Project REPORT

Project Name: Smart Solution for Railways

Team ID: PNT2022TMID35915

Team members: Sarath Vignesh A, Denicke Solomon H, Nishanth M, Dhanesh K

1. INTRODUCTION:

1.1 Project Overview :

The project title smart Solution for railways is an attempt to make train journeys more safer and smarter. The railways is the most preferred mode of transport due to its speediness and reduced cost. This project tries to provide solutions to some of the existing user concerns such as paperless travel, proper communication of train arrival and departure times, monitoring the health of the loco pilot continuously to avoid mishaps, automatic lights and automatic AC temperature adjustments. For this very purpose IBM node red service, MIT app inventor, TinkerCad and IBM Watson IoT platform have been used.

1.2 Purpose:

Though train journeys are widely preferred, there are some factors which makes the train journeys unpleasant at times. It includes delay in train timings, theft, misbehaving and so on. In this project, we aim to address some of these problems with smarter solutions thereby promoting the use of public transport.

2. LITERATURE SURVEY:

2.1 Existing Problems:

1) Automatic braking system and alarming based on health monitoring of locomotive pilot

2) Interconnecting lights with sensor for automatic switching on and off to save power

3) Connecting Air Conditioners in AC coaches with temperature sensor which regulates and adapts to the temperature conditions.

4) Fire alarm intimation to the locomotive pilot and automatic water sprayer in case of any fire in the passenger cars. Also provides alert to the nearby Fire station

5) Automatic platform allotment in large stations

6) Automatic train traffic control

7) QR scanner based ticket checking and automatic door opening

8) Wake up call/alert to the user on nearing the destination

9) Automatic Railway crossing barricade system

10) Enhanced and automated waiting list queue clearance

2.2 References:

[1] "GSM and GPS Based Vehicle Location and Tracking System", BaburaoKodavati, V. K. Raju, S. Srinivasa Rao, A.V. Prabu, T. Appa Rao, Dr. Y. V. Narayana, International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 1, Issue 3, pp.616 625 2000.

[2] "Predicting Transit Vehicle Arrival Times". Kidwell,B, Geographic Laboratory, Bridgewater State College, Bridgewater, Mass., 2001.

[3] "Public Transport System Ticketing system using RFID and ARM processor Perspective Mumbai bus facility B.EST, Saurabh Chatterjee, Prof.BalramTimande, International Journal of Electronics and Computer Science Engineering, 2012.

[4] A User-Centered Design Approach to Self-Service Ticket Vending Machines". KARIN SIEBENHANDL GUNTHERSCHREDER, MICHAEL SMUC, EVA MAYR AND MANUEL NAGL IEEE TRANSACTION OPROFESSIONAL COMMUNICATION, VOL. 56, NO. 2, JUNE 2013.

[5] Vehicle Tracking and Locking System Based on GSM and GPS", R. Ramani, S. Valarmathy, Dr. N. SuthanthiraVanitha, S. Selvaraju, M. Thiruppathi, R. Thangam, MECS I.J. Intelligent Systems and Applications, 2013, 09.

[6] "Bus Tracking & Ticketing using USSD Real-time application of USSD Protocol in Traffic Monitoring", Siddhartha Sarma, Journal of Emerging Technologies and Innovative Research (JETIR) www.jetir.org, Dec 2014 (Volume 1 Issue 7).

[7] "Urban public transport service co-creation: leveraging passenger's knowledge to enhance travel experience. Antonio" A. Nunesa, Teresa Galvaoa, Joao Falcao e Cunhaa 2015.

2.3 Problem Statement Definition:

1) Paperless ticket checking is widely being implemented in all the sectors. The same concept if implemented in the railways would provide users a hassle-free verification process. To facilitate this idea, QR code is generated with the ticket details of the passenger once a ticket is booked.

2) The mishaps due to sudden medical issues of the loco pilot can be avoided by constantly monitoring the health conditions

3) The delay in train timings can be conveyed quickly by the live location tracking which can be done with the help of GPS module.

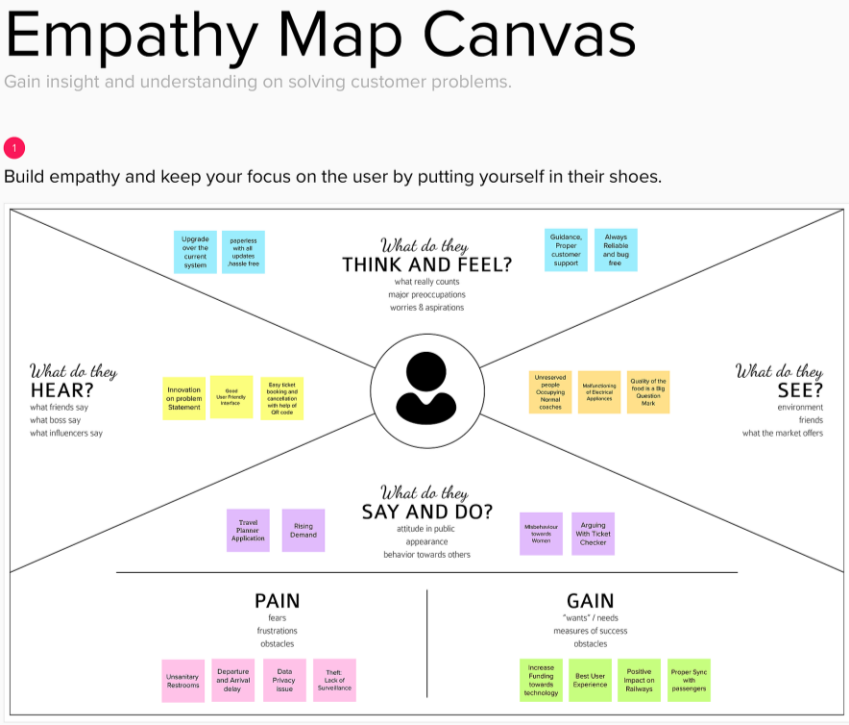
4) Automatic light switching can help in reducing the usage of electricity

5) Automatic AC temperature control helps in maintaining a constant temperature through out the journey.

