PROJECT BASED EXPERIENTIAL LEARNING PROGRAM (NALAIYA THIRAN)

SMART SOLUTIONS FOR RAILWAYS

A PROJECT REPORT

Submitted by

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Project Report

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INTRODUCTION

INTRODUCTION

1.1 PROJECT OVERVIEW

The goal of our project is to develop smart solutions for railways, it has been designed to reduce the work load of the user and also the use of paper. Here in this project, we have all the features shown below.

Features:

- A Web page is designed for the public where they can book tickets by seeing the available seats.
- After booking the train, the person will get a QR code which has to be shown to the Ticket Collector while boarding the train.
- The ticket collectors can scan the QR code to identify the personal details.
- A GPS module is present in the train to track it. The live status of the journey is updated in the Web app continuously
- All the booking details of the customers will be stored in the database with a unique ID and they can be retrieved back when the Ticket Collector scans the QR Code.

1.2 PURPOSE

The main purpose behind our project is to speed up the process of ticketing and prevent wastage of time at the ticket counters present at railway stations. This also resolves the issue with the running status of rains where people get confused on where the train is located at. With the help of our service, people can book tickets or easily locate and track trains from anywhere across the world.

We have also worked on easing the task of ticket collectors to check and verify tickets of passengers. A unique QR code is given to every customer upon a successful transaction which is scanned later by the ticket collector for verification. Once the ticket collector scans the QR code, he gets full details of the person in journey.

LITERATURE SURVEY

LITERATURE SURVEY

2.1 : Survey & References:

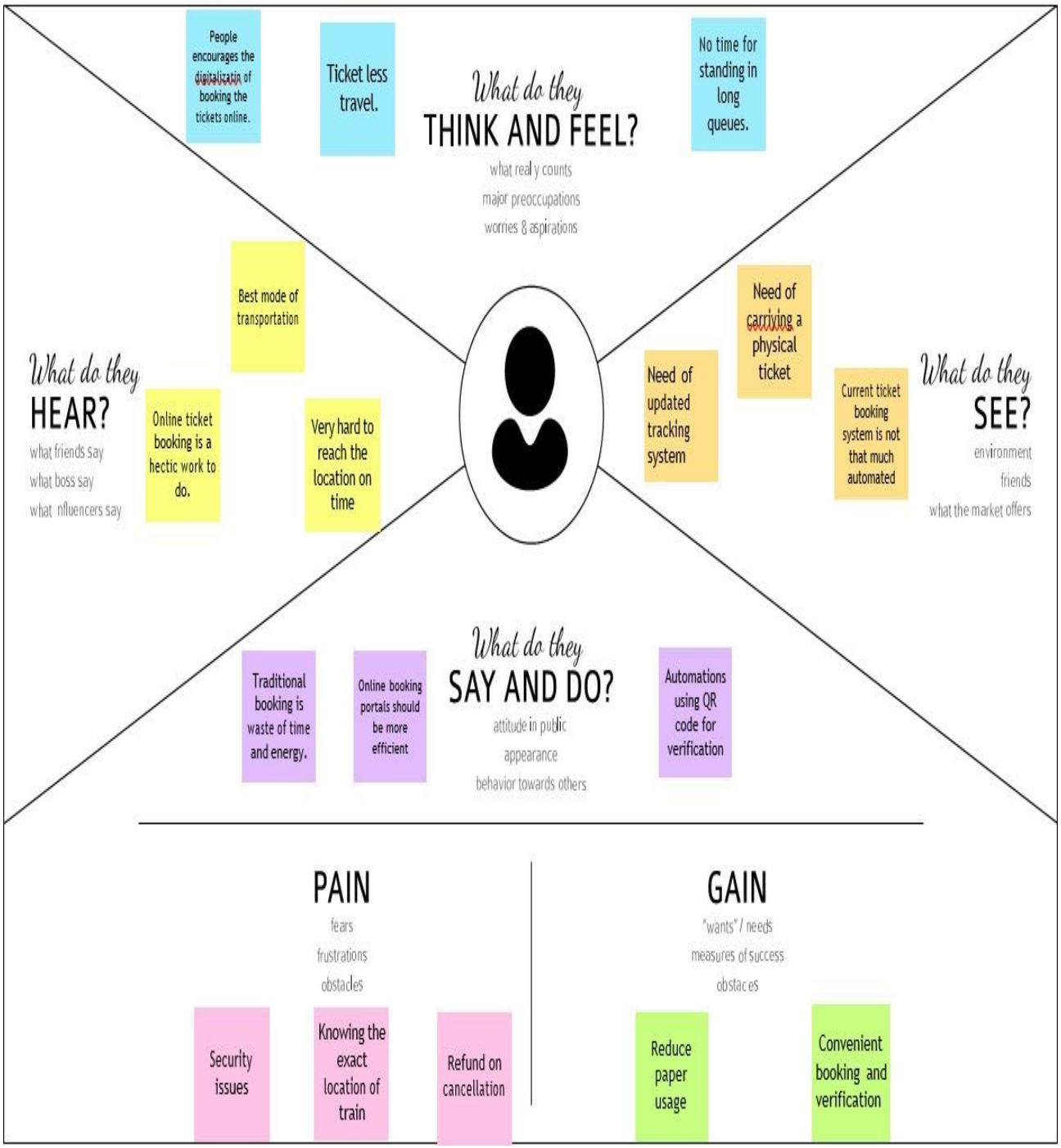
S.NO	PAPER	AUTHOR	YEAR	METHOD AND ALGORITHM
1	5G Key Technologies for Smart Railways	Bo Ai; Andreas F. Molisch; Markus Rupp	2020	Fifth-generation (5G) technologies could be a promising solution to dealing with the design challenges on high reliability and high throughput for HSR communications. Based on our in-depth analysis of smart rail traffic services and communication scenarios, we propose a network slicing architecture for a 5G-based HSR system. With a ray tracing-based analysis of radio wave propagation characteristics and channel models for millimeter wave bands in railway scenarios, we draw important conclusions with regard to appropriate operating frequency bands for HSRs. mymargin Specifically, we have identified significant 5G-based key technologies for HSRs, such as spatial modulation, fast channel estimation, cell-free massive multiple-input-multipleoutput (MIMO), mmWave, efficient beamforming, wireless backhaul, ultrareliable low latency communications, and enhanced handover strategies. Based on these technologies, we have developed a complete framework of 5G technologies for smart railways and pointed out exciting future research directions.
2	Towards the Internet of Smart Trains	Paula FragaLamas	2022	Advantages of the latest generation of broadband communication systems (e.g., LTE, 5G, IEEE 802.11ad) and the emergence of Wireless Sensor Networks (WSNs) for the railway environment are also explained together with the strategic roadmap to ensure a smooth migration from GSM-R. Furthermore, this survey focuses on providing a holistic approach, identifying scenarios and architectures where railways could leverage better commercial IIoT capabilities. After reviewing the main industrial developments, short and mediumterm IIoT-enabled services for smart railways are evaluated. Then, it is analyzed the latest research on predictive maintenance, smart infrastructure, advanced monitoring of assets, video surveillance systems, railway operations, Passenger and Freight Information Systems (PIS/FIS), train controlsystems, safety assurance, signaling systems, cyber security and energy efficiency. Overall, it can be stated that the aim of this article is to provide a detailed examination of the state-of-the-art of different technologies and services that will revolutionize the railway industry and will allow for confronting today challenges
3	Smart Railways: A Charging Strategy for Railway Towards Energy Storage Systems	Antonio P. Martins, Vitor A. Morais	2020	Railway is the most commonly used transportation vehicle. Most of the people choose this transportation mainly for low cost and it gives comfort ability. To increase this comfort zone and to reduce the number of accidents, our system gives a complete solution.This paper track and detect the arrival of the train by using GPS and not by the sensors. This way of train tracking using GPS is embedded with our mobile application. Using this application the engine driver controls the railway gate
4	Smart Phone & IoT-Based Intellectual Messaging of Platform Details in Railways	J.DHIVYA ROSE	2022	Indian Railways provide many useful services to its passengers like ticketing, PNR status checking, and train status. The intension of our work is to provide an additional service to India's biggest railway transportation network. The work contributes in the use of IoT along with other technologies like the RFID tags and QR. The RFID tags that are attached to every train by the transportation department acts as a transmitter. Each station has a receiver RFID tag that receives the signals of the passing and halting trains and sends it further to the microcontroller. In addition, IR sensors are used to identify the platform number. Along with the RFID signals, IR sensors also sense the interrupt signal and send this signal to the microcontroller. This controller processes the received signals and identifies the platform in which the train arrives. technology or the QR technology could be used to alert the commuter through a message who has logged in to the application with the handheld device. In addition, the coach position and the nearest entry gate to reach the platform is also communicated in advance before the train reaches the railway station.

