# SMART SOLUTION FOR RAILWAYS

## A PROJECT REPORT

TEAM ID

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# CONTENTS

# 1  INTRODUCTION

## 1.1  PROJECT OVERVIEW

Smart Solutions for railways is designed to reduce the work load of the user and also the use of paper. It provides a web page designed for the public where they can book tickets after seeing the available seats. After booking tickets, the person will get a QR code which can be used for verifying the ticket by the Ticket Collector. A GPS module is present in the train to track it. The live location of the train is updated to the users in the web app continuously, thus enabling users to know the real-time location of the train and estimate the arrival time.

## 1.2  PURPOSE

Passengers have to carry a physical ticket which may get lost, leading to unnecessary delays and hardships. The software allows verification via QR codes, which speeds up the process tremendously.

Passengers who are on a hurry may not have enough time to wait for the train indefinitely. The live location of the train can help them make the decision to wait or take some other mode of transport.

# 2  LITERATURE SURVEY

## 2.1  EXISTING PROBLEM

The authors of [1] have worked to create Android Suburban Railway (ASR) ticketing, mainly to buy suburban tickets which is the most challenging when compared to booking the long journey tickets through 'M-ticket', since 'M-tickets' often fail with suburban (local travel) tickets. ASR tickets can be bought with just a smartphone application, where you can carry your suburban railway tickets on your smartphone as a QR (Quick Response) code. It uses the

smartphone's "GPS" facility to validate your ticket. The user's ticket information is stored in a CLOUD database for security purposes which is missing in the present suburban system. Also, the ticket checker is provided with a checker application to search for the user's ticket with the ticket number in the cloud database for checking purposes.

In [2], the issues surrounding data capture and transmission to a storage system, powering of onboard systems, and the analysis of data and the distribution of information derived from the data are discussed. The advancements made in communication tools help in providing the actual condition and tracking of the rail vehicles in real-time to customers and entities in charge of maintenance by transmitting all the captured data to effective web-based applications and monitoring platforms that can be accessed through PC, tablets, or even smartphones.

[3] focuses on different communication technologies under the paradigm of IoT. The broadband communication technologies like Global System Mobile Communications- Railway (GSM-R), Long Term Evaluation (LTE), fifth generation (5G), IEEE 802.11 and Wireless Sensor Networks (WSN). In India, UIDAI Aadhar is used in this system in the process of booking tickets. The smart railway reservation database is maintained by two databases; one is the railway database and another one is maintained by UIDAI. It is efficient to use these two databases and perform a query service between two databases. Tickets are stored with the help of an Aadhar number and are verified utilizing the databases available.

The system proposed by [4] reforms the current ticket booking process for Suburban Railway. With the help of this application, travellers will be able to book their tickets through their mobile using Wi-Fi connectivity. It can also keep the track of most recent ticket purchases. This is an effort towards a queue-less ticket booking system and helps passengers utilize their time efficiently, which is

wasted waiting in these queues. This system provides the facility and flexibility to book tickets using restricted Wi-Fi zones available on platforms. The provided Android application can be only accessed within the Wi-Fi zones only. After ticket booking, tickets will be downloaded directly on smartphones.

In the Indian Railways transport system and most other public transport systems, a passenger cannot book a ticket after the charting of the train is done. A seat remains unused if a passenger does not board a train or cancels his ticket after the charting of the train is done. The approach taken by [5] to overcome this issue is by using a dynamic seat allocation system that employs a QR Code containing the URL to an online website for railway reservations. In the QR code, a passenger-specific URL is stored. When a hand-held terminal device running on android OS reads this URL during the check-in of a passenger, the status of the seat is updated in the central database. Any passenger who doesn't

board the train would imply that their QR code check-in procedure was not completed, and after a specified time interval the ticket for that seat is automatically made available in the system for booking to other passengers.

To track the real-time positions of trains, the authors of [6] propose a system that enables the communication of real-time information about a train's position. By reading the data provided by all running trains, a complete network of each active train and its real-time position is obtained. The system uses an Arduino to provide the required computational power. The GPS module connected to the Arduino reads satellite data in accurately identify its current position. Using this data, the Arduino can compute the train's current latitude, longitude and speed of motion. An Ethernet Shield is used to provide each train with a static IP address. The remote user who wishes to track a train's position types in the IP address of the train in their web browser, which opens up the control panel for the train's Arduino and allows the user to view information regarding the train's position and speed.

## 2.2 REFERENCES

[1] S. Karthick and A. Velmurugan, "Android suburban railway ticketing with GPS as ticket checker," 2012 IEEE International Conference on Advanced Communication Control and Computing Technologies (ICACCCT), pp. 63-66, 2012.