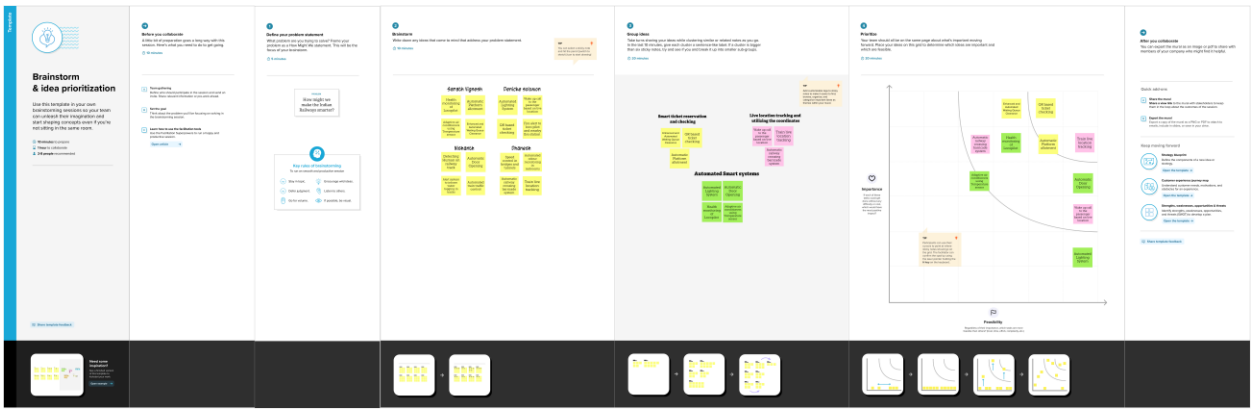
6) The ticket checker can easily verify the ticket details by scanning the QR code with the normal phone camera which is a super easy task.

3. IDEATION AND PROPOSED SOLUTION:

3.1 Empathy Map Canvas:



3.2 Ideation and Brainstorming:



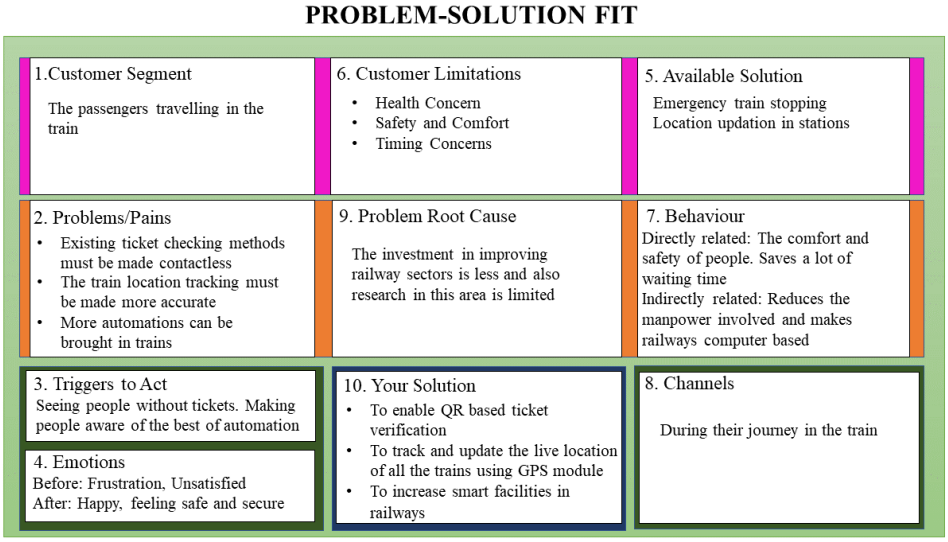
3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	• To design a webpage where public can view and book tickets and to enable paperless ticket verification. • To track the live location of all the trains • To increase smart facilities in railways to ensure passenger safety and comfort

2.	Idea / Solution description	● A QR code is generated whenever a person books a ticket with all the information required to verify the ticket. An entry booth can be designed to verify the QR based ticket and allow the passenger inside the station. ● The live location of the train is captured and updated to all the passengers immediately through the application which is used to understand the delay in the train timings. Also based on the location, a wakeup call is provided to the passenger while nearing his destination and to automatically open and close the crossing barricades in the path. ● To enable environmental light based switching ON and OFF of the lights to enable reduced power usage, to continuously monitor the health of loco pilot and alert the authorities in times of emergency, to install automated door systems in passenger trains and to adaptively change the temperature of air conditioners in AC coaches.
3.	Novelty / Uniqueness	● Automated waiting list clearance ● Health monitoring of loco pilot ● QR based entry and exit into stations ● Wakeup calls and automatic barricades using live location

4.	Social Impact / Customer Satisfaction	• The passengers would be protected from unwanted or ticketless people entering into the railway station • Prevention of accidents that happens because of the emergency conditions of loco pilot and also due to careless railroad crossings • Passengers would have reduced waiting times • Optimized electricity usage
5.	Business Model (Revenue Model)	Transaction Revenue Model
6.	Scalability of the Solution	The booking and tracking software can support a large number of customers. The automations can be implemented in a large scale.

3.4 Problem – Solution Fit:



4. REQUIREMENT ANALYSIS:

4.1 Functional Requirements:

FR No	Functional Requirement (Epic)	User Story / Task

FR-1	Registration	As a user, I can register for the application by entering my email, password, and confirming my password. As a user, I will receive confirmation email once I have registered for the application and can login to the application
FR-2	Ticket Reservation and tracking	As a user I can enter my details and book tickets. As a user, I can track the exact location of the train
FR-3	Connection with service provider	As a User , I can utilize the services like payment gateways by receiving OTPs
	Queue Clearance	As a user, I can use the automatic waiting list clearance
FR-4	QR code generation	As a user , I am able to get a QR code for ticket verification

