NALAIYA THIRAN - IBM PROJECT REPORT

(19IT410T Professional Readiness for Innovation, Employability and Entrepreneurship)

ON

SMART SOLUTIONS FOR RAILWAYS

Submitted by

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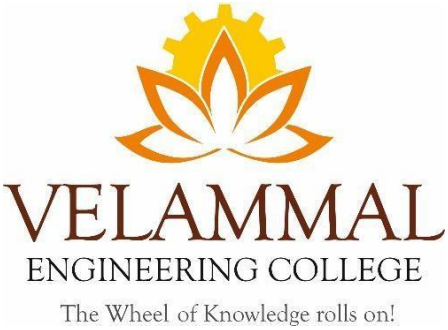
in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING



VELAMMAL ENGINEERING COLLEGE, CHENNAI-66.

(An Autonomous Institution, Affiliated to Anna University, Chennai)

2022-2023

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BONAFIDE CERTIFICATE

Certified that this NALAIYA THIRAN – IBM PROJECT REPORT **"SMART SOLUTIONS FOR RAILWAYS"** is the Bonafide work of "SWETHA G (113219041121), MEENA C(113219041066) RASIKA J(113219041094) and MALAVIKA R (113219041062)" carried out in "PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP (NALAIYA THIRAN-IBM PROJECT)**"** during the Academic Year 2022-2023.

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ABSTRACT

The Railway Ticket generation using android is basically derived from computer reservation system and upgrade to android based ticket generation using QR Code. Railway Ticket generation System contains the details about train schedules and its fare tariffs, passenger reservations and ticket records. A Railway inventory contains all train details with QR Code Information. The online QR Based ticket generation system has its database centrally located which is accessed through an Application Programming Interface (API).With the invent of Railway management system the traveller and the train got the freedom to get a ticket without standing in a queue. For travelling in unreserved section, the passengers have to stand in a queue to get the ticket. In our system, the passenger can generate the unreserved ticket through their android phone itself. The passenger can get the train details by scanning the QR code of a train to get the ticket. The passenger can get a ticket by entering number of seats and payment details. It has also become a hassle free transaction for both the train and the traveler. The Railway reservation system involves three main actors the database, online operator and a database scheduler. The database scheduler updates the database, One of the core functions of the inventory management of railway reservation system is the inventory control. Inventory control steers how many seats are available for the booking in unreserved section

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CHAPTER 1
INTRODUCTION

1.1 PROJECT OVERVIEW

The SMART SOLUTION FOR RAILWAY project aims to improve the facility to use the easiest way to reserve a ticket through online with the help of QR code scanner.During this project we work on IOT devices and we can gain knowledge about how to work with Watson IOT Platform. Connecting and exchanging the sensor data. Also IBM Cloudant DB is also used. Scan the QR code and retrieve the user details about the reservation of the ticket. Generating the user details in the database connecting to the xampp server for the web page. Storing the data in the Cloudant DB. With the QR code we can generate the required data.

1.2 PURPOSE

- In our project, using the web application by writing a code in html css and js the user details can be created.
- Once the details are created it gets stored in the database.
- Once the user clicks the submit button,the QR code is generated and the unique Id is generated along with the details with the unique id is stored in the Cloudant DB.
- In python code, a ticket collector can scan the QR code and the unique is checked along with the id the passenger provided to check the details of the user.
- Also the live location of the train is tracked by using GPS tracker.

CHAPTER 2

LITERATURE SURVEY

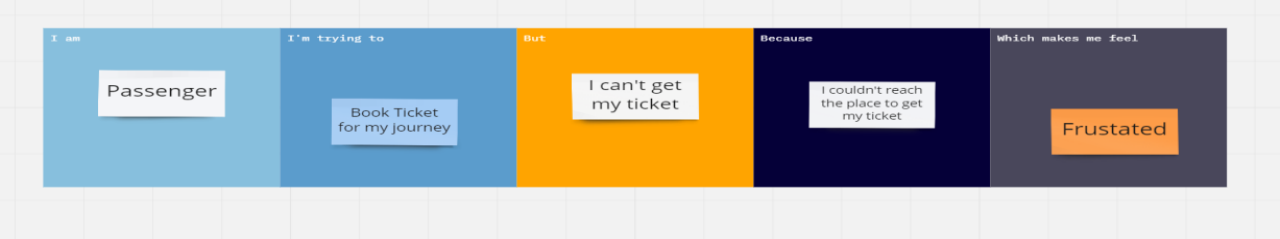
2.1 EXISTING PROBLEM

Author	Title	Source	Findings
Naveen Bhargav et al. (2016)	Automatic Fault Detection of Railway Track System Based on PLC (ADOR TAST)	International Journal of Recent Research Aspects	The sensor is used to detect defect in the train track and the ultraviolet sensor is used to detect the obstruction in front of the train.
B. Siva Rama Krishna et al. (2017)	Railway track fault detection system using IR sensors and Bluetooth technology	Asian Journal of Applied Science and Technology (AJAST)	In the event of any defect on the track it will detect track defect using IR sensors and then it sends a message to the android phone using a Bluetooth module.
Mansi R. Sarwan et al. (2018)	Self-Powered For Railway Track Monitoring Using IoT	IOSR Journal of Engineering (IOSR JEN)	This has resulted in a rapid increase in surveillance of systems, buildings, vehicles, and machines using sensors.
S. Mishra, A. Shrivastava and B. Shrivastav (2019)	A Smart Fault Detection System For Indian Railways	International Journal of Scientific & Technology Research	The device built will be attached to a train engine and contains a sensor that can detect a few meters cracks and as soon as any cracks are found the train driver will receive a

			signal to install emergency brakes and the authorities will be notified of the correct location of the fault
Giovanni Tuveri, Italo Meloni(2019)	Automating Ticket Validation: A Key Strategy for Fare Clearing and Service Planning	International Journal of Scientific & Technology Research	An integrated fare system thus needs to exist, along with an agreement among the service providers for ticket revenue sharing (clearing), to avoid creating a barrier to the adoption of public transport, since users tend to be overwhelmed by many tickets and several purchase methods.

2.2 PROBLEM STATEMENT DEFINITION

The problem that have been occurred in using the application defines the problem statement. The problem statements include Engagement of dedicated staff/window for Pass/PTO and ticketing, Loss of working time of staff requiring pass, Wastage of lot of Paper, Availability of Pass/PTO and ticketing(in night, away from HQ, for the families).



Problem Statement (PS)	Iam (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Traveller	Electronically validatemy seat	There is no such option	There is no sensor located on my seat to validate my ticket	Disappointed
PS-2	Traveller	Get compensation for cancelled trains	There is noimmediate automatic compensation	Thecurrent procedure of requesting for compensation via post or email is not so fast	Helpless

Fig 2.1 Problem Statement

CHAPTER 3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

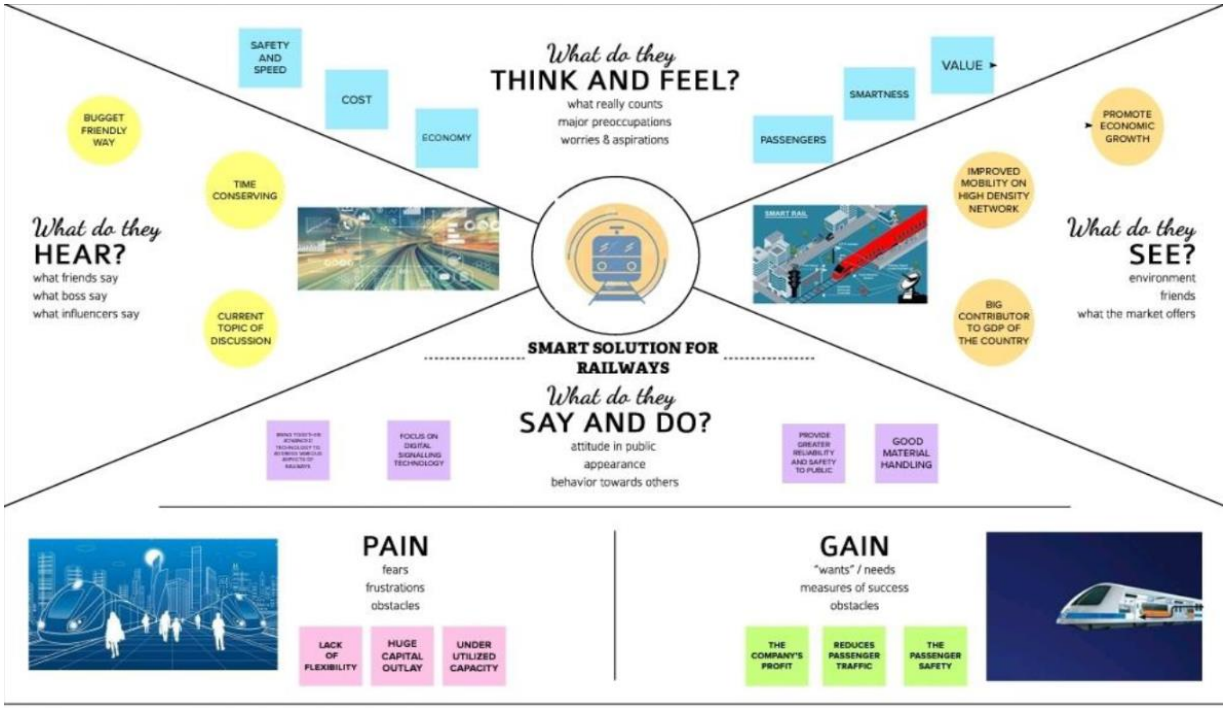


Fig 3. 1 Empathy Map Canvas

3.2 IDEAS LAID OUT BY EACH TEAM MEMBER

· SWETHA.G

• Idea 1: Keep the conversation simple and reliable to the Customers.

• Idea 2: Make the customer feel excited about the features and the platform is operable for the customers.

• Idea 3: The feature that asks about the flexibility of the journey

• Idea 4: Make sure that the customers feel happy by using this feature.

· **MEENA.C**

• Idea 1: Make sure it is available 24/7

• Idea 2: The way they hear about the reservation

• Idea 3: Make sure that the application works efficiently.

• Idea 4: Make the credentials to be confidential.

