

Project Report

Project Title - Smart Solutions For Railways

Project Team ID - PNT2022TMID37954

Project Leader- Naveen S

Project Member – Aadhikirubakaran K

Project Member – Badri S

Project Member - Venkatesh M

Project Member-Sakthivel P

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

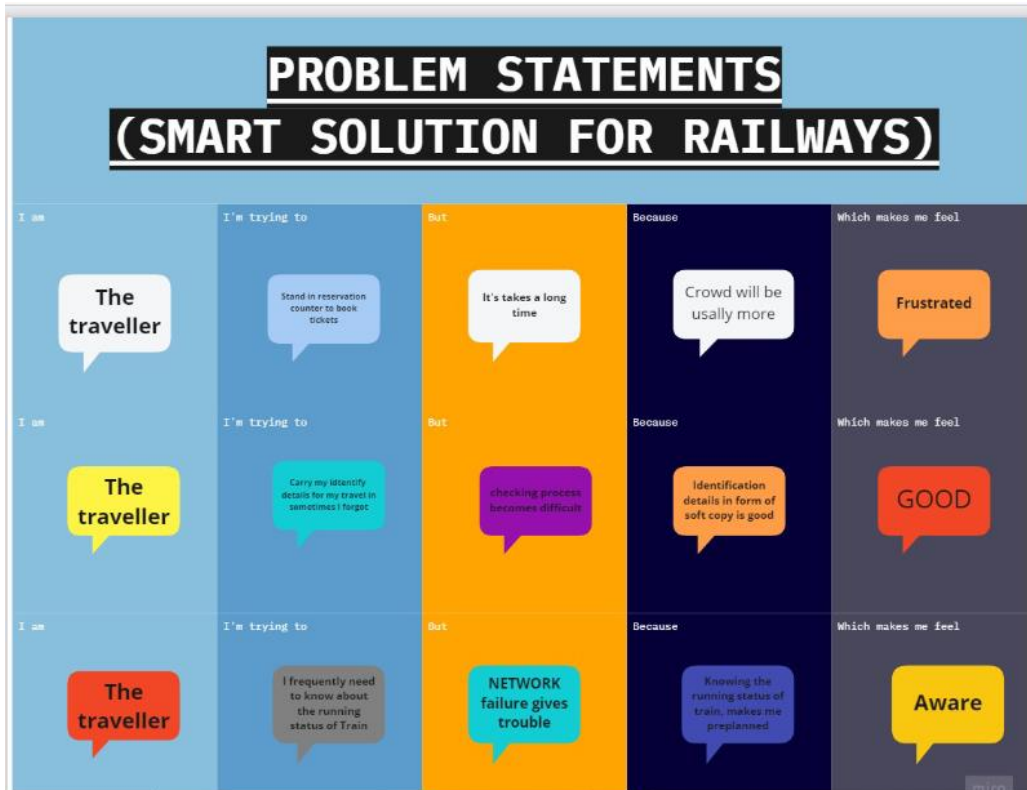
2.2 SURVEY TABLE:

| 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 .i ee.org/document /8026132 |
| Smart Train Detector using IoT Approach | PayalSrivastava, Rana Majumdar, Bonny Paulose, Sunil Kumar. | January,2019 | https://ieeexplore .i ee.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://ieeexplo re.i ee.org/docum ent /9526413 |

| | | | |
|--|--|-----------|---|
| Railway Components Wear: a Smart Platform | Alessandro Massaro, Emanuele, Cannella. | June,2021 | https://ieeexplore.ieee.org/document/9488486 |
|--|--|-----------|---|

