Team ID	PNT2022TMID26639
Project Name	Smart Solution for Railways
Date	18 November 2022
Team Members	H.J.A.Jery Solomon, B.Benjamin David, Anbu, K.Edison,S.Sivan

Project Report Format

1. **INTRODUCTION**

1.1 Project Overview

- A webpage 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 been shown to the ticket collector while boarding the train
- The ticket collector 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 in the unique ID and they can be retrieved back when the ticket collector scans the QR Code.

1.2 Purpose

- Develop a web app for booking the tickets.
- Gain knowledge of Watson IoT Platform.
- Connecting IoT devices to the Watson IoT platform and exchanging the sensor data.
- Gain knowledge on IBM Cloudant DB

- Explore Python client libraries of Watson IoT Platform.
- Explore Python library for integrating OpenCV for accessing the Live Camera Input
- Scan the QR code in live streaming and retrieve the QR code details
- Gain knowledge on web application development.
- Gain knowledge of storing the data in Cloudant DB
- Generating QR codes with the required data

2. LITERATURE SURVEY

2.1 Existing problem

- Maintenance & reliability: as more and more passengers use railways, and 24/7 services become increasingly popular, delays and malfunctions on these networks may also increase.

- Innovation & new products: as demand for the railways increases, so too does the demand for new technologies and innovative solutions;

- Associated costs: keeping costs down, particularly for the end user, is important for any industry and, although we have no control over many costs associated with the rail industry.

- Durability: as demand for freight and passenger trains increases, so too does the physical demand on the railway lines themselves; increasing the need for durable cable protection that can withstand the physical strains of repeated use.

- Withstanding extreme conditions: with the possibilities, capacities, and capabilities of the world's railways so often challenged, so too are the environments these railways can endure; .

2.2 References

[1] Smita Patil, Shruti Desurkar, Deepali Sanaskar (2016) "An intelligent ticket checker application for train using QR code." [2] Karhikram, Sarvanan, Madhavan (2014) "Android application generating QR code as Railway Ticket." [3] Joydeep Singh, Vaibhav Shukla (2015) "Dynamic and transparent seat allocation using QR code in Mobile application." [4] Tushar Dongare, Akshay Babar (2014) "Android application for ticket reservation with GPS as ticket validation." [5] Snehal Kalbhor, Ashwini Mangulkar, Mrs. Snehal Kulkarni (2014) "Android application for local railway ticketing using GPS validation."

2.3 Problem Statement Definition

Im a traveller,
Trying to book a train ticket,
ButIt takes time to book a ticket,
Because ticket booking platform is not organized, which
makes me feel stressed and displeased.

Im a worker
I try to book a train ticket
But there is a long queue and takes more time to book a ticket
Because there are so many people travelling everyday standing in queue
Which makes me feel disrupted

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

- Reduce the work load of the Reduce the use of papers. Details of the customers Continuous live tracking of end user. to be stored in the database. location.
- Qr based tickets booking. Bar code scanning/RF id/NFC. Use of GPS in each environment. Manage database in SQL.
- A web page is designed for the public access. Book tickets by seeing the avaiable seats. QR/OTP/BAR code will be generated and contactless payments
- Database to be secured. Faster transcation. Ease to access. First Come First Serve

3.2 Ideation & Brainstorming

Team gathering Defne who should participate in the session and send an invite. Share relevant information or pre-work ahead. Set the goal Think about the problem you'll be

focusing on solving in the brainstorming session. A B Learn how to use the facilitation tools Use the Facilitation Superpowers to run a happy and productive session
Team leader Ticket cost is high decrease cost Advantages It is very useful for middle class and low class people Disadvantage tough to improve the organisation Member 3 online ticket booking solutions verify the apps and server advantages very usefull to maintain relationship with customers disadvantages work load on devolopers Member 2 Safety sensors solution implementing sensors will have proper checking Advantages safety rail experience disadvantages sensors having high voltage connectivit