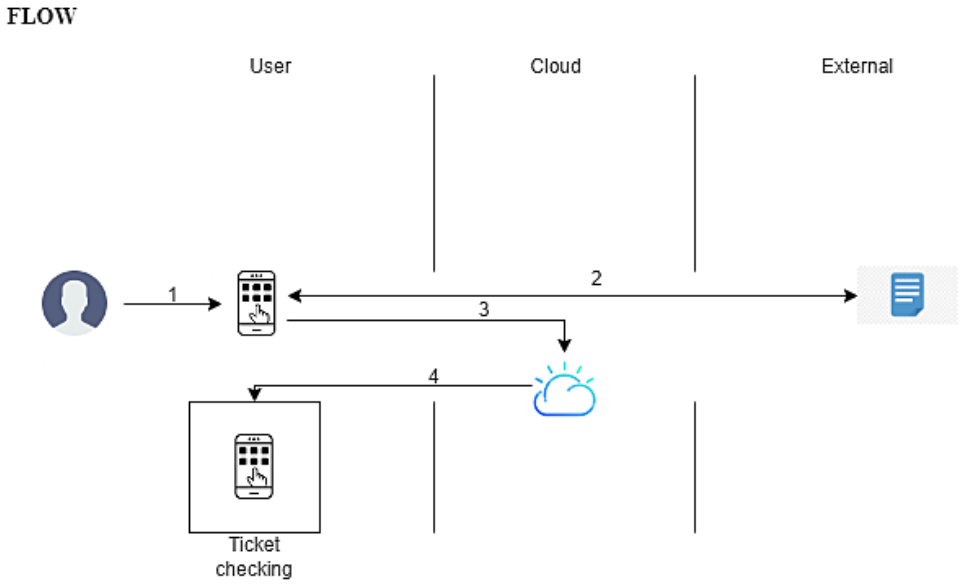
4.2 Non-Functional Requirements:

FR No.	**Non-Functional Requirement**	**Description**
NFR-1	Usability	Within periodic maintenance, we can detect cracksin the railwaytrack. whichwillbe highly usableon remote railway tracks.
NFR-2	Security	Accidents and property damagecan beprevented with the help of our smartsensors whichimmediately sendthe fault to the pilot and administration.
NFR-3	Reliability	Traffic lights and signalling can be madeaccurately withthe help of sensors. so itismore reliable.
NFR-4	Performance	Communication plays a vital role in transferring the crack-detected signaltothe responsible authority so that they can take appropriate measures within a short span.

NFR-5	Availability	Our idea is to make the crack alert to allthe trains passingthrough that fault-prone area.
NFR-6	Scalability	Our project is based on IoT & cloud, which makesthe pilot and authority updated every single sec. Adhoc is easy to handle.

5. Project Design:

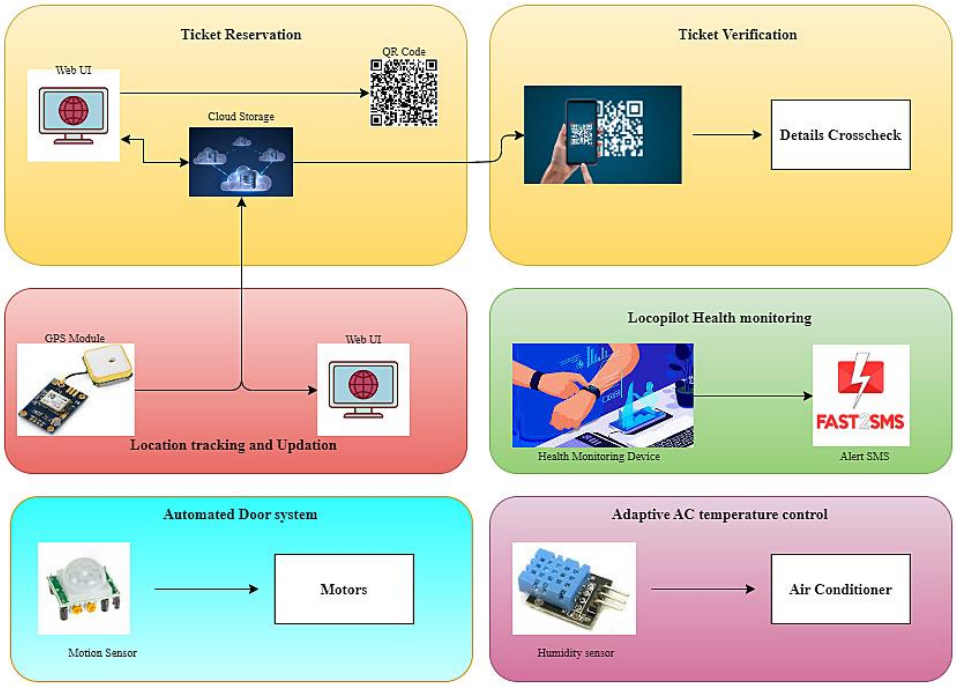
5.1 Data Flow Diagram:



1. User enters login credentials and enter the application for ticket booking
2. The proof documents are uploaded by the user
3. The data and information is stored in cloud database and QR is generated
4. The QR code is scanned by ticket checker and the ticket informations are retrieved from DB

5.2 Solution Architecture:

Architecture Diagram



5.3 User stories:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members

Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	10	High	Nishanth M, Dhanesh K
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application and can login to the application	10	High	Sarath Vignesh A, Denicke Solomon H
Sprint-2	Ticket Reservation and tracking	USN-3	As a user I can enter my details and book tickets.	15	High	Sarath Vignesh A, Denicke Solomon H, Dhanesh K
Sprint-2		USN-4	As a user, I can track the exact location of the train	5	Medium	Denicke Solomon H, Nishanth M
Sprint-3	Connection with service provider	USN-5	As a User , I can utilize the services like payment gateways by receiving OTPs	10	High	Sarath Vignesh A, Nishanth M
Sprint-3	Queue Clearance	USN-6	As a user, I can use the automatic waiting list clearance	10	Medium	Denicke Solomon H, Dhanesh K

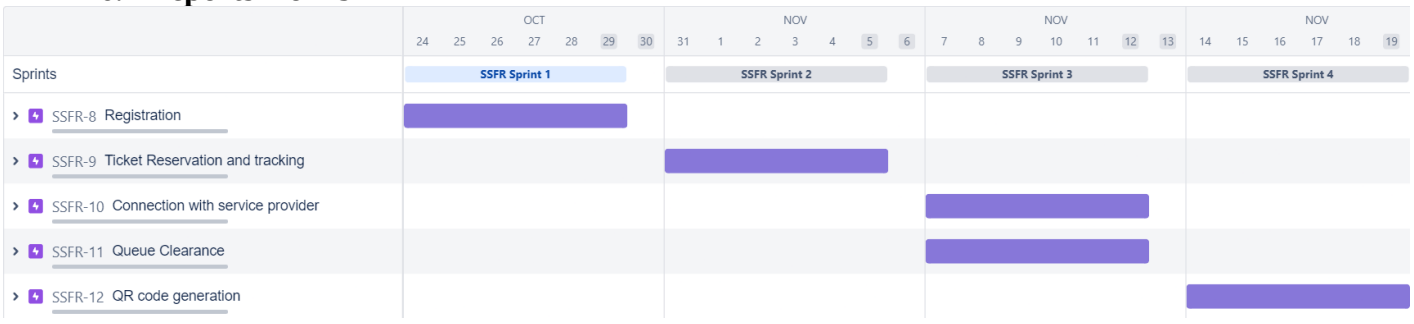
6. PROJECT PLANNING AND SCHEDULING :

