Project Report

Project Title - Smart Solutions For Railways

Project Team ID - PNT2022TMID29390

Project Leader - Pazhaniraj V

Project Member - Hari R

Project Member - Chozharajan M

Project Member - Manojkumar G

1.INTRODUCTION

1.1 PROJECT OVERVIEW

Internet of Things (IoT) gets more pervasive, industrial engineers are looking at new possibilities on how the technology can be leveraged for greater business impact. The rail industry is in a position where it can exploit the potential of industrial IoT and evolve without substantially increasing its investments in infrastructure. The Indian Railways is fitting radio-frequency identification tags (RFID) in all the wagons. These tags will be used for tracking the wagons. Railways is planning to complete tagging all wagons by December 2022. **Smart Solution For Railways** is to manage Indian Railways is the largest railway network in Asia and additionally world's second largest network operated underneath a single management. Today, railways are more important than ever as country and city governments are being asked to find innovative ways to safely get back to business post-COVID, meet the changing needs of their citizens, address urban population increases, and reduce their environmental impact.

1.2 PURPOSE

Smart Solutions for railways is designed to reduce the workload of the user and also the use of paper.The main objective of this study is to provide frameworks on the development of smart train automation methods that can avoid collision risk vehicles, detect their relative distance and speed and therefore inform the driver about a probable accident. The system we proposed will prevent collisions of any form of accident in the railway system. .To meet these challenges and position themselves for future success, many forward-thinking governments and railway operators are looking for smart, intelligent IoT technologies to modernize their railways.Problems that occur due to problems in railroads need to be overcome. The latest method used by the Indian railroad is the tracking of the train track which requires a lot of manpower and is time-consuming.

2.LITERATURE SURVEY

2.1 EXISTING SYSTEM

Most of the public transportation infrastructure in European cities is easily accessible.This paper suggests a conceptual framework and architecture to capture free riders (fare dodgers) in an early stage by using a RFID distance scan combined with people counting techniques as a tool to locate and monitor passengers. As a case study this paper uses the ticketing system in The Netherlands. It is a RFID-based ticketing system which uses a smartcard called OV-Chip card. It explains the current setup in The Netherlands, systems and architectures used and shows where possible problems and improvements could be achieved. An experiment is done to measure certain basic distance read ranges in different situations and locations. The results show that by making use of a different system architecture (RFID technology and People Counting Techniques) an improvement in catching free rides (fare dodgers) in a much earlier stage is inspectors

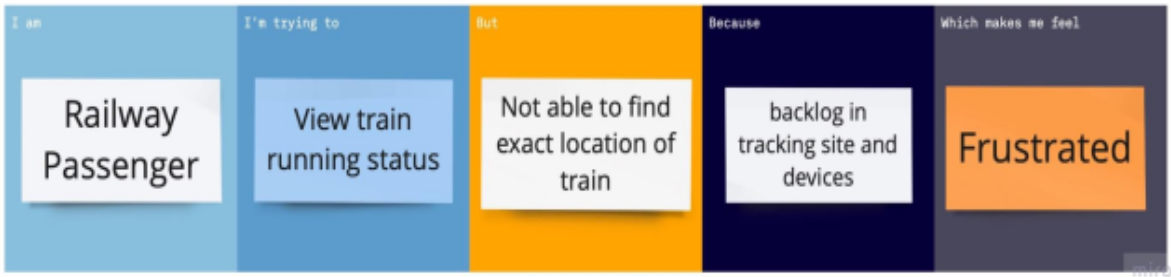
2.2 SURVEY TABLE:

Paper Name	Author Name	Month,Year	Resource Link
Internet Of Things For Smart Railway Feasibility And Applications	OhyunJo, Yong-Kyu Kim, Juyeop Kim	April,2018	https://ieeexplore.ieee.org/document/8026132
Smart Train Detector using IoT Approach	PayalSrivastava, Rana Majumdar, Bonny Paulose, Sunil Kumar.	January,2019	https://ieeexplore.ieee.org/document/8776894
Smart Train Accident Detection And Prevention System Using Iot Technology	R Lakshmi Devi, G Saravanan, K Sangeetha, S Pavithra, S Thiyagarajan.	July,2021	https://ieeexplore.ieee.org/document/9526413
Railway Components Wear: a Smart Platform	Alessandro Massaro, Emanuele, Cannella.	June,2021	https://ieeexplore.ieee.org/document/9488486