RASIKA.J

• Idea 1: Make sure that the payable options are not painful for the customers.
• Idea 2: Check for the monopoly criteria.

• Idea 3: The usability of the train facilities are checked.

• Idea 4: Check for the time complexity.

· **MALAVIKA.R**

• Idea 1: The gain that arrive in the project is noticed.

• Idea 2: Make sure the explanation is clear.

• Idea 3: Check for the improvement and security purpose.

• Idea 4: Provide the ease of accessibility.

Shortlisted Ideas

· Idea 1: Make the web page available for the customers.

· Idea 2: Check for the securable and efficiency.

· Idea 3: Ease of usability.

3.3 PROPOSED SOLUTION

S. No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To meet the new system of GSM-R that lacks the capacity to transmit the volumes of data needed today. Although the railway supply industry has guaranteed continued support for GSM-R until 2030, a new one has to be prepared and rolled out in a test mode before the end of GSM-R sufficiency.The advent of 5G communications after the long term evolution (LTE) and LTE-Advanced (LTE-A) systems provides several technological advances to address these challenges. In this paper, after reviewing the main 5G communication aspects for modern railways, we describe seven main challenges faced by train connectivity, and discuss appropriate solutions. Specifically, we elaborate on techniques for ensuring connectivity and energy efficiency for the passengers' user equipment (UE) through the use of mobile relays (MRs) on top of the train wagons in conjunction with intelligent resource allocation. These challenges pertain to confidentiality, authentication, integrity, non-repudiation, location privacy, identity privacy, anonymity, certificate revocation, and certificate resolution. This article aims to propose a novel taxonomy of security and privacy issues and solutions in ITS. Many challenges were identified to achieve a fully functional, practical and ITS network. Some of these challenges include coordination with different stakeholders, adopting different countries' ITS systems, keeping up with the technology, integration with existing systems, and budget constraints.

2.	Idea / Solution description	Indian Railways (IR) is moving towards the adoption of automation and instrumentation in its maintenance practices for detecting defects/deficiencies in rolling assets. The objective is to achieve machine-assisted automatic identification of defects in the Rolling Stock. This will lead to a paradigm shift in maintenance practices of Rolling Stock of Indian Railways from 'Time Based Maintenance' to 'Condition Based Predictive Maintenance' with a view to enhance reliability and availability along with improved safety of Rolling Stock during run. Although railway accidents happen rarely, their consequences sometimes are catastrophic. The reason for many cases is often human error caused by maintenance of the train, railroad equipment, and infrastructure, as well as an abundance of paperwork that the railway staff handles daily. The main advantage of the mobile applications for engineers and technicians on the railroad is a real-time connection between the control centre and maintenance staff. It significantly simplifies and improves the maintenance of the railroad, offering the staff not no wait for scheduled maintenance, but to fix the issue if it is needed. It allows maintenance staff to receive, review, and action faults as they occur, decreasing response and repair time and increasing network performance, the efficiency of resource usage, and uptime. However, this is also possible if the train has the Internet of Things sensors. Growing populations and rising congestion in urban centre have made traditional railway infrastructure, which takes up a lot of space, difficult to implement. In densely populated urban locations, constructing new metro rail lines costs too much in terms of land acquisition, inspection and levelling , and eventual construction. These projects also take several years to complete, leaving urban cities in a state of congestion for a prolonged period. Indian start up Prime rail Infralabs designs and develops novel urban transit solutions. Apart from providing existing mainline railway,

		rapid transit, and urban transportation with services like surveys, inspections, and design, they also develop radical solutions. PSC Plinths and Bi ebus are two of their patent-pending systems that stand to benefit urban transportation by reducing the costs of laying tracks.
3.	Novelty / Uniqueness	Growing populations and rising congestion in urban centre have made traditional railway infrastructure, which takes up a lot of space, difficult to implement. In densely populated urban locations, constructing new metro rail lines costs too much in terms of land acquisition, inspection and levelling, and eventual construction. These projects also take several years to complete, leaving urban cities in a state of congestion for a prolonged period. Indian start up Prime rail Infralabs designs and develops novel urban transit solutions. Apart from providing existing mainline railway, rapid transit, and urban transportation with services like surveys, inspections, and design, they also develop radical solutions. PSC Plinths and Bi ebus are two of their patent-pending systems that stand to benefit urban transportation by reducing the costs of laying tracks.
4.	Social Impact / Customer Satisfaction	We found that the construction and operation of the railways has degraded, fragmented and destroyed key ecosystems. It increased soil erosion, land degradation, flooding and habitat destruction. It also affected water bodies and wildlife movement. The railways gave people the ability to travel around the country quickly and made different areas more accessible. The railways made India mobile and opened up new vistas and opportunities for its people. It brought in new expertise and trades, new technology and above all, it gave the people a sense of freedom. As the railways grew, their role transformed from a mere provider of transport to something significantly larger

5.	Business Model (Revenue Model)	Increasing fuel prices and spiralling road congestion has meant that rail travel is experiencing something of a renaissance. To enable rail transportation companies to optimize their rail networks, IBM recently unveiled the IBM Travel and Transportation (T&T) Framework. It combines software products to make more intelligent use of all rail assets, from tracks to trains, so companies can meet the increasing consumer demand for more efficient and safer services. The system is made up of elements such as IBM's new customer-centric reservation system, more efficient operations control and smart vision, and parts of it are already operational within some rail networks.
6.	Scalability of the Solution	The main driver behind Smart Railways is efficiency. Advanced technologies such as automation, artificial intelligence (AI), and machine learning have the potential to revolutionize the railway industry. The implementation of digital technologies will lead to operational efficiency, cost benefits, higher customer value, and faster and better services in the railway sector. Integrated security, predictive maintenance, and asset management are a few of the new areas of technology deployment.

3.4 PROBLEM SOLUTION FIT

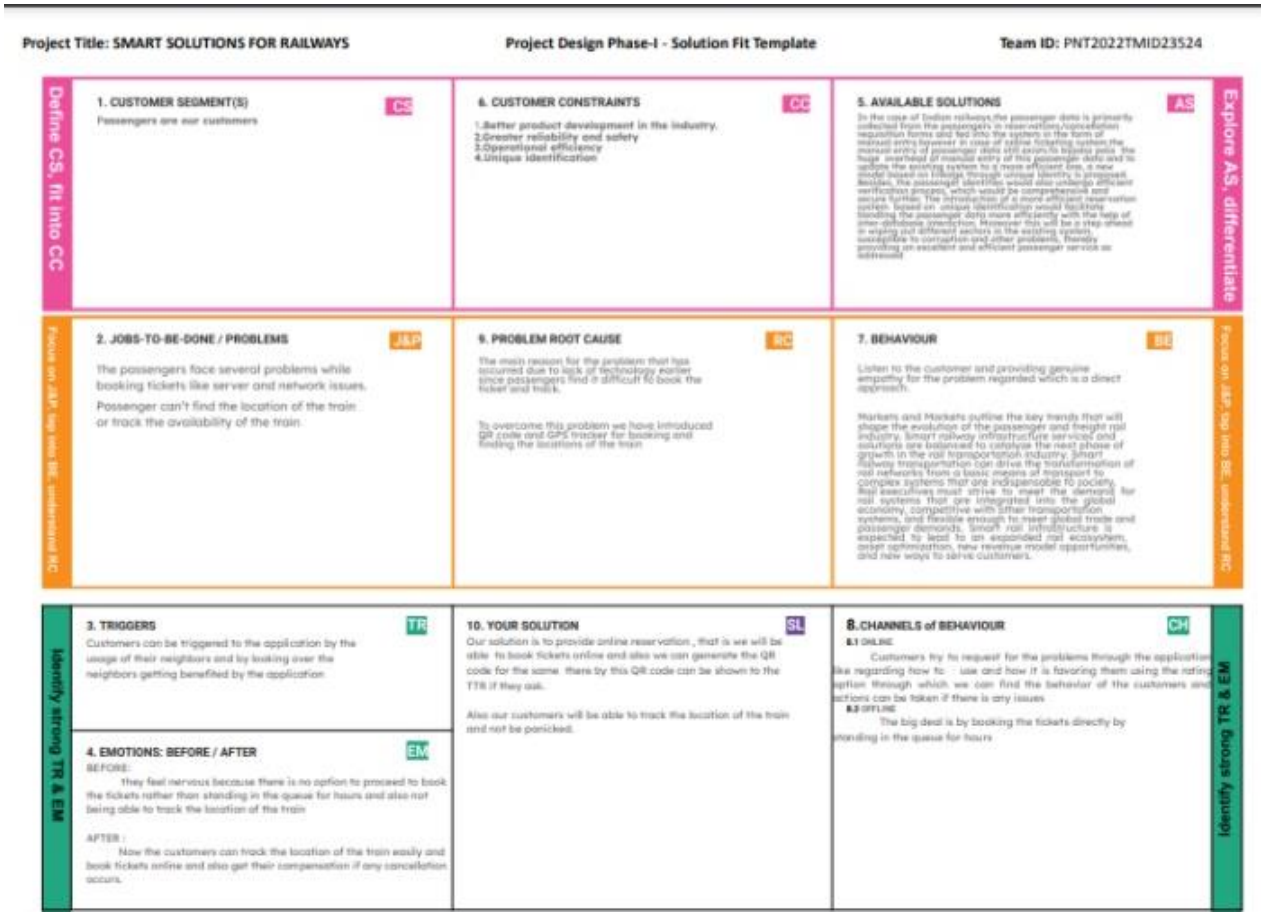


Fig 3.2 Problem solution fit

CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

The following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Passenger ticket booking	Booking through the online railway mobile app and website.
FR-2	Booking Confirmation	Booking confirmation via email booking confirmation via SMS
FR-3	Passenger objections and feedback	Through the online application, SMS, and email to the respective authority.
FR-4	Passenger Schedule	Passenger can see their train timing through the mobile app
FR-5	Passenger Emergency	Passengers in an emergency, in case of accidents, natural disasters, or theft during the journey can complain through online, applications, emergency call, SMS, and email.