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 user, I can register for the application by entering my email, password, and confirming my password.	10	High	Nishanth M, Dhanesh K
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application and can login to the application	10	High	Sarath Vignesh A, Denicke Solomon H
Sprint-2	Ticket Reservation and tracking	USN-3	As a user I can enter my details and book tickets.	15	High	Sarath Vignesh A, Denicke Solomon H, Dhanesh K
Sprint-2		USN-4	As a user, I can track the exact location of the train	5	Medium	Denicke Solomon H, Nishanth M
Sprint-3	Connection with service provider	USN-5	As a User , I can utilize the services like payment gateways by receiving OTPs	10	High	Sarath Vignesh A, Nishanth M
Sprint-3	Queue Clearance	USN-6	As a user, I can use the automatic waiting list clearance	10	Medium	Denicke Solomon H, Dhanesh K
Sprint-4	QR code generation	USN-7	As a user , I am able to get a QR code for ticket verification	20	High	Sarath Vignesh A, Denicke Solomon H, Nishanth M, Dhanesh K

6.2 Reports from JIRA



7. Coding & Solutioning:

7.1 Feature 1: Registration and Login

- User can register their account by entering the credentials
- Trying to register with an existing username (e-mail id) will raise an exception
- User can login to the application using valid credentials
- Trying to log in with wrong credentials will raise exception

7.2 Feature 2: Reserving Ticket

- User can check the seat availability in a particular train
- User can reserve tickets by entering passenger particulars

7.3 Feature 3: Tracking the live location and loco pilot health monitoring

- Users can now track the train’s live location
- Facility for the authorities to monitor health conditions of loco pilots continuously

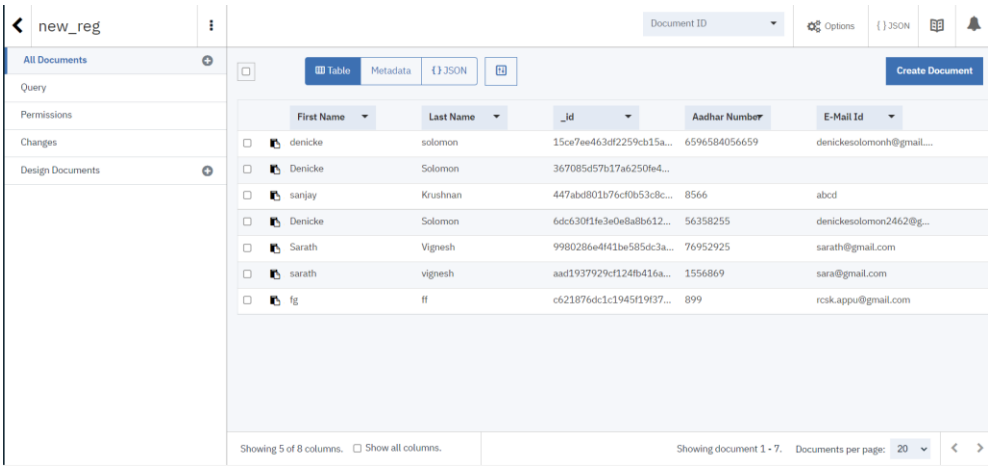
7.4 Feature 4: Generation of QR code

- Users now receive QR code consisting of the journey details immediately when they book tickets