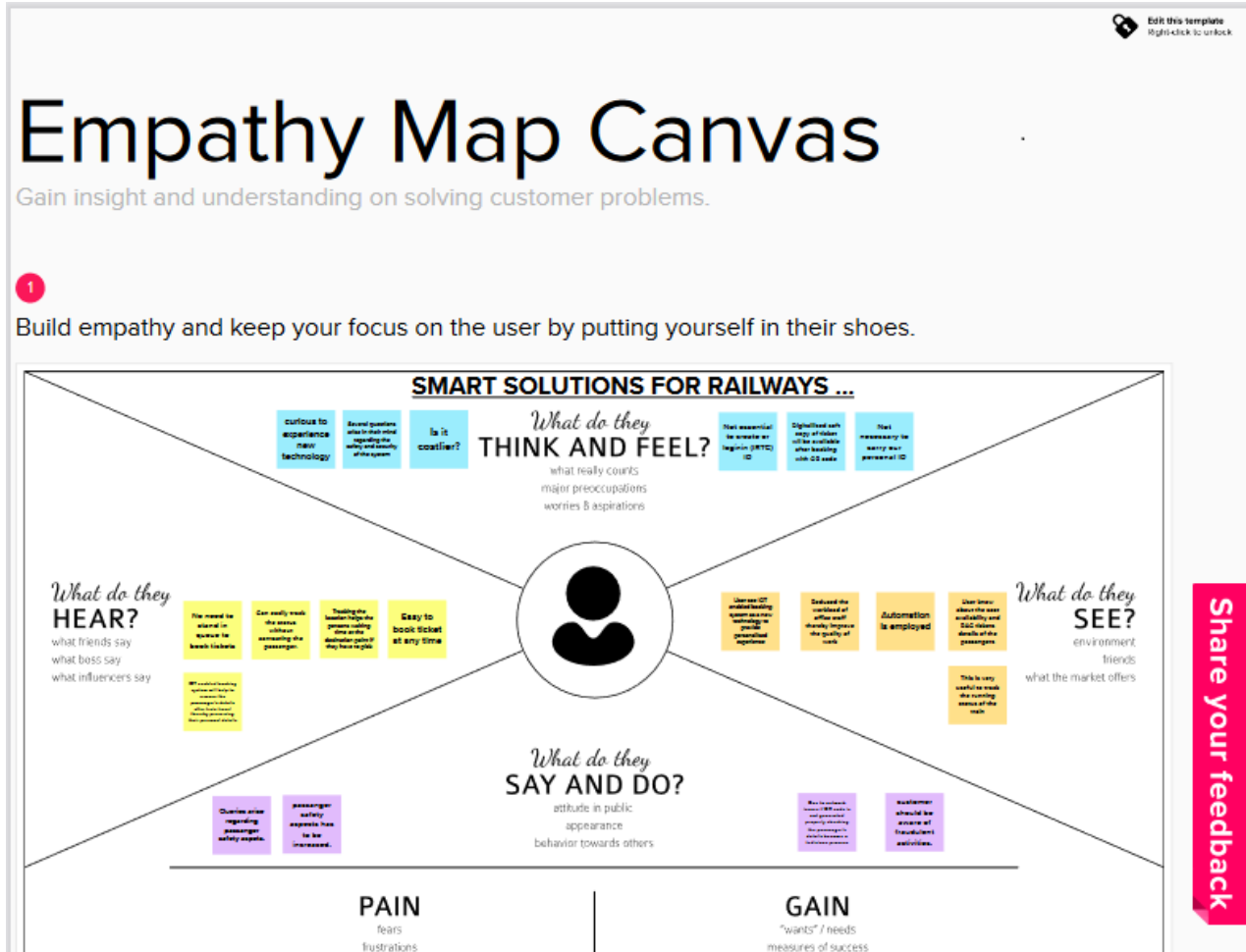
2.3 PROBLEM STATEMENT DEFINITION

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”.