CHAPTER 5
5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS :

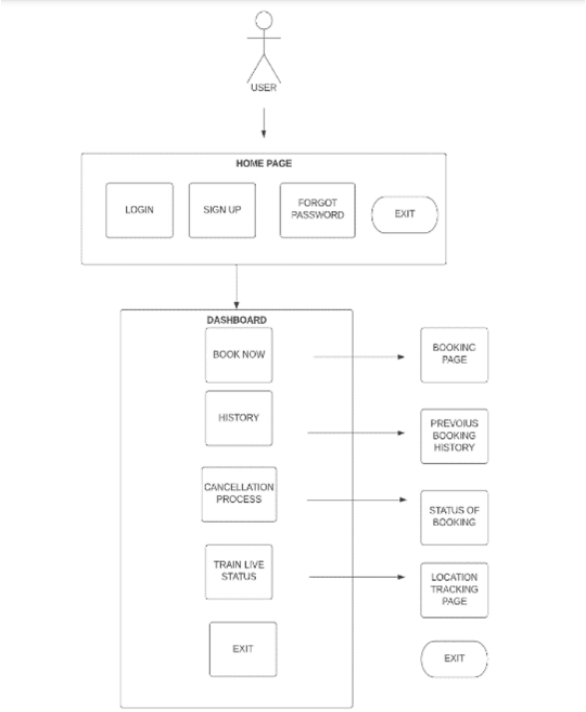


Fig 5.1 Flow Diagram

5.2 SOLUTION AND TECHNICAL ARCHITECTURE:

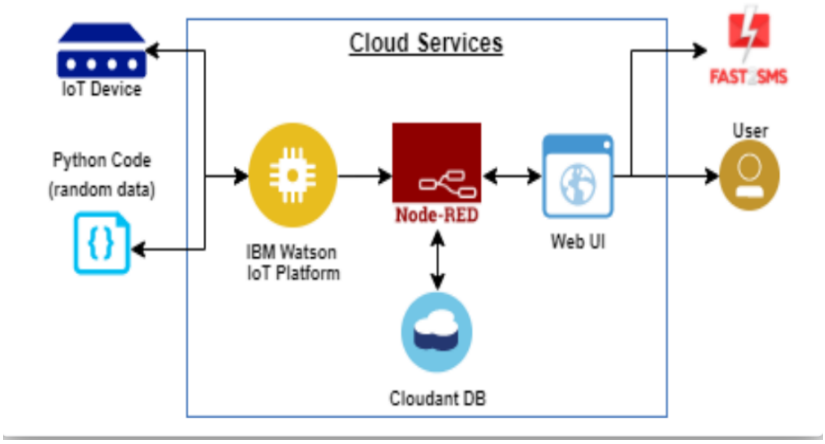


Fig 5.2 Solution and Technical Architecture

5.3 USER STORIES:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Reserving ticket	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
Customer (Mobile user)	Reserving ticket	USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
Customer (Mobile user)	Reserving ticket	USN-3	As a user, I can register for the application and enter the details for reserving the ticket	I can register & access the dashboard with Facebook Login	Low	Sprint-2
Customer (Mobile user)	Dashboard	Users	The details will be stored safely	I can access it using database	Medium	Sprint-3
Customer (Web user)	Reserving ticket	user	Enter the details and click submit button to book ticket	I can use the QR code which is been generated	High	Sprint- 1
Customer Care Executive	Connecting the service provider	customer	Connects with the service by logging in	Can get connected with the server	Medium	Sprint-3
Administrator	Provides the services	admin	The data is given by the user	Can add or update the data provided by the user	High	Sprint-1

CHAPTER 6
PROJECT PLANNING & SCHEDULING

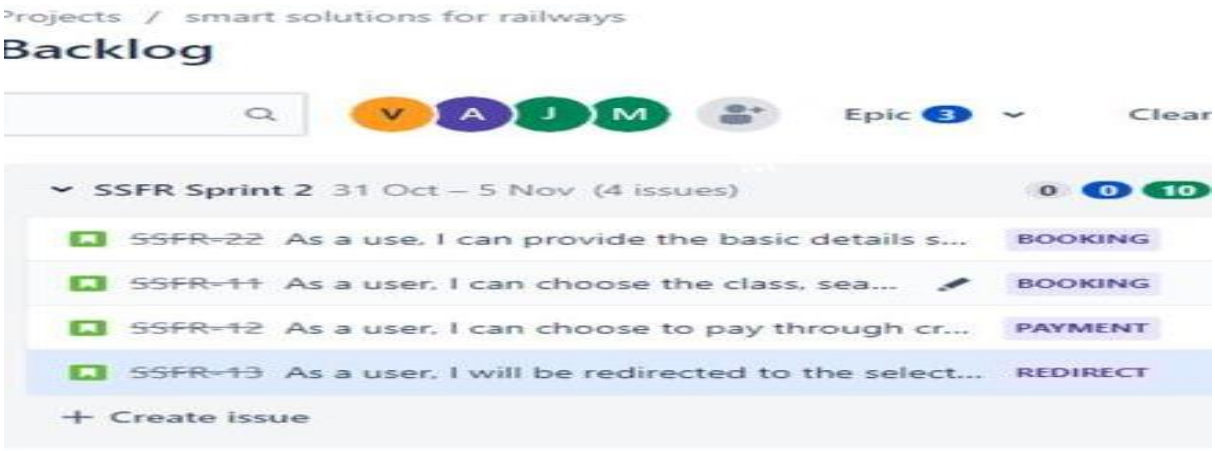
6.1 SPRINT PLANNING & ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a passenger, I want to create a login credentials so I can securely access myself service online account.	15	High	Swetha.G Malavika.R Rasika.J Meena.C
Sprint-1	Ticket Conformation	USN-2	As a passenger, I want to check my ticket whether it is conformed or not.	5	Medium	Swetha.G Malavika.R Rasika.J Meena.C
Sprint-2	Payment	USN-3	As a passenger, I want to pay my ticket cost in online payment	15	High	Swetha.G Malavika.R Rasika.J Meena.C
Sprint-3	Booking Status	USN-4	As a passenger, I want to check my ticket once it is conformed.	5	Medium	Swetha.G Malavika.R Rasika.J Meena.C
Sprint-4	Updating Train Information	USN-5	As an admin, I want to check the trains details like when will train reach stations and update Train information.	10	Medium	Swetha.G Malavika.R Rasika.J Meena.C

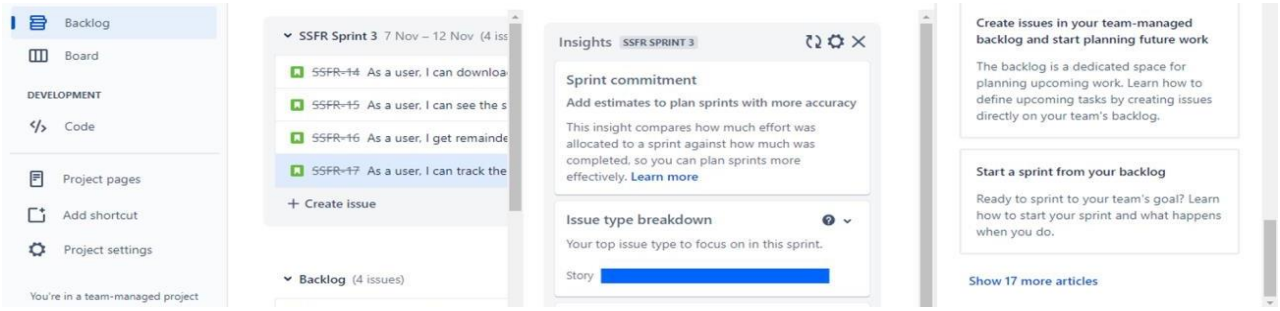
6.2 SPRINT DELIVERY SCHEDULE

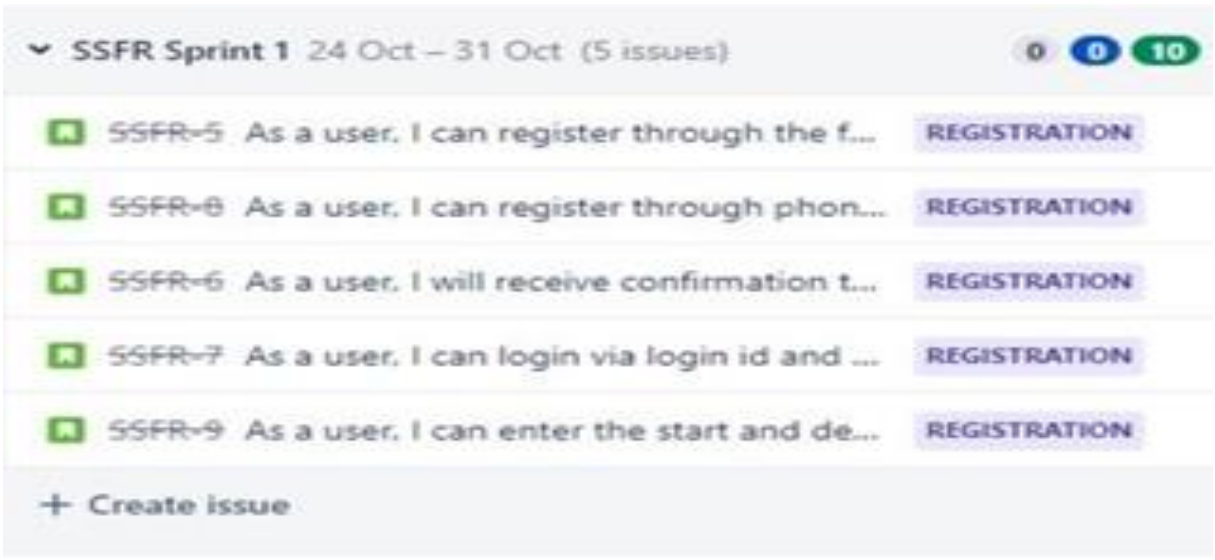
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

