevent misuse.

- Authentication:

The user will be able to login if registered and user needs to provide Email Address and Password to login. Various users with different privileges are able to login with their requirement of the use such as Passenger, Conductor, Depot manager.

- Authorization levels:

To store the QR code in device it requires additional permission from device owner. Conductor application requires additional permission to access Camera to scan QR Code. For the Maps display additional permissions such as Location is required.

- External Interfaces:

Passenger and Conductor Application have Mobile Android interfaces which help to book the tickets and scan the QR code respectively

- Historical Data:

Webpage will help Depot Manager to trace and to check the conductor details and passenger details.

Non-Functional Requirements:

- Accessibility:

Passenger can access the mobile application anywhere and can book ticket. Passenger will also get the benefits of Cash-less payment.

- Capacity:

Multiple users can connect at a time and book the tickets due to the scalability and reliability of the web server.

- Efficiency:

AWS Database is utilized as it is powerful in the computation and highly optimized

- **Quality:**
No loss of data since the data servers provide high reliability and QoS.
- **Reliability:**
Passenger data is secured and all the data is stored with all the security.
- **Security:**
Amazon Web Services provides various level of authentication which provides data security to passenger and it helps to safely manage the mobile application and networks

4. Stakeholders:

A stakeholder is a person or organization that has rights, shares, claims, or interests concerning the system or its properties meeting their needs and expectations. To put it more simply, the interests of stakeholders have some influence on the project, so their opinion should always be taken into account.

- **Passengers:** Ease of access while booking ticket
- **Conductor:** Authentication of Ticket to analyze the validity of ticket
- **Depot Manager:** To manage employee and issues of passenger using Web Pages or Android Application

5. Process Model:

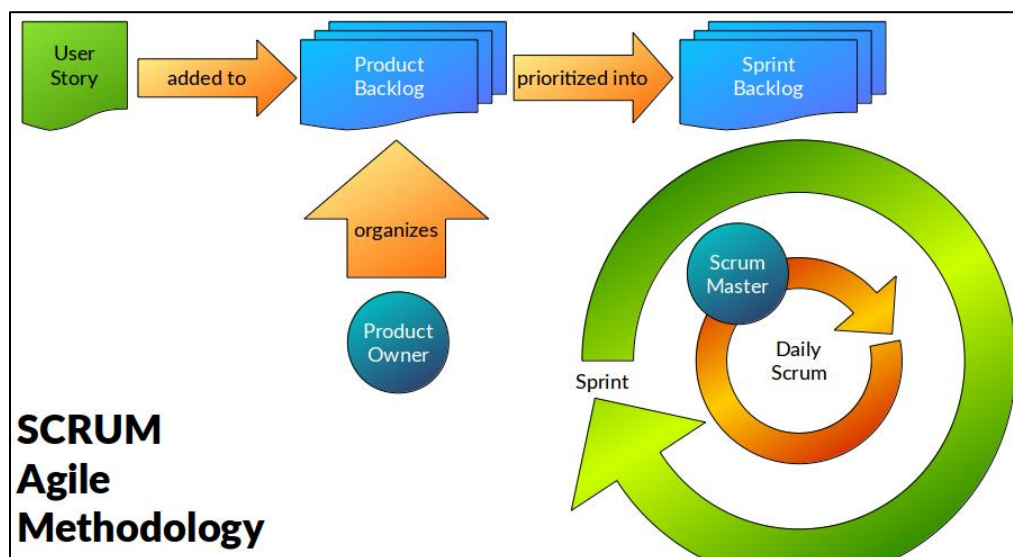


Figure 1: Implementation of Process Model

The project takes less time to develop since it contains less modules. The modules are small in size and takes less amount of time with minimal number of developers. Agile is the best option in this situation since every error can be immediately verified and rectified in a short amount of time with minimal resource usage. Changing and adapting to different technologies is what agile does best and since the feasibility analysis returned in favor of MySQL than firebase the change in structure was simple and easy to adapt. Every week had scrum meetings on the progress of each individual's work in the project and the integration steps to be taken in the project development.