[2] C. Ulianov, P. Hyde and R. Shaltout, "Railway Applications for Monitoring and Tracking Systems," Marinov, M. (eds) Sustainable Rail Transport. Lecture Notes in Mobility. Springer, Cham., 2018.

[3] B. Mallikarjuna, A. K. R. Doddi and G. Sailaja, "Enhanced Railway Reservation System using Internet of Things," 2018 IADS International Conference on Computing, Communications & Data Engineering (CCODE), 2018.

[4] G. Shelar, V. Rathod and S. Patil, "Railway Ticket Booking System with Restricted Wi-Fi Zone," International Journal of Trend in Scientific Research and Development (ijtsrd), vol. 2, no. 4, pp. 611-615, 2018.

[5] Swarup, M. Mohan, A. Dwivedi, C. Sonkar, R. Prasad, M. Bag and V. Singh, "A QR code based processing for dynamic and transparent seat allocation in Indian railway," nternational Journal of Computer Science Issues (IJCSI) 9, no. 3 (2012), p. 338, 2012.

[6] R. I. Rajkumar, P. E. Sankaranarayanan and G. Sundari, "GPS and Ethernet based real time train tracking system," 2013 International Conference on Advanced Electronic Systems (ICAES), pp. 282-286, 2013.

## 2.3 PROBLEM STATEMENT DEFINITION

Who does the problem affect?

Passengers, Voyagers.

## What are the boundaries of the problem?

Railway ticket booking system that generates a unique QR code for each ticket. Tracking the live location of trains using the GPS.

## What is the issue?

Passengers cannot choose the seats they prefer. They have to carry a physical ticket which may get lost. Passengers who got to go quick may not have enough time to wait for the train indefinitely. The live location of the train can help them make the decision to wait or take some other mode of transport.

## When does the issue occur?

All the time.

## Where is the issue occurring?

Existing Train booking systems, train and in railway stations.

## Why is it important that we fix the problem?

Railway is one of the most common modes of transport. Improving the user experience is very important. An efficient way to check the tickets is of top priority.

## Case Studies

1. Arun is a trekker and likes long distance travelling. His preferred mode of transport is Railways as it is cost effective. He wants to enjoy his journey along the way. So, he wants the window seat to adore the nature while travelling.
2. Bharath is a very busy guy and goes from one place to another frequently. He needs a way to minimize the time he waits between the travels so that he finishes his work quickly.
3. KG is a forgetful guy and the only thing he carries all the time is his iPhone. As a result, he likes to have the train ticket in the digital form in his mobile so that he has one less thing to worry about forgetting.

4. HP is a TTE and he wants to verify if the tickets are legitimate reliably and quickly so that he can check a greater number of passengers, reducing the possibilities of travelling without the ticket and escaping the fine.