2.3 PROBLEM STATEMENT DEFINITION

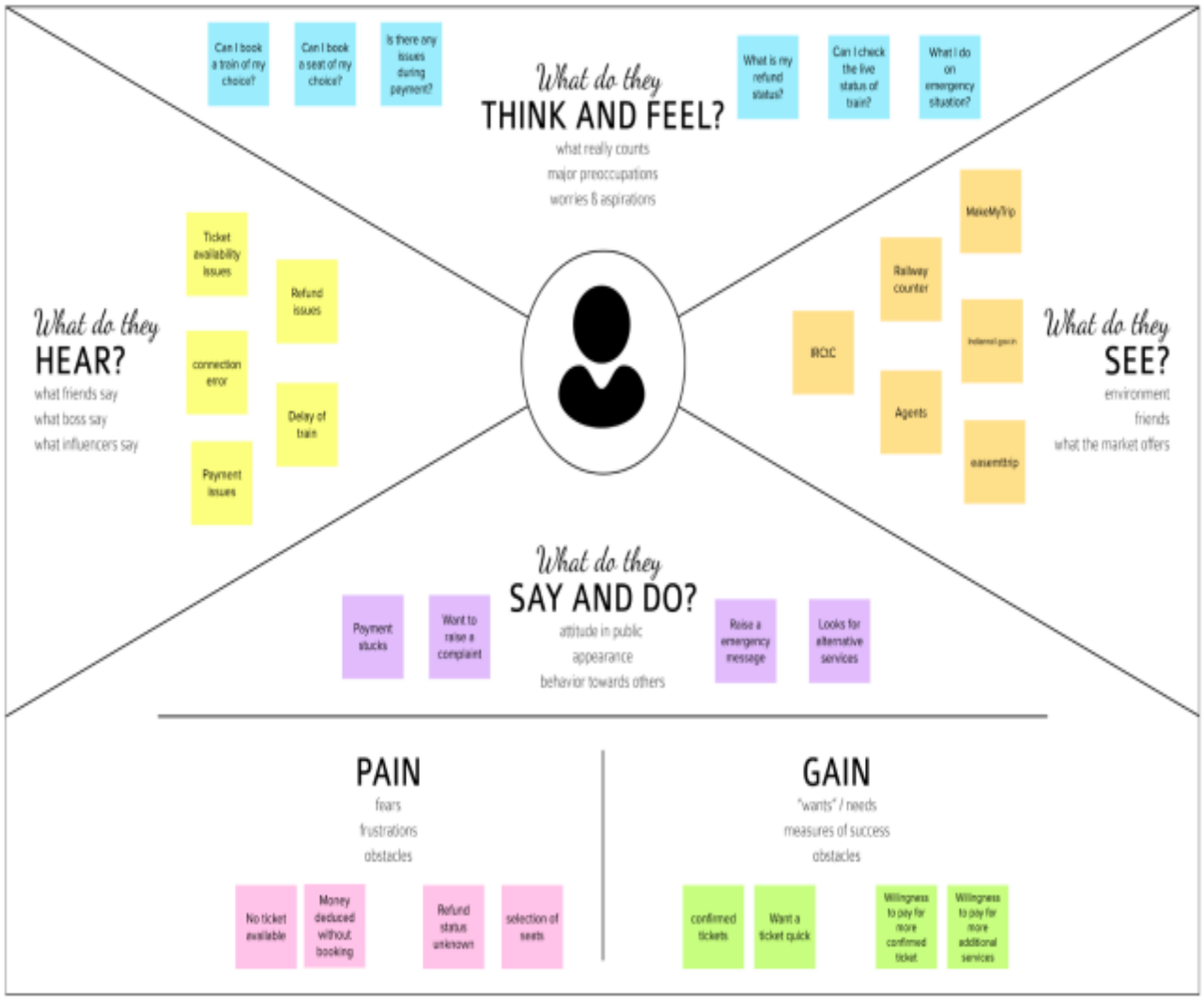
Among the various modes of transport, railways is one of the biggest modes of transport in the world. Though there are competitive threats from airlines, luxury buses, public transports, and personalized transports the problem statement is to answer the question “What are the problems faced by the passengers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

Customer problem statement template:



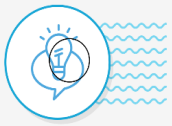
3.IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAINSTORMING

Template



Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

10 minutes to prepare
1 hour to collaborate
2-8 people recommended

Share template feedback

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

A **Team gathering**
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

B **Set the goal**
Think about the problem you'll be focusing on solving in the brainstorming session.

C **Learn how to use the facilitation tools**
Use the Facilitation Superpowers to run a happy and productive session.

Open article →

1 Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

Problem Statement

Smart Solution for railways is designed to reduced the work load of the user and also the use of paper

Key rules of brainstorming
To run an smooth and productive session

- Stay in topic.
- Encourage wild ideas.
- Defer judgment.
- Listen to others.
- Go for volume.
- If possible, be visual.