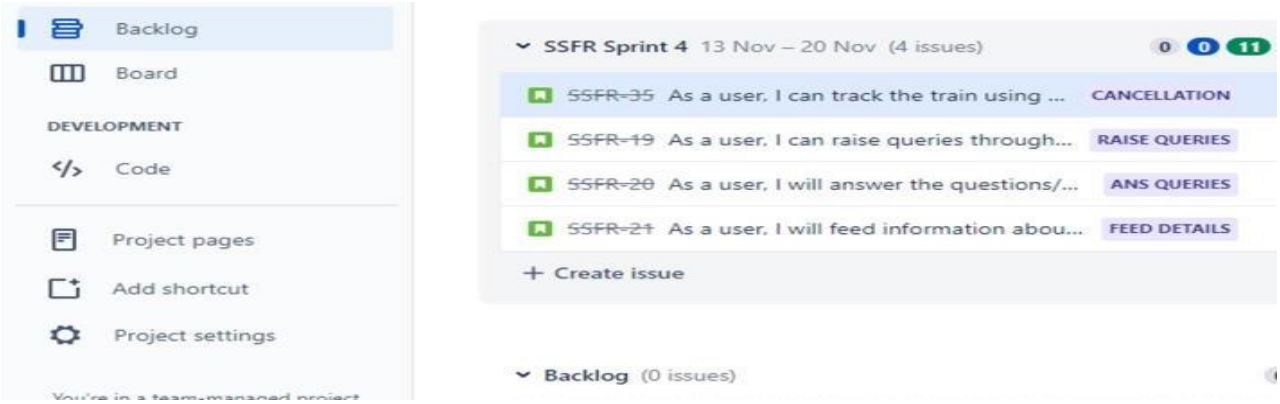
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3	Verifying Tickets	USN-6	As a TC, I want to check the users whether he/she have tickets or not with scanning the QR Code	15	High	Swetha.G Malavika.R Rasika.J Meena.C
Sprint-2	Knowing Current Location details	USN-7	As a passenger, I want to know the train current location.	5	Low	Swetha.G Malavika.R Rasika.J Meena.C
Sprint-4	Raise a compliant	USN-8	As a user, I should able to raise a ticket if something is wrong	10	Medium	Swetha.G Malavika.R Rasika.J Meena.C



6.3 REPORTS FROM JIRA




SSFR Sprint 1 24 Oct – 31 Oct (5 issues)
0 0 10
SSFR-5 As a user, I can register through the f... REGISTRATION
SSFR-8 As a user, I can register through phon... REGISTRATION
SSFR-6 As a user, I will receive confirmation t... REGISTRATION
SSFR-7 As a user, I can login via login id and ... REGISTRATION
SSFR-9 As a user, I can enter the start and de... REGISTRATION
+ Create issue


Backlog
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
SSFR Sprint 4 13 Nov – 20 Nov (4 issues)
0 0 11
SSFR-35 As a user, I can track the train using ... CANCELLATION
SSFR-19 As a user, I can raise queries through... RAISE QUERIES
SSFR-20 As a user, I will answer the questions/... ANS QUERIES
SSFR-21 As a user, I will feed information abou... FEED DETAILS
+ Create issue
Backlog (0 issues)

CHAPTER 7
CODING & SOLUTIONING

7.1 FEATURE 1

NODE RED:

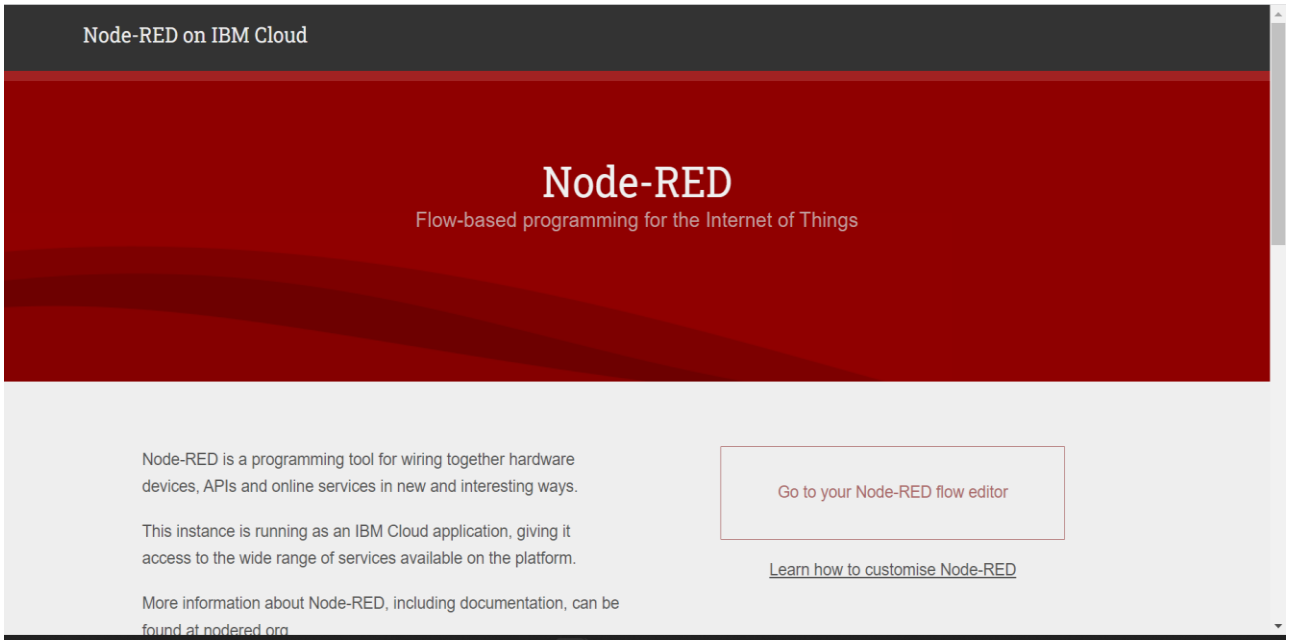


Fig 7.1 Node Red

CLOUDANT DB:

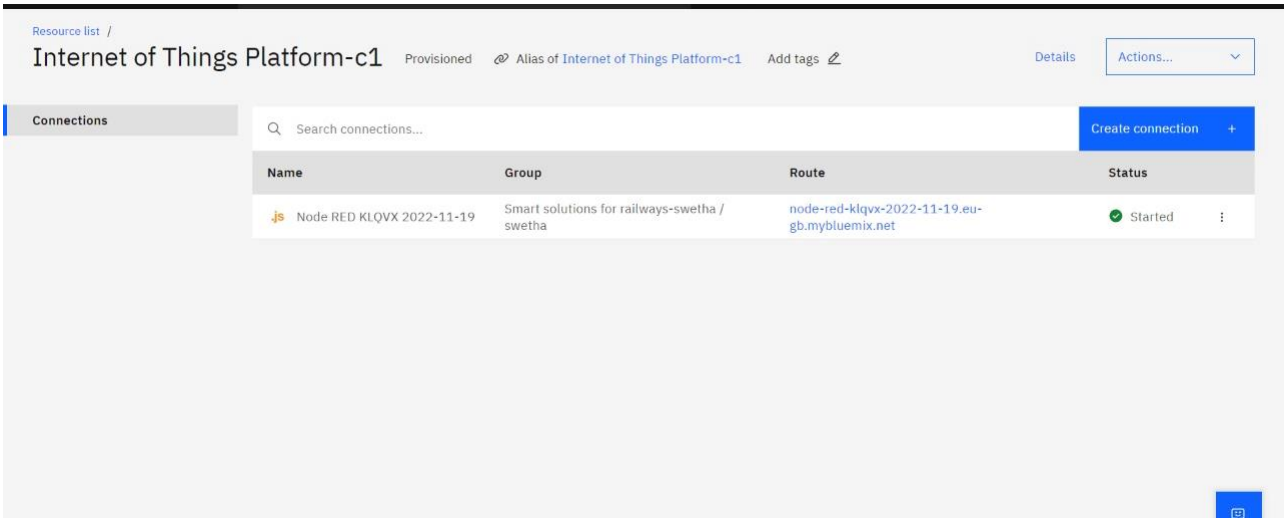


Fig 7.2 Cloudant DB

7.2 FEATURE 2:

HOME PAGE

Fig 7.3 Home Page

QR CODE

Fig 7.4 QR Code

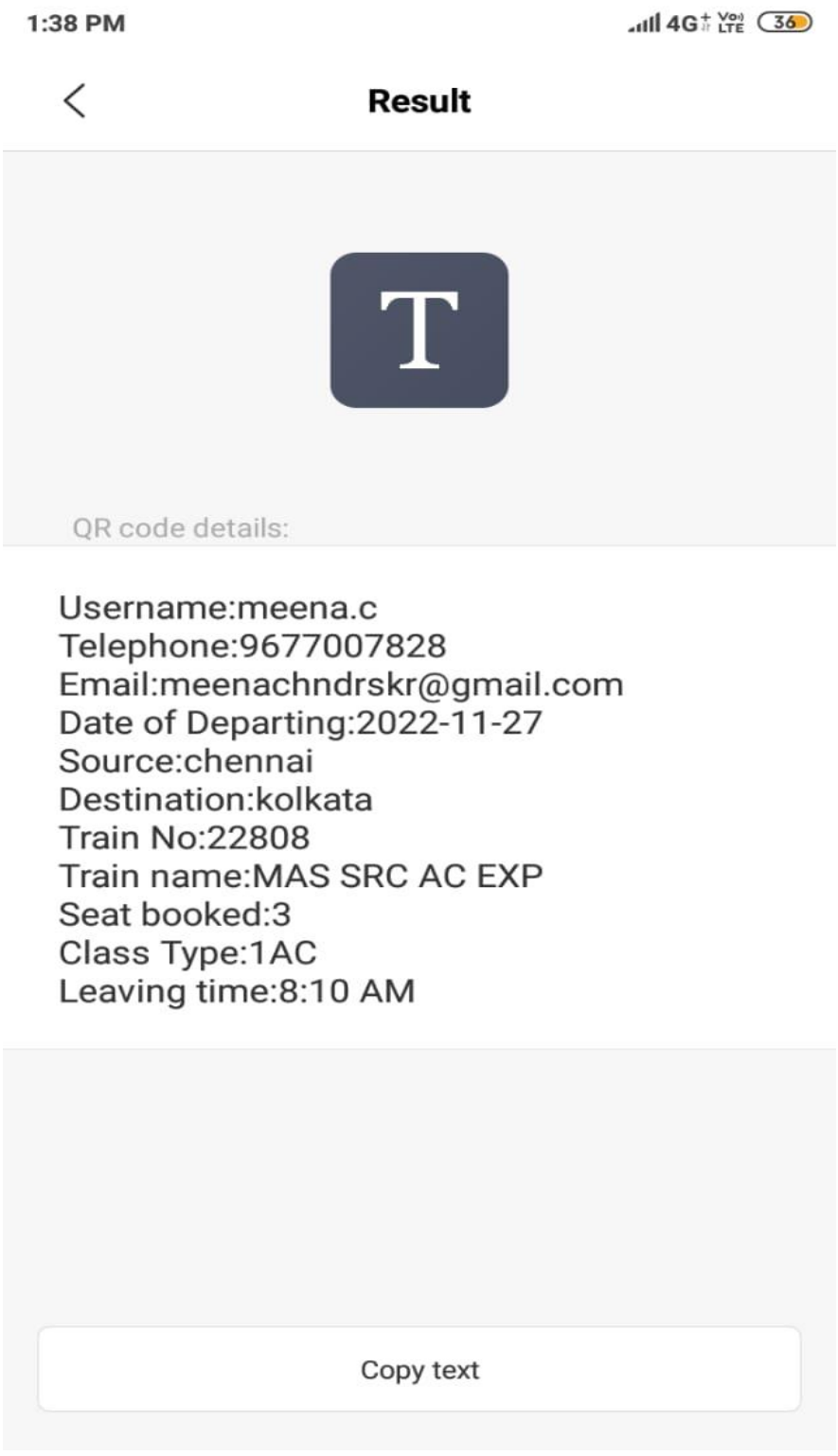


Fig 7.5 Result Page

Fig 7.6 Result Information Page

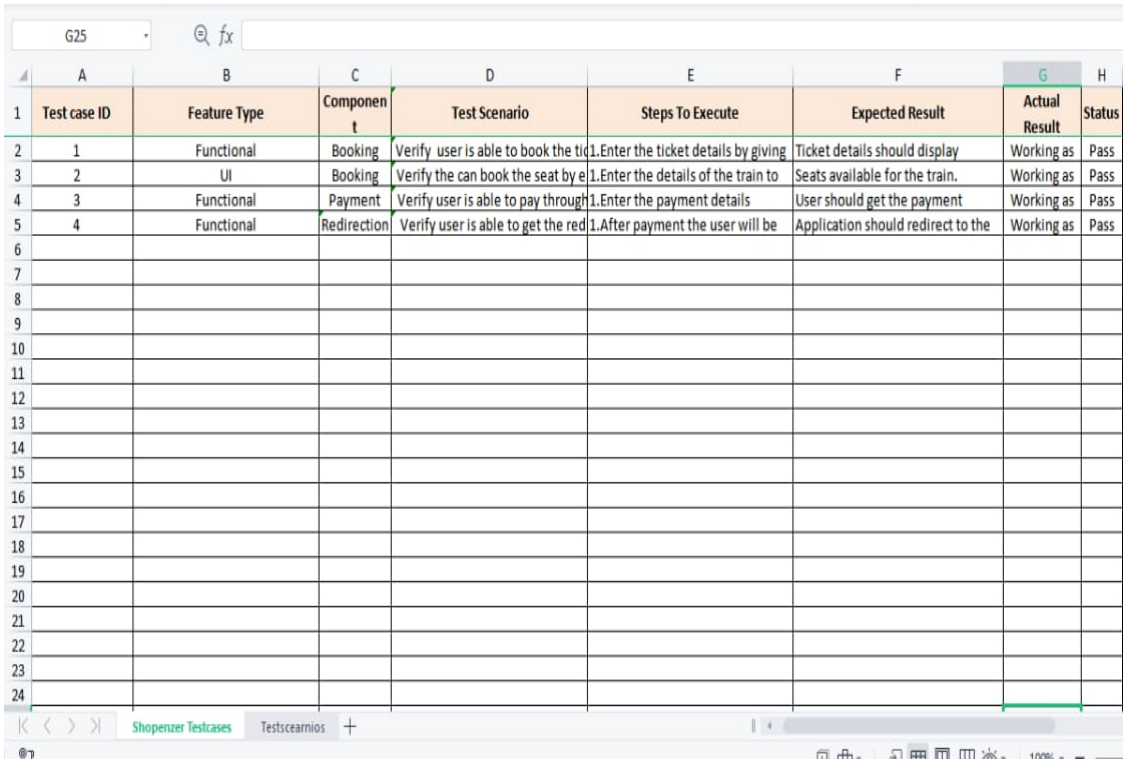
CHAPTER 8

TESTING

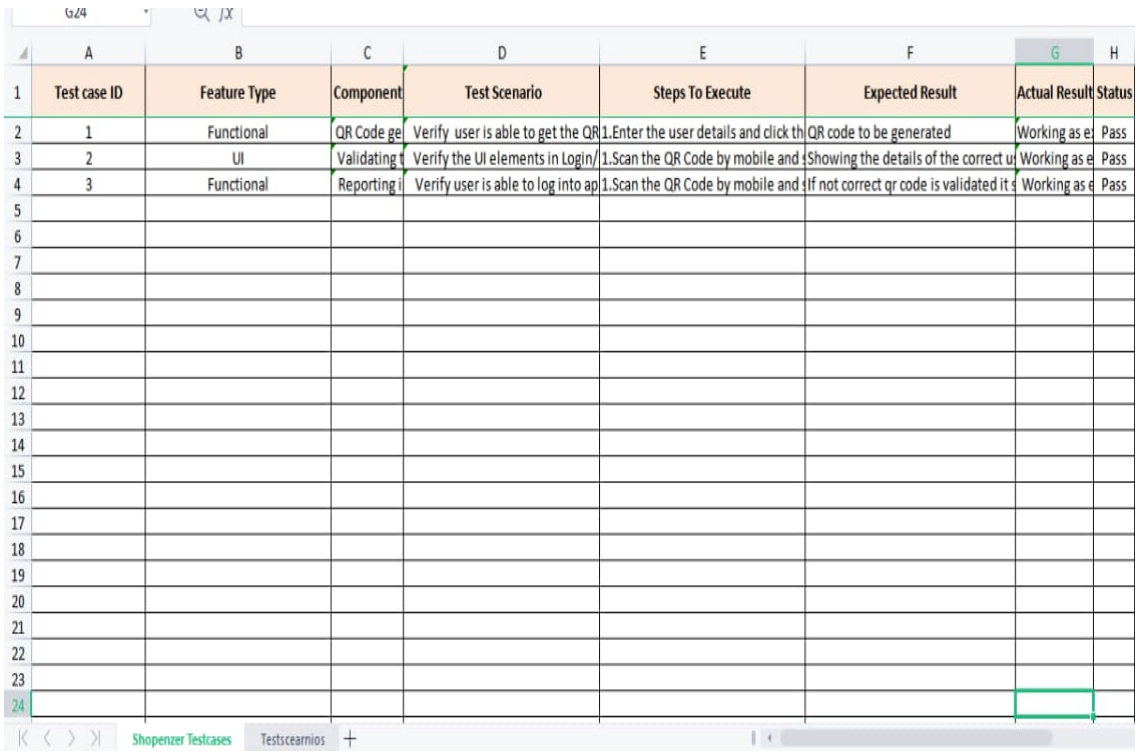
8.1 TEST CASES

1				PNT2022TMID23589			
2				Project - Smart Solutions for Ra			
3				4 marks			
4	**Feature Type**	**Component**	**Test Scenario**	**Steps To Execute**	**Test Data**	**Expected Result**	**Actual Result**	**Status**
5	Functional	Registration	Registration through the form by filling the details	1.Click on register 2. Fill the form by providing the details. 3.Click the final register button		Registration details should display	Working as expected	Pass
6	UI	Generating OTP	Generating OTP for further process	1.Giving details through mobile and ger the otp number.		User can register through mobile by getting the otp	Working as expected	Pass
7	Functional	OTP Verification	Verify user using gmail	1.Enter gmail id and enter the password provided 2.Click submit button.	Username: railways password: user	Otp verified should display	Working as expected	Pass
8	Functional	Login page	Verify user is able to log into application with InValid credentials	1.Enter login page. 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter valid password in password text box	Username: railways password: user	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass
9	Functional	Display location details	Verify user is able to view the map by entering the starting and the destination place.	1.Enter the details of the starting and destination place to get the location map.	Username: railways password: user	A user can view route of the map pointing the location.	Working as expected	Pass
10								
11								
12								
13								

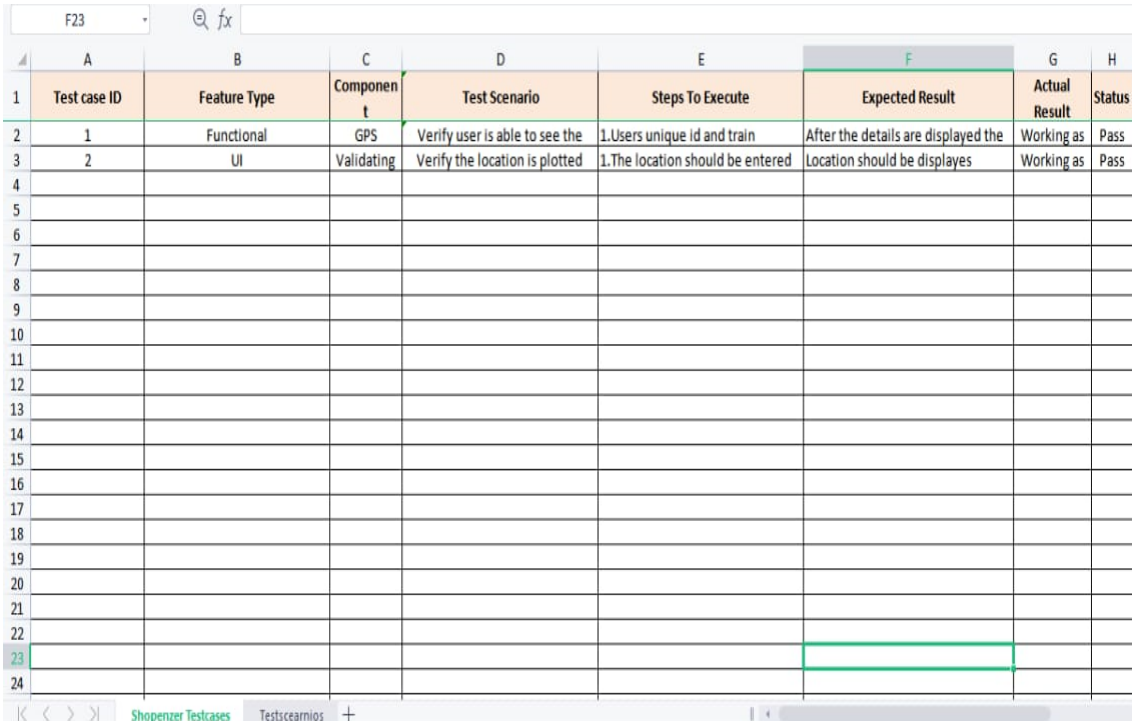
Shopenzer Testcases | Testscearnios



Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Expected Result	Actual Result	Status
1	Functional	Booking	Verify user is able to book the tic	1.Enter the ticket details by giving	Ticket details should display	Working as	Pass
2	UI	Booking	Verify the can book the seat by e	1.Enter the details of the train to	Seats available for the train.	Working as	Pass
3	Functional	Payment	Verify user is able to pay through	1.Enter the payment details	User should get the payment	Working as	Pass
4	Functional	Redirection	Verify user is able to get the red	1.After payment the user will be	Application should redirect to the	Working as	Pass



Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Expected Result	Actual Result	Status
1	Functional	QR Code ge	Verify user is able to get the QR	1.Enter the user details and click th	QR code to be generated	Working as e	Pass
2	UI	Validating t	Verify the UI elements in Login/	1.Scan the QR Code by mobile and	Showing the details of the correct u	Working as e	Pass
3	Functional	Reporting i	Verify user is able to log into ap	1.Scan the QR Code by mobile and	If not correct qr code is validated it	Working as e	Pass



F23

	A	B	C	D	E	F	G	H
1	Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Expected Result	Actual Result	Status
2	1	Functional	GPS	Verify user is able to see the	1.Users unique id and train	After the details are displayed the	Working as	Pass
3	2	UI	Validating	Verify the location is plotted	1.The location should be entered	Location should be displayes	Working as	Pass
4								
5								
6								
7								
8								
9								
10								
11								
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Shopenzer Testcases Testscearnios

8.2 USER ACCEPTANCE TESTING

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the Smart solutions for railways project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	13	4	2	3	22
Duplicate	1	0	5	0	4
External	2	4	0	1	7
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	27	15	15	26	82

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	50	0	0	50
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	1	0	0	1

CHAPTER 9
RESULTS

9.1 PERFORMANCE METRICS

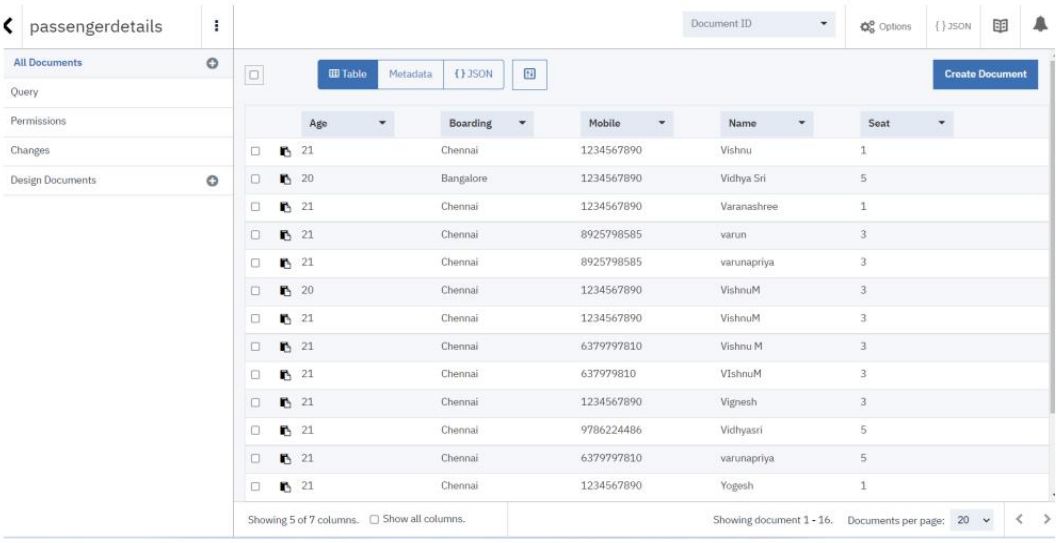

Fig 9.1 Performance Metrics

9.2 ADVANTAGES & DISADVANTAGES

ADVANTAGES

- Openness – compatibility between different system modules, potentially from different
  vendors;
- Orchestration – ability to manage large numbers of devices, with full visibility over them;
- Dynamic scaling – ability to scale the system according to the application needs, through
  resource virtualization and cloud operation;
- Automation – ability to automate parts of the system monitoring application.

DISADVANTAGES

- Approaches to flexible, effective, efficient, and low-cost data collection for both railway vehicles and infrastructure monitoring, using regular trains.
- Data processing, reduction, and analysis in local controllers, and subsequent sending of
  that data to the cloud, for further processing.
- Online data processing systems, for real-time monitoring, using emerging communication technologies.
- Integrated, interoperable, and scalable solutions for railway systems preventive maintenance.

CONCLUSION

The “Railway Ticket Booking System using QR Code” can be bought easily anytime, anywhere and the ticket will be present in the customer’s phone in the form of “Quick Response (QR) Code”. Admin will add the customers based on their adhaar card details which will be retrieved while registration of customer on an android application. After successfully creating an account, customer can book a ticket by specifying the source and the destination and book a ticket. The application will generate a QR code of booked ticket which will be used at railway station to scan the ticket QR 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 SQL 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.

FUTURE SCOPE

In future CCTV systems with IP based camera can be used for monitoring the visual videos captured from the track. It will also increase security for both passengers and railways. GPS can also be used to detect exact location of track fault area, IP cameras can also be used to show fault with the help of video. Locations on Google maps with the help of sensors can be used to detect in which area track is broken. Adoption of Big Data and Internet of Things (IoT) in railways are expected to deliver smart travel and trade solutions in the coming decade. Equipped with real-time monitoring and schedule updates, end users are expected to benefit from efficient cargo movement with error-tracking. Unique elements such as wake up call for railway passengers, destination alerts, and passenger information management are projected to up the adoption of smart railways across nations as governments will strive for better security measures and efficient operations. Future Market Insights recognizes the huge potential for the ICT industry to influence the global smart railways market with its existing strengths of cloud computing services and IoT.

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APPENDIX

SOURCE CODE :

Flask algorithm for developing a web application for reserving a ticket

```
from flask import Flask, render_template, request
import qrcode
from PIL import Image
import MySQLdb.cursors
from flask_mysqldb import MySQL
import requests
from bs4 import BeautifulSoup
import pandas as pd
app = Flask(__name__)

app.config["MYSQL_HOST"] = "localhost"
app.config["MYSQL_USER"] = "root"
app.config["MYSQL_PASSWORD"] = "Grapes$1"
app.config["MYSQL_DB"] = "train"
mysql = MySQL(app)

train_no = ""
@app.route('/home', methods = ['POST', 'GET'])
def home():
   if(request.method == 'POST'):
      username = request.form['username']
      tel = request.form['phoneno']
      email = request.form['email']
      date = request.form['date']
      source = request.form['source']
      destination = request.form['destination']
      seat = request.form['seat']
      trainname = request.form['trainname']
      classname = request.form['classType']
      cursor = mysql.connection.cursor(MySQLdb.cursors.DictCursor)
      cursor.execute('SELECT train_id, startTime, endTime, SourceStation, DestinationStation
FROM traintable WHERE train_name = % s', (trainname,))
      trainDetails = cursor.fetchone()
      price = trainprice(source, destination, classname)
      price  = price * int(seat)
      train_id = str(trainDetails.get('train_id'))
      print(train_id)
      global train_no
      train_no = train_id
      details = "Username:"+username+"\nTelephone:"+tel+"\nEmail:"+email+"\nDate of
Departing:"+date+"\nSource:"+source+"\nDestination:"+destination+"\nTrain
No:"+train_id+"\nTrain name:"+trainname+"\nSeat booked:"+seat+"\nClass
Type:"+classname+"\nLeaving time:"+str(trainDetails.get('startTime'))
      img = qrcode.make(details)



      # trainLocation(train_id)
      img.save('D:\\ELCOT\\Downloads\\Train-ticket-booking-system-main\\Train-ticket-
```

```
booking-system-main\\Ibm Project-SSFR\\static\image\\qrcode.jpg')
        filename = 'qrcode.jpg'
        return render_template('qrcode.html', filename = filename, locatiom = "")
    return render_template('indexs.html')


def trainprice(source, destination, classname):
    if (source == 'chennai' and destination == 'hyderbad') or (source == 'hyderbad' and destination
== 'chennai'):
        if(classname == '1AC'):
            return 1450
        elif(classname == '2AC'):
            return 1200
        elif(classname == 'FC'):
            return 800
        elif(classname == 'SL'):
            return 700
        elif(classname == '2S'):
            return 600
        else:
            return 450
    elif (source == 'chennai' and destination == 'kolkata') or (source == 'kolkata' and destination
== 'chennai'):
        if(classname == '1AC'):
            return 2450
        elif(classname == '2AC'):
            return 2200
        elif(classname == 'FC'):
            return 1800
        elif(classname == 'SL'):
            return 1700
        elif(classname == '2S'):
            return 1200
        else:
            return 1000
    elif (source == 'chennai' and destination == 'pondicherry') or (source == 'pondicherry' and
destination == 'chennai'):
        if(classname == '1AC'):
            return 450
        elif(classname == '2AC'):
            return 200
        elif(classname == 'FC'):
            return 150
        elif(classname == 'SL'):
            return 120
        elif(classname == '2S'):
            return 100
        else:
            return 90
    elif (source == 'kolkata' and destination == 'hyderbad') or (source == 'hyderbad' and
destination == 'kolkata'):
        if(classname == '1AC'):
            return 1450
```

```
        elif(classname == '2AC'):
            return 1200
        elif(classname == 'FC'):
            return 800
        elif(classname == 'SL'):
            return 700
        elif(classname == '2S'):
            return 600
        else:
            return 450
    elif (source == 'pondicherry' and destination == 'hyderbad') or (source == 'hyderbad' and
destination == 'pondicherry'):
        if(classname == '1AC'):
            return 1250
        elif(classname == '2AC'):
            return 1000
        elif(classname == 'FC'):
            return 800
        elif(classname == 'SL'):
            return 700
        elif(classname == '2S'):
            return 600
        else:
            return 450
    elif (source == 'kolkata' and destination == 'pondicherry') or (source == 'pondicherry' and
destination == 'kolkata'):
        if(classname == '1AC'):
            return 2950
        elif(classname == '2AC'):
            return 2300
        elif(classname == 'FC'):
            return 2100
        elif(classname == 'SL'):
            return 1900
        elif(classname == '2S'):
            return 1500
        else:
            return 1000
    else:
        return 1000

@app.route('/location', methods=['GET', 'POST'])
def trainLocation():
    url = "https://www.railyatri.in/live-train-status/"+train_no
    print(type(train_no))

    htmldata = getdata(url)
    soup = BeautifulSoup(htmldata, 'html.parser')

    data = []
    for item in soup.find_all('script', type="application/ld+json"):
        data.append(item.get_text())
```

```
    print(len(data))
    df = pd.read_json(data[2])
    print(df["mainEntity"][0]['acceptedAnswer']['text'])
    return render_template("qrcode.html", filename = '/qrcode.jpg', location =
df["mainEntity"][0]['acceptedAnswer']['text'])


def getdata(url):
     r = requests.get(url)
     return r.text

app.debug = True
app.run(port=5000)
```

