

<b>PROJECT NAME</b>	<b>SMART SOLUTIONS FOR RAILWAYS</b>
<b>TEAM ID</b>	<b>PNT2022TMID42792</b>

## **Project Report**

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# Smart Solution for Railways

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## 1.1 INTRODUCTION

*Railway networks across the world are getting busier and busier; trains travel at higher speeds and carry more passengers or heavier axle loads than ever before. Accordingly, the railway industry calls for new information technologies (ITs) to meet its development. Railway systems have already relied on ITs almost as much as they rely on physical assets, and this dependence is growing as these systems face burgeoning demands in terms of robustness, reliability, and capacity. This chapter will discuss the framework and related technologies for a smart railway based on the Internet of Things (IoT) and big data. On one hand, we present the architecture of a smart railway, which is divided into four layers, i.e., perception and action layer, transfer layer, data engine layer, and application layer, and discuss the advanced and mostly concerned technologies in each layer. On the other hand, we introduce the intelligent rail inspection system, which can be regarded as a case or application of the smart railway. The smart railway shows the potential of improving traditional rail way systems with the development of the IoT and big data.*

## 1.1 PROJECT OVERVIEW

*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 PUPROSE**

*This project deals with the development and implementation of smart phone application which is more effective and simple than current ticketing system. The “Railway Ticket Booking System using QR Code” can be bought easily anytime, anywhere and the ticket will be present in the customer’s phone in the form of “Quick Response (QR) Code”. Admin will add the customers based on their Aadhaar card details which will be retrieved while registration of customer on an android application. After successfully creating an account, customer can book a ticket by specifying the source and the destination and book a ticket. The application will generate a QR code of booked ticket which will be used at railway station to scan the ticket QR code. GPS facility is used for validation of the ticket at the source and deletion at the destination. The information for each user is stored in a SQL database for security purpose which is unavailable in the current suburban railway system. Also the ticket checker is provided with an application to search for the user’s ticket with the ticket number in the cloud database for checking purposes.*

## **2. LITERATURE SURVEY**

S.NO	PAPER	AUTHOR	YEAR	METHOD AND ALGORITHM
	5G Key Technologies for Smart Railways	Bo Ai; Andreas F. Molisch; Markus Rupp; Zhang-		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

1		Dui Zhong	2020	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-multiple-output (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	<u>Paula Fraga-</u>	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

		<u>Lamas</u>	<p><i>main industrial developments, short and medium- term 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 control systems, 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</i></p> <p><i>railway industry and will allow for confronting today challenges</i></p>
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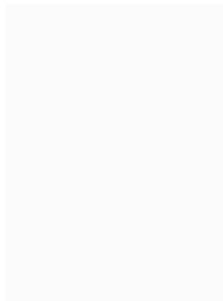
3	Smart Railways:			<p>The huge power requirements of future railways require the usage of energy-efficient strategies towards amore intelligent railway system.</p> <p>The usage</p> <p>of on-board energy storage systems enables better</p>
	A Charging			usage of the traction energy with a higher degree of
	Strategy for	Vítor A. Morais,, João	2020	freedom. In this article is proposed a top-level
	Railway	L. Afonso, António P.		charging controller forthe on-board and wayside
	Towards Energy Storage Systems	Martins		<p>railway energy storage systems. Its structure</p> <p>comprehends two processing levels: a real-time fuzzy</p> <p>logic controller for each energy storage system, and a genetic algorithm meta-heuristic, that remotely and automatically tune the fuzzy rules weight. As global results, the reduction of regenerated energy is 22.3%with the fuzzy logic controller. With the optimization strategy, this reduction can be further extendedto 28.7%. The need for a smart railway framework is also discussed towards a realistic implementation of such charging strategy. Thus, with a high degree of flexibility, the efficiency of railway energy systems</p> <p>can be increased with the proposed</p>

				framework.
4	Smart Phone &IoT-Based Intellectual Messaging of Platform Details in Railways	J.DHIVYA ROSE	2022	<p>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</p>

				<i>train reaches the railway station.</i>
5	<i>Smart Rail for Smart Mobility</i>	RUI CRUZ	2018	<i>Urban mobility is facing significant challenges nowadays; several factors affect the way people move, mainly but not only, within cities and large metropolitan areas. These factors are usually related to the way of life and mobility needs of the human being, leading to social constraints and environmental issues, overcrowding the undersized transportation networks and infrastructures. The pressure for better planning, improved sustainability and governance on transportation is therefore higher, with a shift in focus to technological changes in order to improve policies for all stakeholders involved on mobility. In this scenario, rail is one of the most affected transportation modes (mainly within large urban and metropolitan areas), having to deal with increasing demands in</i>



			<p><i>limited infrastructures, a situation that leads to congestion on operations and safety problems. Improvement or evolution in rail is traditionally done at significant costs, and is highly</i></p> <p><i>dependent on political decisions, making it difficult for rail</i></p>
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				<p><i>to be in line with the evolution of mobility systems. However, the modal shift towards public transport and the high potential of rail within green and sustainable transport modes, gives it the opportunity to grow,</i></p> <p><i>according to the "Smart Rail" vision.</i></p>
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## 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. Reliable cable protection, as mentioned above, serves to reduce the risk of any damage to cables, and the consequent damages associated*

*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 - such as the rising price of fuel - what we do have control over is keeping any unforeseen damages and malfunctions which may occur due to damaged or broken cables to a minimum, which will in turn lower these costs.*

*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. All our products are tested beyond industry standard to ensure that, however high the demand, our applications protect those cables time and time again*

## 2.2 REFERENCES

- Bo Ai;
- Andreas F. Molisch
- Markus rupp;

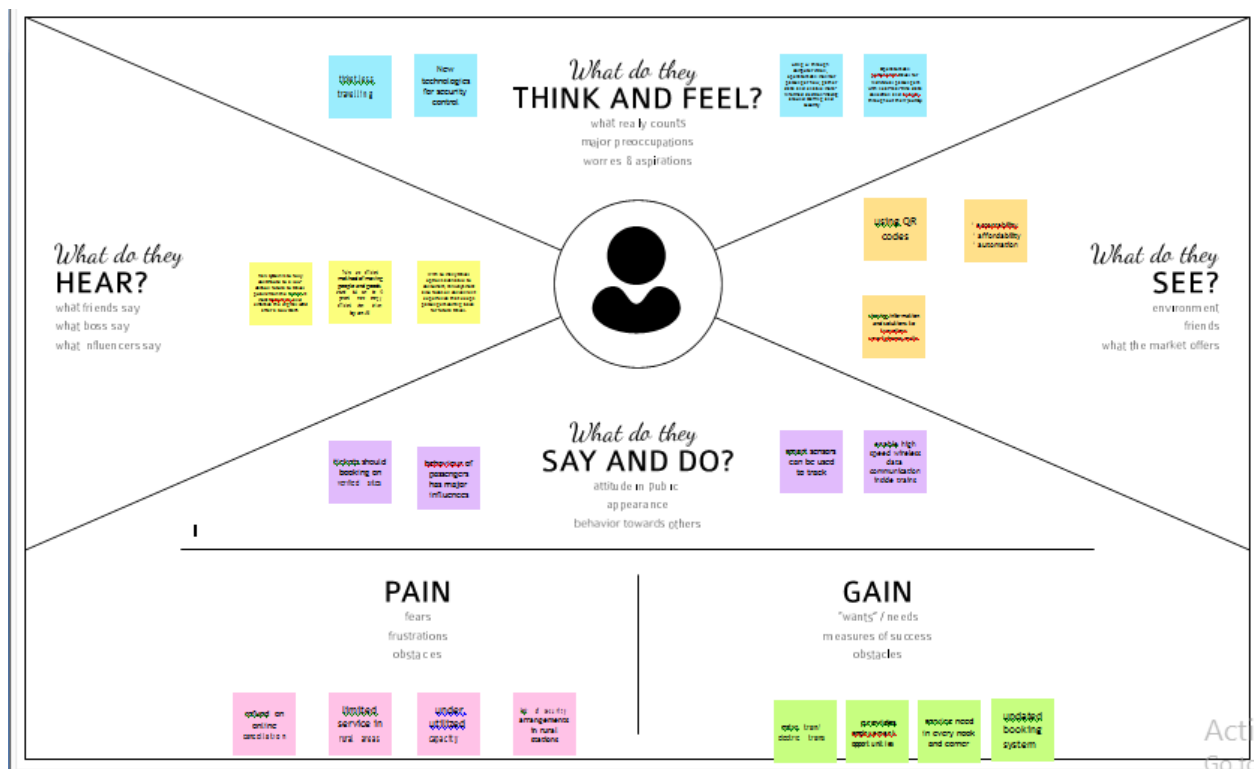
- Zhang-Dui Zhong
- Paula Fraga-Lamas
- Vitor A.
- Morais
- Joasa L.
- Atonso
- Antonio p.
- J.Dhivya Rose
- RUI CRUZ