2.2 Problem Statement Definition

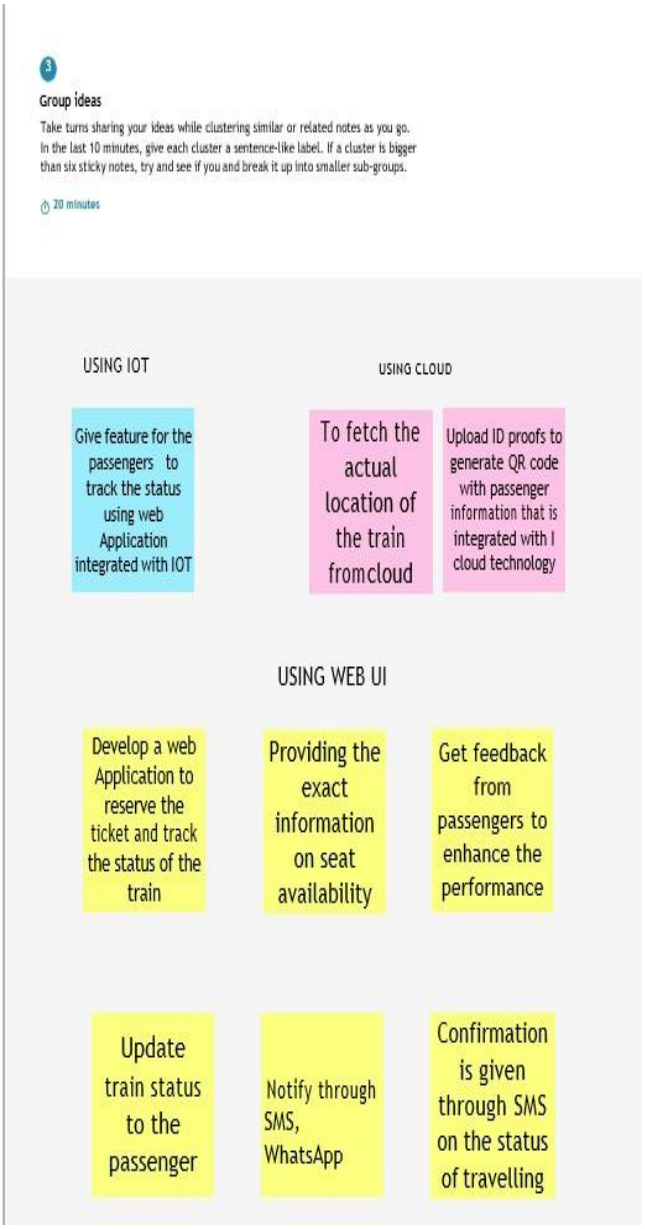
Among the various modes of transport, railways is one of the biggest modes of transport in the world. Though there are competitive threats from airlines, luxury buses, public transports, and personalized transports the problem statement is to answer the question “What are the problems faced by the passengers while travelling by train at station and on board”.

IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation and Brainstorming



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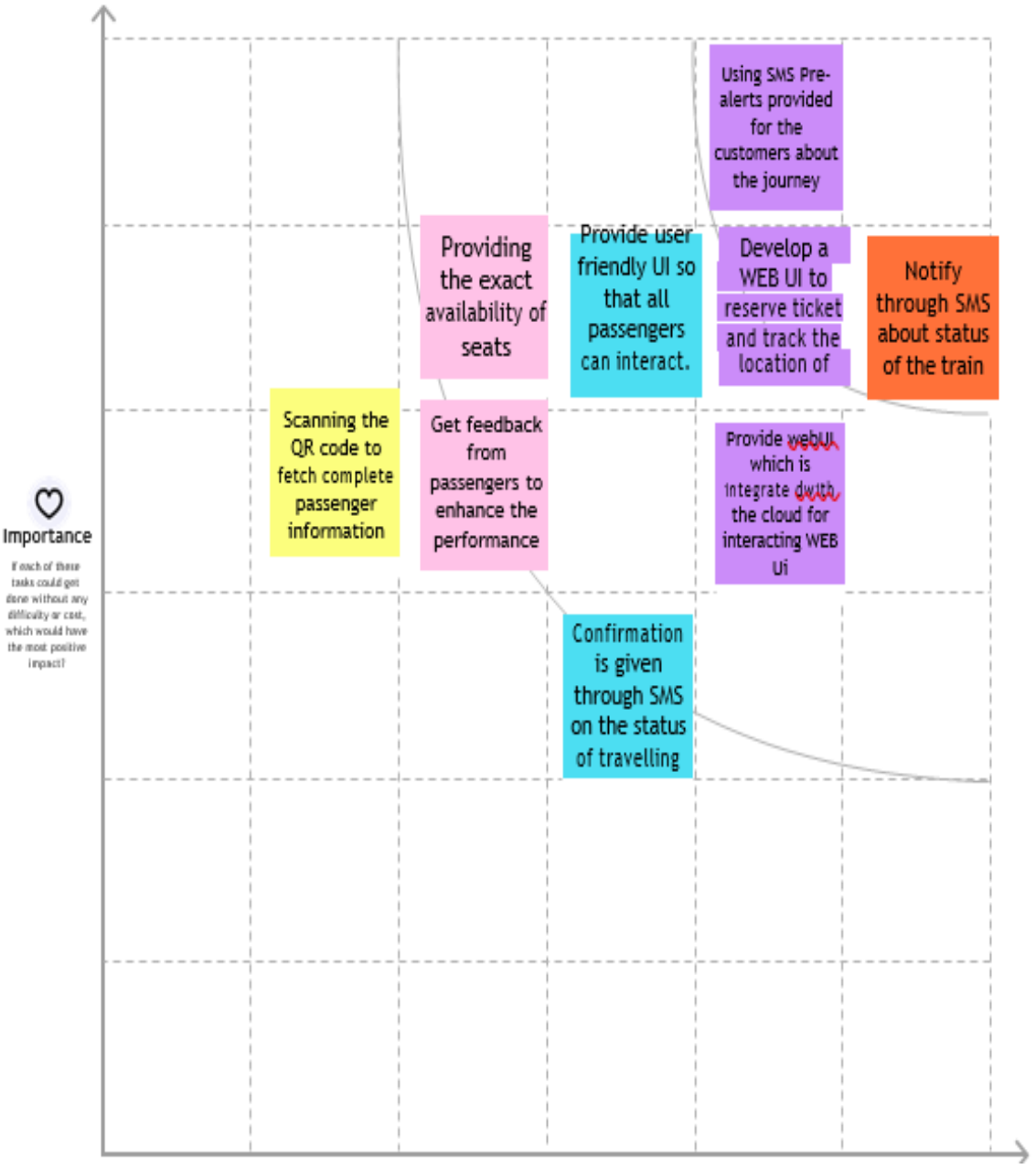
Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