3.3 Proposed Solution

S.No. Parameter Description 1. Problem Statement (Problem to be solved) ➢ The passenger convenience in making ticket reservations through the counter is poor. ➢ There will be no information about the ticket availability until all the ticket has booked. ➢ The printed tickets may be erased or torn by moisture, which is a problem for the traveller. The usage of paper tickets was to blame for this. ➢ The passengers will encounter the problem of being unable to reserve the preferred seat. ➢ While travelling either with family or friends the seats were distributed randomly. So they can't interact with each other properly as they thought. ➢ Long-haul passengers desire window seats, and issue of ticket loss has a significant impact on them. ➢ In their busy schedule as fast roaming world public in need of online booking process. The queues in front of the ticket counters in railway stations have been drastically increased over the period of time. 2. Idea / Solution description ➢ The user can book tickets using the website, where they will receive a QR code which can be scanned instead of using tickets to retrieve the user's information. ➢ By installing a GPS module inside the train, website can also display the train's real-time positions. The journey's location will be regularly updated on the website. ➢ Additionally, the website enables users to reserve the desired seat. ➢ The booking details of the user will be stored in the database which can be retrieved anytime. 3. Novelty / Uniqueness ➢ The webpage will offer the customer a QR code, which will cut down on paperwork. ➢ It allows the user to reserve the preferred seat. ➢ All of the client booking information will be saved in the database with a special ID which can be retrieved when the ticket collector scans the QR Code. 4. Social Impact / Customer Satisfaction ➢ There is no need going to the station to book tickets because they can be booked online, and the transaction process is also made simple. ➢ One can manage online ticket booking and apply for a cancellation in case of any change ➢ All confirmations and cancellations will be sent to the consumer by provided email or mobile phone. 5. Business Model (Revenue Model) ➢ The user of this application can check the seat availability and they can select the seats to their convenience. ➢ It makes the ticket booking simple for the clients to schedule daily shuttles and journeys, and it eliminates carrying around tickets. The customer can also view the train's current location. ➢ For using the abovementioned facility, a specific amount of fees may be charged, particularly if a customer wants to

reserve their preferred seat they must pay extra for an ticket. 6. Scalability of the Solution ➢ Elimination of physical paper tickets becoming environment friendly and contributing for greener planet by ignoring printout. ➢ While booking ticket in counter the clients had to carry cash and while booking E-ticket you are paying through online directly from bank or payment apps which makes work more easy for the clients. ➢ This reduces the wastage of the papers and the environment

3.4 Problem Solution fit

1. CUSTOMER SEGMENT(S) CS 2. JOBS-TO-BE-DONE / PROBLEMS J&P 9. PROBLEM ROOT CAUSE RC 7. BEHAVIOUR BE Explore AS, differentiate understand RC Focus on J&P, tap into BE, Define CS, fit into CC Focus on J&P, tap into BE, understand RC The user can book tickets on a website, where they will also receive a QR code that they can display to the ticket collector so that the ticket collector can scan it to retrieve the user's information. Passengers who are travelling in the train and ticket collector Due of their busy schedules and frequent international travel, the public needs an online booking method. In recent years, the waits in front of the ticket windows in railroad stations have gotten substantially longer. The primary cause of the issue is a lack of technology in the past, since customers find it challenging to book tickets and check the whereabouts of trains. In order to solve this issue, we implemented the QR code and GPS tracker for purchasing tickets and locating trains. Reducing the paper work of customer. We can show sincere empathy for the customer's dilemma by paying attention to what they have to say. We may quickly learn how the consumer encounters problems with the application by reviewing the ration session. Saves paper and work load *A website has been created where users may purchase tickets and receive a QR code that they can display to the ticket collector so they can scan it to retrieve the passenger's information. *By installing a GPS module inside the train, the website also displays the train's real-time positions. *The journey's location will be updated consistently on the website. The database will contain the user's booking information, which may be retrieved at any time. People can book their tickets through online and they get a QR code through sms In web application passenger details is stored and the ticket collector can view their details at any time.