## 2.3 PROBLEM STATEMENT DEFINITION

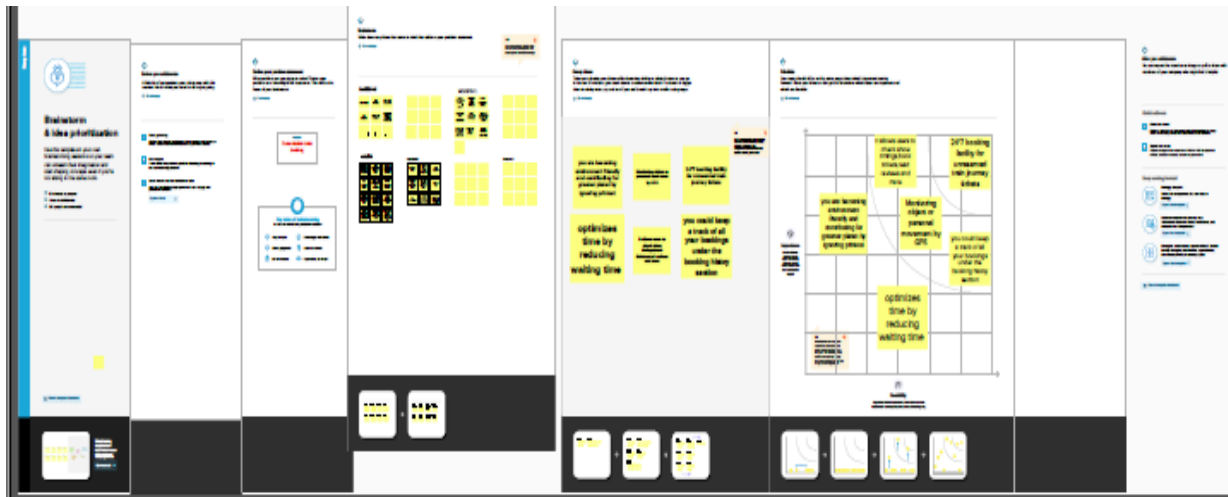
- Engagement of dedicated staff/window for Pass/PTO and ticketing.
- Loss of working time of staff requiring pass.
- Wastage of lot of Paper.
- Availability of Pass/PTO and ticketing(in night, away from HQ, for the families).

## 3.IDEATION&PROPOSED SOLUTION

### 3. 1EMPATHY MAP CANVAS



### 3.2 IDEATION& BRAINSTROMING



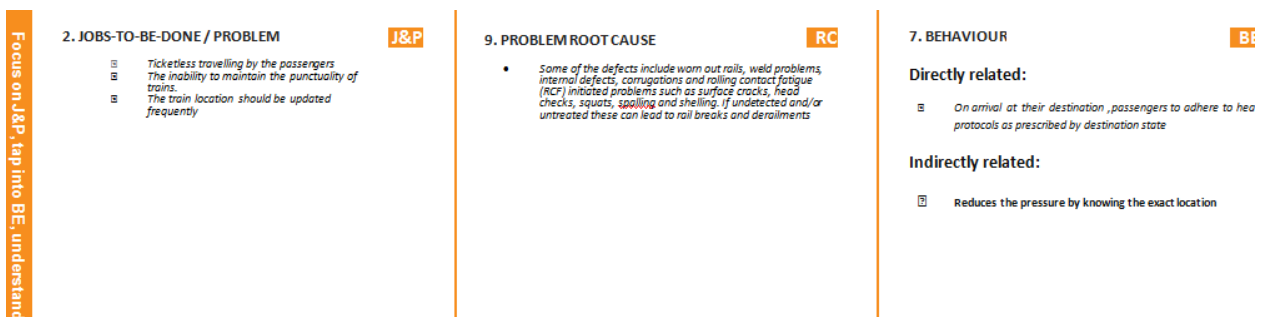
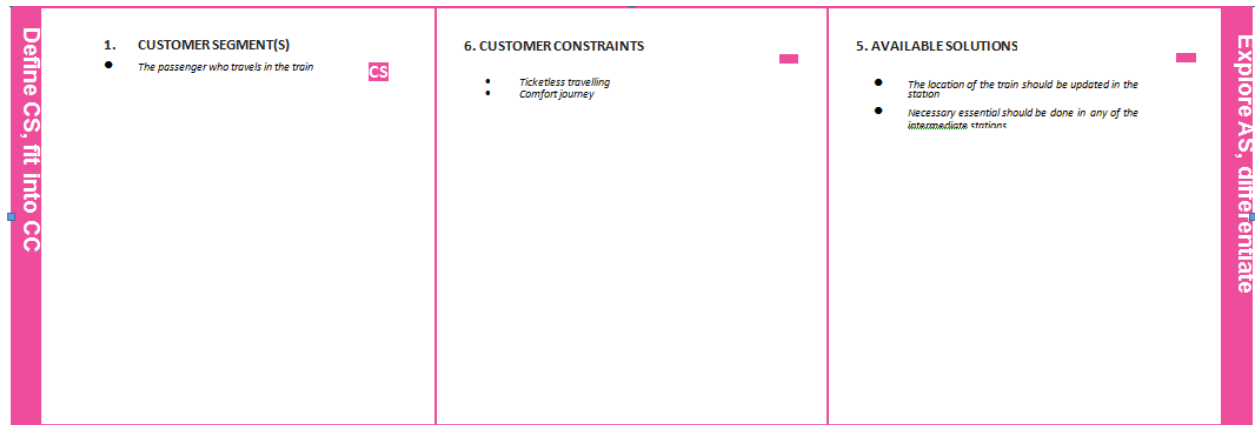
### 3.3 PROPOSED SOLUTION