# 3 IDEATION & PROPOSED SOLUTION

## 3.1 EMPATHY MAP CANVAS
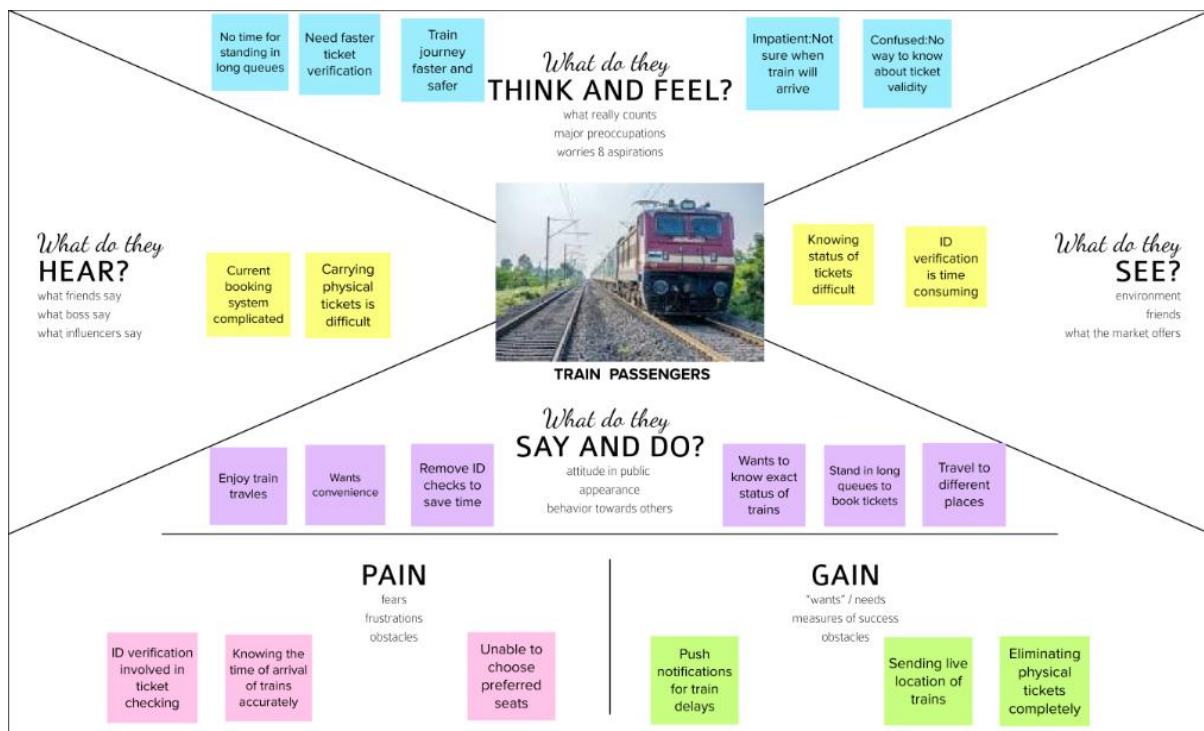


## 3.2 IDEATION & BRAINSTORMING

Internet of Things

- Regulate coach temperature in AC coaches using temperature sensors
- Monitor track condition through sensors

Machine Learning

- Berth suggestion based on passenger details
- Predict chances of confirmation of tickets in waiting list

Web Interface

- Send platform information through text messages
- Bookmyshow style ticket booking
- Crash detection and sending SOS messages to first responders
- Pre-book food for train journey
- Contact information of doctors at next station in case of emergency
- Push notifications for train reminders
- Share live location of trains
- Easy access for train drivers to seek medical help
- Push notification for train delays and alternate trains
- Get passenger feedback regarding issues in journey
- Reminders for train maintenance

Cloud

- Upload the ID cards needed for verification to cloud

## 3.3 PROPOSED SOLUTION

Solution description

Using GPS modules to provide users with the train's location and estimated time of arrival. A web UI will be used as a portal for users, which also generates unique QR codes on successful ticket booking. QR codes can be used to streamline the ticket verification process

Novelty/Uniqueness

1. Using ML for predicting if the ticket will get confirmed from the waiting list
2. Improving the security of the QR code and the date stored
3. Regulating temperature in AC coaches
4. Crash detection and sending SOS to first responders

## Social Impact / Customer Satisfaction

1. Trust of users on Railways increases
2. Accidents will be reduced
3. Users will save time and plan their work accordingly

## Business Model

Offering Yearly/Monthly Subscription based model to the competent Railway Authorities.

## Scalability of the Solution

1. The solution uses off the shelf technologies and no specialized software in used
2. Hardware requirements involve only a QR code scanner and GPS module which can be installed on the trains

## 3.4 PROBLEM SOLUTION FIT



| | |
|---|---|
| **1. CUSTOMER SEGMENT(S)** `CS` | |
| Passengers, Voyagers who wish to travel to different locations | |

**6. CUSTOMER CONSTRAINTS** `CC`

Passengers cannot choose the seats they prefer.

They have to carry a physical ticket which may get lost.

Passengers who got to go quick may not have enough time to wait for the train indefinitely.

**5. AVAILABLE SOLUTIONS** `AS`

Passengers can take multiple physical copies of a ticket to prevent losing them

TTE will have to manually verify the identity of each passenger

**Define CS, fit into CC** | **Explore AS, differentiate**

**2. JOBS-TO-BE-DONE / PROBLEMS** `J&P`

The live location of the train must be easily accessible by the users

Ticket verification must be streamlined

Unnecessary documents should not be carried by passengers

**9. PROBLEM ROOT CAUSE.** `RC`

Train booking infrastructure is outdated

Popularity of train travel has exploded

Trains are rarely on schedule

**7. BEHAVIOUR** `BE`

Bring original documents on train rides

Take multiple copies of train tickets

Arrive at station early to ensure they don't miss the train

**Focus on J&P, tap into BE, understand RC**

**3. TRIGGERS** `TR`
Holidays
Neighbours going on vacation
Work-related travel

**4. EMOTIONS: BEFORE / AFTER** `EM`

Confident -> Confused: No way to know about the validity of the ticket

Excited -> Impatient: Not sure when train will arrive

Energetic -> Tired: TTE ticket verification takes too long per person

**10. YOUR SOLUTION** `SL`

Using GPS modules to provide users with the train's location and estimated time of arrival.

A web UI will be used as a portal for users, which also generates unique QR codes on successful ticket booking.

QR codes can be used to streamline the ticket verification process.