Account Pre requisites

Developing a QR code for generating the QR code by displaying the details

indexs.html

```
 <!DOCTYPE html>
        <html>
            <head>
                <title>Online Ticket booking</title>
                <link rel="preconnect" href="https://fonts.googleapis.com">
                <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
                <link href="https://fonts.googleapis.com/css2?family=Oswald&display=swap"
    rel="stylesheet">
            </head>
            <style>
                *{
                    padding: 0px;
                    margin: 0px;
                    text-decoration: none;
                }
                .container{
                    text-align: center;
                    top: 20%;
                    left: 38%;
                    position: relative;
                    height: auto;
                    width: 400px;
```

```
            border-radius: 20px;
            background-color: skyblue;
        }
        .container h1{
            paddding: 30px;
            font-family: 'Oswald', sans-serif;
        }
        .form-control{
            margin-top: 8px;
            padding: 10px;
            width: 250px;
            border-radius: 50px;
        }
        .form-control1{
            width: 270px;
            padding: 10px;
            border-radius: 50px;
        }
        .btn{
            padding: 10px;
            border-radius: 10px;
        }
    </style>
    <body>
        <div class="container">
            <h1>Train Booking System</h1>
            <form action="/home" method="post" enctype="multipart/form-data">
                <input type="text" class="form-control" name="username"
placeholder="Traveller name"><br><br>
                <input type="tel" class="form-control" name="phoneno" pattern="[0-
9]{10}"><br><br>
                <input type="email" class="form-control" name="email"
placeholder="abc@gmial.com"><br><br>
```

```
            <input type="text" placeholder="Departing" onfocus="(this.type='date')"
onblur="if(this.value==''){this.type='text'}" id="date" class="form-control" name="date"
onchange="populateTrain('destination', 'trainname')"><br><br>

            <select name="source" id="source" class="form-control1"
onchange="populateDestination(this.id,'destination')" required>

               <option value=""> -- </option>

               <option value="chennai">Chennai</option>

               <option value="hyderbad">Hyderbad</option>

               <option value="kolkata">Kolkata</option>

               <option value="pondicherry">Pondicherry</option>

            </select><br><br>

            <select name="destination" id="destination" class="form-control1"
onchange="populateTrain(this.id, 'trainname')" required>

            </select><br><br>

            <select name="trainname" id="trainname" class="form-control1">

            </select><br><br>

            <input type="number" name="seat" id="seat" class="form-control" max="15"
placeholder="No of seats"><br><br>

            <select name="classType" id="classType" class="form-control1"
placeholder="Select the class">

               <option value="">--</option>

               <option value="1AC">Air-Conditioned First Class</option>

               <option value="2AC">Air-Conditioned Two-Tier Class</option>

               <option value="FC">First Class (Non AC)</option>

               <option value="SL">Sleeper Class</option>

               <option value="2S"> Second Class</option>

               <option value="GS">Unreserved/General Class (2S)</option>

            </select><br><br>

            <input type="submit" class=btn>


         </form>

      </div>

      <script>

         function populateDestination(source, destination)

         {
```

```
var s1 = document.getElementById(source);
var s2 = document.getElementById(destination);
s2.innerHTML ="";
if(s1.value == "chennai")
{
   var destinationLocation = ['hyderbad|Hyderbad', 'kolkata|Kolkata',
'pondicherry|Pondicherry']
}
else if(s1.value == "kolkata")
{
   var destinationLocation = ['chennai|Chennai', 'hyderbad|Hyderbad',
'pondicherry|Pondicherry']
}
else if(s1.value == "hyderbad")
{
   var destinationLocation = ['chennai|Chennai', 'kolkata|Kolkata',
'pondicherry|Pondicherry']
}
else if(s1.value == "pondicherry")
{
   var destinationLocation = ['chennai|Chennai', 'kolkata|Kolkata',
'hyderbad|Hyderbad']
}
var createNewOptions = document.createElement("option");
createNewOptions.value = "";
createNewOptions.innerHTML = "--";
s2.options.add(createNewOptions);
for(var option in destinationLocation)
{
   var pair = destinationLocation[option].split("|");
   var createNewOptions = document.createElement("option");
   createNewOptions.value = pair[0];
   createNewOptions.innerHTML = pair[1];
   s2.options.add(createNewOptions);
```

```
    }
}
function populateTrain(destination, trainname)
{

    var s1 = document.getElementById("source").value;
    var s2 = document.getElementById(destination);
    var date = document.getElementById("date").value;
    date = String(date);
    date = new Date(date);
    date = date.getDay();
    if(!(s1.trim() == '' && s2.value.trim() == ''))
    {
        console.log(s1, s2, date);

        var s3 = document.getElementById(trainname);

        console.log(s1);
        console.log(s2.value);

        let sunday = 0;
        let monday = 1;
        let tuesday = 2;
        let wednesday = 3;
        let thursday = 4;
        let friday = 5;
        let saturday = 6;
        console.log(date);
        var list = [];
        s3.innerHTML = "";
        switch (s1) {
            case "chennai":
```

```
                    if(s2.value == "hyderbad"){
                        if(date == sunday || date == monday || date ==  tuesday || date ==
wednesday || date == thursday ||date == friday|| date == saturday)
                        {
                            list.push("HYB FEST SPL");
                            list.push("MAS HYB EXPRESS");
                            list.push("CHARMINAR EXP");
                            list.push("CGL KCG EXPRESS");
                        }
                        if(date == friday)
                        {
                            list.push("MAS SC EXPRESS");
                        }
                        if(date.value == wednesday)
                        {
                            list.push("VM SC EXP");
                        }
                    }
                    else if(s2.value == "kolkata")
                    {
                        if(date == sunday || date == monday || date ==  tuesday || date ==
wednesday || date == thursday ||date == friday|| date == saturday)
                        {
                            list.push("MAS SRC AC EXP");
                            list.push("COROMANDAL EXP");
                        }
                        if(date==wednesday)
                        {
                            list.push("MAS SRC EXPRESS");
                        }
                    }
                    else if(s2.value == "pondicherry")
                    {
```

```
                    if(date == sunday || date == monday || date ==  tuesday || date ==
wednesday || date == thursday ||date == friday|| date == saturday)
                    {
                       list.push("MS PDY EXPRESS");
                       list.push("MS QLN EXPRESS");
                    }
                    if(date == wednesday)
                    {
                       list.push("BBS PDY SPL");
                    }
                 }

                 break;
              case "hyderbad":
                 if(s2.value == "chennai")
                 {
                    list.push("KCG CGL EXPRESS");
                    list.push("CHENNAI SF EXP");
                    list.push("CHARMINAR");
                    list.push("KCG CGL EXPRESS");
                 }
                 else if(s2.value == "kolkata")
                 {
                    if(date == sunday || date == monday || date ==  tuesday || date ==
wednesday || date == thursday ||date == friday|| date == saturday)
                    {
                       list.push("FALAKNUMA EXP");
                       list.push("SC SHM WKLY EXP");
                    }
                    if(date==tuesday)
                    {
                       list.push("SC SHM AC EXP");
                    }
```

```
                }
                else if(s2.value == "pondicherry")
                {
                   if(date==wednesday)
                   {
                      list.push("SC RMM SPL");
                   }
                   if(date==monday)
                   {
                      list.push("SC MDU SPL");
                   }
                   if(date==thursday)
                   {
                      list.push("HYB MDU SPL");
                   }
                }
                break;
             case "kolkata":
                if(s2.value=="chennai"){
                   if(date == sunday || date == monday || date ==  tuesday || date ==
wednesday || date == thursday ||date == friday|| date == saturday)
                   {
                      list.push("COROMANDAL EXP");
                      list.push("CHENNAI MAIL");
                   }
                   if(date.value==thursday)
                   {
                      list.push("HWH TPJ SF SPL");
                   }
                }
                else if(s2.value=="pondicherry")
                {
```

```
                    if(date==monday)
                    {
                        list.push("SRC PDY SPL");
                    }
                    if(date == sunday || date == monday || date ==  tuesday || date ==
wednesday || date == thursday ||date == friday|| date == saturday)
                    {
                        list.push("HUH PDY SUF SPL");
                    }
                }
                else if(s2.value=="hyderbad")
                {
                    if(date == sunday || date == monday || date ==  tuesday || date ==
wednesday || date == thursday ||date == friday|| date == saturday)
                    {
                        list.push("FALAKNUMA EXP");
                    }
                    else if(date==wednesday)
                    {
                        list.push("SHM SC SUF EXP");
                    }
                    else if(date==friday)
                    {
                        list.push("GHY SC EXPRESS");
                    }
                }
                break;
            case "pondicherry":
                if(s2.value=="chennai")
                {
                    if(date == sunday || date == monday || date ==  tuesday || date ==
wednesday || date == thursday ||date == friday|| date == saturday)
                    {
```

```
        list.push("PDY MS EXPRESS");
        list.push("PDY SRC EXPRESS");
    }
    if(date==wednesday)
    {
        list.push("PDY BBS EXPRESS");
    }
}
else if(s2.value=="kolkata")
{
    if(date==saturday)
    {
        list.push("PDY SRC EXPRESS");
    }
    if(date==wednesday)
    {
        list.push("PDY HOWRAH EXP");
    }
}
else if(s2.value=="hyderbad")
{
    if(date==friday)
    {
        list.push("MDC SC SPL");
        list.push("RMM SC SPL");
    }
    else if(date==wednesday)
    {
        list.push("MDC SC SPL");
    }
}
break;
```

```
                    default:
                        break;
                }
                if(list.length==0){
                    window.alert("No train is avaliable for this
"+document.getElementById("date").value);
                }
                for(var option in list)
                {
                    var createNewOptions = document.createElement("option");
                    createNewOptions.innerHTML = list[option];
                    s3.options.add(createNewOptions);
                }
                console.log(list)
            }
        }
    </script>
</body>
</html>
```