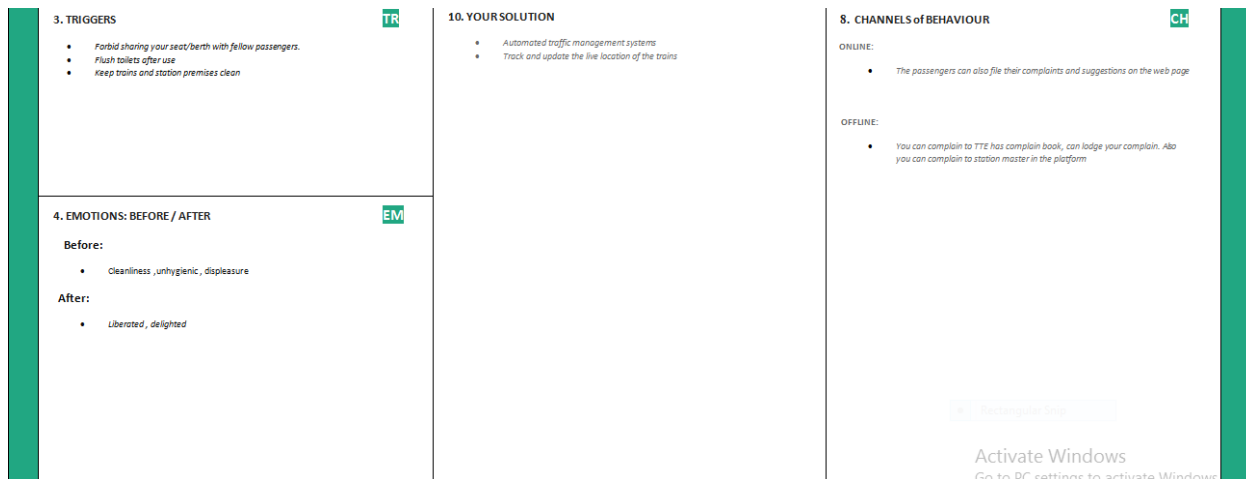
*Project team shall fill the following information in proposed solution template.*

S.No.	Parameter	Description
1.	<i>Problem Statement (Problem to be solved)</i>	<i>Customizable ticket booking.</i>
2.	<i>Idea / Solution description</i>	<i>Online ticket booking</i>  <i>Monitoring object or person movement by GPS.</i>
3.	<i>Novelty / Uniqueness</i>	<i>Gives freedom to potential visitors to book tickets anytime they want.</i>
4.	<i>Social Impact / Customer Satisfaction</i>	<i>User friendly</i>  <i>24*7 customer support</i>  <i>Highly recommended</i>
5.	<i>Business Model (Revenue Model)</i>	<i>Advertisement</i>  <i>Convenience fee over the pricing of tickets</i>

6.	Scalability of the Solution	<p><i>IoT sensors or automated safety monitoring and prediction of wheel and bearing failure ,as well as detection of oil or gas leakages.</i></p> <p><i>IoT enabled advanced analytics allows railway operators to find data-driven solutions to improve fleet control and rail operations ,as well as increases passenger satisfaction.</i></p>
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### 3.4 PROBLEM SOLUTION FIT





## 4.REQUIREMENT ANALYSIS

### 4.1 FUNCTIONAL REQUIREMENT

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Ticket Booking	Ticket booking through the website and mobile apps
FR-2	Booking Confirmation	Ticket confirmation via Email Booking Confirmation via SMS
FR-3	Passenger Feedback and Objections	Through the email to the respective and online application
FR-4	Passenger Schedule	Passenger can see their train training through the mobileapp and website
FR-5	Passenger Emergency	Passenger in an emergency, in case of accidents, or theftduring the journey and health issues in the trin can complain through the website or mobile apps or emergency calls , SMS , email and online application

### 4.2 NON-FUNCTIONAL REQUIREMENT

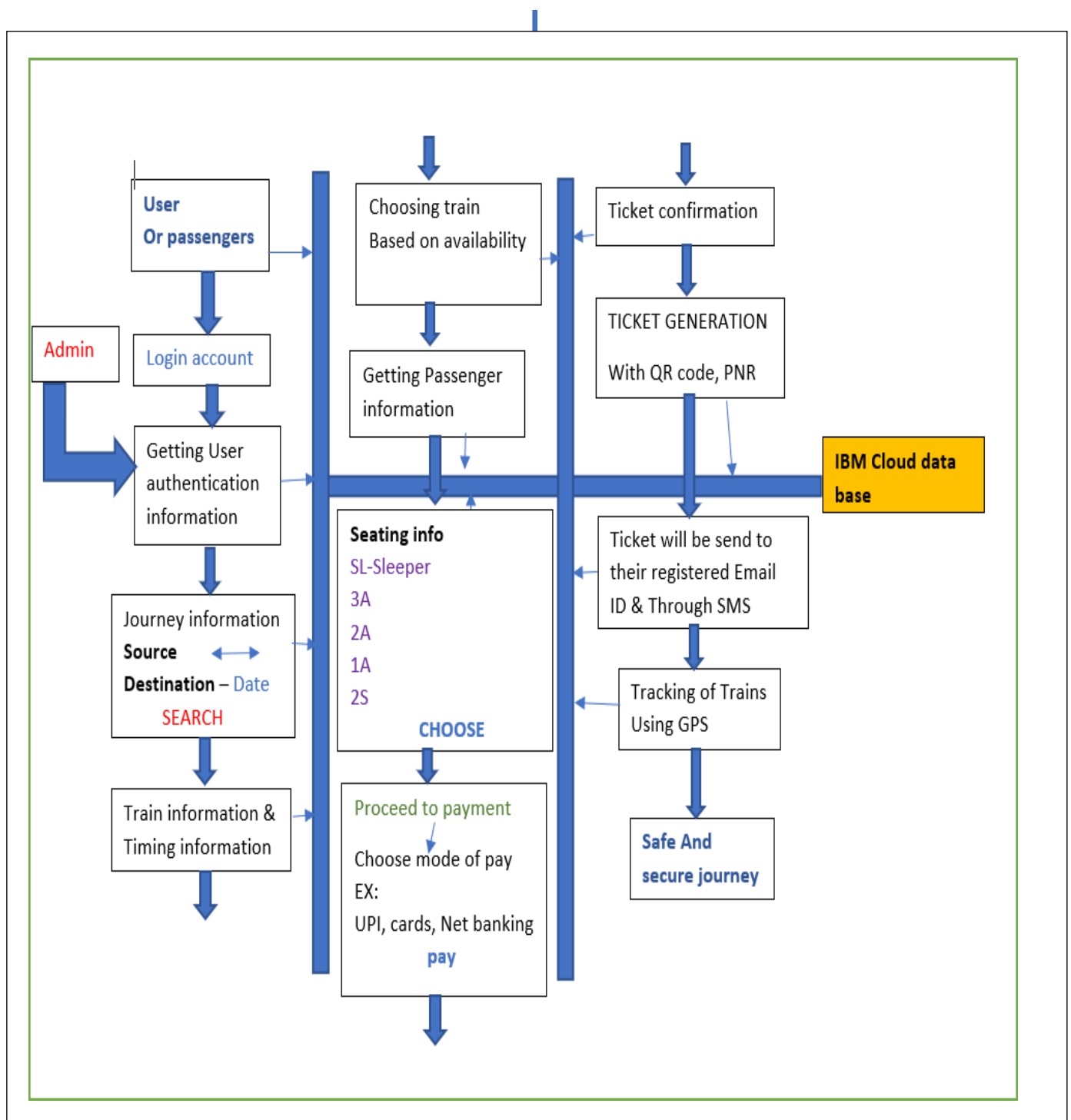
FR No.	Non-Functional Requirement	Description
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NFR-1	Usability	Within periodic maintenance , we can detect cracks in the railway track. Which will be highly usable on the remote railway tracks.
NFR-2	Security	Accidents and property damage can be prevented with the help of our smart sensors which immediately send the fault to the leader and administration.
NFR-3	Reliability	Traffic lights and signalling can be made accurately with the help of sensors. so it is more reliable.
NFR-4	Performance	Communications plays a vital role in transferring the crack-detected signal to the responsible authority so that they can take appropriate measures within a short span.
NFR-5	Availability	Our plan is to make the crack alert to all the sub stations to inform the trains about the fault