Brainstorm

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

Pazhaniraj V		Hari R		Chozharajan M		Manojkumar G	
Where is my train	Show Available tickets	Generate QR	Show tips for new user	Make User Friendly UI	Show my current location in my travel	Give Unique Id for my Booking	Add taxi sevices
Available Trains in my route	Book more Tickets	Secure Banking Booking	Order food with ticket	Emergency and Safety Services	Cancel my booking	Easily access the web app	Find the nearby railway Station

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

Pazhaniraj V

See available Train

Show available Tickets

Hari R

Generate QR Code

Secure Payment

Chozharajan M

Make User friendly UI

Current Status of train

Manojkumar G

Access through all Devices

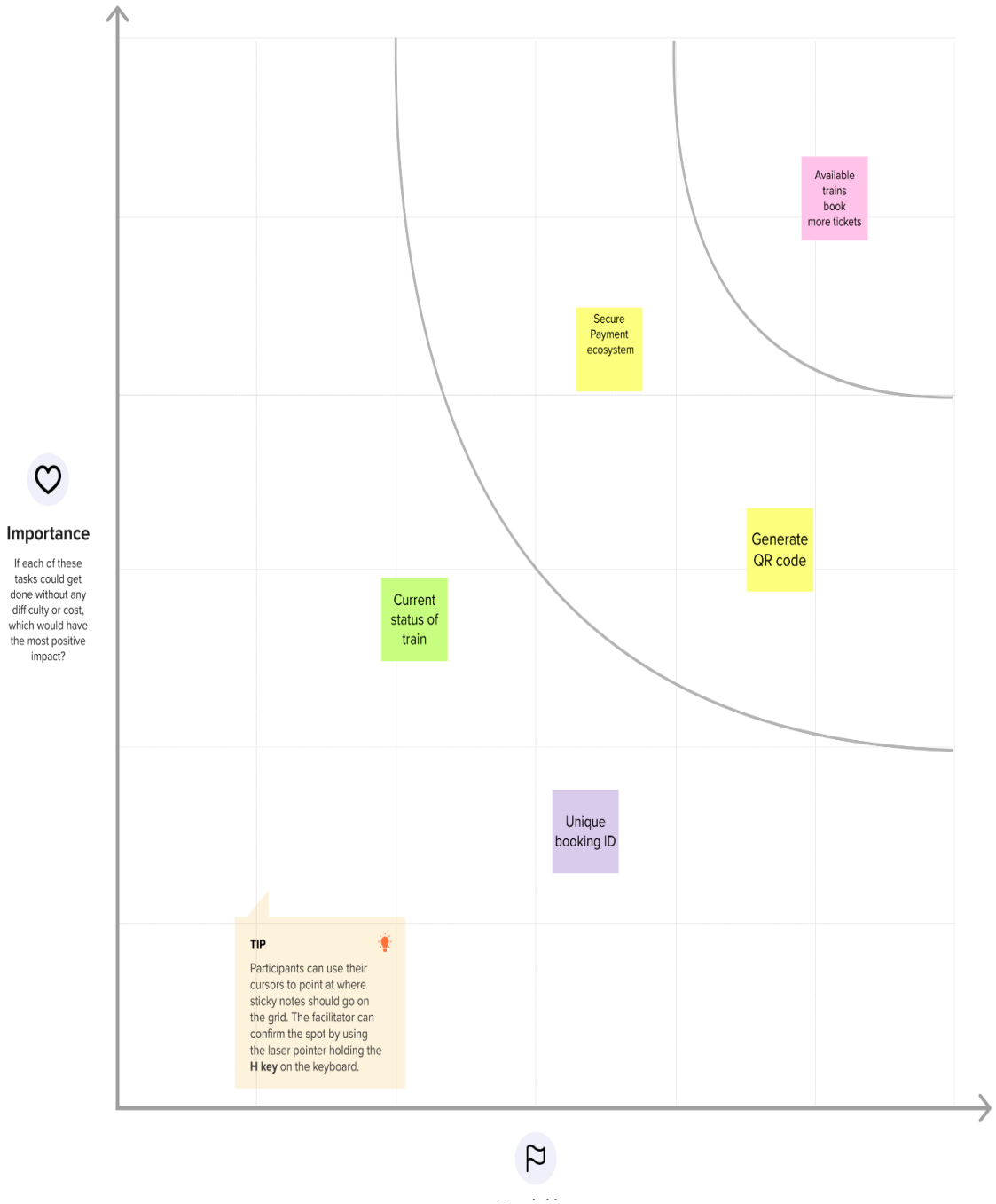
Unique Booking Id

4

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.