The specifications are not required at beginning and changing frequently. The bus ticket fare changes according to the area and sometimes the increment in fare which results in changing of fare in the application and database can be modified easily. The cost of project remains as estimated but the delivery of new components are based on the requirements and their priority. This model provides us very high success rate, as the modules as distributed in chunks and developed as per the requirement which helps while integrating it in whole application which further leads to detect the error in the system after completely loading the module in the application.

6. Module identification

The project is divided into three major parts. One is the android app for passenger where the passenger can book the e-ticket and the other android app for the conductor to verify the e-ticket generated by the user. The third part is the admin page for the depot to control the staff details and payment information. Based on the functionality, the project is divided into the following modules

1. Authentication and registration:

The authentication module consists of two parts where one is the registration and the other is the login part. Registration process for the Passenger app requests the passenger to enter the details such as the name, email ,address and contact no etc. along with password which is then stored in the database. After the registration the login activity is started and the user enters the login details to access the app home interface. It's the same for the conductor app and the admin page.

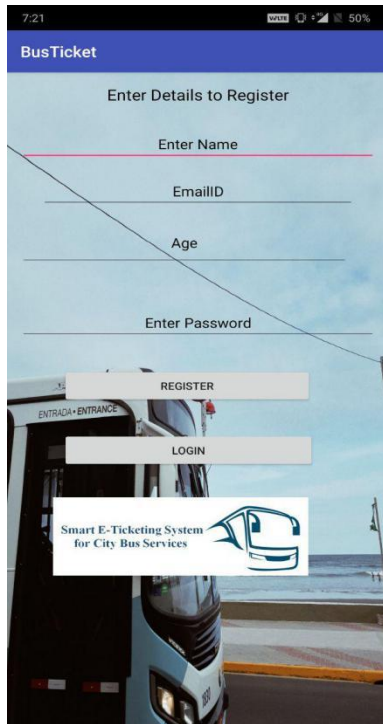


Figure 2: Registration Page

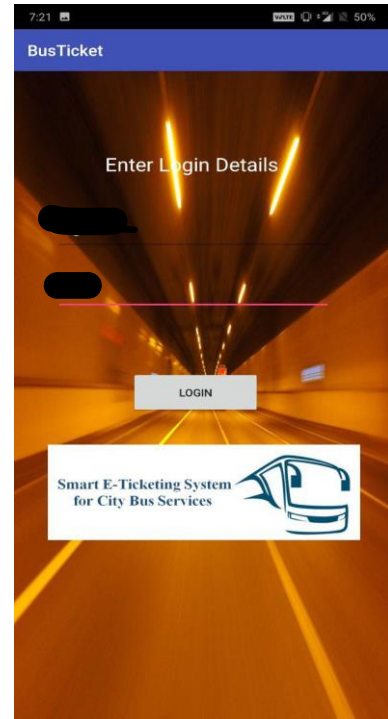


Figure 3: Login page

2. Journey ticket creation:

After the successful authentication, the app's homepage is the place where passenger can select the journey details and book the ticket. The passenger will be able to select the source stop, destination bus stop and the date of the journey which is mostly used with the system time.