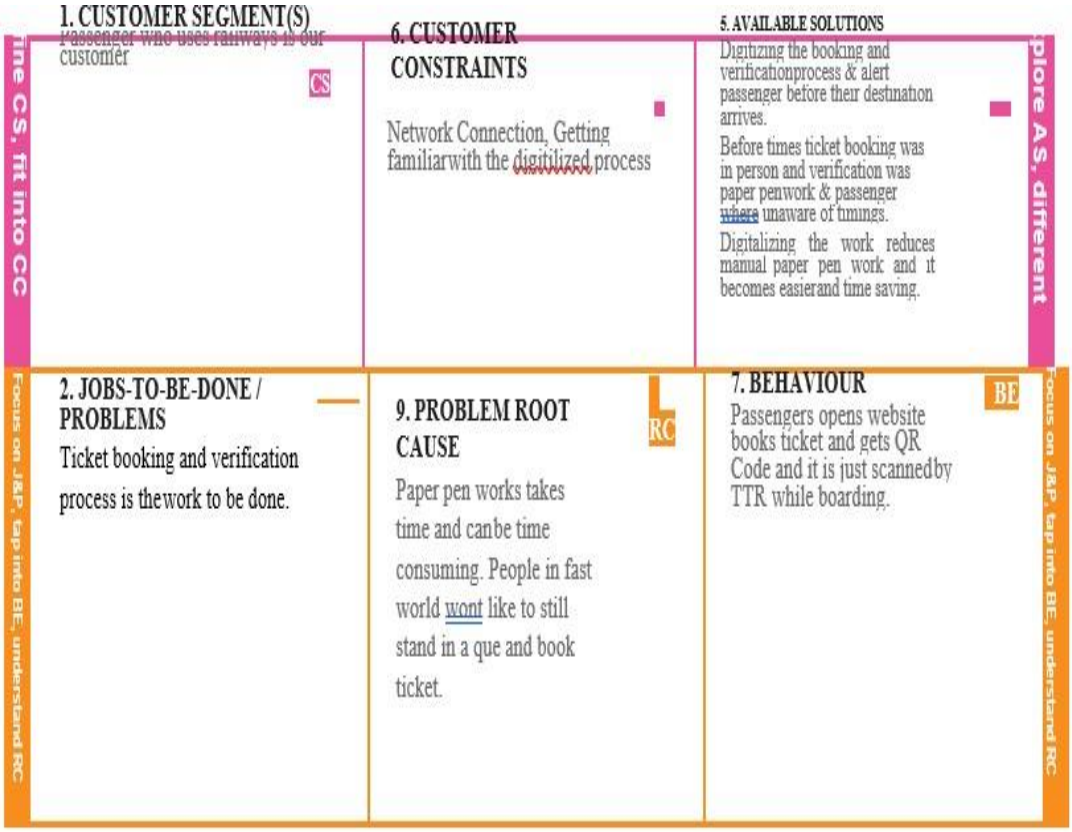
20 minutes



3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To create a satisfiable online train ticketbooking system.
2.	Idea / Solution description	First a website is created in which the customersare required to register their details, so that they are able choose the train which they prefer. The trains which are available are listed by the website based on the customer's preference. The customers are shown the number of available in each compartments from which they will choose which compartment that they prefer but the ticket will be provided at random from their chosen compartment. The ticket registration details and a unique QR code will be provided to the customers after registering and paying for the ticket through the website. The website allows the customers to track it via GPS from half hour before its prescribed departure time. The customers are required to confirm their seats by using the QR code given to them by the website using a QRcode scanner. They are able to track the traintill it reaches their destination.
3.	Novelty / Uniqueness	The customers are able to track the train throughout their journey using the websiteThere is an emergency option in the website which directly informs the traveling ticket examiner who can if required can contactthe driver.The customers are able to view and order the types of food provided in the trainusing the website.
4.	Social Impact / Customer Satisfaction	Provides variety of options and better security.
5.	Business Model (Revenue Model)	Various trains register their details in the trainand the website is approved by the railway division of that state.
6.	Scalability of the Solution	Depends on the approval of the railway divisionof the area to be used and also the number of trains registered in the website and the information that they shared with the website.

3.4 Problem Solution Fit



|

3. TRIGGERS TR Neighbour who booked their tickets through website and said about paperless verification.Know about new smart systems in railways through news.	10. YOUR SOLUTION SL Our solution is to design a website where we can book ticketand receive QR Code which can be scanned during boarding. Passengers can also monitor the train status and aswell as they are alerted through mobile before their destination arrives.	8. CHANNELSof BEHAVIOUR CH Online : Passenger book on their own. Offline : Passenger book through service centersor at railways.
4. EMOTIONS: BEFORE / AFTER EM Before : Unaware, Time consuming, Difficulty. After : Aware, Time saving, Easy		

REQUIREMENT ANALYSIS

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4.1 Functional Requirements

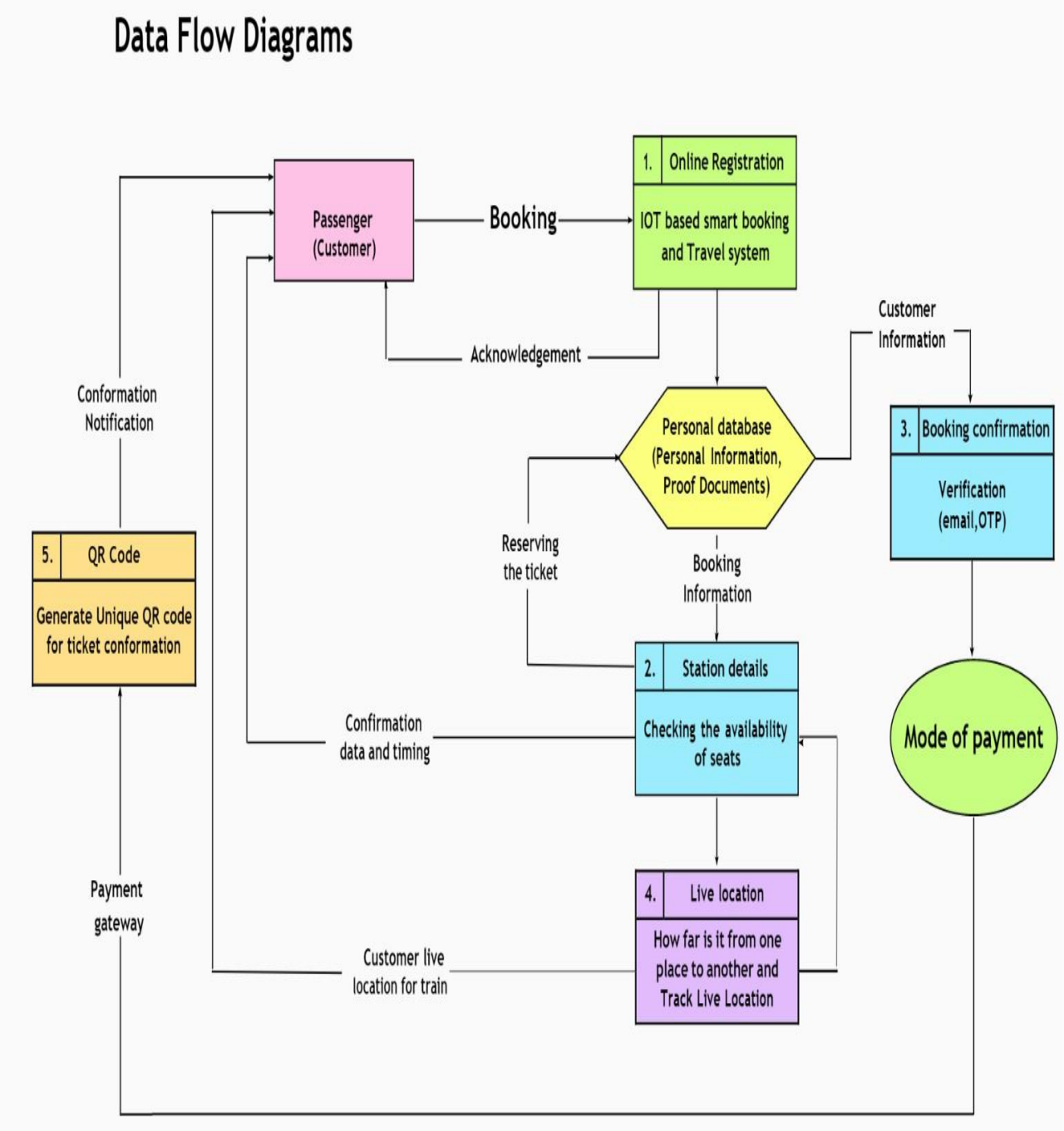
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Registration**	Registration through Website Registration through Form
FR-2	**User Confirmation**	Confirmation via - EmailOTP
FR-3	**QR Code**	Sending QR Code via mail
FR-4	**Verification**	Ticket Scanner on each coach