3.IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



2

Brainstorm

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

⌚ 10 minutes

10

You can select a railway zone and its line panel (which is closest) (see the screen showing)

BRAIN STROMING (SMART SOLUTIONS FOR RAILWAYS.).

person 1

Book ticket
in advance

Split your
booking

looking for
cash back
offers

use IRTC
payment
cards

person 2

Available
senior
citizen
Quota

Choose to
travel in
sleeper
class

Get online
food at low
cost

Selecting a
preium train
travel

person 3

By PNR
number to
book a Railway
retiring room

Selecting C-
catering
catering
service

Enhancing
TATKAL
ticket Quota

Book LHB
coaches
Train

person 4

Ensure
safety in
Trains

For
complaints,
dial 139

For
complaints
contact TC
also...

cleaness
complaint,dial
5000

Team ID:RNT2022THID27254

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 can 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 | <p>Providing exact seat booking by allowing the user to book the particular seat they want.</p> <p>Providing exact train location via communication between IOT GPS module in train and web application directly.</p> |
| 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

Project Title:

Project Design Phase-I - Solution Fit Template

Team ID: PNT2022TMDXXXXXX

| | | | | |
|--|---|---|---|---------------------------|
| Define CS, fit into CC | 1. CUSTOMER SEGMENT(S) <small>Who is your customer? i.e. working parents of 0-5 y.o. kids</small> | 6. CUSTOMER CONSTRAINTS <small>What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no car, network connection, available services.</small> | 5. AVAILABLE SOLUTIONS <small>Which solutions are available to the customer when they face the problem? or tried to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking</small> | Explore AS, differentiate |
| | 2. JOBS-TO-BE-DONE / PROBLEMS <small>Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.</small> | 9. PROBLEM ROOT CAUSE <small>What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations</small> | 7. BEHAVIOUR <small>What does your customer do to address the problem and get the job done? TR: Directly related: find the right solar panel installer, calculate usage and billing; Indirectly associated: customers spend free time on volunteering work (i.e. Green projects)</small> | |
| Focus on J&P, fit into BE, understand RC | 3. TRIGGERS <small>What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.</small> | 10. YOUR SOLUTION <small>If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then leave it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.</small> | 8. CHANNELS of BEHAVIOUR 8.1 ONLINE <small>What kind of actions do customers take online? Research online channels from #7</small> 8.2 OFFLINE <small>What kind of actions do customers take offline? Research offline channels from #7 and use them for customer development.</small> | Identify strong TR & EM |
| | 4. EMOTIONS: BEFORE / AFTER <small>How do customers feel when they face a problem or a job and afterwards? i.e. loss, treasure > confident, in control - use it in your communication strategy & design.</small> | | | |

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 | <p>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 the required ticket(s).</p> <p>The Railway Reservation System will provide the available Train-list, and Seat-availability, via-details.</p> |
| FR-05 | Payment Process | <p>To book a ticket passengers can pay through online/offline mode. If the passenger selects 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.</p> |

| | | |
|--------------|----------------------|--|
| 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. |
|--------------|----------------------|--|