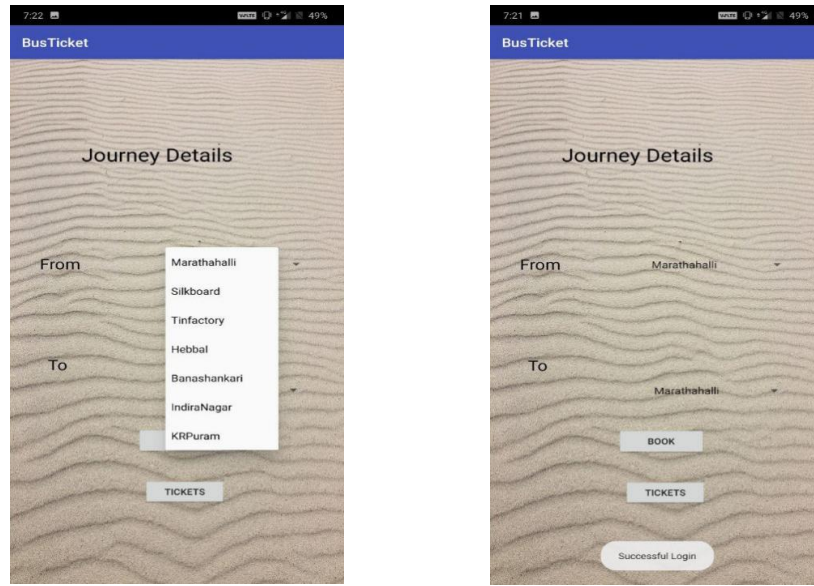


Figure 4: Journey Selection

3. Ticket summary:

The ticket booked is shown on the summary page for the conductor verification and on the conductor app this section is used to show whether the booking after the QR code scanning is valid or not. The payment section shows a text field for the user to enter the mobile number if the user chooses to get a ticket booking confirmation.

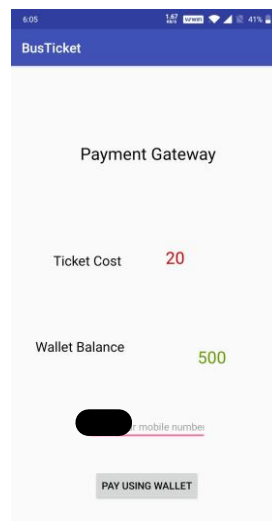


Figure 5: Payment Summary

4. QR Code:

With the successful payment the ticket id generated is converted into a QR Code for the conductor to verify the ticket using the conductor android app. The QR code generator uses the Zxing library from the android studio to both generate and scan the code from within the app. Once the QR Code is generated it is saved as a JPEG in the internal storage of the phone for latter verification. The QR code also has a text showing the source, destination and the date of journey to better identify the correct QR code if the user has multiple bookings.

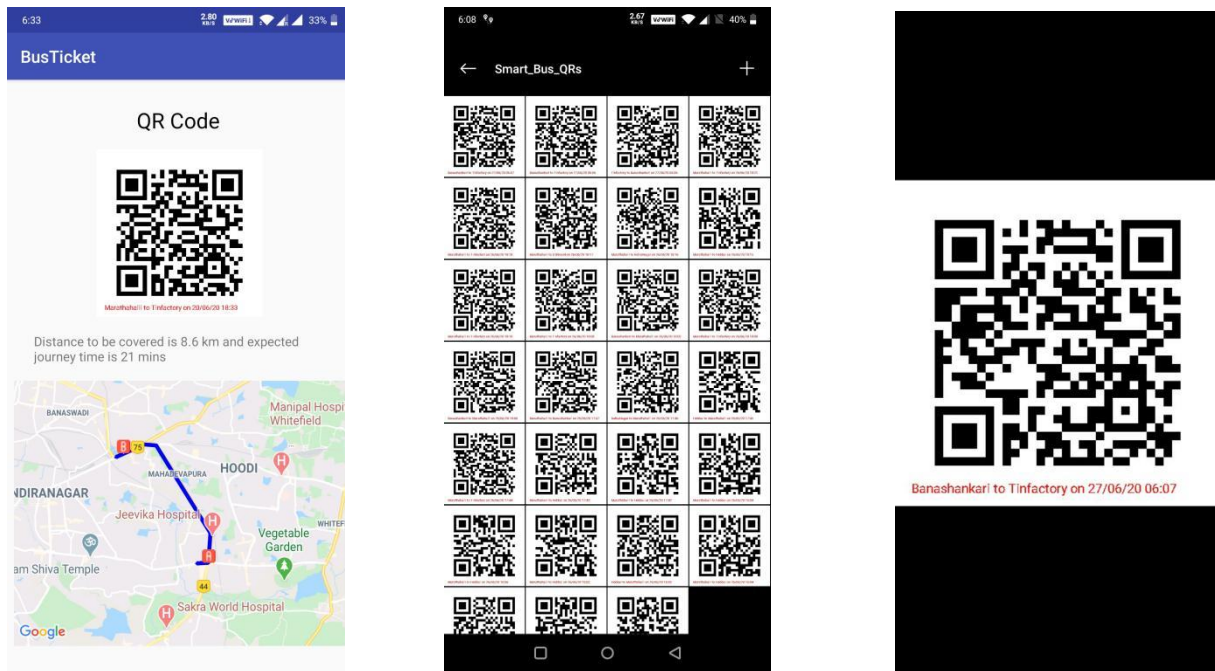


Figure 6: Booking Summary showing QR Code and the QR saved in Gallery

5. Maps:

Once the payment is confirmed and the user is shown a maps activity to check the source and destination in the maps and the current location of the user. The source is shown as 'A' and the destination is shown as 'B'. The current location of the user is shown as a blue dot. For the convenience of the user the distance between the place and the estimated time to reach it is also shown in the ticket summary window.