4.2 Non Functional Requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Easy to understand and use Sending notification when train arrived
NFR-2	**Security**	To provide more security and use flexibly
NFR-3	**Reliability**	No one can misuse this application
NFR-4	**Performance**	To give better perform
NFR-5	**Availability**	User friendly

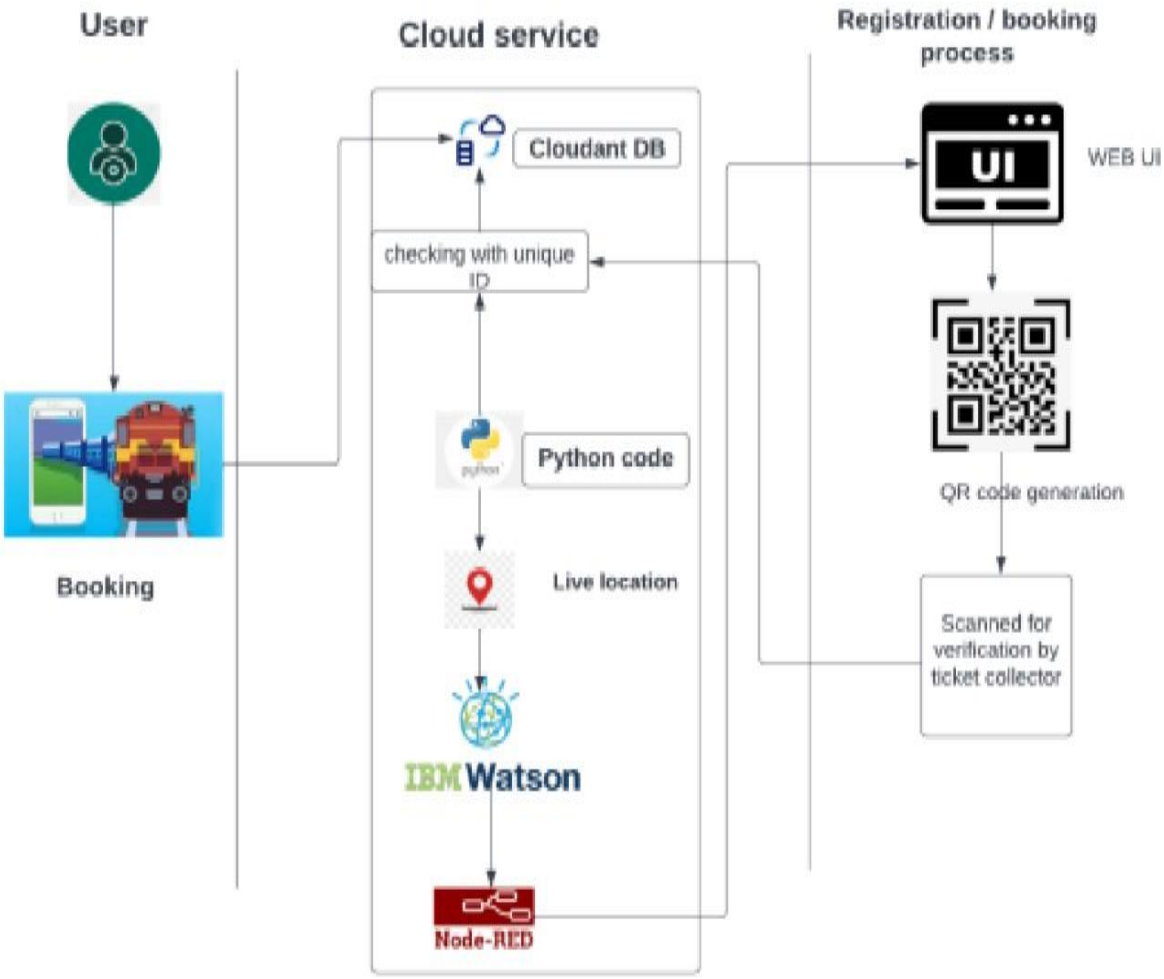
PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture

Technical Architecture:



5.3 User Stories

Functional Requirement (Epic)	User Story / Task	Story points	Priority	Sprint
Registration	As a user, I can register for the application by entering my email, password, and confirming my password.	1	High	Sprint-1
	As a user, I will receive confirmation email once I have registered for the application	3	High	Sprint-1
	As a user, I can register for the application using my mobile number and confirm through OTP received	3	Medium	Sprint-1
	As a user, I can register for the application through Gmail	1	Medium	Sprint-1
Login	As a user, I can log into the application by entering email & password	2	High	Sprint-2
Dashboard	As a user, I can navigate through the dashboard to get the details of seat availability and booking after logging in and entering the desired location and date	3	High	Sprint-2
	As a user, I can fill in my details and upload my ID proof and book ticket by online transaction	3	High	Sprint-3
	As a user, I can get the QR code for the payment and ticket booked	3	Medium	Sprint-3
Additional features	As a user, I can see the booking history and cancellation of tickets is also possible	1	Medium	Sprint-4
	As a user, I can check the weather updates and location accuracy	2	Low	Sprint-4

Functional Requirement (Epic)	User Story / Task	Acceptance criteria	Priority	Release
	completion of paymentI'll be redirected to thebooking website.	be done I can move back tothe initial payment page		
Ticket generation	As a user, I candownload the generated e-ticket for my journey along with the QR codewhich is used for authentication during my journey.	I can show the generated QR codeso that authentication can be done quickly.	High	Sprint-1
Ticket status	As a user, I can see the status of my ticket Whether it's confirmed/waiting/RAC.	I can confidentiallyget the Information and arrange alternate transport if the ticket isn't Confirmed	High	Sprint-1
Remainders notification	As a user, I get remainders about my journey A day before my actual journey.	I can make sure that I don't miss the journey because ofthe constant notifications.	Medium	Sprint-2
	As a user, I can track the train using GPS andcan get information such as ETA, Current stop and delay.	I can track the trainand get to know about the delays pian accordingly	Medium	Sprint-2
Ticket cancellation	As a user, I can cancel my tickets if there's anyChange of plan	I can cancel the ticket and get a refund based on how close the date is to the journey.	High	Sprint-1
Raise queries	As a user, I can raise queries through the query box or via mail.	I can view my pervious queries.	Low	Sprint-2
Answer the queries	As a user, I will answerthe questions/doubts Raised by the customers.	I can view the queries and make itonce resolved	Medium	Sprint-2
Feed details	As a user, I will feed information about thetrains delays and add extra seats if a new compartment is added.	I can view and ensure the corrections of the information fed.	High	Sprint-1