NFR-6	<b>Scalability</b>	Our project is based on IOT and cloud ,which makes the leader and authority updated every single sec. Adhoc is easy to handle.
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## 5.PROJECT DESIGN

### 5.1 DATA FLOW DIAGRAM



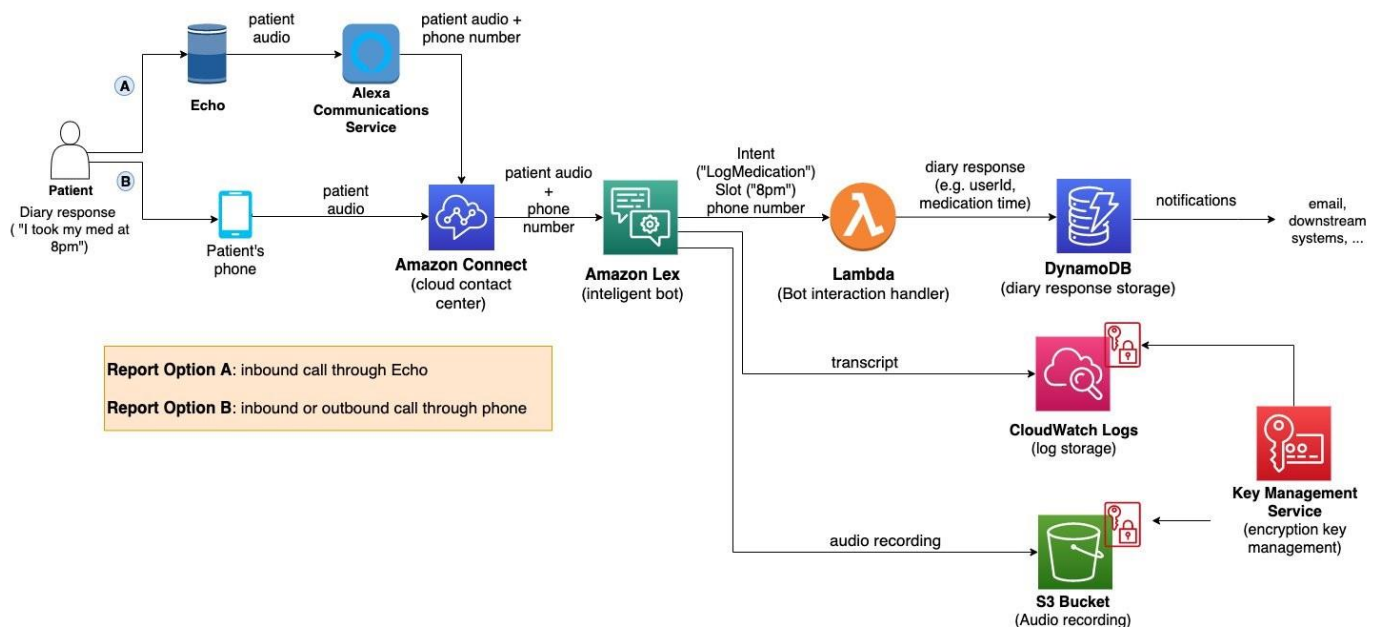


## 5.2 SOLUTION & TECHNICAL ARCHITECTURE

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

### Example - Solution Architecture Diagram:



## 5.3 USER STORIES

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Reserving ticket	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)	Reserving ticket	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)	Reserving ticket	USN-3	As a user, I can register for the application and enter the details for reserving the ticket	I can register & access the dashboard with Facebook Login	Low	Sprint-2
Customer (Mobile user)	Dashboard	Users	The details will be stored safely	I can access it using database	Medium	Sprint-1
Customer (Web user)	Reserving ticket	User	Enter the details and click submit button to book tickets	I can use the QR code which is been generated	High	Sprint-1
Customer Care Executive	Connecting the service provider	Customer	Connects with the service by logging in	Can get connected with the server	Medium	Sprint-3
Administrator	Provides the services	Admin	The data is given by the user	Can add or update the data provided by the user	High	Sprint-1

## 6.PROJECT PLANNING & SCHEDULING

## 6.1 SPRINT PLANNING& ESTIMATION

### 6.2 SPRINT DELIVERY SCHEDULE

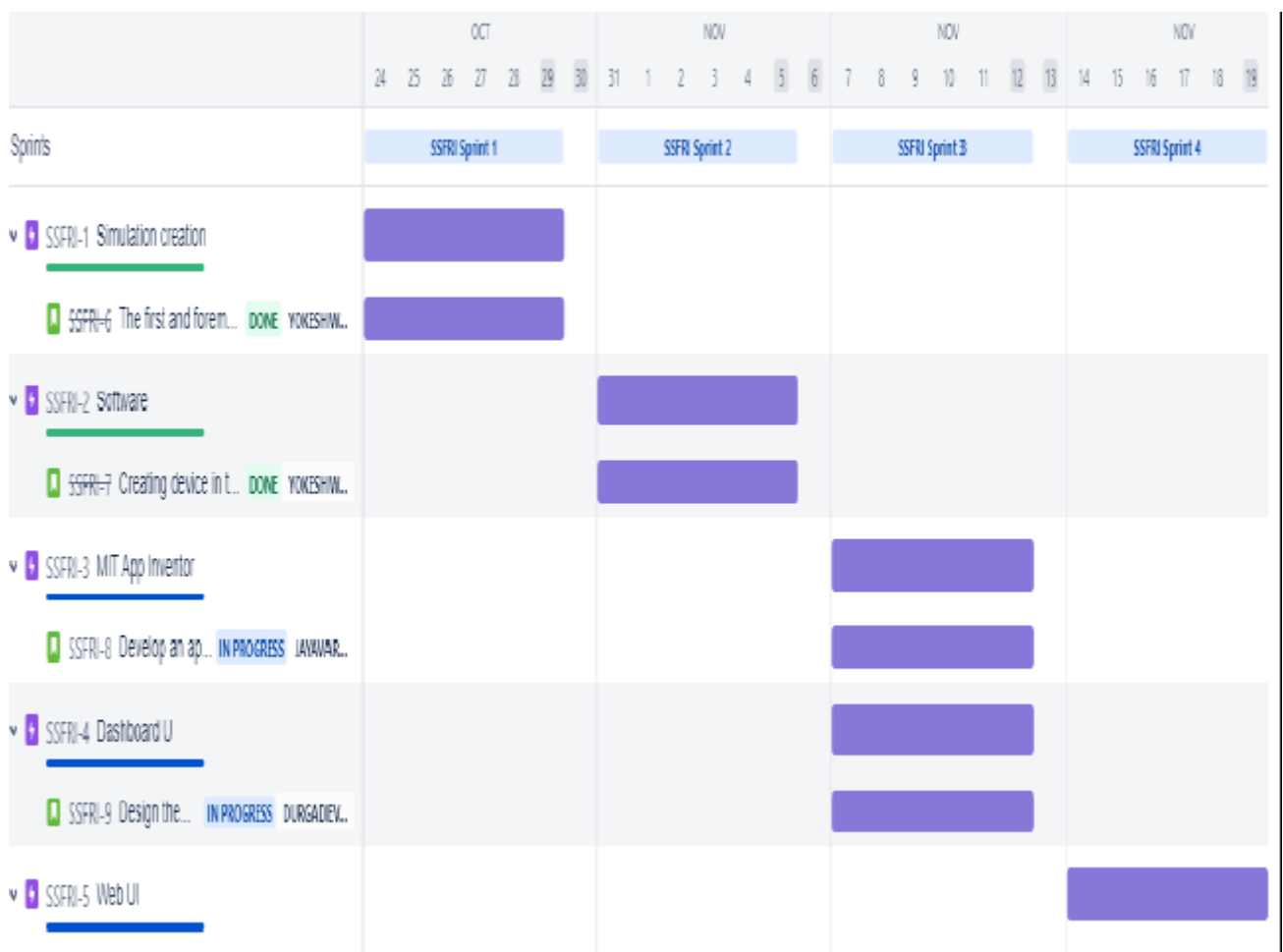
Prepare Empathy Map	To capture user pain and gains Prepare List of Problem Statement	11 SEPTEMBER 2022
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Ideation	Prioritise a top 3 ideas based on feasibility and Importance	18 SEPTEMBER 2022
Proposed Solution	Solution include novelty,feasibility,business model,social impact and scalability of solution	24 SEPTEMBER 2022
Problem Solution Fit	Solution fit document	1 October 2022
Solution Architecture	Solution Architecture	1 October 2022
Customer Journey	To Understand User	9 October 2022