**8.CHANNELS of BEHAVIOUR** `CH`
**8.1 ONLINE**
Ticket booking through IRCTC website

**8.2 OFFLINE**
Arriving at station early to check train status

Verifying passenger's ID proof

**Identify strong TR & EM**

# 4 REQUIREMENT ANALYSIS

## 4.1 FUNCTIONAL REQUIREMENTS

The functional requirements are given in Table 1.

| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | User Registration | Registration through Form Registration through Gmail |
| FR-2 | User Confirmation | Confirmation via Email Confirmation via Mobile OTP |

| FR-3 | Journey Details | The system must enable the users to search for the available trains with the expected time of arrival and travel for a given source and destination. |
|---|---|---|
| FR-4 | Ticket Booking | The system must allow the users to book Railway tickets for the seats they prefer. |
| FR-5 | Payment Gateway | The system must provide the payment gateway, usingwhich the users can pay the price of the tickets that they booked. |
| FR-6 | Ticket Verification | The system must generate a unique QR code for each booked ticket and store it in the database so that it canbe verified by the Train Ticket Examiner. |
| FR-7 | Live Tracking the Train | The system must track the location of the trains in realtime and make it accessible to the users. |
| FR-8 | Push Notification | The system must send push notification to the passengers in case there is a delay in the arrival of thetrain. |
| FR-9 | Waiting List | The system must show the probability that a ticket will be confirmed from the waiting list. |