7.5 Add on Hardware Features:

- Automatic lights and AC temperature adjustment

7.6 Database Schema: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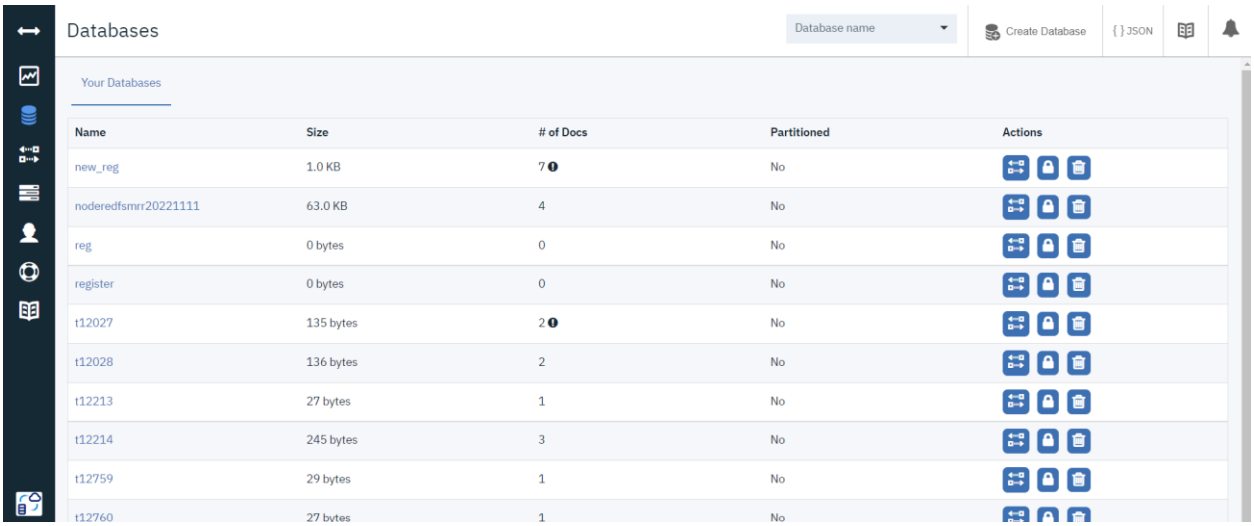
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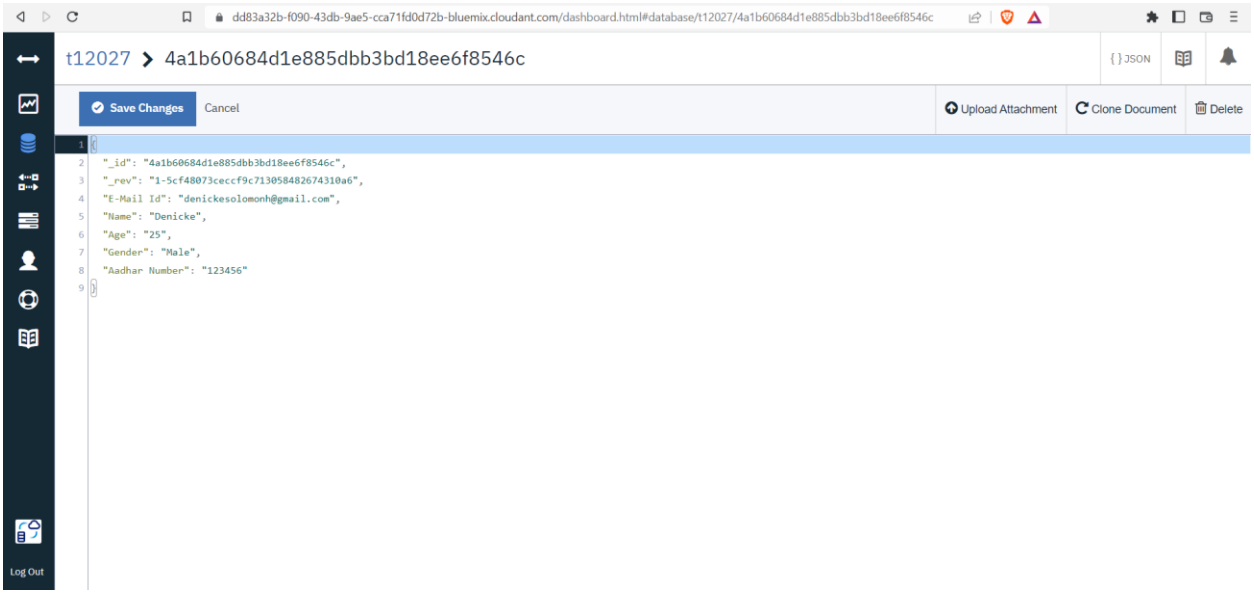
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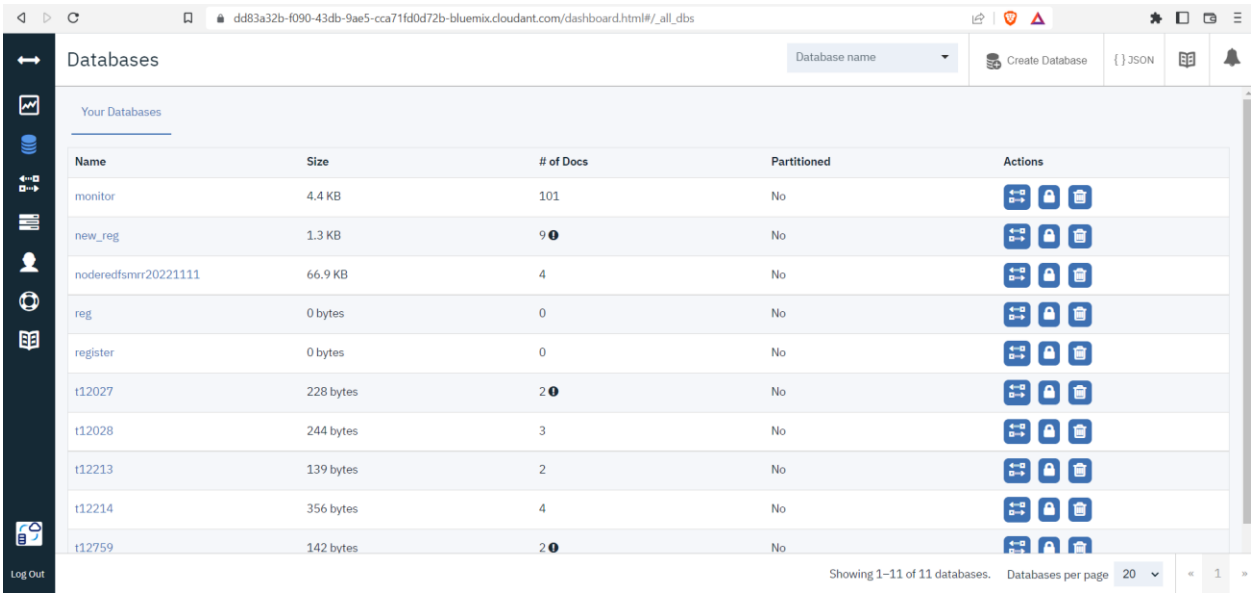
