

K. L. N. COLLEGE OF ENGINEERING

(An Autonomous institution, affiliated to Anna University, Chennai)

ELECTRONICS AND COMMUNICATION ENGINEERING



Smart Solutions for Railways

INTERNET-OF-THINGS DOMAIN

Team ID : PNT2022TMID11527

Team Leader : M.S. SANTHOSHKUMAR

Team Members : 1. K.B.S. SANJAY

2. R. YOGESH

3. A.R.L. SANTHOSHKUMAR

4. M. SARATH KUMAR

Faculty Mentor : Dr. JANAKIRAMAN NITHIYANANTHAM, Prof(ECE)

Evaluator : Dr. P. KARPAGAVALLI, ASP(ECE)

Industry Mentor : Mr. BARADWAJ

BONAFIDE CERTIFICATE

Certified that this project report “**SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES**” is the bonafide work of

“SANTHOSHKUMAR (910619106049),

SANJAY K.B.S (910619106047),

SANTHOSHKUMAR A.R.L (910619106050),

YOGESH R. (910619106071),

SARATH KUMAR M. (910619106305)”,

Who carried out the project work under our supervision.

SIGNATURE

FACULTY MENTOR

Mr. JANAKIRAMAN
NITHIYANANTHAM

ASSISTANT PROFESSOR

ELECTRONICS AND
COMMUNICATION ENGINEERING
K.L.N COLLEGE OF ENGINEERING

SIGNATURE

FACULTY EVALUATOR

Dr. P. KARPAGAVALLI
ASSISTANT PROFESSOR

ELECTRONICS AND
COMMUNICATION ENGINEERING
K.L.N COLLEGE OF ENGINEERING

SIGNATURE

DR.V.KEJALAKSHMI

HEAD OF THE DEPARTMENT

**ELECTRONICS AND COMMUNICATION ENGINEERING
K.L.N COLLEGE OF ENGINEERING**

ABSTRACT

The explosively growing demand of Internet of Things (IoT) has rendered roadscale advancements in the fields across sensors, radio access, network, and hardware/software platforms for mass market applications. In spite of the recent advancements, limited coverage and battery for persistent connections of IoT devices still remains a critical impediment to practical service applications. In this paper, we introduce a cost-effective IoT solution consisting of a device platform, gateway, IoT network, and platform server for smart railway infrastructure. Then, we evaluate and demonstrate the applicability through an in-depth case study related to IoT-based maintenance by implementing a proof of concept and performing experimental works. The IoT solution applied for the smart railway application makes it easy to grasp the condition information distributed over a wide railway area. To deduce the potential and feasibility, we propose the network architecture of an IoT solution and evaluate the performance of the candidate radio access technologies for delivering IoT data in the aspects of power consumption and coverage by performing an intensive field test with system level implementations. Based on the observation of use cases in interdisciplinary approaches, we figure out the benefits that the IoT can bring.

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CHAPTER – 1

1. INTRODUCTION

1.1. PROJECT OVERVIEW:

The railway has been playing a fundamental role of public transportation since the 19th Century, in which a steam locomotive began to be run. From that moment, the railway was regarded as a core method to transport massive population moving along the determinant paths within and between metropolitan cities. The basic technology of the railway has been so far progressed and recently enables a high-speed railway system which satisfies the public demand on travelling a far distance. The railway possesses the inherent characteristics of high capacity and energy efficiency, and those merits motivate the governments of many countries to encourage and support the railway for public interest. Consequently, the governments consider the railway significant when they establish transport policies.

1.2. PURPOSE:

This project is to make people book train tickets via Online and can have their tickets on their mobile phones in a QR code form, which get generated after they book tickets. This QR code should be shown to the ticket collector, so that he scans it to cross-check the personal details and to confirm whether the right person is there at the right seat. Under the aforementioned CBM concept, a maintenance staff inspects the condition of each entity in the railway system and repairs or replaces it if necessary. The upper part shows the detailed procedure of the CBM. The first step is to inspect each maintenance target according to a guideline specific to the target. For each target, the maintenance staff directly visits the site and measures various indices dedicated to the target at a specific inspection period. Based on the analysis of the measurement results, the staff decide which status each target is in and whether the target needs any maintenance actions. The candidate maintenance actions are then prioritized based on the significance and criticality, and the budget for the maintenance actions is negotiated, which bounds the range of the execution for the maintenance actions.