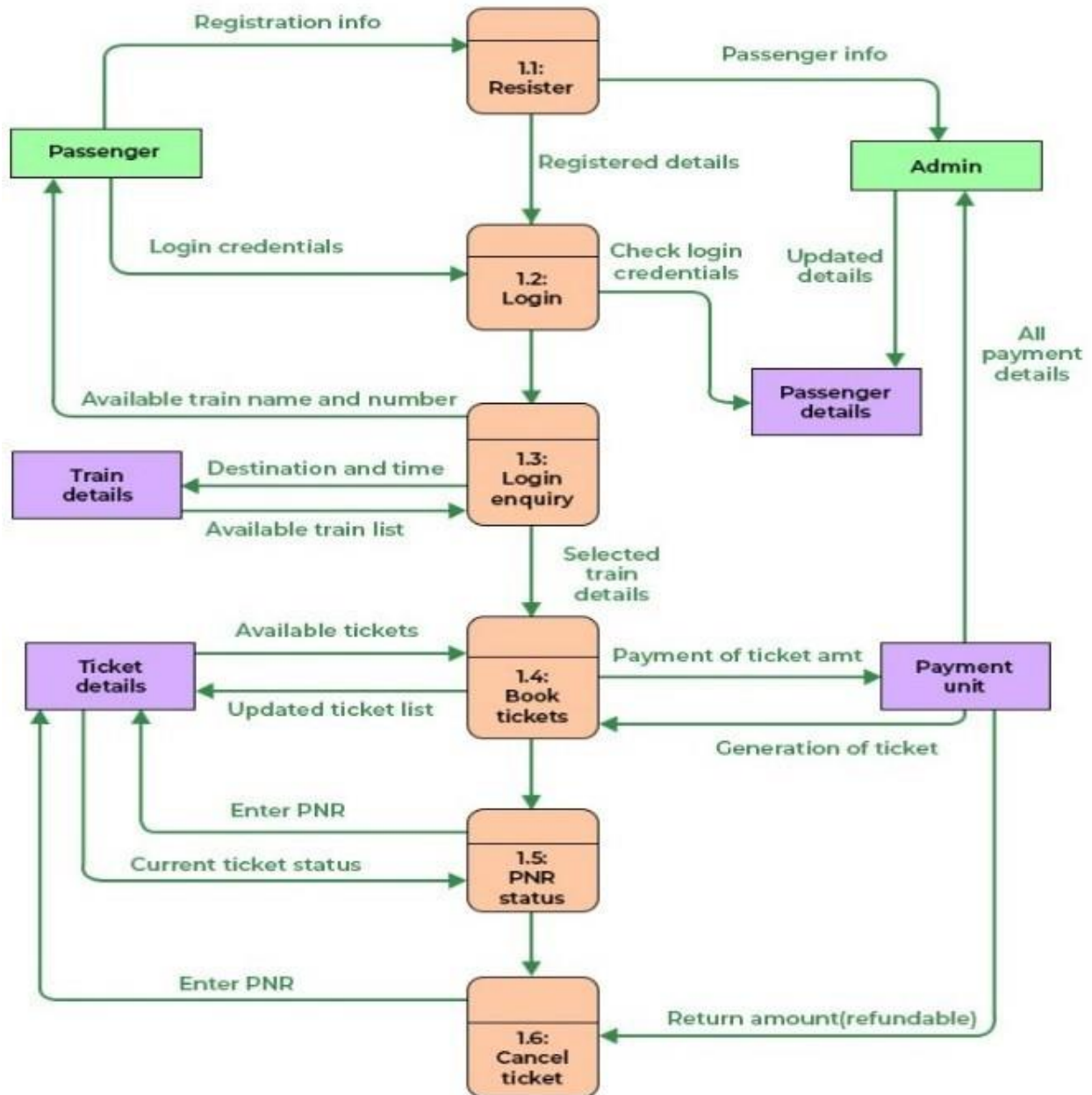
4.2 NON-FUNCTIONAL REQUIREMENTS

| 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. |

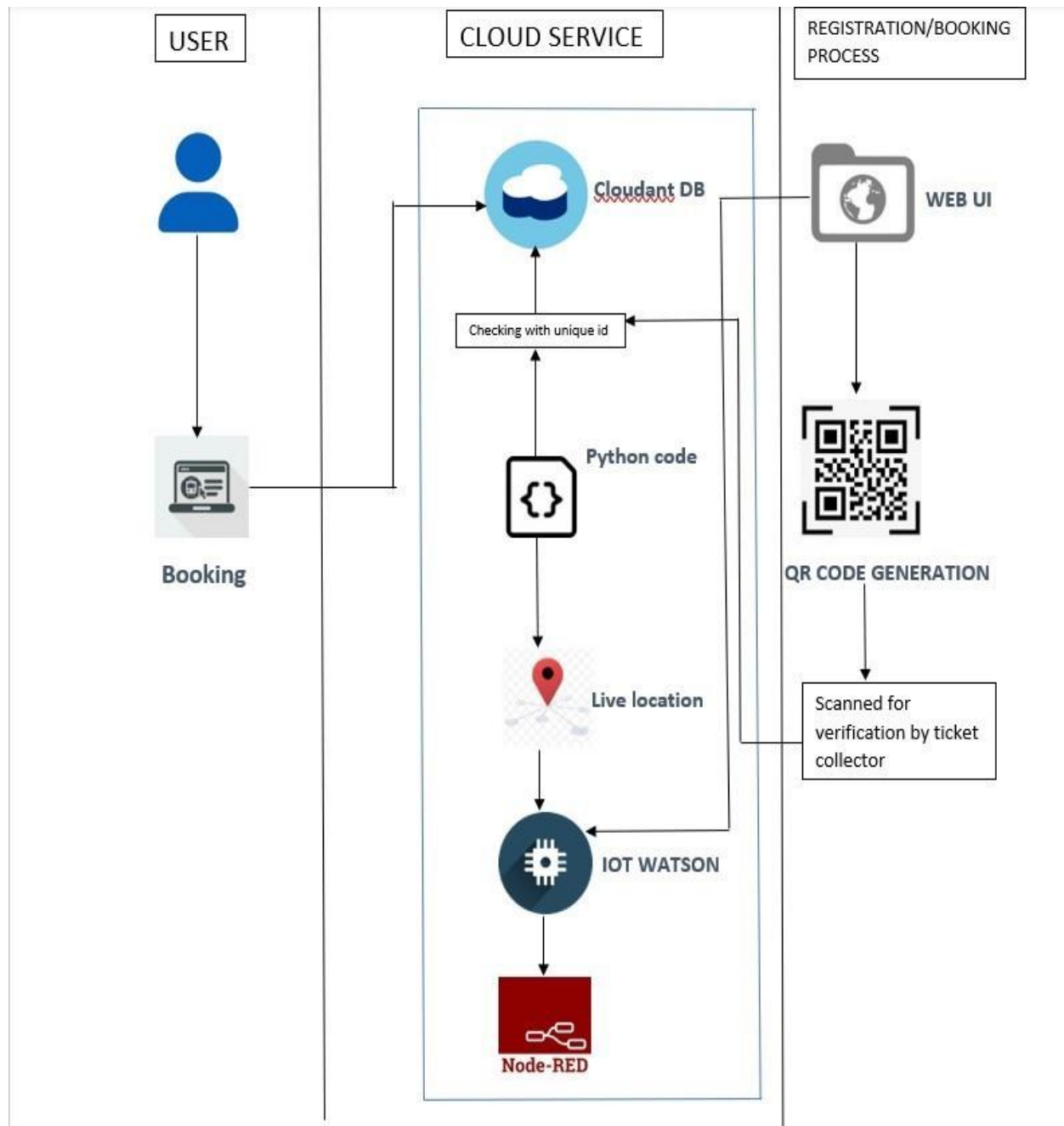
| | | |
|---------------|--------------|---|
| NFR-05 | Availability | QR code is send through the Message and email id or phone number. |
| NFR-06 | Scalability | Session management is available for web app.Numerous user can access the web easily |

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, register for the application by entering my email, and password, 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 | Naveen S, Aadhikirubakaran K, Venkatesh M,Sakthivel P,Badri S |
| Sprint 1 | USN 2 | Configure the IBM Cloud services Which is used to complete this project | 4 | Medium | Naveen S, Aadhikirubakaran K, Venkatesh M,Sakthivel P,Badri S |
| 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 | Naveen S, Aadhikirubakaran K, Venkatesh M,Sakthivel P,Badri S |
| 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 | Naveen S, Aadhikirubakaran K, Venkatesh M,Sakthivel P,Badri S |

| | | | | | |
|----------|-------|--|----|------|--|
| Sprint 2 | USN 1 | Configure the connection security and Create the API keys that are used to access the IBM Iot platform | 10 | High | Naveen S, Aadhikirubakaran K, Venkatesh M,Sakthivel P,Badri S |
|----------|-------|--|----|------|--|