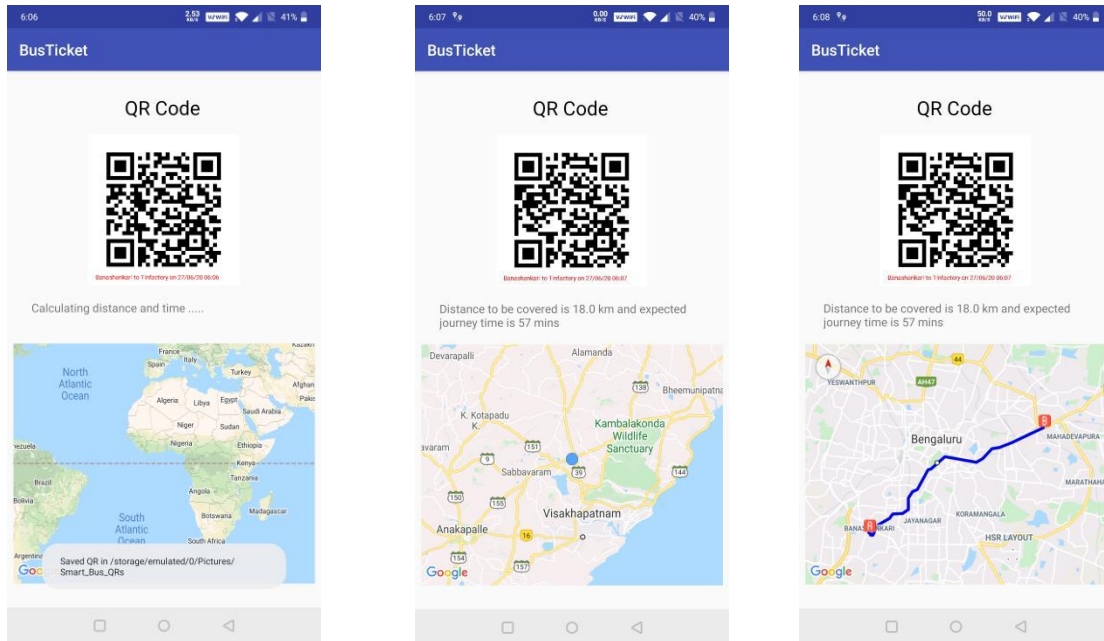


Figure 7: Booking Summary showing QR Code and the QR saved in Gallery

6. SMS Service:

Once the payment is done the user get a SMS confirmation to confirm the booking status of the ticket. This is done using a SMS API where the app sends a http request to the server with the mobile number to send an sms.

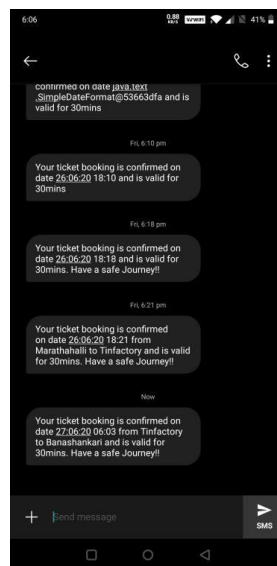


Figure 8: Ticket booking confirmation SMS

7. Verification Method:

After booking the ticket, the Bus conductor could verify the ticket. The validity for a single ticket to be used is 30 minutes. After every 30 minutes tickets are invalid. The logo with Green and Red Mark helps conductor to understand the ticket with visual analysis.