	Interactions and experiences with application	
<b>Functional Requirement</b>	Prepare functional Requirement	15 October 2022
<b>Data flow Diagrams</b>	Data flow diagram	15 October 2022
<b>Technology Architecture</b>	Technology Architecture diagram	16 October 2022
<b>Project Development-Delivery of sprint 1,2,3 &amp;4</b>	Develop and submit the developed code by testing it	24 October 2022 – 19 November 2022

## 6.3 JIRA



## 7. CODING & SOLUTION

### 7.1 FEATURE 1

FEATURES :

- ❖ Login Page
- ❖ Sign Up
- ❖ About

- ❖ Ticket booking Form
- ❖ QR code generation

## HOME PAGE :

### LOGIN PAGE

≡ Home

LOGIN PAGE NEW USER? SIGN UP ABOUT

Login

username \*

password \*

LOGIN

## SIGN UP PAGE

≡ Home

LOGIN PAGE

NEW USER? SIGN UP

ABOUT

Sign Up

Choose a username \*

Choose a password \*

Enter your email address \*

Enter your Phone Number \*

SUBMIT

CANCEL

## ABOUT

≡ Home

LOGIN PAGE

NEW USER? SIGN UP

ABOUT

About

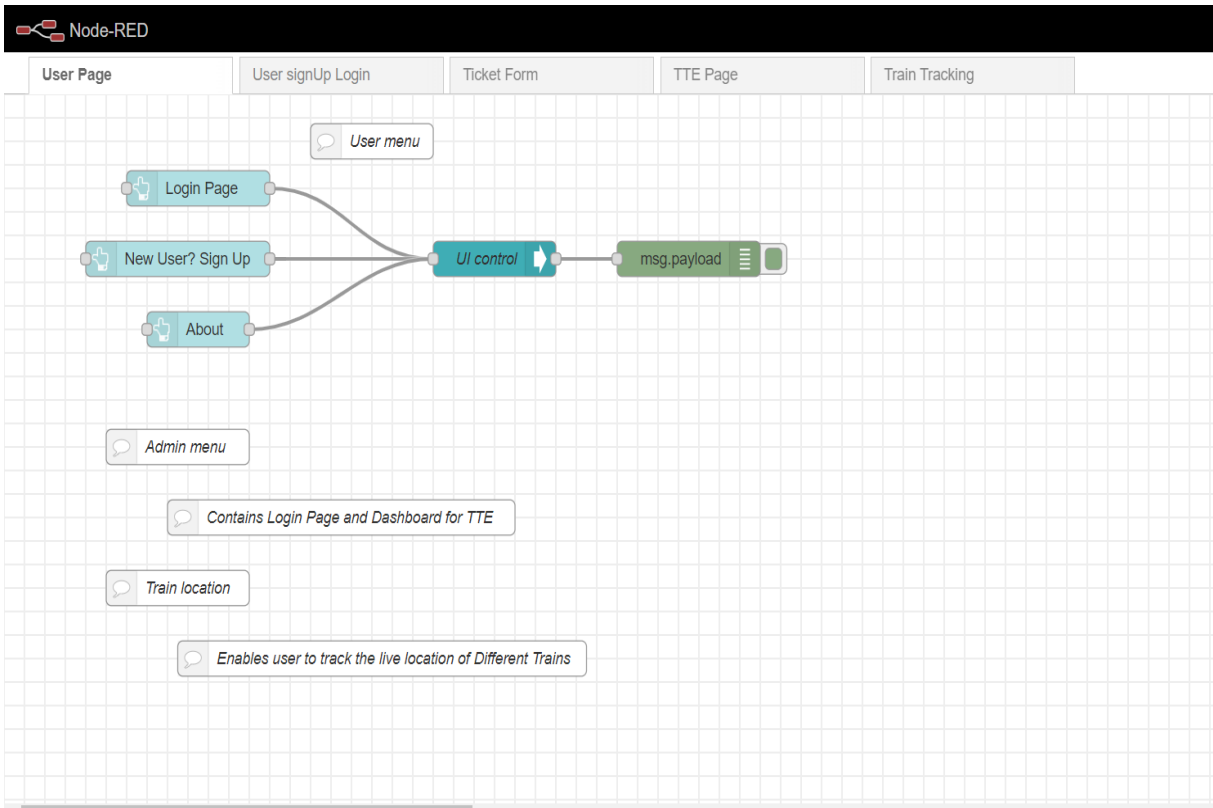
**Book me App** helps you to book the ticket at your comfort zone and place.  
Our App breaks the usual way to book the train ticket.