CHAPTER – 2

2. LITERATURE SURVEY:

2.1. EXISTING PROBLEM:

Seven reports were reviewed in detail for the literature review, with the majority of these providing some evidence to support the theory that the introduction of waste collections is associated with a reduction in waste arising. The following text should be reviewed with consideration given to the fact that these studies were not specifically designed to assess the impact of waste collections on at source food waste reduction. Therefore, evidence is taken from these reports to be used in different context from that in which it was collected. Overall the reports demonstrate that while there is some evidence to support the theory that implementing a waste collection can lead to an overall reduction in collected waste, there is currently no significant evidence to demonstrate to what extent this is due to prevention at source as opposed to diversion to home composting. A number of the reports support the need for further research in this area.

2.2. REFERENCES:

- [1] Wang Lei. ARIS-based modelling of enterprise systems and application service [D] . Nanjing Nanjing University of Science 2006 19-27.
- [2] Mei Xiaodong. Online booking system feasibility study and practice [J] . Railway Technology Innovation,2004, (1):35-38.
- [3] Han Peiyong. Database Technology. Northwestern Polytechnical University Press.

2.3. PROBLEM STATEMENT DEFINITION:

Smart Solutions for railways is designed to reduced the work load of the user and also the use of paper. Here in this project we have all the features shown below

- .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.