4. **REQUIREMENT ANALYSIS**

4.1 Functional requirement

Following are the functional requirements of the proposed solution. FR No. Functional Requirement (Epic) Sub Requirement (Story / Sub-Task) FR-1 Passenger Registration Application-based Registration with the Required Information FR-2 Passenger Login Use the unique username and complementary password to Log In FR-3 Admin Login Login Using the Admin Username and Password FR-4 Passenger Books Ticket By providing the necessary details, one books a ticket through an app. FR-5 Selecting the Seat While

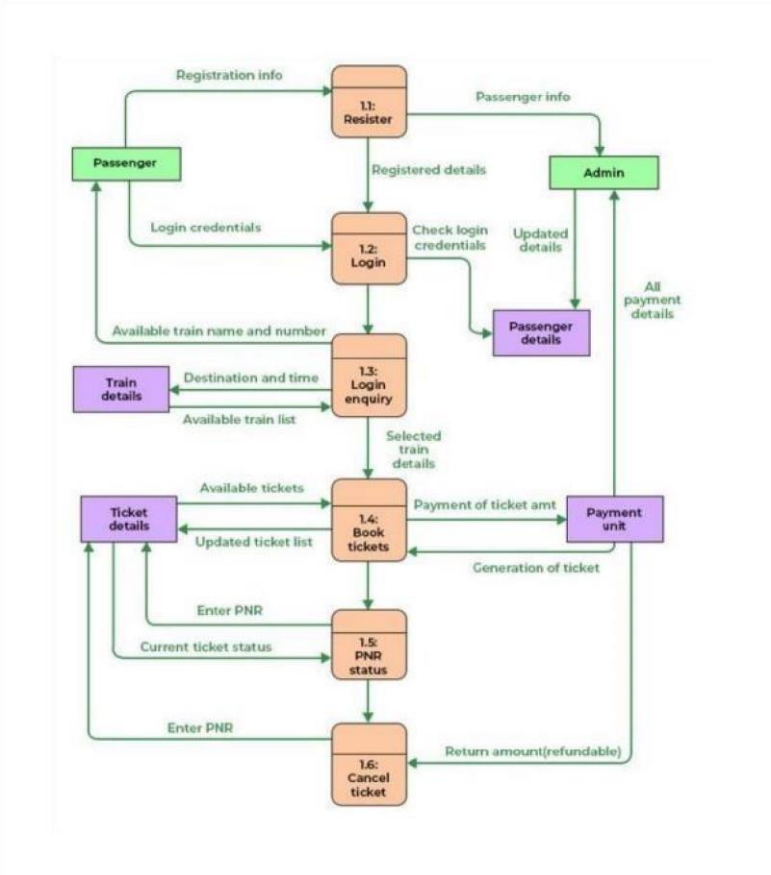
booking passenger should select which seat is comfortable for him/her. FR-6 QR Code Generation A QR Code is generated following a successful booking FR-7 Admin Cancel the Booking Admin may cancel a passenger's ticket if the information is unsuitable or the passenger is thought to be inappropriate. FR-8 Tracking the location of Train Passenger can view the current location of his/her Train. FR-9 TTR Verifies the Passenger TTR scans the QR Code that the user displays, providing the user with information that needs to be confirmed

4.2 Non-Functional requirements

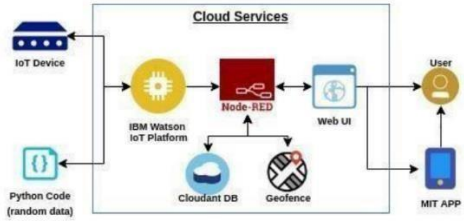
Following are the non-functional requirements of the proposed solution. FR No. NonFunctional Requirement Description NFR-1 Usability The application is simple enough for users with little experience using mobile devices. NFR-2 Security Only the system's data administrator is able to modify the access rights for a given piece of system information. NFR3 Reliability When any update fails, the database update procedure must roll back any linked updates. NFR-4 Performance For visitors who use an LTE mobile connection to view the website, the front page load time must be under 2 seconds. NFR-5 Availability The deployment of a new module shouldn't affect the accessibility of the main page, the product pages, or the checkout pages, and it shouldn't take more than an hour. The rest of the pages that might encounter issues must present a notice with a countdown indicating when the system will be back up. NFR-6 Scalability The maximum number of visitors to the website must be expandable to accommodate 10,000 users at once