PROJECT PLANNING AND SCHEDULING

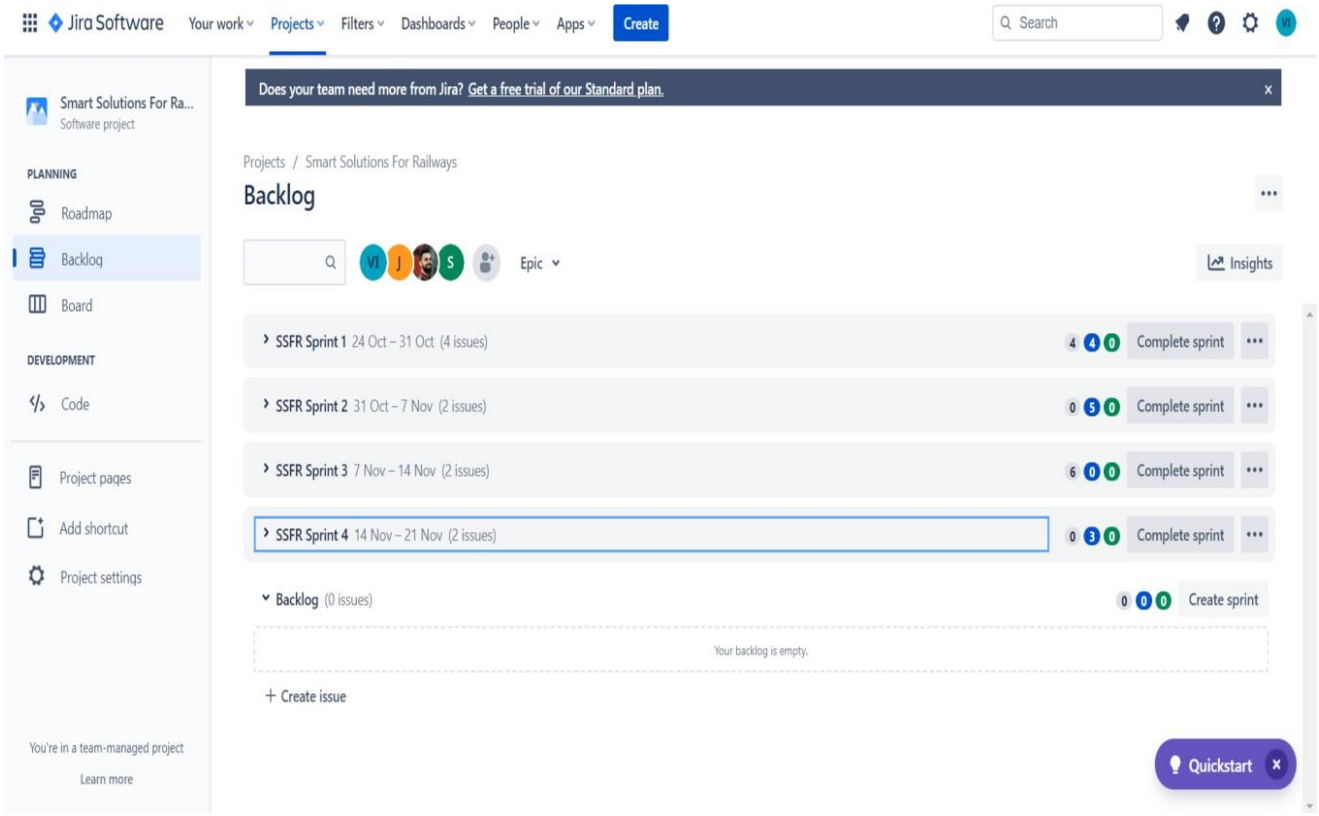
6.1 Sprint Planning & Estimation

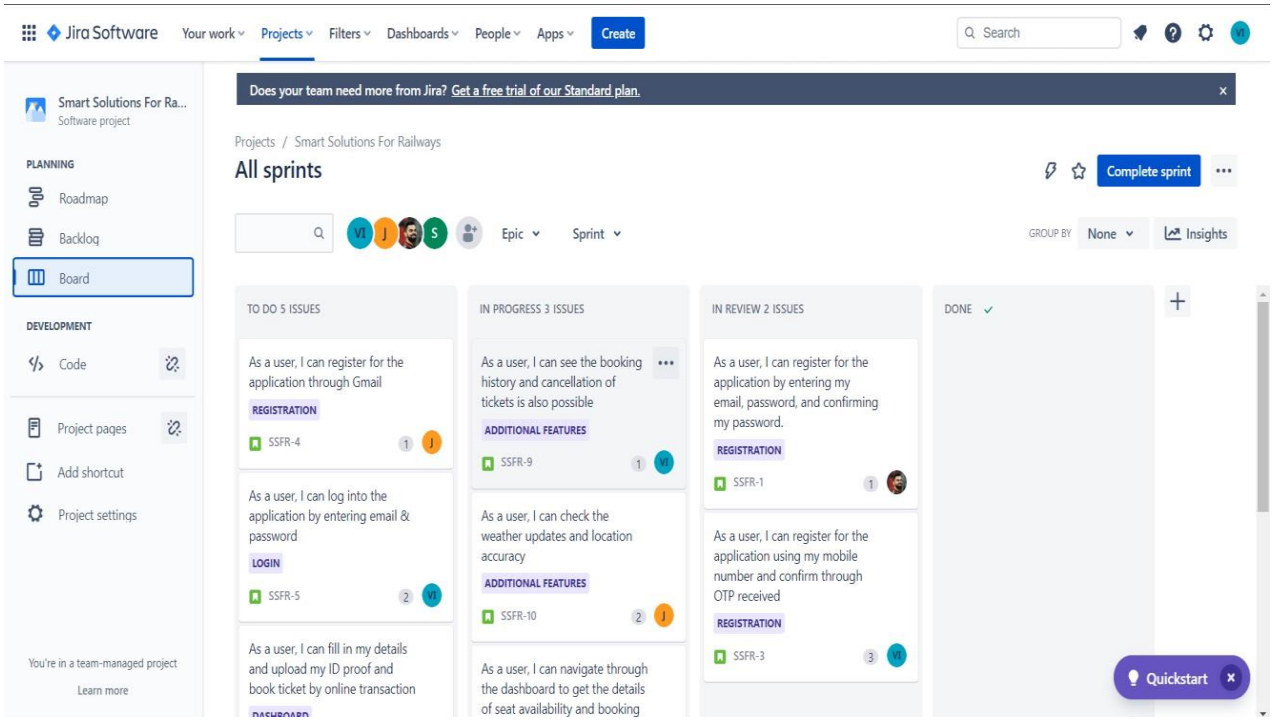
Team members	Functional Requirement (Epic)	User Story / Task	Story points	Priority	Sprint
Jagadeesh R Shanmuk P	Registration	As a user, I can register for the application by entering my email, password, and confirming my password.	1	High	Sprint-1
Jagadeesh R Shanmuk P		As a user, I will receive confirmation email once I have registered for the application	3	High	Sprint-1
Shanmuk P Vishnu P		As a user, I can register for the application using my mobile number and confirm through OTP received	3	Medium	Sprint-1
Shanmuk P Jaya Sai Krishna P		As a user, I can register for the application through Gmail	1	Medium	Sprint-1
Vishnu P Jagadeesh R	Login	As a user, I can log into the application by entering email & password	2	High	Sprint-2
Vishnu P Jaya Sai Krishna P	Dashboard	As a user, I can navigate through the dashboard to get the details of seat availability and booking after logging in and entering the desired location and date	3	High	Sprint-2
Vishnu P Jagadeesh R		As a user, I can fill in my details and upload my ID proof and book ticket by online transaction	3	High	Sprint-3
Everyone		As a user, I can get the QR code for the payment and ticket booked	3	Medium	Sprint-3
Jaya Sai Krishna P Vishnu P	Additional features	As a user, I can see the booking history and cancellation of tickets is also possible	1	Medium	Sprint-4
Shanmuk P		As a user, I can check the weather updates and location accuracy	2	Low	Sprint-4