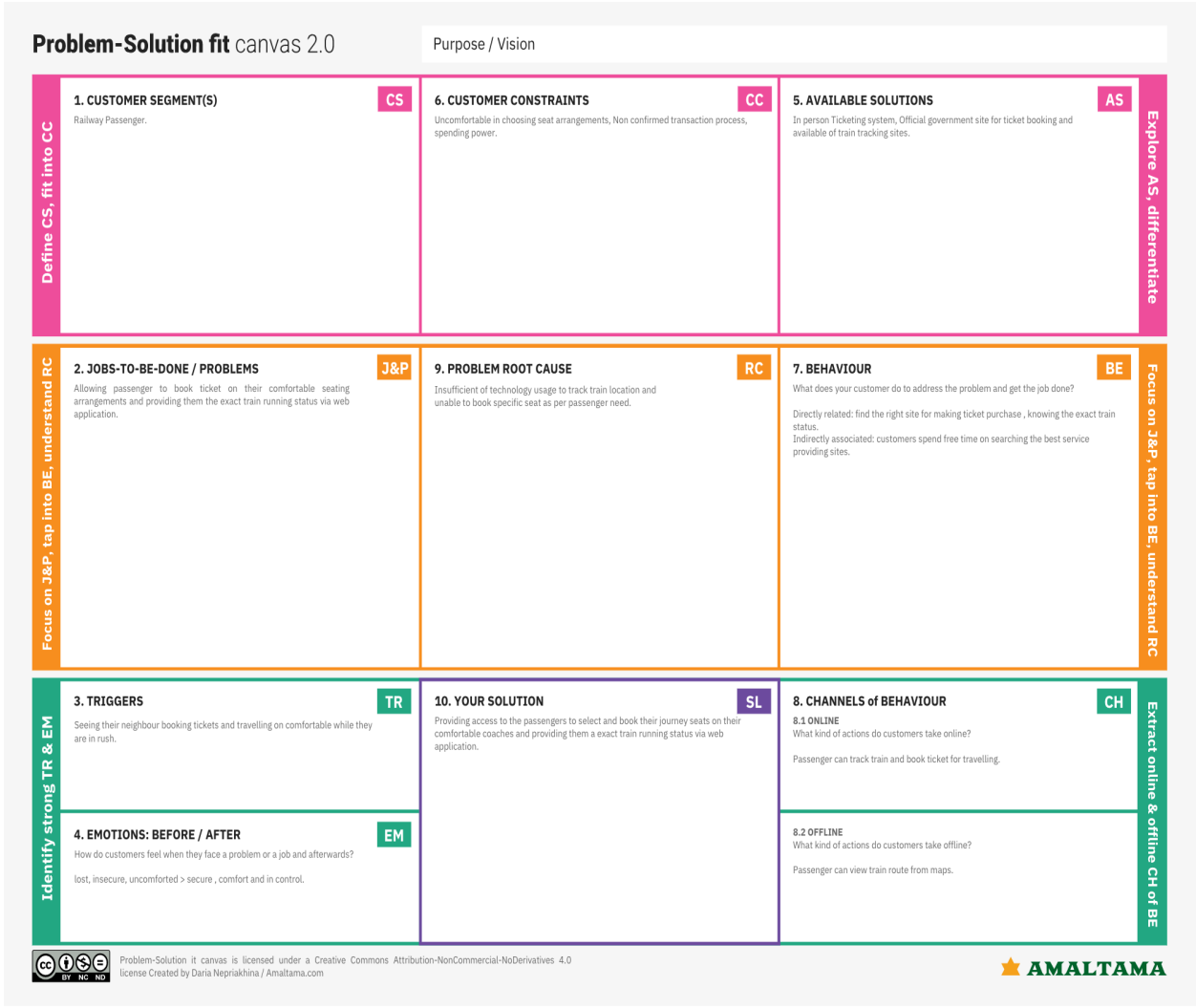
20 minutes



3.3 PROPOSED SOLUTION

S.No	Parameter	Description
01	Problem Statement	Tracking seat availability for booking ticket and train running status via web application.
02	Solution	Providing exact seat booking by allowing the user to book the particular seat they want. Providing exact train location via communication between IOT GPS module in train and web application directly.
03	Novelty	Allows users to book tickets based on their seat and coach convenience.
04	Business Model	No-Fee Model
05	Social Impact	Passenger can travel on their chosen seat comfortably
06	Scalability Of Solution	Can handle the multiple user at same time.

3.4 PROBLEM SOLUTION FIT



AMALTAMA

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	If Passenger wants to book tickets.Firstly,they need to register as a new user in a web app.User need to enter an email or phone number and create a strong password for registration
FR-2	User verification	The verification code is sended to the registered email id or phone number for registration.
FR-3	User confirmation	The verification code is entered in to the app application.After finishing that home page is opened.After verification, user can proceed to login with valid credential.