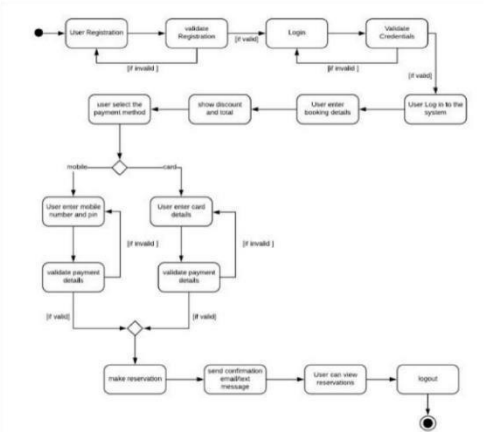
5. **PROJECT DESIGN**

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture





5.3 User Stories

User Type Functional Requirement (Epic) User Story Number User Story / Task Acceptance criteria Priority Release Customer (Mobile user, Web user) Registration USN-1 As a user, I can register through the form by Filling in my details I can register and create my account / dashboard High Sprint-1 USN-2 As a user, I can register through phone numbers, Gmail, Facebook or other social sites I can register & create my dashboard with

Facebook login or other social sites High Sprint-2 17 Conformation USN-3 As a user, I will receive confirmation through email or OTP once registration is successful I can receive confirmation email & click confirm. High Sprint-1 Authentication/Login USN-4 As a user, I can login via login id and password or through OTP received on register phone number I can login and access my account/dashboard High Sprint-1 Display Train details USN-5 As a user, I can enter the start and destination to get the list of trains available connecting the above I can view the train details (name & number), corresponding routes it passes through based on the start and destination entered. High Sprint-1 Booking USN-6 As a use, I can provide the basic details such as a name, age, gender etc… I will view, modify or confirm the details enter. High Sprint1 USN-7 As a user, I can choose the class, seat/berth. If a preferred seat/berth isn't available I can be allocated based on the availability. I will view, modify or confirm the seat/class berthselected High Sprint-1 Payment USN-8 As a user, I can choose to pay through credit Card/debit card/UPI. I can view the payment Options available and select my desirable choice To proceed with the payment High Sprint-1 USN-9 As a user, I will be redirected to the selected Payment gateway and upon successful I can pay through the payment portal and confirm the booking if any changes need to High Sprint-1 User Type Functional Requirement (Epic) User Story Number User Story / Task Acceptance criteria Priority Release completion of payment I'll be redirected to the booking website. be done I can move back to the initial payment page 18 Ticket generation USN-10 As a user, I can download the generated e ticket for my journey along with the QR code which is used for authentication during my journey. I can show the generated QR code so that authentication can be done quickly. High Sprint-1 Ticket status USN-11 As a user, I can see the status of my ticket Whether it's confirmed/waiting/RAC. I can confidentially get the Information and arrange alternate transport if the ticket isn't Confirmed High Sprint-1 Remainders notification USN-12 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 of the constant notifications. Medium Sprint-2 USN-13 As a user, I can track the train using GPS and can get information such as ETA, Current stop and delay. I can track the train and get to know about the delays pian accordingly Medium Sprint2 Ticket cancellation USN-14 As a user, I can cancel my tickets if there's any Change 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 USN-15 As a user, I can raise queries through the query box or via mail. I can view my pervious queries. Low Sprint-2 Customer care Executive Answer the queries USN-16 As a user, I will answer the questions/doubts Raised by the customers. I can view the queries and make it once resolved Medium Sprint-2 Administrator Feed details USN-17 As a user, I will feed information about the trains 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

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

- Be razor-sharp clear about what needs to be done to complete a particular user story. The whole team needs to understand the effort and complexity. Don't keep the knowledge to a single person. Knowledge silos will slow down the team.
- Highlight all risks during sprint planning.
- Remove all unknowns as much as possible. User stories should be elaborated continuously until it gets to its "ready" state.
- Be very critical about the scope of the user story. Be aware of scope-creep especially when building towards an MVP.
- Split user stories if you can especially if it can be delivered in parallel and without too much dependency.
- Identify the most common user story that is straightforward and can be easily identified as a "normal-sized" user story.