| | | | | | |
|----------|-------|---|----|--------|--|
| Sprint 2 | USN 2 | Create the Node-red services | 10 | High | Naveen S, Aadhikirubakaran K, Venkatesh M,Sakthivel P,Badri S |
| 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 | Naveen S, Aadhikirubakaran K, Venkatesh M,Sakthivel P,Badri S |
| Sprint 3 | USN 1 | Develop the Node-Red application | 10 | Medium | Naveen S, Aadhikirubakaran K, Venkatesh M,Sakthivel P,Badri S |
| Sprint 3 | USN 2 | Testing the Web UI by giving the Required inputs | 10 | Medium | Naveen S, Aadhikirubakaran K, Venkatesh M,Sakthivel P,Badri S |

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/Signup 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 registration 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 |

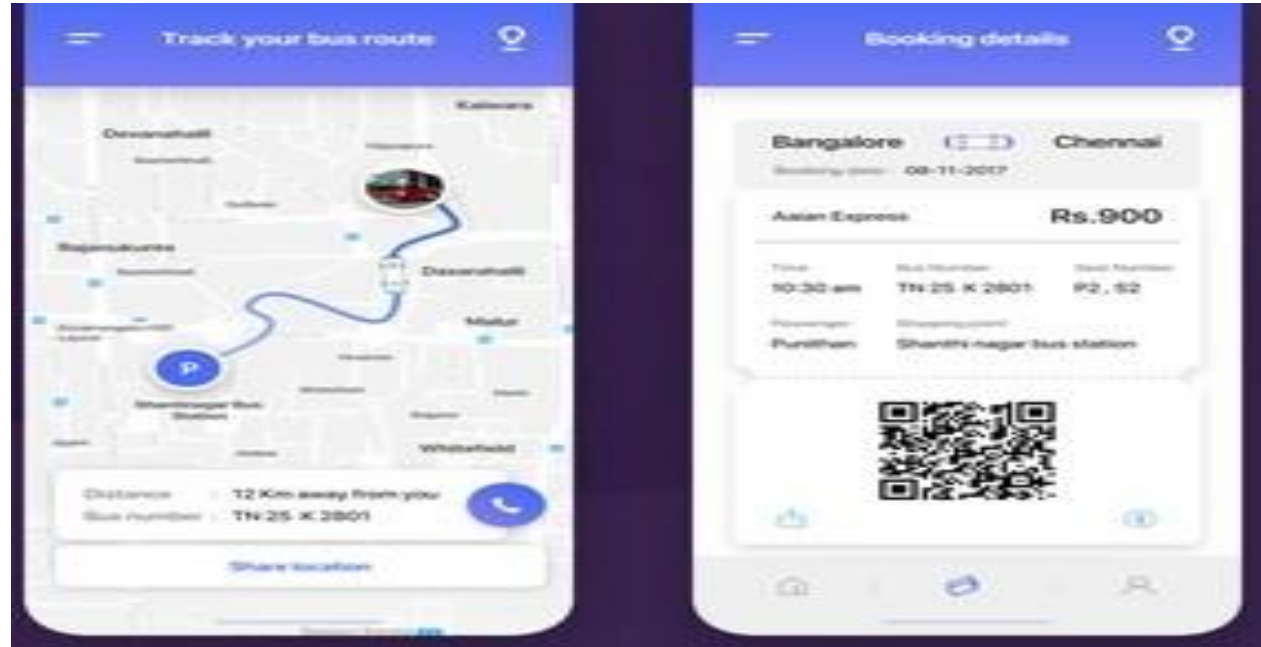
| | | | | | | | | | | |
|-------------|------------|----------------------|--|---|---|--|-------------------------|------|---|--------------------|
| booking-03 | Functional | Book the train Page | Verify the User is able to book the train and generate the qr code | 1. select the required details. 2. Click the Next Button 3. Enter the passenger details 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 mobilenno: 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 details 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 mobilenno: 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 button | 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/Development%20The%20Python%20Script>

13.2 GITHUB LINK AND PROJECT DEMO LINK

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