*Table 1: Functional Requirements*

# 5 PROJECT DESIGN
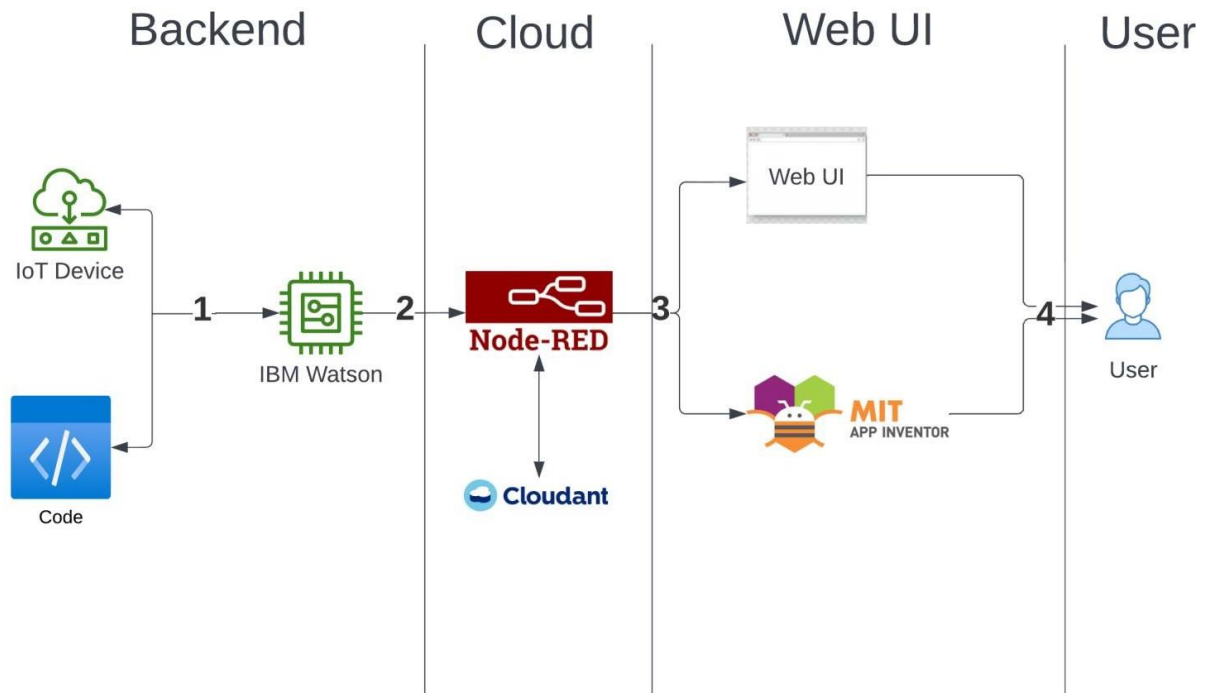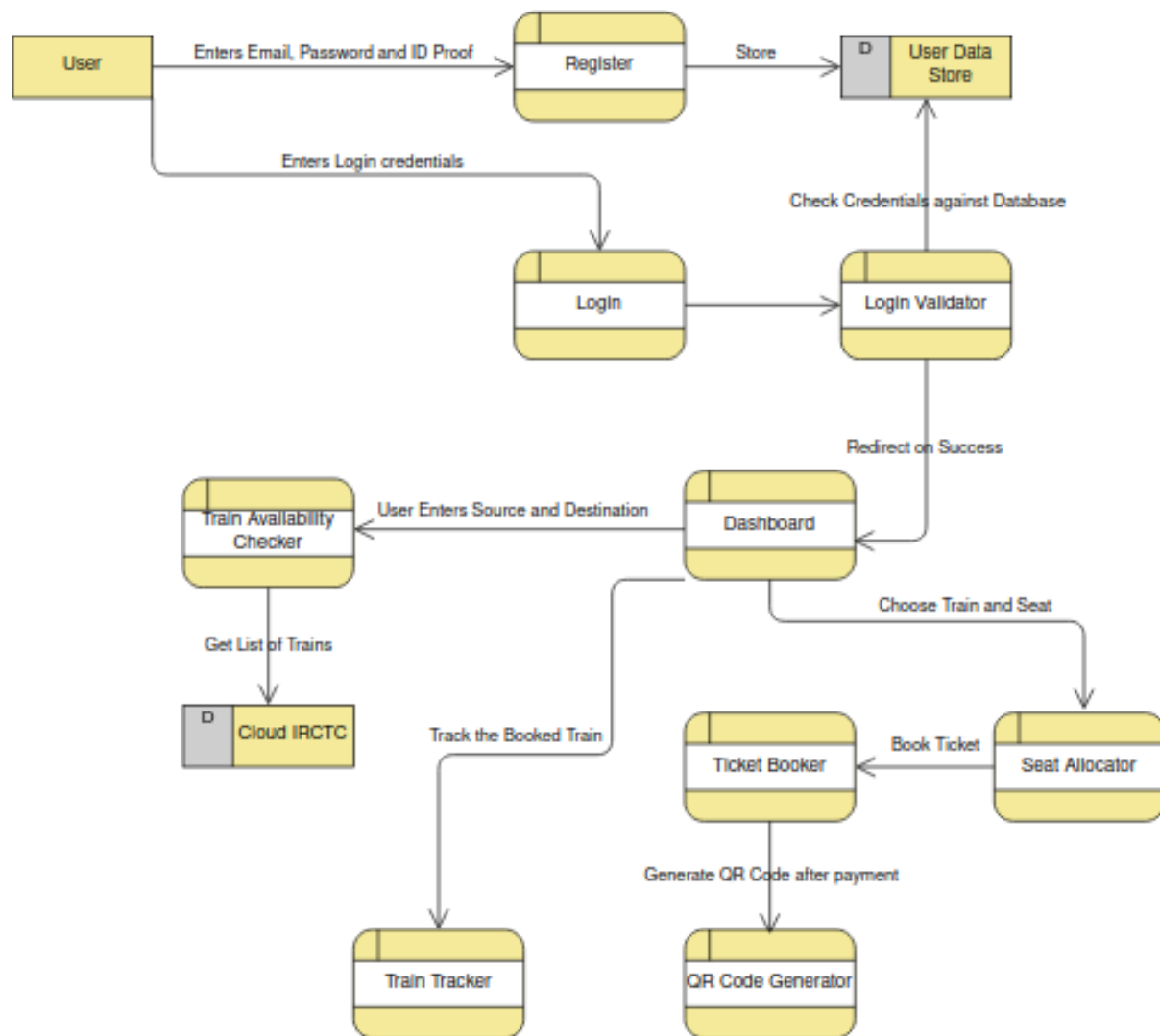
## 5.1 DATA FLOW DIAGRAMS



*Figure 1: Flow Diagram*

In Figure 1:

1. Sending sensor data to IBM Watson
2. Strong date Cloud using Cloudant
3. Sending the stored date from Cloud User Interface created
4. Displaying the interface to the User

## 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 / Webuser) | UI | USN-1 | As a user, I can register for the application by entering my email, password, and confirmingmy password. | I can access my account / dashboard | High | Sprint-1 |
| Customer (Mobile/ Webuser) | Login | USN-2 | As a user, I will receive confirmation emailonce I have registered | I can receive confirmation email & click confirm | High | Sprint-1 |

| | | | for the application | | | |
|---|---|---|---|---|---|---|
| Customer (Mobile user) | Booking tickets | USN-3 | As a user, I can register for the application and enter the details for reserving the ticket. | I can view and modify the details | High | Sprint-2 |
| Customer (Web user) | Booking tickets | USN-4 | As a user,I can enter my details to book traintickets | I can book tickets and receive a QR code | High | Sprint-2 |
| Customer (Mobile user) | Dashboard | USN-5 | The details of the particular user are displayedalong with previous and current ticket bookinghistory | I can change the information when required | Medium | Sprint-3 |
| Customer Care Executive | Helps users resolve queries and gives them better user experience | | Makes sure proper service is provided to all theusers | Has privilege to report queries of users to the respective teams that built a particular service of the application | Medium | Sprint-4 |
| Admin | Administers the working of the application | | The data provided by users are monitored by admins. | Can make modifications to data provided by users | High | Sprint-1 |