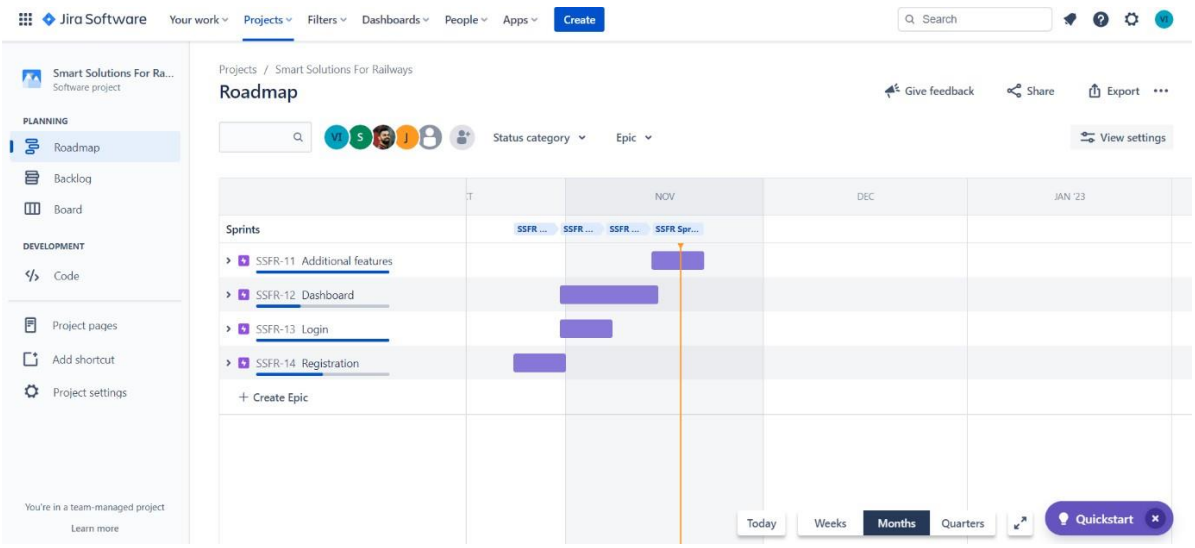
6.2 Sprint Delivery Schedule

SPRINT	TOTAL STORY POINTS	DURATION	START DATE	END DATE	STORY POINTS COMPLETED (AS ON PLANNED DATE)	SPRINT RELEASE DATE(ACTUAL)
Sprint-1	20	6 days	20 Oct 2022	26 Oct 2022	20	26 Oct 2022
Sprint-2	20	6 days	28 Oct 2022	02 Nov 2022	20	26 Oct 2022
Sprint-3	20	6 days	04 Nov 2022	10 Nov 2022	20	26 Oct 2022
Sprint-4	20	6 days	12 Nov 2022	17 Nov 2022	20	26 Oct 2022

6.3 Reports from JIRA






Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
Smart Solutions For Ra...
Software project
PLANNING
Roadmap
Backlog
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / Smart Solutions For Railways
Roadmap
Give feedback
Share
Export
Status category
Epic
View settings
NOV
DEC
JAN '23
Sprints
SSFR ...
SSFR ...
SSFR ...
SSFR Spr...
SSFR-11 Additional features
SSFR-12 Dashboard
SSFR-13 Login
SSFR-14 Registration
Create Epic
Today
Weeks
Months
Quarters
Quickstart

CODING AND SOLUTIONING

7. Coding & Solutioning

7.1 Features 1

- IOT device
- IBM Watson platform
- Node red
- Cloudant DB
- Web UI
- Geofence
- MIT App
- Python code