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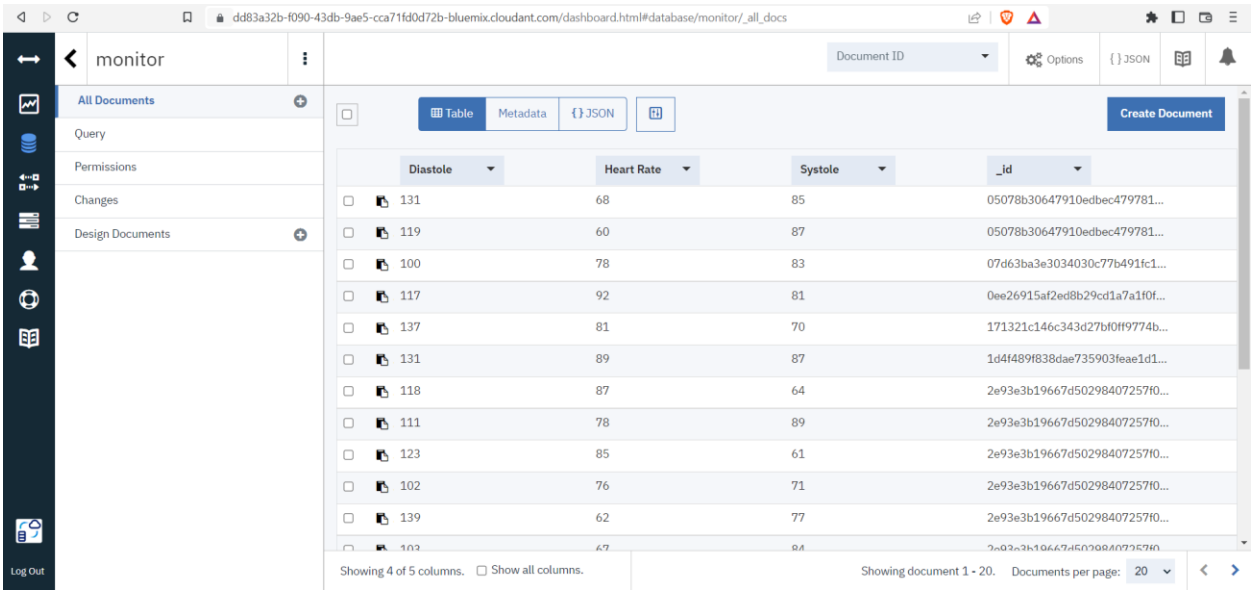
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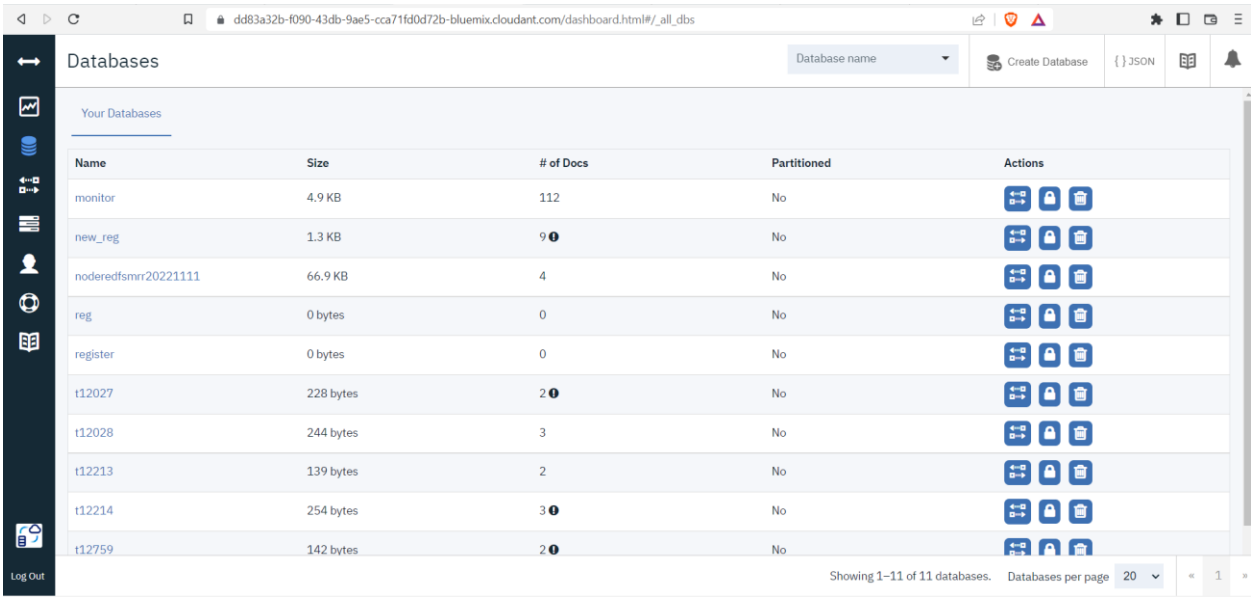
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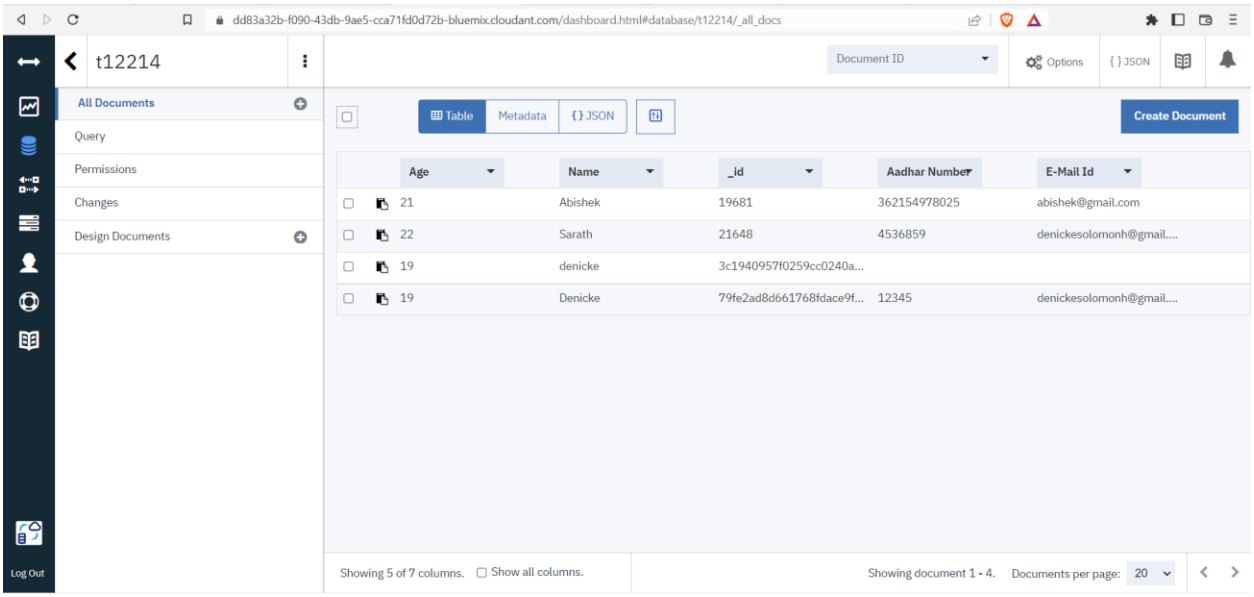
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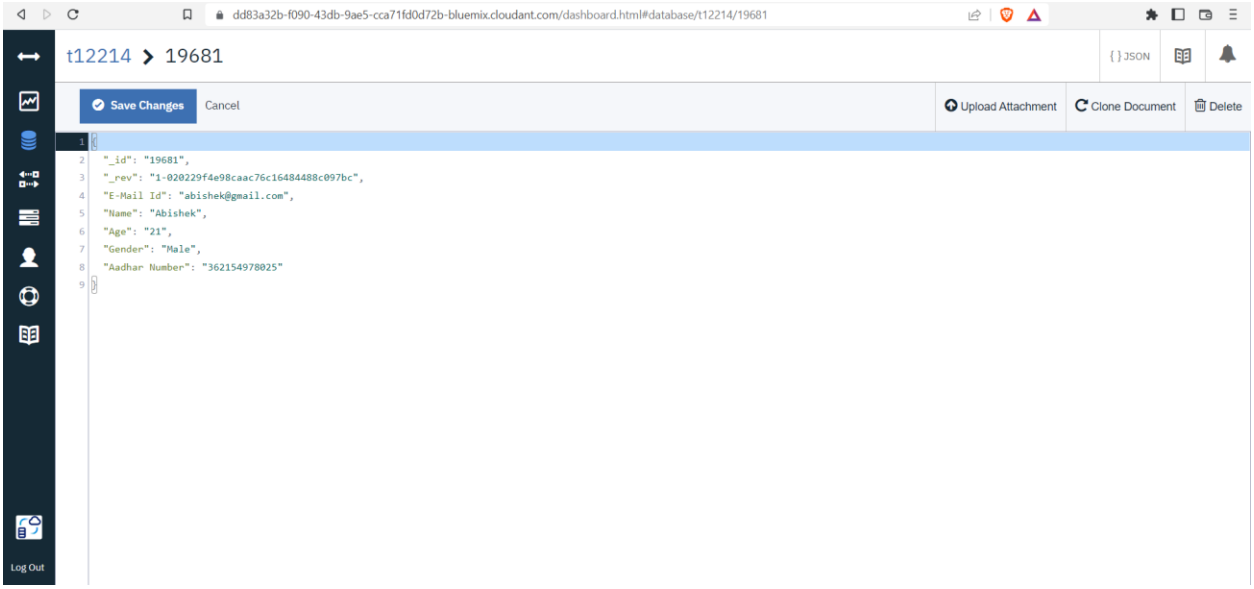