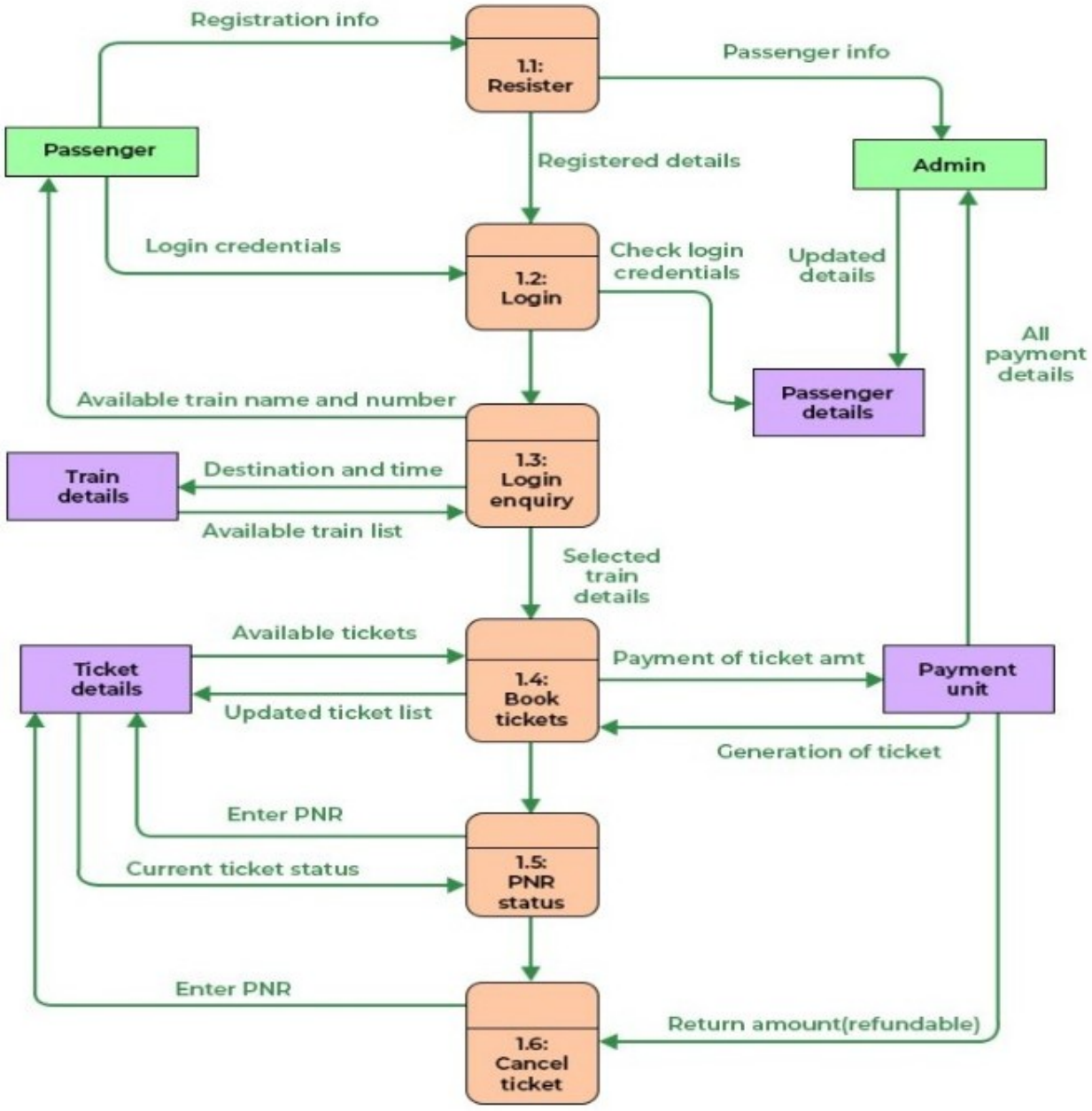
FR-4	Process of booking	When the home page is opened there will be a from and to option.Then, the passenger has to provide his/her details with the date of the journey, names of the passengers and their details, origin station details,destination station details, and the class type of therequiredticket(s) The Railway Reservation System will provide the available Train-list, and Seat-availability, via-details.
FR-05	Payment Process	To book a ticket passengers can pay through online/offline mode. If the passenger select the online payment mode The ui shows a lot of payment options like net banking, upi, and different card payment. Through various options the passenger can make payment and it can be done in a secure manner.
FR-06	Confirmation message	The confirmation will sent to register email or Phone number.E-ticket will be sent and also QR code sent to register email id and phone number.Passenger can show the QR Code to ticketer to verification.