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# 6 PROJECT PLANNING & SCHEDULING

## 6.1 SPRINT PLANNING & ESTIMATION

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | User registration | USN-1 | As a user, I can register for the application by entering my email, password, and confirming my password. | 5 | High | Arun Tiilak Karthe, Bharath Kumar D P |
| Sprint-1 | User Login | USN-2 | As a user,I can log into the application by entering email and password. | 5 | High | Sri Priyan S, Harish J |
| Sprint -1 | Creating databases in IBM Cloud | USN-3 | Databases are created to store user and ticket booking details. | 5 | High | Sri Priyan S, Bharath Kumar D P |
| Sprint-1 | Location tracker simulation using IBM Watson Platform | USN-4 | The live location of trains is simulated using location tracker device. | 4 | Medium | Arun Tiilak Karthe,Harish J |
| Sprint-2 | Checking availability of trains and booking tickets | USN-5 | As a user ,I can search for the available trains with the expected data,time of arrival and travel for a given source and destination and book tickets. | 5 | High | Sri Priyan S,Arun Tiilak Karthe |
| Sprint-2 | QR Code generation for ticket | USN-6 | As a user,I can get a QR code after making payment which can be verified by the train ticket examiner | 5 | High | Bharath Kumar D P,Harish J |
| Sprint-2 | User Interface for QR code | USN-7 | As a user,I can get my tickets verified using QR code scanner | 5 | High | Sri Priyan S,Bharath Kumar D P |
| Sprint-2 | Integration with payment gateways | USN-8 | As a user , I can pay the price for the tickets booked using payment gateways | 5 | High | Arun Tiilak Karthe,Harish J |
| Sprint-3 | Live tracking the trains | USN-9 | As a user , I can track the live location for trains after booking tickets using GPS | 5 | High | Sri Priyan S, Bharath Kumar DP |
| Sprint-3 | Sending push notification to users | USN-10 | As a user,I can receive text messages in case there is a delay in the arrival of trains | 3 | Low | Arun Tiilak Karthe,Harish J |
| Sprint-4 | Testing the application | USN-11 | The application is tested to check if it works as desired.. | 4 | High | Arun Tiilak Karthe, Bharath Kumar D P |
| Sprint-4 | Deploying the application | USN-12 | The final application is deployed to IBM cloud. | 3 | Medium | Harish J,Sri Priyan 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 | 19 | 6 Days | 24 Oct 2022 | 29 Oct 2022 | 19 | 29 Oct 2022 |
| Sprint-2 | 20 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | 20 | 05 Nov 2022 |
| Sprint-3 | 8 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | 8 | 12 Nov 2022 |
| Sprint-4 | 7 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | 7 | 19 Nov 2022 |

# 7 CODING & SOLUTION

## 7.1 LOCATION TRACKING

```
from wiotp.sdk import device
import time

gpsConfig = {
    'identity' : {
```

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```python
        'orgId': 'f336wj',
        'typeId': 'GPS',
        'deviceId': 'GPS123'
    },
    'auth': {
        'token': '12345678'
    }
}

client = device.DeviceClient(gpsConfig)
client.connect()

lat = 13.0827
lon = 80.2707
while lat > 12.5:
    location = { 'name': 'Chennai Express', 'lat': lat, 'lon': lon }
    client.publishEvent(eventId="status", msgFormat="json", data=location,
qos=0)
    lat -= 0.01
    lon -= 0.01
    time.sleep(1)
```



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## 7.2 LOGIN FLOW



## 7.3 QR CODE GENERATION FLOW
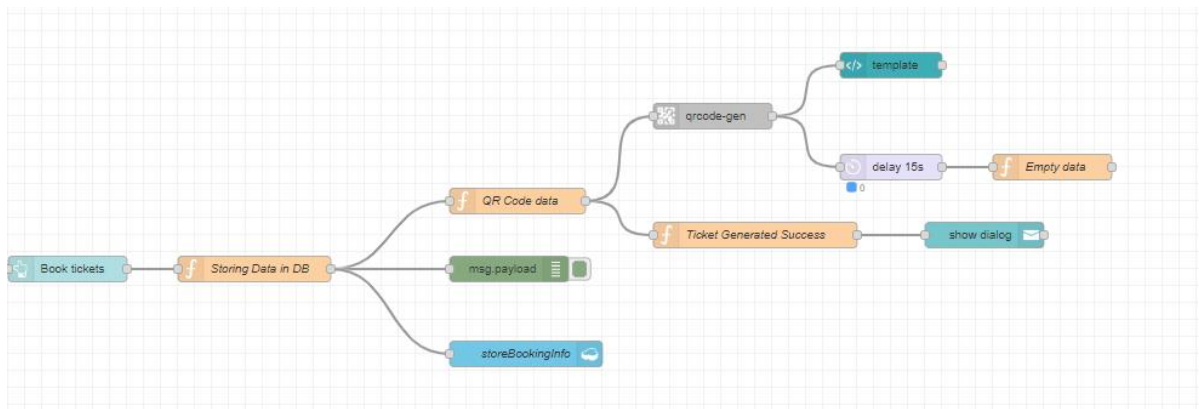


## 7.4 QR CODE READER