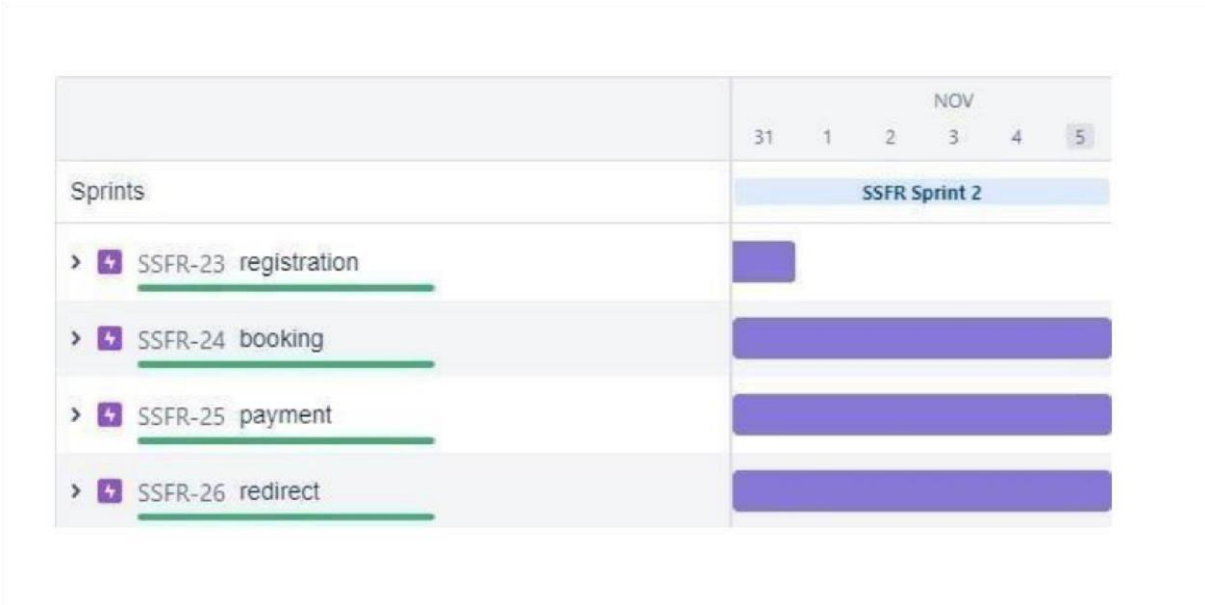
- Effort
- Complexity
- Risks
- Unknowns