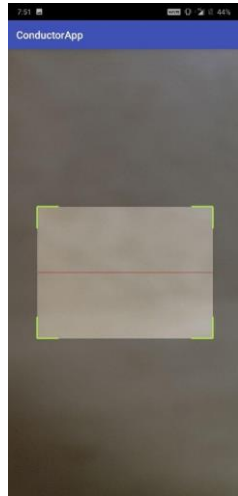


Figure 9: QR Code Scanner

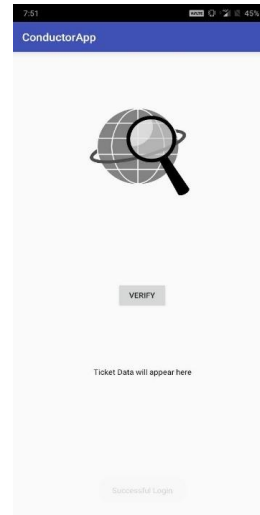


Figure 10: Conductor Verification

8. Admin page:

The admin page is used for the system controlling for the depot. It consists of allocation of monthly passes, wallet for the depot, driver and bus details. The monthly pass is only issued from the depot portal and can't be done from within the app. The wallet option in the web page shows the budget and the number of monthly passes available for distribution. Admin page is used mainly by the depot to store the details of the driver, conductor, bus details and their routes.

Admin Management

Employee Data	Register Employee	Budget/Transactions	Contact
Please Enter the Employee Details			
Enter Name <input type="text"/>			
Email ID <input type="text"/>			
Contact No. <input type="text"/>			
Age <input type="text"/>			
Username <input type="text"/>			
Password <input type="text"/>			
<input type="button" value="Register"/>			

Figure 11: Depot Manager Web Page

9. Test Case Report

The test case here assumes the source being “KRPuram” and the destination being “Marathahalli” for ticket booking and verification outputs.

1. AWS Database Tables Creation:

The below figure shows the table which are developed in AWS MySQL using EC2 instance. The below tables contains: Journey fares, User details, Employee Details, Ticket history, Ticket data, etc.

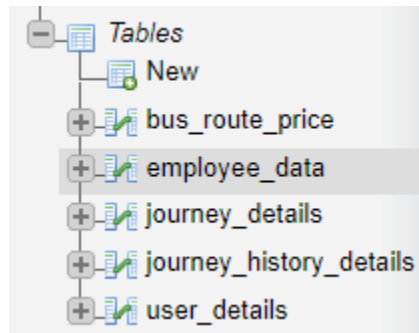


Figure 12: Database Generated Tables

2. Registration:

The below figure 12 shows the process of registration of user and after registering the user the password will be securely stored in the database. The figure 13 shows about the user registration row in the table.

The figure 15 shows the Log In page for user this page will require Login Id and Password to be entered in the application for further ticket booking process. If password fails to be entered correctly then the Login fails.

4. Ticket Booking:

The figure 16, shows us the interface for Journey detail selection. The test case here is then selected.

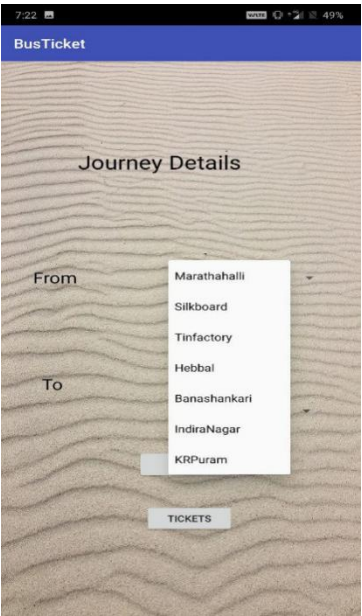


Figure 16: Journey Selection

Figure 17, shows the rows in the database after successful completion of ticket booking

	jid	username	from_address	to_address	ticketdata
<input type="checkbox"/> Edit Copy Delete	1		KRPuram	Tinfactory	KRPuramTinfactory07112019192152
<input type="checkbox"/> Edit Copy Delete	2		Tinfactory	Silkboard	TinfactorySilkboard07112019192152
<input type="checkbox"/> Edit Copy Delete	3		KRPuram	Marathahalli	KRPuramMarathahalli07112019192152
<input type="checkbox"/> Edit Copy Delete	4		Tinfactory	Marathahalli	TinfactoryMarathahalli07112019192152
<input type="checkbox"/> Edit Copy Delete	5		KRPuram	Marathahalli	KRPuramMarathahalli07112019192743

Figure 17: Table for QR Code generation and validation

Event:

The below figure 18 shows the event which will trigger in the database and delete the tickets from the table. The tickets can be deleted after 30 minutes of ticket generation. According to the requirements the successful payment bus ticket should be valid for 30 minutes.