```python
import cv2
import time
import pyzbar.pyzbar as pz
from ibmcloudant.cloudant_v1 import CloudantV1
from ibm_cloud_sdk_core.authenticators import BasicAuthenticator

authenticator = BasicAuthenticator ('apikey-v2-
157db41pwa7immzmyhhr9ezh7ll4nql1q2gbcdn9xcnk',
'3620d13725bc37d50ff9e9d9bf5d4b73')
service = CloudantV1(authenticator=authenticator)
service.set_service_url ('https://apikey-v2-
157db41pwa7immzmyhhr9ezh7ll4nql1q2gbcdn9xcnk:3620d13725bc37d50ff9e9d9bf5d4b73@
994dc686-4910-4586-b44f-0b06c6953c31-bluemix.cloudantnosqldb.appdomain.cloud')
```

```python
cap = cv2.VideoCapture(0)
font = cv2.FONT_HERSHEY_PLAIN

while True:
    _, frame = cap.read()
    decodedObjects = pz.decode(frame)
    for obj in decodedObjects:
        a=obj.data.decode('UTF-8')
        cv2.putText(frame,"Ticket", (50, 50), font, 2,(255,0, 0), 3)
        try:
            response = service.get_document(db='sp45_db',
doc_id=a).get_result()
            print(response)
            time.sleep (5)
        except Exception as e:
            print ("Not a Valid Ticket")
            time.sleep (5)
    cv2.imshow ("Frame", frame)
    if cv2.waitKey (1) & 0xFF == ord('q'):
        break