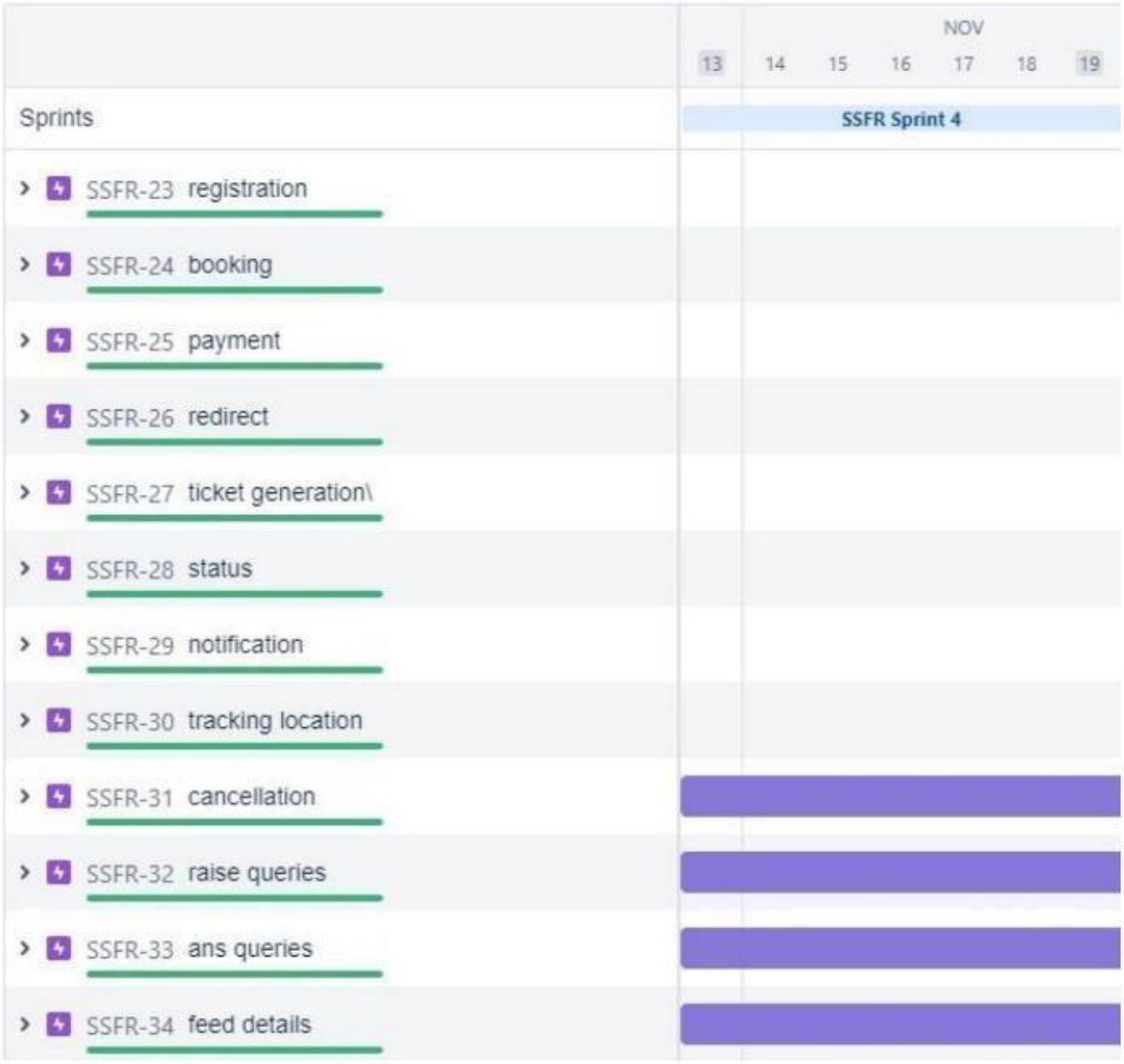
6.2 Sprint Delivery Schedule

Market Overview: The growing applications of IOT technologies as well as cloud based services in various industries have raised the demand for smart railways so as to integrate the new generation services and solutions for their operation. Moreover, the contribution of information and communications technology in smart railways further gives rise to efficient and modern forms of transportation. The global smart railways market was valued at USD 14,328.9 million in 2018 and is projected to reach USD 48,778.1 million by the end of 2027. In addition to this, the market is estimated to register a CAGR of 14.7% during the forecast period, i.e., 2019-2027. Growth Highlights based on region during 2017-2027: The global smart railways market is segmented by regions into North America, Latin America, Europe, Asia-Pacific and Middle East and Africa, out of which, the market in Europe is anticipated to hold the leading share in smart railways market over the forecast period. This can be attributed to the huge investments made by government on smart railway projects along with growing adoption of Internet of Things in this region.

The market in North America is anticipated to hold the second largest share on account of upcoming high-speed train projects in the U.S. and Canada. The market in Asia Pacific is estimated to observe a significantly high growth in the upcoming years as a result of rising advancements in the region. For instance, China is focusing on the development of high-speed trains in order to reduce the travel time between railway stations

6.3 Reports from JIRA





7. **CODING & SOLUTIONING (Explain the features added in the project along with code)**

7.1 Feature 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

7.3 Database Scheme (if Applicable)

8. **TESTING**

8.1 Test Cases

Test case ID	Feature Type	Component	Test Scenario	Pre-requisite	Steps to Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation	BUG	Executed By
1	Functional	Registration	Registration through the form by filing in my details.		1.Click on register 2.Fill the registration form 3.click Register		Registration form to be filled is to be displayed	Working as expected	Pass				Nikhila
2	UI	Generation OTP	Generating the otp for further process		1.Generating of OTP number		user can register through phone numbers, Gmail, Facebook or other social sites and to get	Working as expected	Pass				Preethiha
3	Functional	OTP verification	Verify user otp using mail		1.Enter gmail id and enter password 2.Click submit	Username: abc@gmail.com Password: Testing123	OTP verified this to be displayed	Working as expected	Pass				Kishokkumar
4	Functional	Login page	Verify user is able to log into application within Valid credentials		1.Enter into login page 2. Click on My Account dropdown button 3. Enter invalid user name/email text box 4.Enter valid password in password and text box 5.Click on login button	Username: abc@gmail.com Password: Testing123	Application should show incorrect email or password validation message	Working as expected	Pass				Raguram