Benefits of using our App

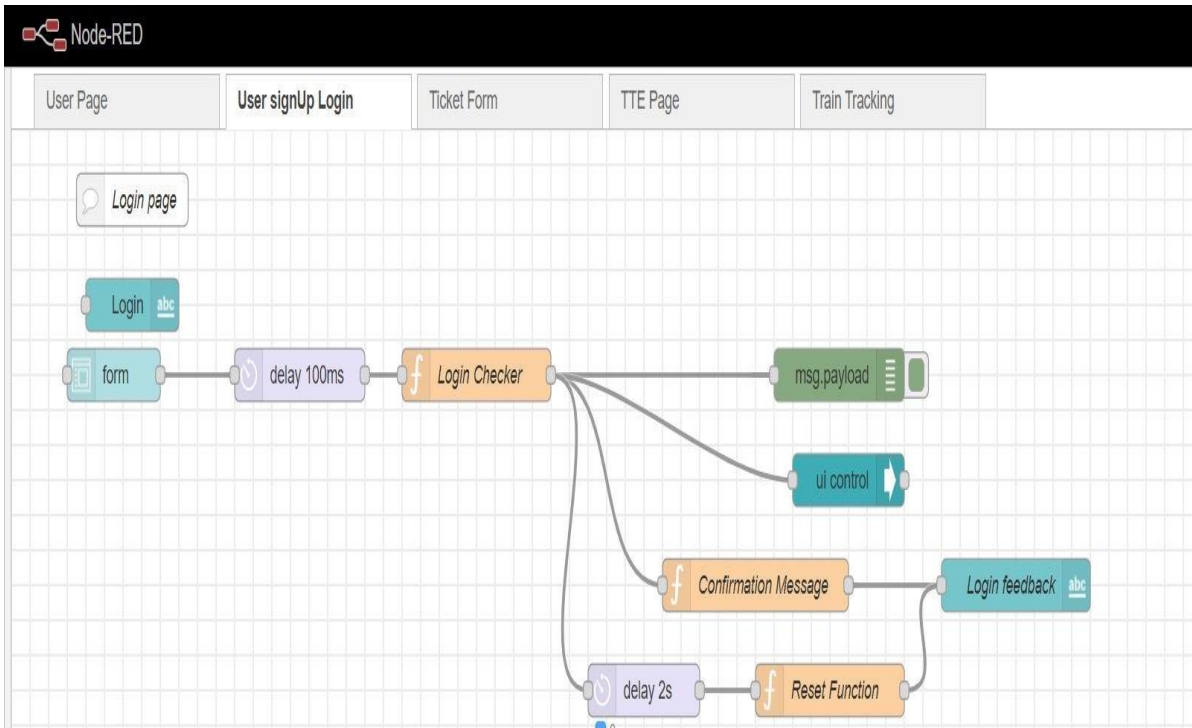
- Online Ticket Booking
- Automated Ticket verification
- Work Load reduction for user

# NODE RED FLOW :

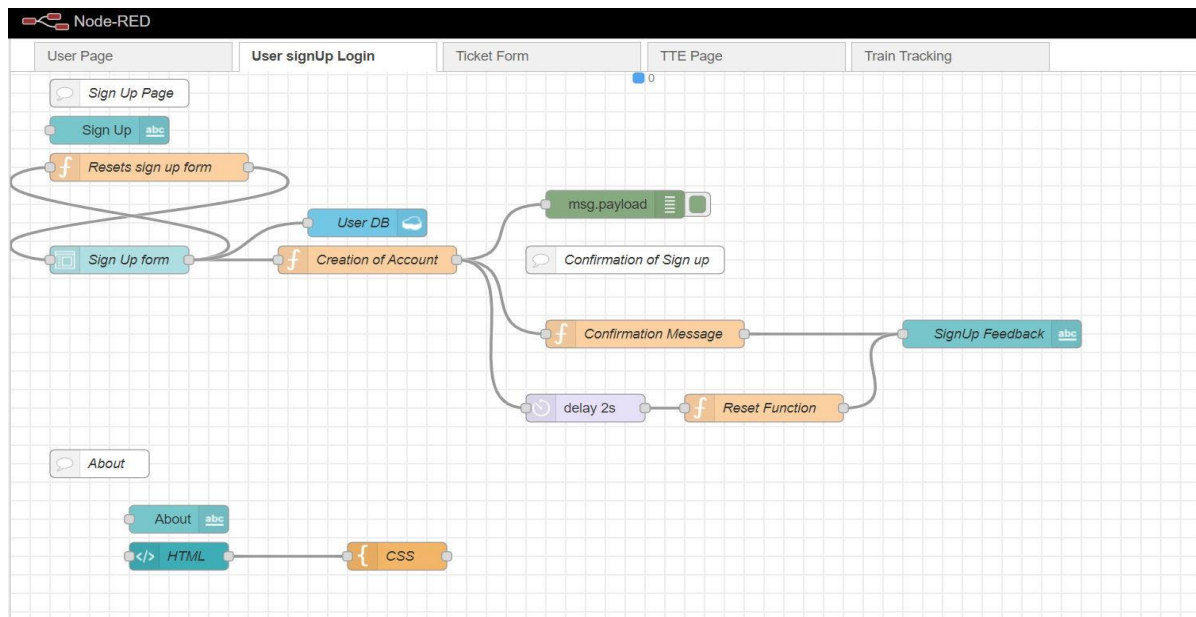
## Home page flow



## Login page flow



## Sign up flow



## TICKET BOOKING FORM :

≡ passenger

BOOK A TICKET!

CHECK STATUS

From

salem

To:

goa

Seat

Select option

Seat preference

Asile

Date of Journey

10/11/2022

Name \*

Age \*

Mobile Number \*

LOGOUT

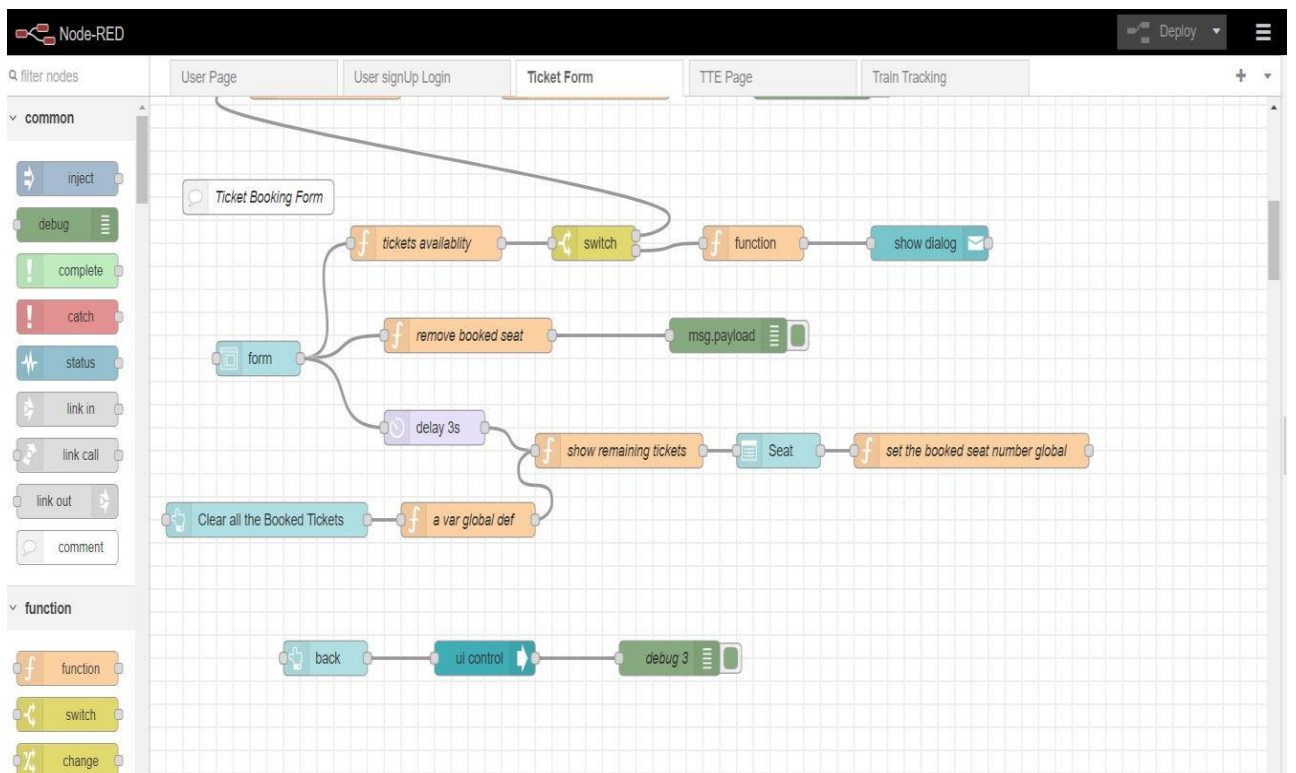
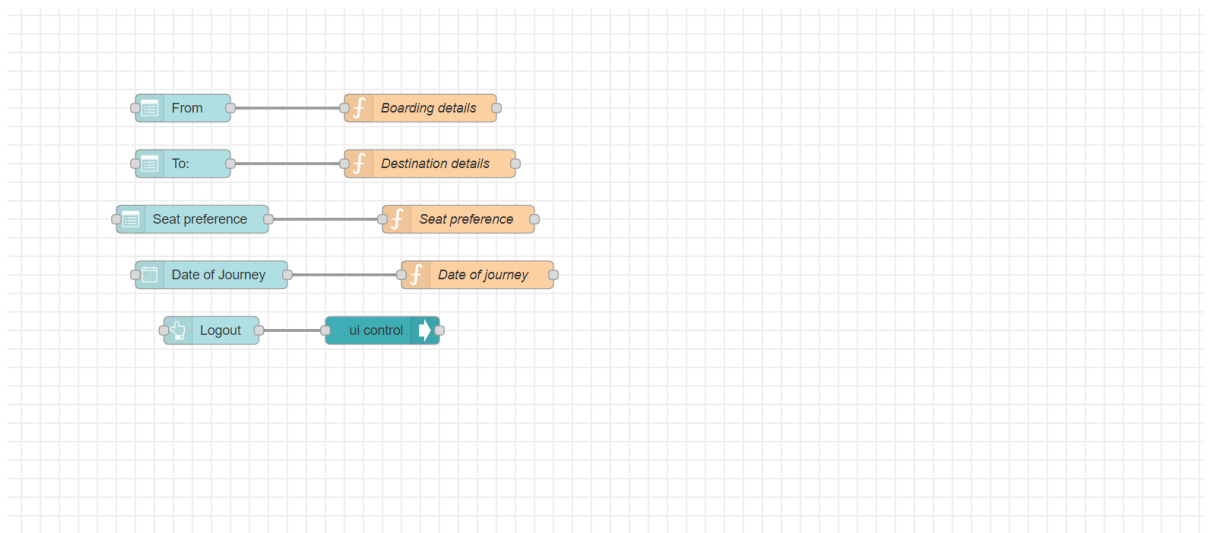
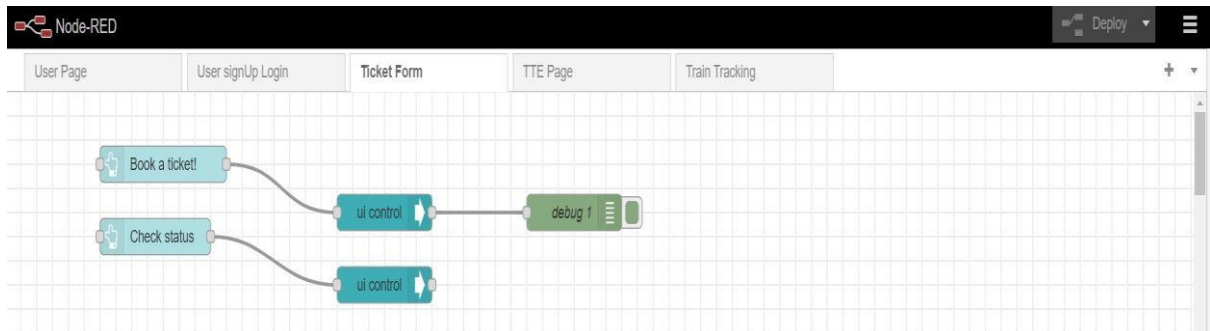
SUBMIT