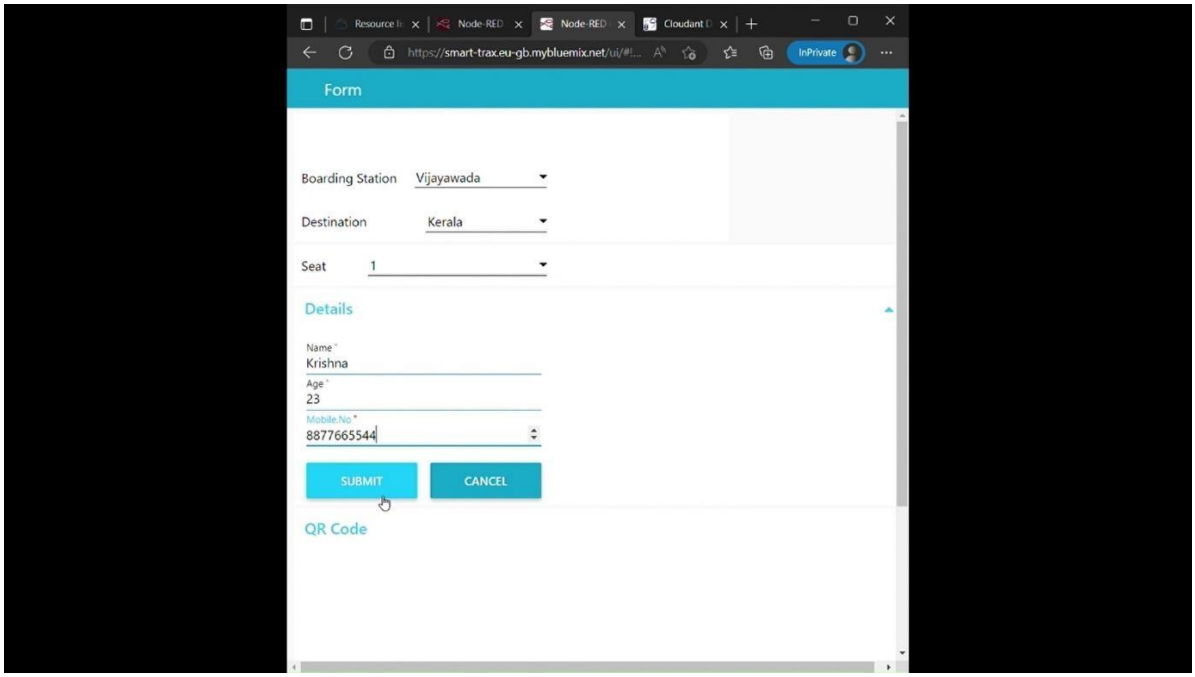
7.2 Feature 2

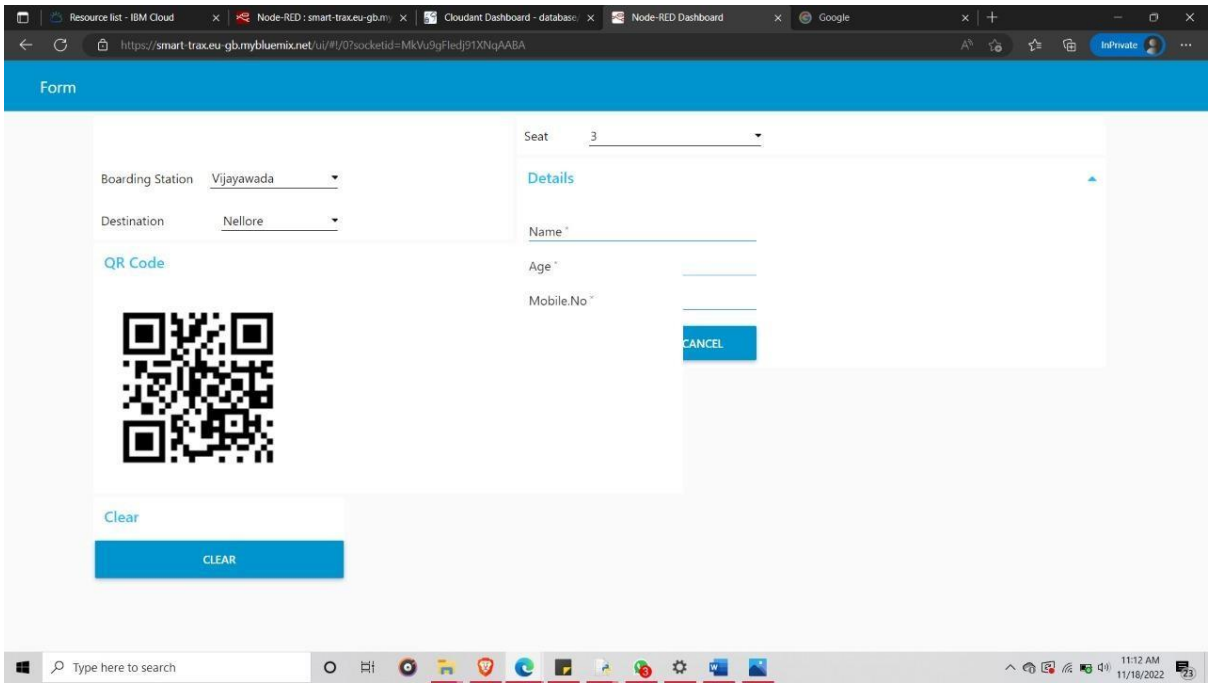
- Registration
- Login
- Verification
- Ticket Booking
- Payment
- Ticket Cancellation
- Adding Queries

TESTING

8.1 Test Cases:

Test Case 1:




Resource list - IBM Cloud
Node-RED : smart-trax.eu-gb.my
Cloudant Dashboard - database
Node-RED Dashboard
Google
https://smart-trax.eu-gb.mybluemix.net/ui/#!/0?socketid=MkVu9gFledj91XNqAABA
InPrivate
Form
Seat 3
Boarding Station Vijayawada
Destination Nellore
Details
Name *
Age *
Mobile.No *
QR Code
CANCEL
Clear
CLEAR
Type here to search
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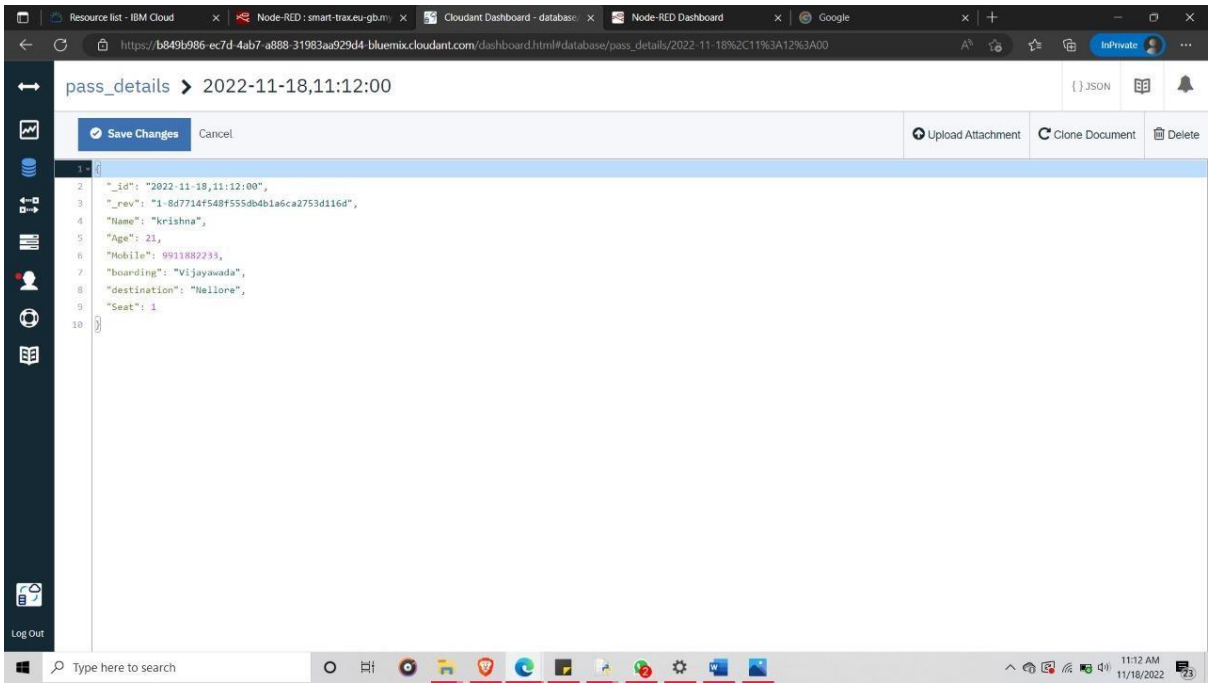
11/18/2022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Node-RED Dashboard
Google
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InPrivate
pass_details > 2022-11-18,11:12:00
{ } JSON
Save Changes
Cancel
Upload Attachment
Clone Document
Delete
{
"_id": "2022-11-18,11:12:00",
"_rev": "1-8d7714f548f555db4b1a6ca2753d116d",
"Name": "krishna",
"Age": 21,
"Mobile": 9911882233,
"boarding": "Vijayawada",
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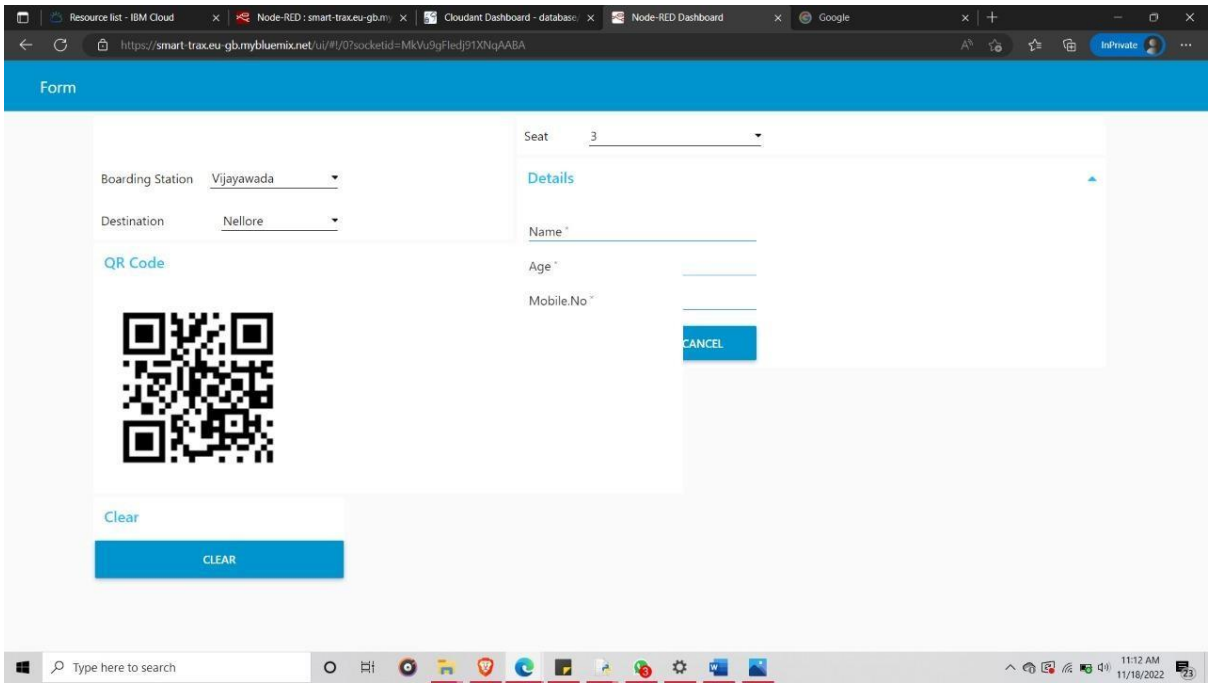
Log Out
Type here to search
11:12 AM
11/18/2022