qrcode.html

```
<!DOCTYPE html>
<html>
<head>
<title>Online Ticket booking</title>
<style>
.container{
text-align: center;
top: 20%;
left: 38%;
position: relative;
height: auto;
width: 400px;
```

```
        border-radius: 20px;
        }
        img{
            width:250px;
            height:250px;
        }
    </style>
</head>
<body>
    <div class="container">
        <h3>Scan the QRCode and get your train ticket.</h3>
        <img src="{{url_for('static',filename = '/Image/'+filename)}}">

        <p>{{location}}</p>

        <form action="/location" method="POST"  enctype="multipart/form-data">
            <input type="submit">
        </form>

    </div>

    <script>
        function displayLocation()
        {
            document.getElementById("paragraph").innerHTML = "{{location}}";
        }
    </script>
</body>
</html>
```

3. SQL CONNECTION

query.sql

```
create database train;
use train;
drop table TrainTable;
create table TrainTable(
id int auto_increment,
train_id varchar(10),
train_name varchar(100),
startTime varchar(20),
endTime varchar(20),
monday boolean,
tuesday boolean,
wednesday boolean,
thursday boolean,
friday boolean,
saturday boolean,
sunday boolean,
primary key(id));

alter table TrainTable
add (SourceStation varchar(100), DestinationStation varchar(100));
alter table TrainTable
add(City varchar(100));

desc TrainTable;
select * from traintable;

insert into TrainTable(train_id, train_name, startTime, endTime, monday, tuesday, wednesday,
thursday, friday, saturday, sunday, SourceStation, DestinationStation, City)
value("02759", "HYB FEST SPL", "5:30 PM", "6:35 AM", true, true, true, true, true, true, true,
"Chennai Egmore", "Secunderabad Jn", "Hyderbad"),
```

("12603", "MAS HYB EXPRESS", "4:45 PM", "5:05 AM", true, true, true, true, true, true, true, "MGR Chennai Central", "Secunderabad Jn", "Hyderbad"),

("06059", "MAS SC EXPRESS", "7:30 PM", "8:25 AM", false, false, false, false, true, false, false, "MGR Chennai Central", "Secunderabad Jn", "Hyderbad"),

("12759", "CHARMINAR EXP", "6:10 PM", "7:15 AM", true, true, true, true, true, true, true, "MGR Chennai Central", "Secunderabad Jn", "Hyderbad"),

("06043", "VM SC EXP", "6:05 PM", "8:25 AM", false, false, true, false, false, false, false, "Tambaram", "Secunderabad Jn", "Hyderbad"),

("06059", "MAS NSL EPRESS", "8:55 AM", "11:20 PM", false, false, false, false, false, false, true, "MGR Chennai Central", "Secunderabad Jn","Hyderbad"),

("17651", "CGL KCG EXPRESS", "3:50 PM", "7:55 AM", true, true, true, true, true, true, true, "Tambaram", "Secunderabad Jn", "Hyderbad"),

("12604", "CHENNAI SF EXP", "5:15 PM", "5:55 AM", true, true, true, true, true, true, true, "Secunderabad Jn", "MGR Chennai Central", "Chennai"),

("12760", "CHARMINAR", "6:55 PM", "8:15 AM", true, true, true, true, true, true, true, "Secunderabad Jn", "MGR Chennai Central","Chennai"),

("16004", "NSL MAC WKLY EXP", "1:35 aA", "4:45 PM", false, false, false, true, false, false, false, "Kacheguda", "MGR Chennai Central","Chennai"),

("17652", "KCG CGL EXPRESS", "4:30 PM", "8:08 AM", true, true, true, true, true, true, true, "Kacheguda", "Tambaram","Chennai"),

("22808", "MAS SRC AC EXP", "8:10 AM", "10:30 AM", false, false, false, true, false, false, true,"MGR Chennai Central", "Santragachi Jn", "Kolkata"),

("12842", "COROMANDEL EXP", "8:45 AM", "11:55 AM", true, true, true, true, true,true, true, "MGR Chennai Central", "Howrah Jn", "Kolkata"),

("06058", "MAS SRC EXPRESS", "3:15 PM", "7:00 PM", false, false, true, false, false, false, false, "MGR Chennai Central", "Howrah Jn", "Kolkata"),

("12841", "COROMANDAL EXP", "2:50 PM", "5:00 PM", true, true, true, true , true, true, true, "Howrah Jn", "MGR Chennai Cental", "Chennai"),

("02663", "HWH TPJ SF SPL", "5:35 PM", "8:45 PM", false, false, false, true, false, false, true,"Howrah Jn", "MGR Chennai Central", "Chennai"),

("12839", "CHENNAI MAIL", "11:45 PM","3:50 AM", true, true, true, true, true, true, true, "Howrah Jn", "MGR Chennai Central", "Chennai"),

("16115", "MS PDY EXPRESS", "6:10 PM", "10:15 PM", true, true, true, true, true, true, true, "Chennai Egmore", "Villupuram Jn", "Pondicherry"),

("06101", "MS QLN EXPRESS", "5:00 PM", "7:20 PM", true, true, true, true, true, true, true, "Chennai Egmore", "Villupuram Jn", "Pondicherry"),

("08496", "BBS PDY SPL", "8:10 AM", "11:50 AM", false, false, true, false, false, false, false, "Chennai Egmore","Pondicherry", "Pondicherry"),

("12897", "PDY BBS EXPRESS", "6:45 PM", "10:05 PM", false, false, true, false, false, false, false, "Pondicherry", "Chennai Egmore", "Chennai"),

("16116", "PDY MS EXPRESS", "5:35 AM", "9:30 AM", true, true, true, true, true, true, true,

"Pondicherry", "Chennai Egmore", "Chennai"),

("06010", "PDY SRC EXPRESS", "6:45 PM", "10:40 PM", false, false, false, false, false, false, true, "Pondicherry", "Chennai Egmore", "Chennai"),

("12704", "FALAKNUMA EXP", "3:55 PM", "5:55 PM", true, true, true, true, true, true, true, "Secunderbad Jn", "HowRah Jn", "Kolkata"),

("12774", "SC SHM AC EXP", "5:40 AM", "9:05 AM", false, true, false, false, false, false, false, "Secunderbad Jn", "HowRah Jn", "Kolkata"),

("22850", "SC SHM WKLY EXP", "5:40 AM", "9:05 AM", true, true, true, true, true, true, true, "Secunderbad Jn", "HowRah Jn", "Kolkata"),

("12703", "FALAKNUMA EXP", "7:25 AM", "9:15 AM", true, true, true, true, true, true, true, "Howrah Jn", "Secunderbad Jn", "Hyderbad"),

("22849", "SHM SC SUF EXP", "12:10 PM", "2:25 PM", false, false, true, false, false, false, false, "Howrah Jn", "Secunderbad Jn", "Hyderbad"),

("12514", "GHY SC EXPRESS", "1:05 AM", "4:00 AM", false, false, false, false,true, false, false, "Howrah Jn", "Secunderbad Jn", "Hyderbad"),

("07254","MDC SC SPL", "10:25 PM", "4:00 PM", false, false, false, false,true, false, false, "Villupuram Jn", "Secunderbad Jn", "Hyderbad"),

("07696","RMM SC SPL", "5:20 PM", "12:50 PM", false, false, false, false,true, false, false, "Villupuram Jn", "Secunderbad Jn", "Hyderbad"),

("07192","MDC SC SPL", "10:40 AM", "7:25 AM", false, false, true, false,false, false, false, "Villupuram Jn", "Secunderbad Jn", "Hyderbad"),

("07253", "HYB MDU SPL", "4:35 PM", "8:35 AM", false, false, false, true, false, false, false, "Secunderbad Jn", "Villupuram Jn", "Pondicherry"),

("07191", "SC MDU SPL", "9:25 PM", "3:30 PM", true, false, false, false, false, false, false, "Secunderbad Jn", "Villupuram Jn", "Pondicherry"),

("07695", "SC RMM SPL", "7:05 PM", "1:16 PM", false, false, true, false, false, false, false, "Secunderbad Jn", "Villupuram Jn", "Pondicherry"),

("06009", "SRC PDY SPL", "2:10 PM", "9:45 PM", true, false, false, false,false, false, false, "SANTRAGACHI Jn", "Pondicherry", "Pondicherry"),

("12867", "HUH PDY SUF SPL", "11:30 PM", "8:50 PM", false, false, false, false,false, false, true, "Howrah Jn", "Pondicherry", "Pondicherry"),

("06010", "PDY SRC EXPRESS", "6:45 PM", "4:30 AM", false, false, false, false,false, true, false, "Pondicherry", "Santragachi Jn", "Kolkata"),

("12868", "PDY HOWRAH EXP", "12:45 PM", "10:40 PM", false, false, true, false, false, false, false, "Pondicherry", "Howrah Jn", "Kolkata")

GITHUB & PROJECT DEMO LINK

GitHub : https://github.com/IBM-EPBL/IBM-Project-22977-1659863607

Project Demo Link :

https://drive.google.com/file/d/1uCTjJFlQ3TZ1VYhaTVgLfIztKtaEN6Wp/view?usp=share_link