4.2 NON-FUNCTIONAL REQUIREMENTS

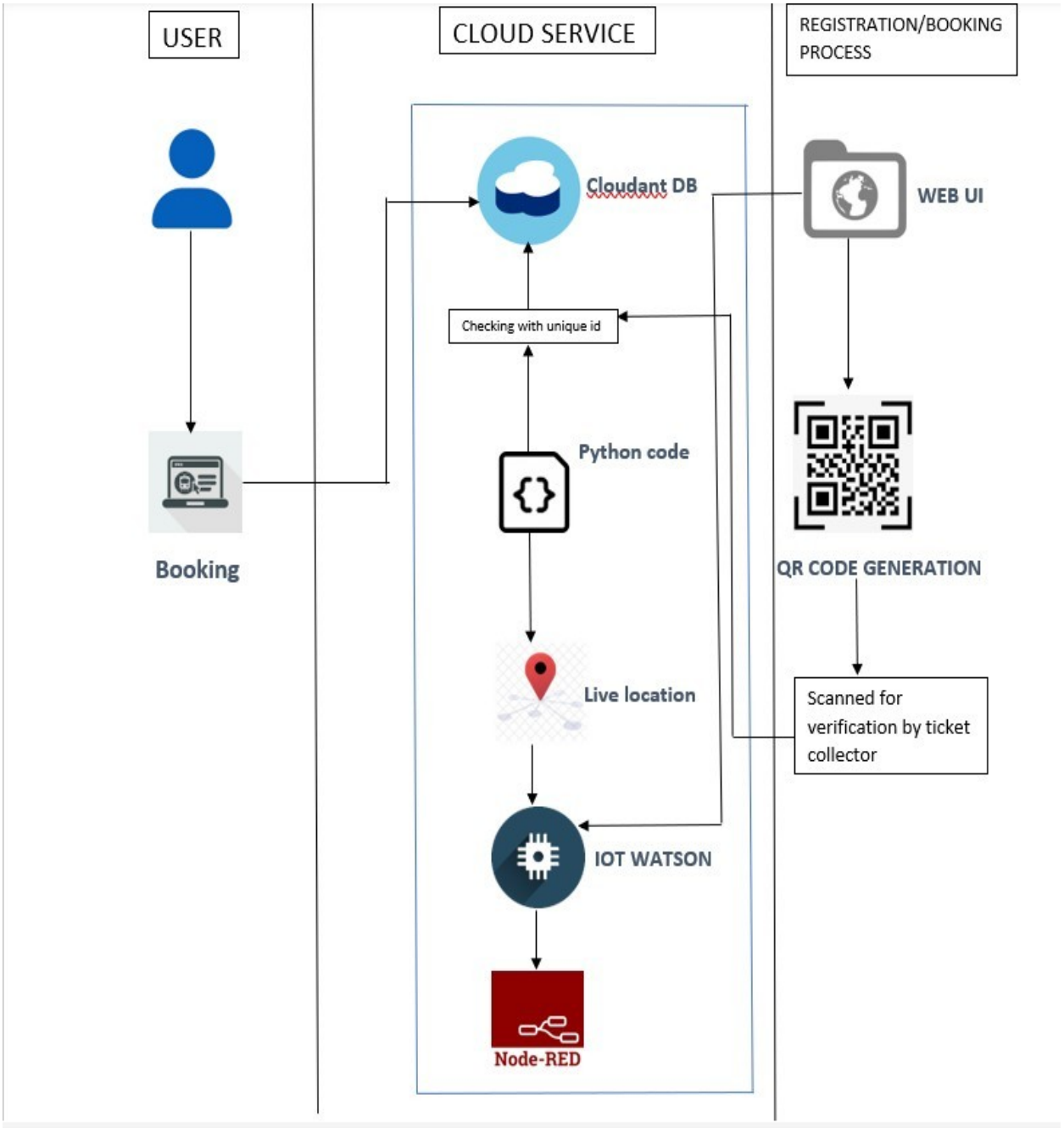
NFR NO	Non-Functional Requirement	Description
NFR-1	Usability	The web app can easily accessible because of its sleek and simple user interface
NFR-2	Security	The web app can access only by valid user and password credential. The payment gateway have lot of security
NFR-03	Reliability	In the process booking ticket, passenger may face session timed timed out or network error.The web app auto save option.Therefore lot time is saved.
NFR-04	Performance	The application is work faster with good network connection.
NFR-05	Availability	QR code is send through the Message and email id or phone number.
NFR-06	Scalability	Session management is available for web app.Numerous user can access the web easily

5.PROJECT DESIGN

5.1.DATA FLOW DIAGRAMS



5.2 SOLUTION & TECHNICAL ARCHITECTURE



5.3.User Stories

User Type	Functional requirements	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	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)	Registration	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)	Registration	USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
Customer (Mobile user)	Login	USN-4	As a user, I can log into the application by entering email & password	I can log in to the application by entering email & password	High	Sprint-1
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-4
Customer Care Executive	Connecting the service provider	Customer	Connects with the service by logging in	Can get connected with the server	Medium	Sprint-3

6.PROJECT PLANNING AND SCHEDULING

6.1.SPRINT PLANNING & ESTIMATION

Sprint	User Story Number	User Story/Task	Story Points	Priority	Team Members
Sprint 1	USN 1	Creating IBM Cloud services which are being used in this project	6	High	Pazhaniraj V, Hari R, Manoj kumar G, Chozharajan M.
Sprint 1	USN 2	Configure the IBM Cloud services Which is used to complete this project	4	Medium	Pazhaniraj V, Hari R, Manoj kumar G, Chozharajan M.
Sprint 1	USN 3	IBM Watson Iot Platform acts a mediator to connect the web application to Iot devices.So create Iot Watson Platform.	5	Medium	Pazhaniraj V, Hari R, Manoj kumar G, Chozharajan M.
Sprint 1	USN 4	In order to connect Iot watson platform to Ibm cloud services, so create a device in Iot Watson Platform and get the valid credentials	5	High	Pazhaniraj V, Hari R, Manoj kumar G, Chozharajan M.
Sprint 2	USN 1	Configure the connection security and Create the API keys that are used to access the IBM Iot platform	10	High	Pazhaniraj V, Hari R, Manoj kumar G, Chozharajan M.