RESULTS


Resource list - IBM Cloud
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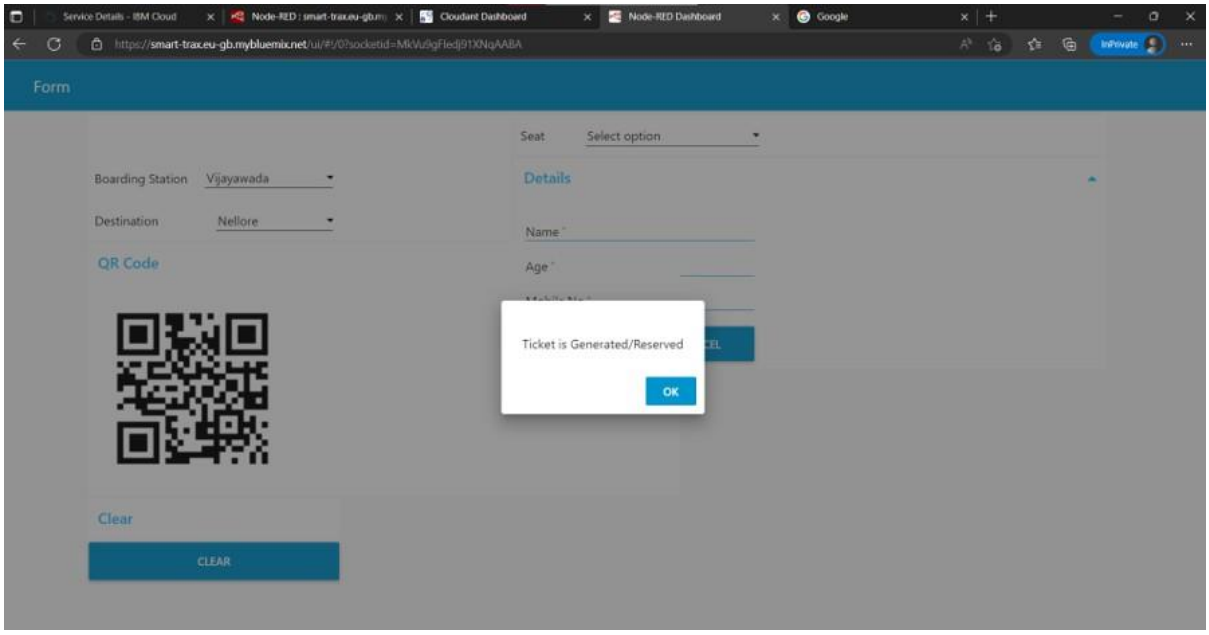
InPrivate
Form
Seat 3
Boarding Station Vijayawada
Destination Nellore
Details
Name *
Age *
Mobile.No *
CANCEL
QR Code
Clear
CLEAR
Type here to search
11:12 AM
11/18/2022


Service Details - IBM Cloud
Node-RED : smart-trax.eu-gb.my
Cloudant Dashboard
Node-RED Dashboard
Google
https://smart-trax.eu-gb.mybluemix.net/ui/#!/0?socketid=MkVu9gFledj91XNqAABA
InPrivate
Form
Seat Select option
Boarding Station Vijayawada
Destination Nellore
Details
Name *
Age *
QR Code
Ticket is Generated/Reserved
OK
Clear
CLEAR

11. CONCLUSION

With the help of this application user can book tickets based on the seats availability. If the tickets are available then they can book the ticket by giving their details and travel information by completing the payment. Once the process is completed the ticket is booked and a QR code is generated for that particular ticket and in that every single data is available. The ticket collector can scan the QR code In order to verify the ticket without the help of physical ticket. After scanning that QR if data is valid then the ticket is verified and or else it displays " Invalid Ticket". Besides that location and running status can also be seen.

12 Future scope

Cloud computing and IOT are embedded to provide the risk free ticket booking and live location update whereas in future AI may come into act and make our journey faster and safer. It will help us in determining the exact arrival time of trains for passenger ease. By means of IOT maintenance of tracks and trains will be easy and can be figured out easily.

13 APPENDIX

13.1 SOURCE CODE:

QR SCAN CODE:

```
from http import client

import cv2

import pyzbar

from pyzbar.pyzbar import decode

import time


from ibmcloudant.cloudant_v1 import CloudantV1

from ibmcloudant import CouchDbSessionAuthenticator

from ibm_cloud_sdk_core.authenticators import BasicAuthenticator


authenticator = BasicAuthenticator('apikey-v2-x5kge2ue09set5w3y7zqwppcsu8yssimj438ufbetnx',
'75782580a79baa3efdec4c2191edd956')

service = CloudantV1(authenticator=authenticator)


service.set_service_url('https://apikey- v1:bluemix:public:cloudantnosqldb:eu-
gb:a/af8c55f19d9049829c5c0392aadc59fc:fb323159-d66d-4d19-aca8-964b30838da0:resource-
key:ca0cc22c-c1f0-4316-8339-42d43cf49bfc")

cap= cv2.VideoCapture(0)

font = cv2.FONT_HERSHEY_PLAIN


while True:

    _, frame = cap.read()
```

```
        decodedObjects = decode(frame)
        for obj in decodedObjects:
            #print ("Data", obj.data)
            a=obj.data.decode('UTF-8')
            cv2.putText(frame, "Ticket", (50, 50), font, 2, (255, 0, 0), 3)

            #print (a)
            try:
                response = service.get_document(
                db='IBM_railways',
                doc_id = a
                ).get_result()
                print (response)
                time.sleep(5)
            except Exception as e:
                print(a)
                print ("Not a Valid Ticket")
                time.sleep(5)

        cv2.imshow("Frame",frame)
        if cv2.waitKey(1) & 0xFF ==ord('q'):
            break
cap.release()
cv2.destroyAllWindows()
client.disconnect()
```

LOCATION CODE:

```
import wiotp.sdk.device
import time
import random

myConfig = {
  "identity": {
  "orgId": "dbzllk",
    "typeId": "GPS",
    "deviceId": "12345"
  },
  "auth": {
    "token": "12345678"
  }
}

def myCommandCallback(cmd):
  print("The Message received from IBM IoT Platform is : %s" % cmd.data['command'])
  m=cmd.data['command']

def pub(data):
  client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
```

```
  print("Data is published Successfully:%s",myData)


client = wiotp.sdk.device.DeviceClient(config=myConfig)
client.connect()


while True:
  myData={'name':'Train1','lat':10.184363,'lon': 77.922702}
  pub(myData)
  time.sleep(3)
  myData={'name':'Train1','lat':10.213225,'lon': 77.898765}
  pub(myData)
  time.sleep(3)
  myData={'name':'Train1','lat':10.285035,'lon': 77.921569}
  pub(myData)
  time.sleep(3)
  myData={'name':'Train1','lat':10.343369,'lon': 77.958056}
  pub(myData)
  time.sleep(3)
  myData={'name':'Train1','lat':10.356829,'lon': 77.980861}
  pub(myData)
  time.sleep(3)
  client.commandCallback = myCommandCallback
client.disconnect()
```

13.2 Github and Project Demo Links:

https://github.com/IBM-EPBL/IBM-Project-30658-1660152415

Demo Video Link:

https://github.com/IBM-EPBL/IBM-Project-30658-1660152415/blob/main/Final%20deliverables/Project_Demo.mp4