CHAPTER – 3

3. IDEATION & PROPOSED SOLUTIONS:

3.1. EMPATHY MAP CANVAS:

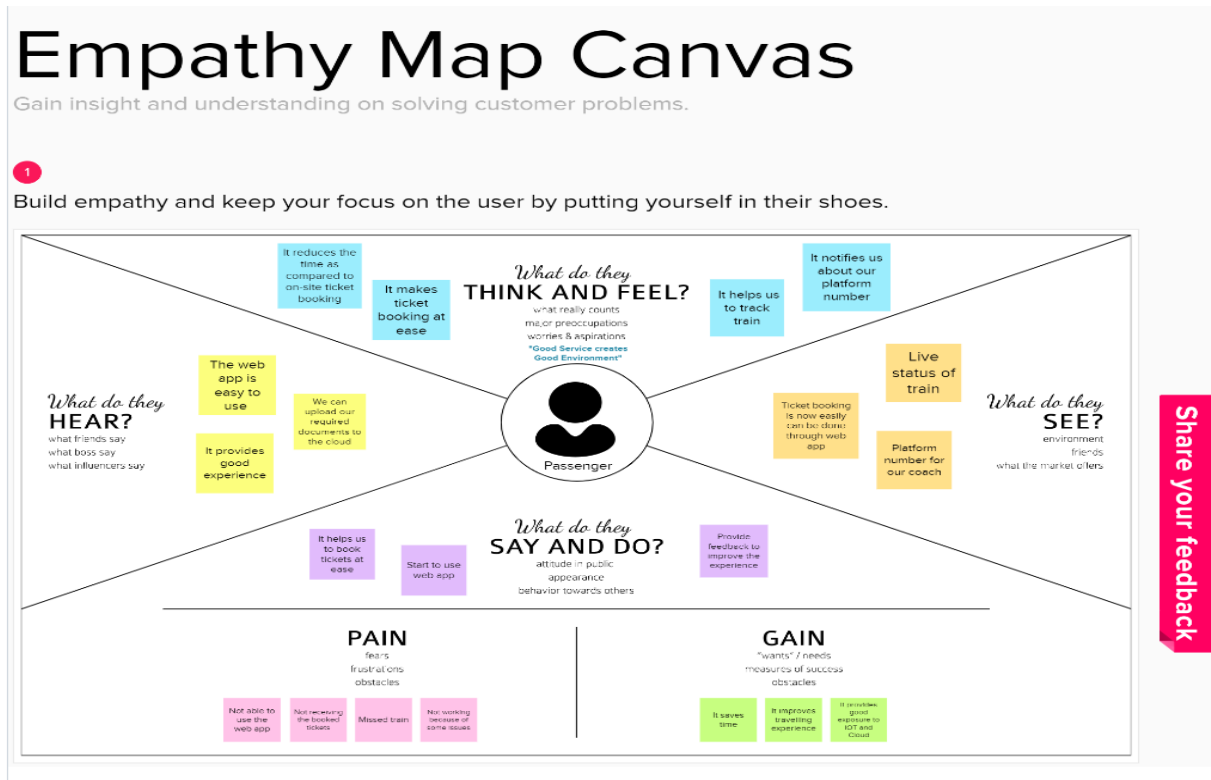


Figure -3.1

3.2. IDEATION & BRAINSTORMING:

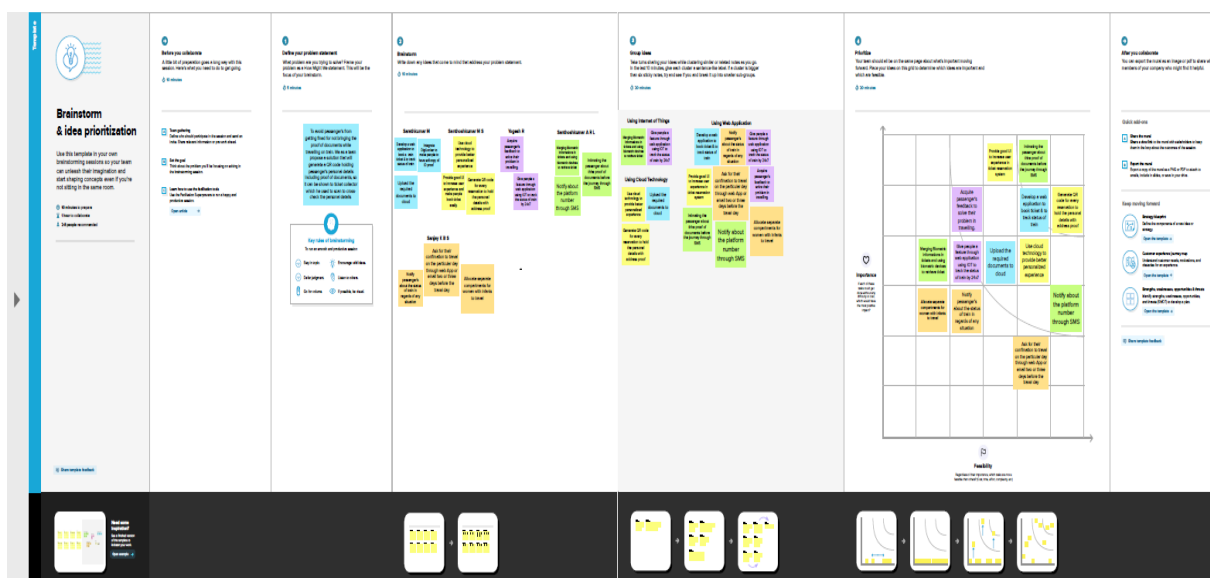


Figure -3.2

3.3. PROPOSED SOLUTION:

Proposed Solution Template

Date	06 November 2022
Team ID	PNT2022TMID11527
Project Name	Project – Smart Solutions For Railways
Maximum Marks	2 Marks

Proposed Solution Template:

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

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	<ul style="list-style-type: none">• Smart Solutions for railways is designed to reduce the work load of the user and also the use of paper and also provides the live location of the train.• 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.• Ticket reservation through counter is not sufficient and convenient for the passengers. The passengers are struggling to get tickets in the time from ticket counters. So they like to switch over online ticket booking.

2.	Idea / Solution description	<ul style="list-style-type: none"> • A webpage is designed in which the user can book tickets and will be provided with a QR code which will be shown to the ticket collector and the ticket collector will be scanning the QR code to get the passenger details. • The webpage also shows the live locations of the train by placing a GPS module in the train. The location of the journey will be updated continuously in the webpage. • The booking details of the user will be stored in the database which can be retrieved anytime.
3.	Novelty / Uniqueness	<ul style="list-style-type: none"> • A QR code will be provided by the webpage to the user which will reduce the paper work. • 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. You can also view interactive seat map.
4.	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"> • The booked tickets are made easy to use and it is also reliable and no need to go to station for booking tickets and the transaction process is also made easy.

		<ul style="list-style-type: none"> • One can manage online ticket booking and apply for a cancellation in case of change in plans. • The customer will be notified on email as well as cell phone on all confirmation and cancellations.
5.	Business Model (Revenue Model)	<ul style="list-style-type: none"> • With this solution-By using this application, the customer can schedule their destination, view interactive seat map and select their seat for their convenience. • Moreover, it enables your customers organize trips and daily shuttles effortlessly and it also reduces the carrying of tickets. The customer can also watch the current location of the train. • Without this solution- they have to travel to the station to book tickets and also have to carry their tickets to show ticket collector.