Test case ID	Feature Type	Component	Test Scenario	Pre-requisite	Steps to Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation	BUG	Executed By
8	Functional	Payment	user, I can choose to pay through credit Card/debit card/UPI.		1. User can choose payment method 2. Pay using the method		payment for the booked tickets to be done using payment method through either the following methods credit Card/debit card/UPI	Working as expected	Pass				Raguram
9	Functional	Redirection	user can be redirected to the selected.		1. After payment the user will be redirected to the previous		After payment the usre will be Working as redirected to the previous page	Working as expected	Pass				Kishokkumar
10	Functional	Ticket generation	A user can downloaded the generated e-ticket for my journey along with the QR code which is used for authentication during my		1. Enter method of reservation 2. Enter name, age, sender 3. Enter how many tickets want to be booked 4. Also enter the number members details like		Tickets booked to be displayed	Working as expected	Pass				Nikhila
11	UI	Ticket status	a uercan see the status of my ticket whether it's		1. Known to the status of the tickets booked		known to the status of the tickets booked	Working as	Pass				Preethiha

Test case ID	Feature Type	Component	Test Scenario	Pre-requisite	Steps to Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation	BUG	Executed By
5	Functional	Display Train details	The user can view about the available train details		As a user, I can enter the start and destination to get the list of trains available connecting the above	Username: abc@gmail.com Password: 1236786867868 76876	A user can view about the available trains to enter start and destination details	Working as expected	Fail				Nikhila
6	Functional	Booking	user can provide the basic details such as a name, age, gender, etc.,		1. Enter method of reservation 2. Enter name, age, sender 3. Enter how many tickets want to be booked 4. Also enter the number members details like		Tickets booked to be displayed	Working as expected	Pass				Kishokkumar
7	UI	Booking seats	User can choose the class seat/berth. If a preferred seat/berth isn't available I can be allocated based on the availability		1. Known to which the seats or available		known to the status of the tickets booked	Working as expected	Pass				Preethiha
			user, I can choose to pay through credit Card/debit card/UPI.		1. User can choose payment method 2. Pay using the method		payment for the booked tickets to be done using payment method	Working as					

9. **RESULTS**

9.1 Performance Metrics

10. **ADVANTAGES & DISADVANTAGES**

Advantages

- **Fast and Easy to implement**
- **Reliable**
- **Can avoid longer queues**
- **Safe and Secure**

Disadvantages • Network Jamming due to heavy signal traffic • Hacking Personal informations • Server not responding in non organized operations • Deployment of ticketing staffs

11. CONCLUSION

The Smart Railway Solutions elaborated in this study are meant to expand the knowledge of railway officials of the region on the options available for them to deal with the challenges posed by the pandemic. The COVID -19 pandemic that started as health crisis quickly morphed into socio-economic challenge of humongous proportions- the effects of which would be felt for long time. As transport has been one of the worst hit sectors by pandemic, the crisis affords an opportunity for transport community to revisit approaches that led to transport development. Generally, transport and economic growth has followed one and another. However, in its pursuit to support economic activities the rapid growth in transport had many negative consequences that have become quite apparent now. It is widely acknowledged that the business-as-usual approach to transport would have many unsustainable outcomes. Therefore, efforts have been made by countries to increase the sustainability of transport in all its dimensions with focus on its social and environmental aspects. The increasing emissions from transport and its impact on climate change is well documented and needs an urgent response.

12. FUTURE SCOPE

Adoption of Big Data and Internet of Things (IoT) in railways are expected to deliver smart travel and trade solutions in the coming decade. Equipped with real-time monitoring and schedule updates, end users are expected to benefit from efficient cargo movement with error-tracking.

GitHub & Project Demo Link