Details

Event name

Remove_interval_Time

Status

ENABLED

Event type

RECURRING

Execute every

1

MINUTE

Start

2020-06-26 00:00:00

End

2020-10-27 00:00:00

Definition

```
1 DELETE FROM journey_details WHERE timestamp<DATE_SUB(NOW(),INTERVAL 30 MINUTE)
```

Figure 18: QR code reject event

After the Event trigger all the entries which are generated for 30 minutes or more than 30 minutes are removed as shown in figure 19.

✓ MySQL returned an empty result set (i.e. zero rows). (Query took 0.0002 seconds.)

```
SELECT * FROM `journey_details`
```

☐ Profiling [[Edit inline](#)] [[Edit](#)] [[Explain SQL](#)] [[Create PHP code](#)] [[Refresh](#)]

Figure 19: Empty QR code table

Figure 20 shows the table which contains all the journey details with all the historic data maintained for any future issue or discrepancies.

<div>←T→</div>			jid	username	from_address	to_address	ticketdata	timestamp
<div><div><div></div></div><div>Edit</div><div><div></div></div></div>	<div><div><div></div></div><div>Copy</div><div><div></div></div></div>	<div><div><div></div></div><div>Delete</div><div><div></div></div></div>	195	vig	Banashankari	Tinfactory	BanashankariTinfactory27062020061425	2020-06-27 09:08:33
<div><div><div></div></div><div>Edit</div><div><div></div></div></div>	<div><div><div></div></div><div>Copy</div><div><div></div></div></div>	<div><div><div></div></div><div>Delete</div><div><div></div></div></div>	196	vig	Banashankari	Tinfactory	BanashankariTinfactory27062020061625	2020-06-27 09:08:33
<div><div><div></div></div><div>Edit</div><div><div></div></div></div>	<div><div><div></div></div><div>Copy</div><div><div></div></div></div>	<div><div><div></div></div><div>Delete</div><div><div></div></div></div>	197	vig	Banashankari	Tinfactory	BanashankariTinfactory27062020061713	2020-06-27 09:08:33
<div><div><div></div></div><div>Edit</div><div><div></div></div></div>	<div><div><div></div></div><div>Copy</div><div><div></div></div></div>	<div><div><div></div></div><div>Delete</div><div><div></div></div></div>	198	vig	KRPuram	Marathahalli	KRPuramMarathahalli27062020074814	2020-06-27 09:08:33

Figure 20: Permanent table for user details

5. Payment Gateway

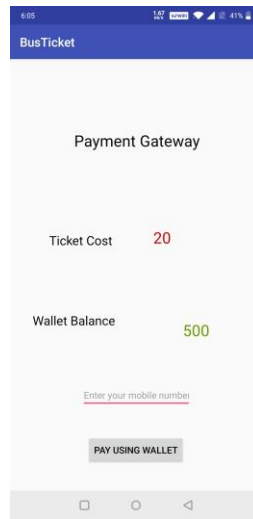


Figure 21: Payment Summary

The figure 21 shows the Payment Summary and the payment mode for purchasing the ticket.

6. SMS Service

After the successful payment, a SMS is sent to the users mobile number entered during payment. For the test case here, the SMS received can be shown in the below figure.

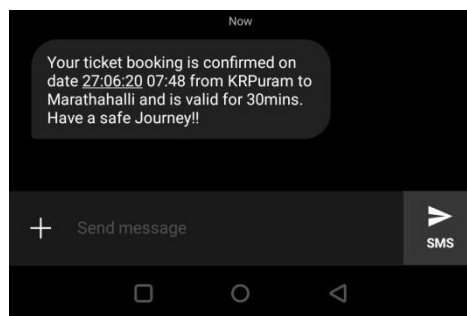


Figure 22: SMS showing confirmation of the test case

7. Maps

There are two parts to the maps module which are, the distance and estimated time display while the other is the maps window which shows the source and the destination. Here in the Fig. 23 , the distance between the locations and the estimated time is displayed as well as the maps activity for the current test case is shown.