8. TESTING AND RESULTS:

8.1 Test Cases:

- Registration using details
- Attempt to re-register using the same E-mail Id
- Logging in with correct credentials
- Attempt to login with wrong credentials

- Entering the boarding and destination stations : i) Both stations are same ii) Different Stations
- Live train location tracking
- Health conditions updation
- Reserving ticket using passenger details, reviewing the details and QR code generation

8.2 User Acceptance Testing:

Date	19-Nov-22
Team ID	PNT2022TMID35915
Project Name	Smart Solution for Railways
Maximum Marks	4 marks

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Executed By
Register_TC_OO1	Functional	Sign Up page	Verify whether the user is able to register his account when clicked on sign up button		1.Open the app and click on signup button to register 2.Enter the required credentials and press submit	First Name : Sarath Last Name : Vignesh Phone Number :9753656958 Aadhar Number :4633598200 E-Mail Id : sarath@gmail.com Password : sarath	The user details must be stored in database and the user must see success message	Working as expected	Pass	Sarath Vignesh A
Register_TC_OO2	UI	sign up page	Verify the UI elements in Signup page		1.Open the app and click on sign up button to register 2.Verify Singup page with below UI elements: a.First Name text box b.Last name text box c.Phone number text box d.Aadhar number text box e.E-Mail Id text box f.password text box g.Signup and back button	First Name : Sarath Last Name : Vignesh Phone Number :9753656958 Aadhar Number :4633598200 E-Mail Id : sarath@gmail.com Password : sarath	Application should show below UI elements: a.First Name text box b.Last name text box c.Phone number text box d.Aadhar number text box e.E-Mail Id text box f.password text box g.Signup and back buttons in blue colour	Working as expected	Pass	Dhanesh K
Register_TC_OO3	Functional	Sign up page	Verify user cannot create a duplicate account using the same E-Mail Id		1.Open the app and click on signup button to register 2.Enter the same Mail ID and press submit	E-Mail Id: sarath@gmail.com	User should receive a prompt stating an account already exist with this E-mail	Working as expected	Pass	Denicke Solomon H
Login_TC_OO1	Functional	Login page	Verify user is able to log into application with valid credentials		1.Open the app 3.Enter Valid email in Email text box 4.Enter valid password in password text box 5.Click on login button	E-mail: sarath@gmail password: sarath	Application should show 'login succesfull' message	Working as expected	Pass	Nishanth M
Login_TC_OO2	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Open the app 3.Enter invalid email in Email text box 4.Enter invalid password in password text box 5.Click on login button	E-mail: sarath@gmail.com password: sarath123 (or) E-mail: sarath1@gmail.com password: sarath	Application should show 'invalid credentials!! Try again' message.	Working as expected	Pass	Sarath Vignesh A

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Maximum Marks	4 marks

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Executed By
Login_TC_OO3	UI	Login page	Verify the UI elements in login page		1.Open the app 2.Verify Login page with below UI elements: a.E-Mail Id text box b.password text box c.Login button	E-mail: sarath@gmail password: sarath	Application should show below UI elements: a.E-Mail Id text box b.password text box c.Login button in blue colour	Working as expected	Pass	Denicke Solomon H
menu_TC_OO1	UI	Menu page	Verify whether the user is able to view the destination & boarding station dropdown when clicked on book ticket button		1.Open the app and login 2.Press the book ticket button		The dropdown menu page for boarding and destination station must show up	Working as expected	Pass	Sarath Vignesh A
Journey_TC_OO1	Functional	Journey details page	check if the user has entered same destination and boarding stations		1.Open the app and login 2.Press the book ticket button 3.choose the same boarding and destination stations and click on search trains	Boarding Station : Salem Destination Station : Salem	User should receive a notification showing 'invalid selection'	Working as expected	Pass	Denicke Solomon H
Seatcheck_TC_OO1	Functional	Book ticket page	Verify whether the user is able to see the number of seats available in a particular train		1.Open the app and login 2.Press the book ticket button 3.choose the boarding and destination stations and click on search trains	Boarding Station : Chennai Destination Station : Bangalore	The corresponding train number and the seats available must be displayed	Working as expected	Pass	Nishanth M
Reserve_TC_OO1	Functional	Reserve ticket page	Verify user can reserve tickets in a particular train if seats are available		1.Open the app and login 2.Press the book ticket button 3.choose the boarding and destination stations and click on search trains 4.Check for seat availability and press book ticket 5. Enter the passenger details and press submit	Name: Denicke Age:19 Gender:Male Aadhar Number: 123456	The data must be stored in database and the user should receive a page showing review of all the details entered	Working as expected	Pass	Denicke Solomon H