CANCEL

BACK



## TICKET BOOKING FORM FLOW :



## QR CODE GENERATION :

≡ passenger

BOOK A TICKET! CHECK STATUS

From coimbatore

To: mysore

Seat Select option

Age \*

Mobile Number \*

LOGOUT SUBMIT CANCEL

BACK

QR Code

{ "name": "Anu", "age": 20, "no": 9634589710 }

Ticket is Booked

OK

≡ passenger

BOOK A TICKET! CHECK STATUS

From coimbatore

To: mysore

Seat Select option

Seat preference Middle

Date of Journey 12/11/2022

Name \*

Age \*

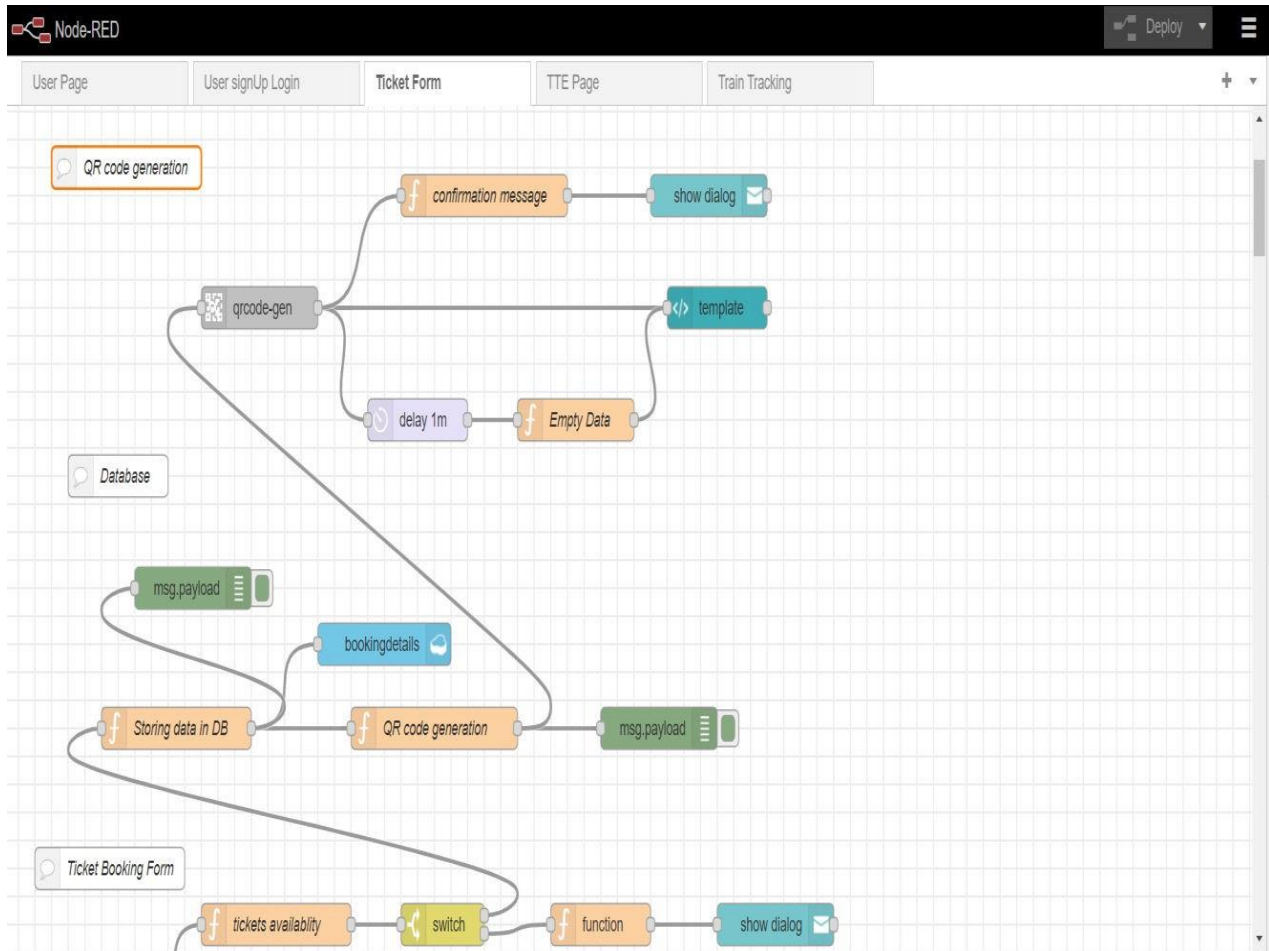
Mobile Number \*

LOGOUT SUBMIT CANCEL

BACK

QR Code

## QR CODE GENERATION FLOW:



## 7.2FEATURE 2

### FEATURES:

- 1) Login page
- 2) TTE dashboard which contains clear button
- 3) Ticket verification
- 4) Displaying verified user details in web ui

### LOGIN PAGE:

Admin - TTE

Login

username \*

password \*

LOGIN

**TTE dashboard which contains clear button:**

TTE\_dashboard

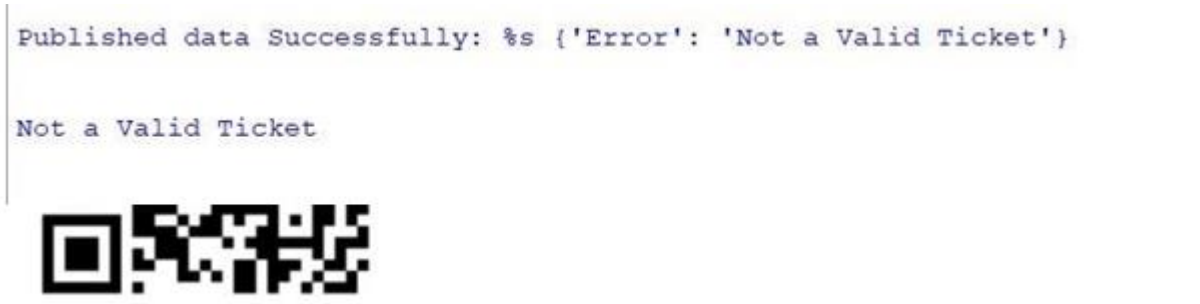
Welcome! The Details of scanned QR code is shown below:

{"Error": "Not a Valid Ticket"}

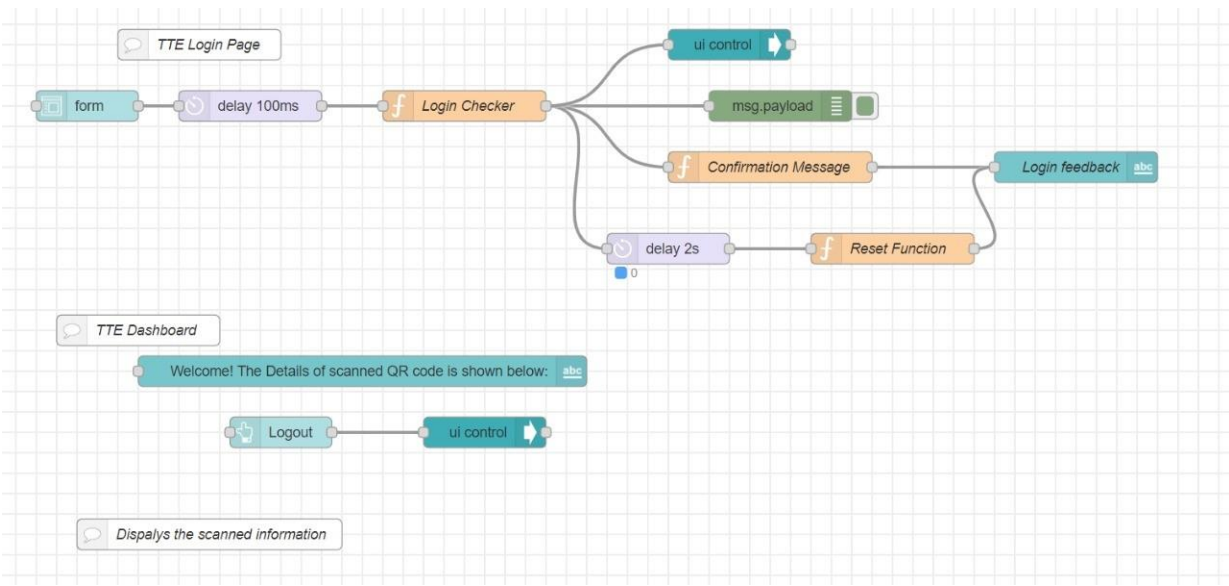
LOGOUT

CLEAR ALL THE BOOKED TICKETS

Ticket verification:



NODE-RED FLOW:



8. TEST CASE

Section	Total Cases	Not Tested	Fail	Pass
Home page	3	0	0	3
Login page	4	0	0	4
Booking	10	0	0	10
Passenger Details	6	0	0	6
TTE	3	0	0	3
Train Tracking	2	0	0	2

Payment	2	0	0	2
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## 9. RESULTS

Needless to say, there is a better way to do it. We are of course talking about simplifying reservations, booking online and accepting payments. Online booking systems like Hotelogix work by providing a secure and customizable booking platform through which your guests can check the availability, view the property, and pay directly on your website. Over the years, we have seen the impact that an online booking platform can have on businesses. From a boost in sales to dramatically simplifying the reservation process for both arriving guests and employees, investing in an online booking system only maximizes your returns.

## 10. ADVANTAGES&DISADVANTAGE

### ADVANTAGES

*\*Ticket should be available without wasting time.*

*\*Ticket should be check using scanning this should be advance technology use in that system and also secure.*

*\*Only register user and book a ticket.*

### DISADVANTAGES

*\*Active internet connection required to book a ticket.*

*\*User cannot cancel his booking.*

## 11. CONCLUSION

Smart Ticketing system is a total express railway ticketing solution architecture that will change everything in railways business. Smart Ticketing system offers a wide variety of benefits build for commuters and Railway authorities. For commuters travel is unified, simplified, cost-effective and comfortable. Even they are notified with attractive offers based on their travelling patterns and details of less crowded coaches in a train, which make their journey safe, happy and comfortable. For Railway authorities, only authorize commuters travel, no wastage of paper, security of commuters is ensured, No cash money transaction needs to be done and less staff and resources required. With this Smart Ticketing architecture implemented on cloud, give an added benefit of scalability and performances at any point of time. We make a system that checks the ticket of passenger in trains through IOT based System. After entered in train ticket is checked by a System. We studied the entire layer that is used in IOT. This system describes the whole architecture of 1OT. In fact, the most IOT architecture includes all the existing technologies that are used to make a new System.

## **12.FUTURE SCOPE**

In future we are trying to solve the problem like network issues and cancelling the ticket with full refunds and developing the app and we will select our seat in online and get our food on our seat itself

## **13.APPENDIX**

### **GITHUB & PROJECT DEMO LINK**

**<https://github.com/IBM-EPBL/IBM-Project-14899-1659591695>**