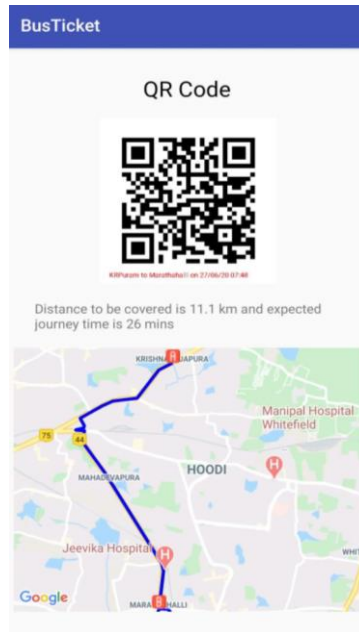


Figure 23: Maps showing the test case locations

8. QR Code Generator

Figure 24 shows the QR Code generated after successful payment of ticket. The QR code contains Start and Destination data with date and time the ticket payment has been completed.

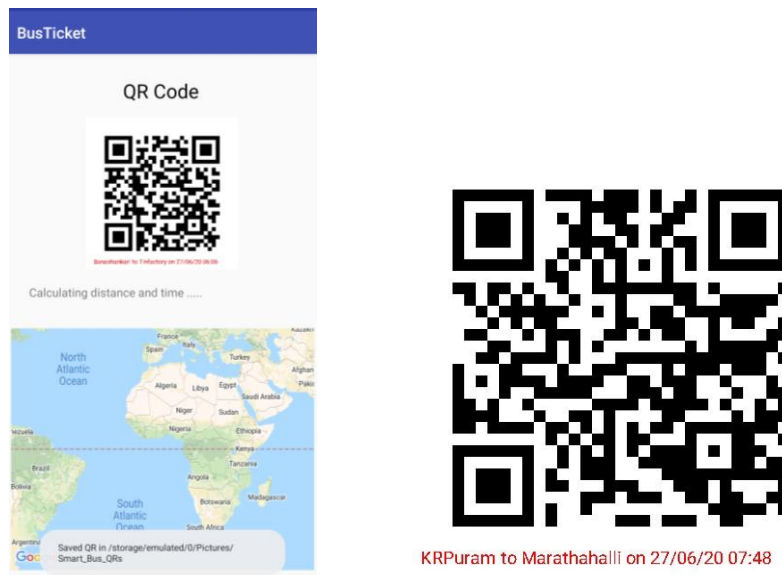


Figure 24: QR Code on the ticket summary window(L) and QR Code saved in the storage(R)

9. Conductor QR Scan

The figure shown below is the interface of conductor to validate the ticket condition. If the ticket generation is done within 30 minutes then the ticket status will be “Approved”, if the ticket generation time is more than 30 minutes then the ticket is “Rejected” and to buy a new ticket.



Figure 25: Approved Ticket

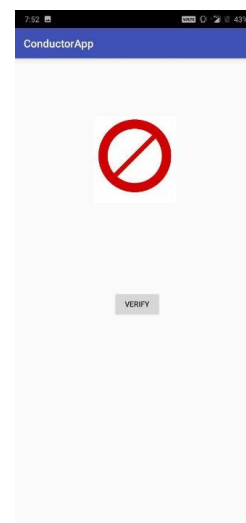


Figure 26: Rejected Ticket

10. Conclusion:

The Android app developed for the passengers makes it easier to book tickets and eliminates the hassle of paying in crowded places and often not getting back the balance amount taken by the conductor. In this scenario the passenger can book the ticket 30 minutes before their commute which is then expired after a certain period of time. The conductor who has the scanner app scans the ticket of the passenger eliminating the need for paying back the balance in a crowded environment.

11. Future Enhancement:

The customer app can be improved in many ways further enhancing the capabilities of the customer in ease of managing the journey details.

- A fingerprint recognition module can be added to the app replacing the traditional login method for a faster and secure way of authentication.
- Adding support for more third party payment services including PayPal, UPI etc.

- Including more features such as one tap booking from history which takes the previous booking history and repeats the booking process, easier and best for daily commuters.
- A Grid Menu for QR codes to be shown within the app itself instead of going to the Gallery for viewing images.

12. References

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