Sprint 2	USN 2	Create the Node-red services	10	High	Pazhaniraj V, Hari R, Manoj kumar G, Chozharajan M.
Sprint 3	USN 1	Develop the python script that locate (latitude, longitude) data to Iot platform and the other python code and to read the QR code and fetch data from the cloudant DB	20	High	Pazhaniraj V, Hari R, Manoj kumar G, Chozharajan M.
Sprint 3	USN 1	Develop the Node-Red application	10	Medium	Pazhaniraj V, Hari R, Manoj kumar G, Chozharajan M.
Sprint 3	USN 2	Testing the Web UI by giving the Required inputs	10	Medium	Pazhaniraj V, Hari R, Manoj kumar G, Chozharajan M.

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

7.CODING AND SOLUTIONING

7.1 Feature 1 :

- IOT Device
- IOT Watson Platform
- Node Red
- Cloudant DB
- Web UI
- Geofence
- MIT App
- Python Code

7.1 Feature 2 :

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

8.TESTING

8.1. TEST CASES

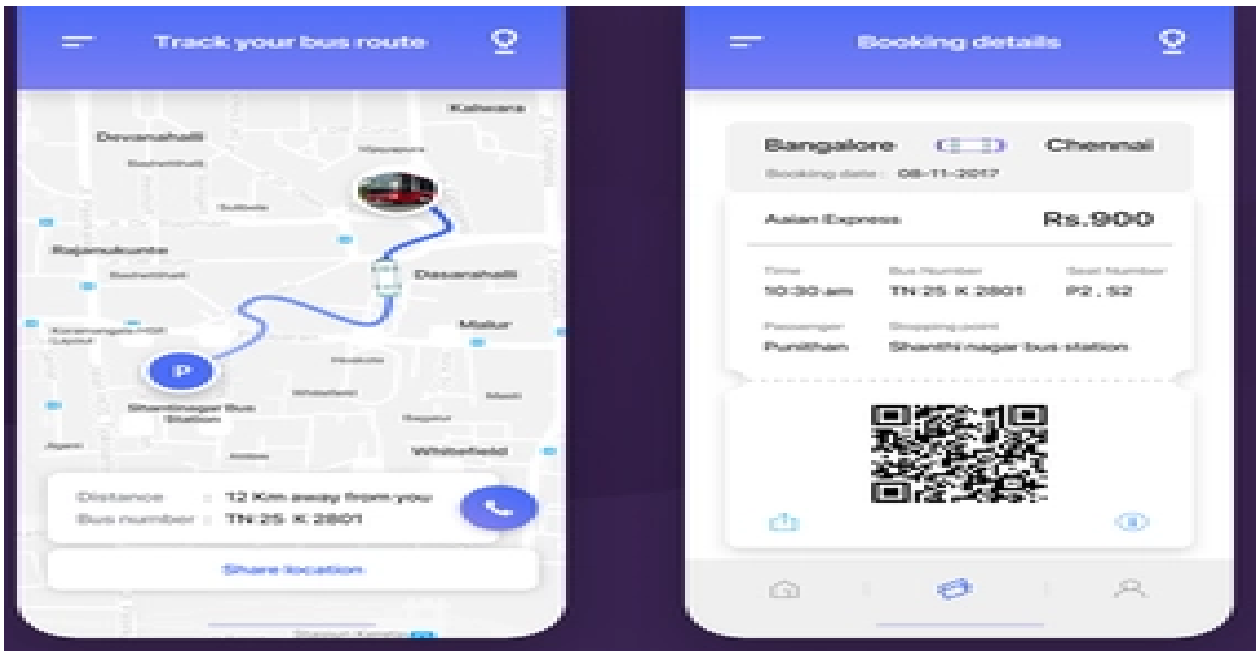
Test case Id	Feature Type	Component	Test Scenario	Steps to Execute	Test Data	Expected Result	Actual Result	Status	Comments	Bug ID	Executed by
LoginPage_01	Functional	Home Page	Verify user is able to see the Login/Signup popup when Signin/signup button	1.Enter URL and click go 2.click the Sign Up button and Sign In button shown Below	project Url	Login/Signup popup should display	Working as expected	Pass			User 1
LoginPage_02	UI	Home Page	Verify the UI elements in Login/Signup popup	1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup with below UI elements: a.email text box b.password text box c.Login button d.Dont't have an account? Sign up	project Url	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.Dont't have an account? Sign up	Working as expected	Pass			User 3
LoginPage_03	Functional	Home Page	Verify the User is able to register and create a new login credentials.	1.Enter URL and click go 2.Click on Sign Up button 3.Enter the details in the below UI elements: a.email text box b.password text box c.first name text box d.last name text box 4.Click Sign Up button	email: ramkrish2405@gmail.com password: krish2405 firstname: Rama lastname: krishnan	Application should update the database with the given dataset. Then must show the Box that says that the registeration is successfull.	Working as expected	Pass			User 1
LoginPage_04	Functional	Home Page	Verify the User is able to register and create a new login credentials.	1.Enter URL and click go 2.Click on Sign Up button 3.Enter the details in the below UI elements: a.email text box b.password text box c.first name text box d.last name text box 4.Click Sign Up button	email: ramkrish2405@gmail.com password: krish2405 firstname: Rama lastname: krishnan	Application should display that the email is already taken	not Working as expected	fail	The Application starts Crashing	BUG-1000	User 2
dashboard-01	UI	Main Page	Verify the UI elements in Dashboard	1.Login the application 2.verify the below UI Elements: a.book the train button b.Track the train button c.Booking history button d.Logout button	email: ramkrish2405@gmail.com password: krish2405	Application should display the below UI Elements: a.book the train button b.Track the train button c.Booking history button d.Logout button	Working as expected	pass			User 2
booking-01	UI	Book the train Page	Verify the UI elements in Dashboard	1.verify the below UI Elements: a.from button b.to button c.select the train button d.select the time button e. select the seat button f. back and next button	selecting the options given	Application should display the below UI Elements: a.from button b.to button c.select the train button d.select the time button e. select the seat button f. back and next button	Working as expected	pass			User 2
booking-02	UI	Book the train Page	Verify the UI elements in Dashboard	1.verify the below UI Elements: a.from button b.to button c.select the train button d.select the time button e. select the seat button f. back and next button	selecting the options given	Application should display the below UI Elements: a.from button b.to button c.select the train button d.select the time button e. select the seat button f. back and next button	not Working as expected	fail	the button gets stuch and display one over another	BUG-1001	User 3