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Team ID	PNT2022TMID35915
Project Name	Smart Solution for Railways
Maximum Marks	4 marks

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Executed By
Review_TC_OO1	Functional	Review page	Verify user is directed to the review page showing all the booked ticket details		1.Open the app and login 2.Press the book ticket button 3.choose the boarding and destination stations and click on search trains 4.Check for seat availability and press book ticket 5. Enter the passenger details and press submit 6. Review the details	Name: Denicke Age:19 Gender:Male Aadhar Number: 123456	Application should show a review page consisting of all the passenger & ticket details	Working as expected	Pass	Dhanesh K
Gps_TC_OO1	Functional	Live location page	Verify whether the user is able to view the live location of the train and his own location		1.Open the app and login 2.From the menu navigate to track live location page		The usermust be able to view his location and the trains's location	Working as expected	Pass	Dhanesh K
Gps_TC_OO2	UI	Live location page	Verify whether the world map with the location markers are seen		1.Open the app and login 2.From the menu navigate to track live location page		The Map UI with the markers must be visible	Working as expected	Pass	Sarath Vignesh A
Health_TC_OO1	Functional	Database	The health conditions of the loco pilot must be updated in the database		1.From the sensors,the loco pilot's blood pressure and heart rate are transmitted to the database	Heart Rate :72 Systole: 109 Diastole : 80	The health conditions must be uploaded in the database through IBM watson and Node red platform	Working as expected	Pass	Nishanth M
QR_TC_OO1	Functional	QR code page	Verify user receives the QR code once a ticket is booked successfully		1.Open the app and login 2.Press the book ticket button 3.choose the boarding and destination stations and click on search trains 4.Check for seat availability and press book ticket 5. Enter the passenger details and press submit 6. Review the details and press pay and confirm		The user must receive the QR code containing all the ticket details	Working as expected	Pass	Denicke Solomon H

				Date	19-Nov-22					
				Team ID	PNT2022TMID35915					
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				Maximum Marks	4 marks					
Test case ID	**Feature Type**	**Component**	**Test Scenario**	**Pre-Requisite**	**Steps To Execute**	**Test Data**	**Expected Result**	**Actual Result**	**Status**	**Executed By**
QR_TC_OO2	Functional	QR code page	verify user can save and share the QR code for ticket verification process		1.Open the app and login 2.Press the book ticket button 3.choose the boarding and destination stations and click on search trains 4.Check for seat availability and press book ticket 5. Enter the passenger details and press submit 6. Review the details and press pay and confirm 7. On the Qr code page press save and click on any option		User must be able to save or share the QR code	Working as expected	Pass	Sarath Vignesh A
QR_TC_OO3	UI	QR code page	verify whether the save option is available		1.Open the app and login 2.Press the book ticket button 3.choose the boarding and destination stations and click on search trains 4.Check for seat availability and press book ticket 5. Enter the passenger details and press submit 6. Review the details and press pay and confirm 7. On the Qr code page press save and click on any option		The save button and the home button is available in white colour. If the user presses the save option, then the pop up shows many options such as save to device, share via gmail, whatsapp etc	Working as expected	Pass	Dhanesh K
QR_TC_OO4	Functional	QR code page	verify whether the ticket collector can scan and verify the ticket		1.Open the camera and focus on the QR code 2. Check and verify the details		On scanning the QR code, the ticket collector must be able to retrieve the ticket details and verify it	Working as expected	Pass	Nishanth M

9. ADVANTAGES:

- Reduces user waiting time by accurate location tracking
- The passengers need not carry the ticket copies in hand
- Ticket verification is a easy process since the TC only needs to use his phone camera

10. DISADVANTAGES:

- The QR code can be misused since these contain all the personal particulars. So extra caution is necessary.
- Live location may not always be accurate due to the prevailing network issues in the surrounding area.

11. CONCLUSION:

The world is improving in technology day by day. There is a new, fast and smart technology being brought into existence each new day. The attempt to make railways smarter is the motive of this project and we have addressed some of the prevailing user concerns.

12. FUTURE SCOPE:

- The app must be made more stable and there are still a lot of developments such as integrating payment facilities exist.
- The misbehaviour against women in trains must be addressed.
- The QR code readers can be installed in the entrance of the stations to reduce human involvement and make the process automated.
- The health monitoring system must be made smarter such that it does not require an authority to monitor the conditions all the time.

13. APPENDIX

13.1 GPS Location Source code

```
 import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
import requests
import json


#Provide your IBM Watson Device Credentials
organization = "fdd82r"
deviceType = "Pi"        #Credentials of Watson IoT sensor simulator
deviceId = "123"
authMethod = "token"
authToken = "12345678"



# Initialize the device client.
try:
```

```
 deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": authToken}
 deviceCli = ibmiotf.device.Client(deviceOptions)
 #.....


except Exception as e:
 print("Caught exception connecting device: %s" % str(e))
 sys.exit()


# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
deviceCli.connect()
while True:
    i = random.uniform(11.632299,13.130195)
    i=round(i,6)
    m=random.uniform(77.560710,80.255989)
    m=round(m,6)
    j=random.randint(60,90)
    k=random.randint(60,100)
    l=random.randint(100,140)
    #Send random data to node-red to IBM Watson
    data = { 'Latitude' : i, 'Longitude' : m, 'Heart Rate':k, 'Systole':j,"Diastole":l}
    print(data)
    def myOnPublishCallback():
        print("\nPublished gprs location = to IBM Watson\n")


    success = deviceCli.publishEvent("Data", "json", data, qos=0, on_publish=myOnPublishCallback)
    time.sleep(60)
```

```
    if not success:
        print("Not connected to IoTF")
    time.sleep(1)

deviceCli.disconnect()
```

Note: Remaining features are implemented using MIT app inventor & Node red along with code.

13.2 Git Repo Link:

https://github.com/IBM-EPBL/IBM-Project-385-1658300023

13.3 Demo Video Link:

https://youtu.be/eyXS-4Z03QE