cap.release()
cv2.destroyAllWindows()
service.disconnect()
```

## 7.5 FINAL FLOW
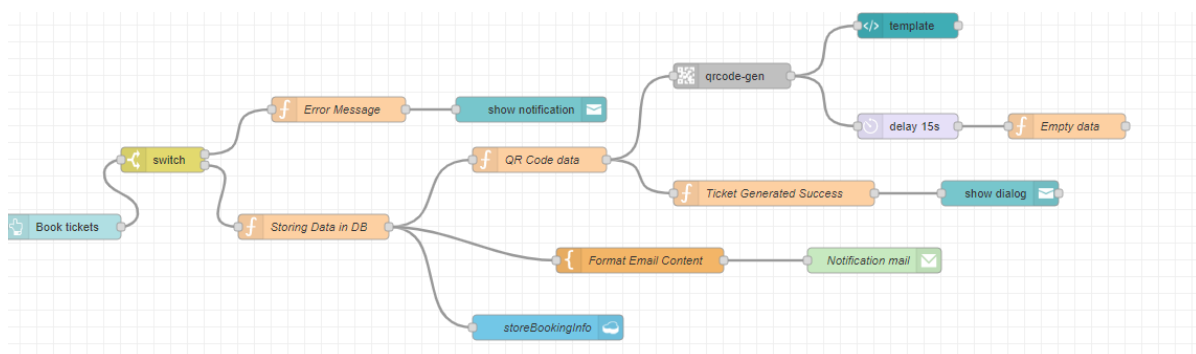




Ticket booked-Details reg  Inbox ×

████████@gmail.com
to me ▾

2:40 PM (0 minutes ago)

Boarding Station: Chennai
Destination Station: Hyderabad
Seats: 2

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# 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(Y/N) | BUG ID | Executed By |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TC01 | Functional | Scanner | Scanning QR Code | QR Code scanner | Open camera and scan | QR Code | Display details of tickets | Same as expected | Completed | - | N | - | Arun Tiilak Karthe |
| TC02 | Functional | Database | Correct data must be fetched | User already registered | Login to webapp | Email & Password | Correct email-password pair logs in user | Same as expected | Completed | - | N | - | Bharath Kumar D P |
| TC03 | Functional | Database | Sending mail reminders | User booked ticket | Book tickets | Any valid booking | Train details sent to mail | Same as expected | Completed | - | N | - | Harish J |
| TC04 | Exception Reporting | Scanner | Scanning Invalid QR Code | Random QR code generated | Open camera and scan | Random QR Code | Error message | Same as expected | Completed | - | N | - | Sri Priyan S |

## 8.2  USER ACCEPTANCE TESTING

Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

| Resolution | Severity 1 | Severity 2 | Severity 3 | Severity 4 | Subtotal |
|---|---|---|---|---|---|
| By Design | 5 | 3 | 4 | 0 | 12 |
| Duplicate | 1 | 1 | 0 | 1 | 3 |
| External | 3 | 1 | 1 | 0 | 5 |
| Fixed | 9 | 5 | 5 | 1 | 20 |
| Not Reproduced | 0 | 0 | 0 | 0 | 0 |
| Skipped | 0 | 0 | 0 | 0 | 0 |
| Won't Fix | 0 | 0 | 0 | 0 | 0 |
| Totals | 9 | 5 | 5 | 1 | 20 |

Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested.

| Section | Total Cases | Not Tested | Fail | Pass |
|---|---|---|---|---|
| Functional | 3 | 0 | 0 | 3 |
| Exception Reporting | 1 | 0 | 0 | 1 |

# 9 RESULTS

## 9.1 PERFORMANCE METRICS

### NFT - Risk Assessment

| S.No | Project Name | Scope/feature | Functional Changes | Hardware Changes | Software Changes | Impact of Downtime | Load/Volume Changes | Risk Score | Justification |
|---|---|---|---|---|---|---|---|---|---|
| 1 | User Registration | New | Low | No Changes | Low | Moderate | >5 to 10% | GREEN | User registration is a one-time event, can use other exisiting account if needed |
| 2 | Ticket Booking | New | High | No Changes | Moderate | Severe | >5 to 10% | RED | Ticket booking is a core part of the app |
| 3 | QR Code Generation | New | High | No Changes | High | Severe | >5 to 10% | ORANGE | QR generation is crucial |
| 4 | QR Code Checking | New | Moderate | No Changes | Low | Severe | >5 to 10% | ORANGE | QR code verification is vital, but can be substituted by other means |
| 5 | World Map | New | Low | No Changes | Moderate | Moderate | >5 to 10% | GREEN | World map view is a useful feature, but not a vital feature in the application |

### NFT - Detailed Test Plan

| S.No | Project Overview | NFT Test approach | Assumptions/Dependencies/Ris | Approvals/SignOff |
|---|---|---|---|---|
| 1 | User Registration | Load Test | Users register only once | Approved |
| 2 | Ticket Booking | Performance Test | Users have already registered | Approved |
| 3 | QR Code Generation | Performance Test | None | Approved |
| 4 | QR Code Checking | Load Test | Clean Camera + internet needed | Approved |
| 5 | World Map | Performance Test | None | Approved |

### End of Test Report

| S.No | Project Overview | NFT Test approach | NFR - Met | Test Outcome | GO/NO-GO decision | Recommendations | Identified Defects (Detected/Closed/Open) | Approvals/SignOff |
|---|---|---|---|---|---|---|---|---|
| | Smart Solution for railways | Load + Perfomance Testing | Met | Project has met necessary constraints | GO | None | No defects | Approved |

# 10 ADVANTAGES & DISADVANTAGES

Advantages

- Users can track the live location of trains
- QR code generated for each ticket purchase makes it easier to verify purchases
- Push notifications for change in train status allows users to never miss an update

Disadvantages

- Server overhead required to store each QR code
- GPS trackers in trains must be frequently checked to ensure it is in proper condition

# 11 CONCLUSION

Current infrastructure for booking railway tickets is outdated and not suitable for the high volume of tickets booked per day. This project aims to modernize the

process and provide an easier option for passengers to book tickets. It also proves successful in reducing paper usage by removing the need to carry tickets for verification due to the addition of QR code verification. The usage of fraud tickets can also be solved by this.

## 12 FUTURE SCOPE

The web app can be updated with a machine learning model that predicts the likelihood of securing a ticket if it is in "Waiting List", based on the previous booking history for the given train. Food preferences can be obtained via the app while booking tickets which can be useful for handling the logistics required to operate food catering services in trains.

## 13 APPENDIX

GitHub link: [IBM-EPBL/IBM-Project-50562-1660916264: Smart Solutions For Railways (github.com)](#)

Demo Link: [IBM-Project-50562-1660916264/FinalDemo.mov at main · IBM-EPBL/IBM-Project-50562-1660916264 (github.com)](#)