booking-03	Functional	Book the train Page	Verify the User is able to book the train and generate the qr code	1. select the required details. 2. Click the Next Button 3. Enter the passenger detials 4. Click the next button 5. Download the QRcode by clicking Download QRCode button 6. finally click next button.	from: nagarkovil to: kanyakumari train: kanyakumari express time: 9.30am to 1.30pm seat: s3 name: suriya age:22 address: 3/149,madurai mobileno: 1234567896 dateofboarding: 1.12.2022	application should update the database with the given dataset. Then must show the Box that says that the booking is successfull and display the qr code. and the qrcode is able to download when the downloadqrcode button is clicked.	Working as expected	pass			User 3
booking-03	Functional	Book the train Page	Verify the User is able to book the train and generate the qr code	1. select the required details. 2. Click the Next Button 3. Enter the passenger detials 4. Click the next button 5. Download the QRcode by clicking Download QRCode button 6. finally click next button.	from: madurai to: tirunelveli train: tirunelveli express time: 9.30am to 1.30pm seat: s5 name: sam age:22 address: 1/129,madurai mobileno: 5978567896 dateofboarding: 12.12.2022	application should update the database with the given dataset. Then must show the Box that says that the booking is successfull and display the qr code. and the qrcode is able to download when the downloadqrcode button is clicked.	not Working as expected	fail	QR code didnt displayed and unable to download the qr code.	BUG-1002	User 3
tracking-03	UI	track the train Page	Verify the UI elements in Track the train page	1.verify the below UI Elements: a.map page b.location tracking symbol c.back to main page buttn	webpage url	Application should display the UI elements: a. map page b. location tracking symbol c. back to main page button	Working as expected	pass			User 4

9. RESULT

9.1 PERFORMANCES METRICES

QR GENERATION :



10. ADVANTAGES & DISADVANTAGES

10.1 ADVANTAGES

(i) **Orchestration –** ability to manage the large devices with Full visibility over them

(ii) **Dynamic scaling –** ability to scale the system according to the application needs,through the virtualization and Cloud operations

(iii) **Automation -** ability to automate parts of the system monitoring application, leading to better performances Low operation cost.

10.2 DISADVANTAGES

(i) Approaches to flexible, effective, efficient, and low-cost data collection for both railway vehicles and infrastructure monitoring, using regular trains

(ii) Data processing, reduction, and analysis in local controllers and subsequent sending of that data to the cloud , for the further monitoring

(iii) Online data processing systems, for real-time monitoring, using emerging communication technologies.

11.CONCLUSION

The main purpose of Smart Solution For Railways is provide the simple User interface for train ticket booking and generate the QR generate instead of ticket generation and giving live location of trains to passengers. The project is cost effective . By using this techniques lots time will be saved . By using the ultrasonic sensor we can detect the any object in the railway tracks, and it can save from accident and other physical damages, accidents.

12. 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 the security for passengers and railways. GPS can also used to track the exact location of train for emergency purpose and fault area The image monitoring is used for identifying any cracks in the trains.

13. APPENDIX

13.1 SOURCE CODE

https://github.com/IBM-EPBL/IBM-Project-24051-1664442548/tree/main/Develop%20The%20Python%20Script

13.2 GITHUB LINK AND PROJECT DEMO LINK

https://github.com/IBM-EPBL/IBM-Project-24051-1664442548/tree/main/Final%20Deliverables