3.4. PROBLEM SOLUTION FIT:

PROBLEM – SOLUTION FIT Purpose /Vision: For reducing the word load and paper work for passengers

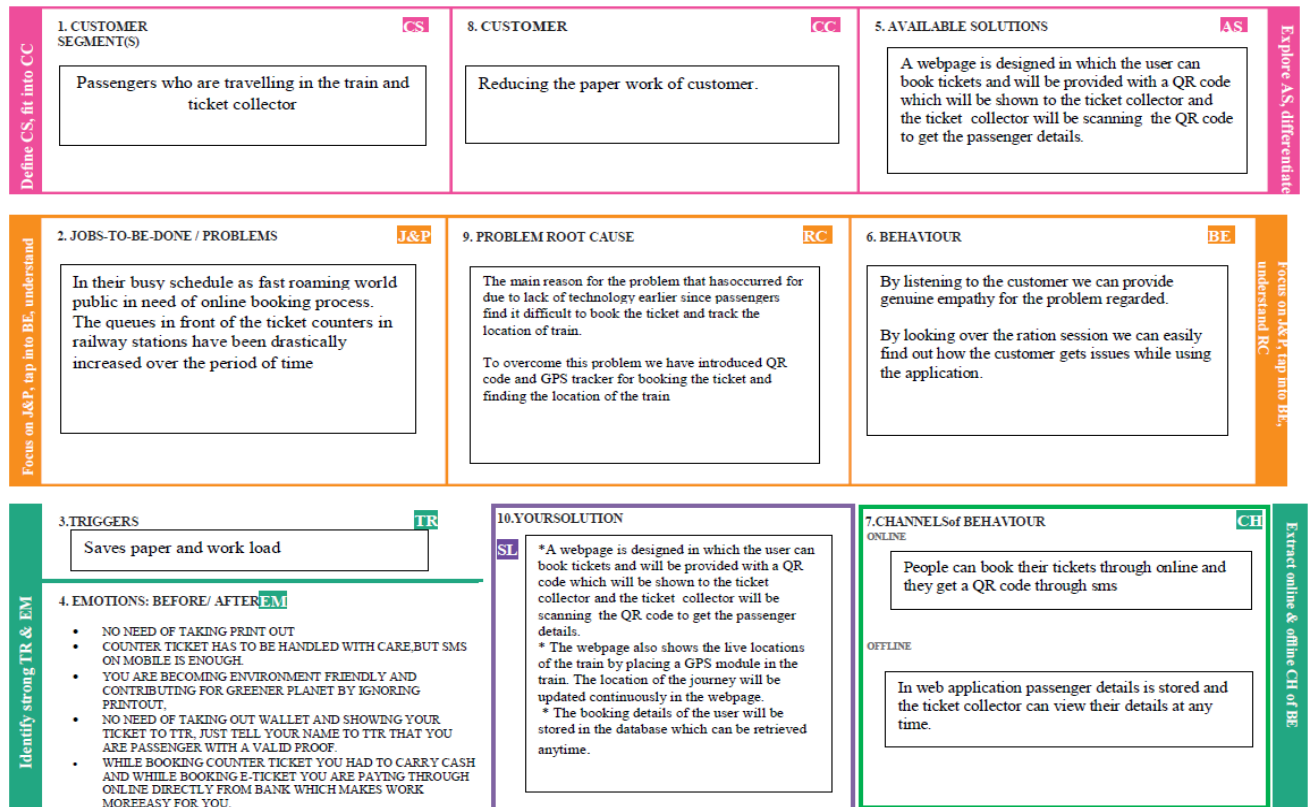


Figure -3.3

CHAPTER – 4

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	User Registration	Before the user registration there will be language selector .All the language is applicable. When user enter in to the application they can see the page of showing enter the email ,mobile number and name. After that in screen it shows the verification code is sent through the email id.
FR-2	User verification	The verification code is sent to the registered email id
FR-3	User confirmation	The verification code is entered in to the app application. After finishing that home page is opened.
FR-4	Process of booking	When the home page is opened there will be a fromand to option. We must enter the details then after that we can able to see the number of trains availability and seats.
FR-5	Payment process	After entering all the details select the payment option like Google pay, PhonePe, PAYTM, etc..., When we select that method it process through selected payment option then payment should be done carefully, then the ticket is confirmed. After confirmation it will return to the page and we can see the details of booking.
FR-6	Confirmation message	After all the QR code will be send through the SMS and email id. QR code will be shown .

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The app is set to easily method only. All the languages will be accessed through by user.

NFR-2	Security	The permissions access is only for the location access only there will be no other unauthorized permission should be entered to it.
NFR-3	Reliability	When the user are entering the details, that time if network connection is disabled. All the details will be stored automatically. No need to enter the details again.
NFR-4	Performance	The application is more secured and it will obtain through the back end . no unauthorized can access the application
NFR-5	Availability	only the QR code is sent through the message and email id only no other information is included
NFR-6	Scalability	At a time more than 300,000 users can obtain .All the data will be stored carefully and other issues will be obtained.

CHAPTER – 5

5. PROJECT DESIGN:

5.1 DATA FLOW DIAGRAMS:

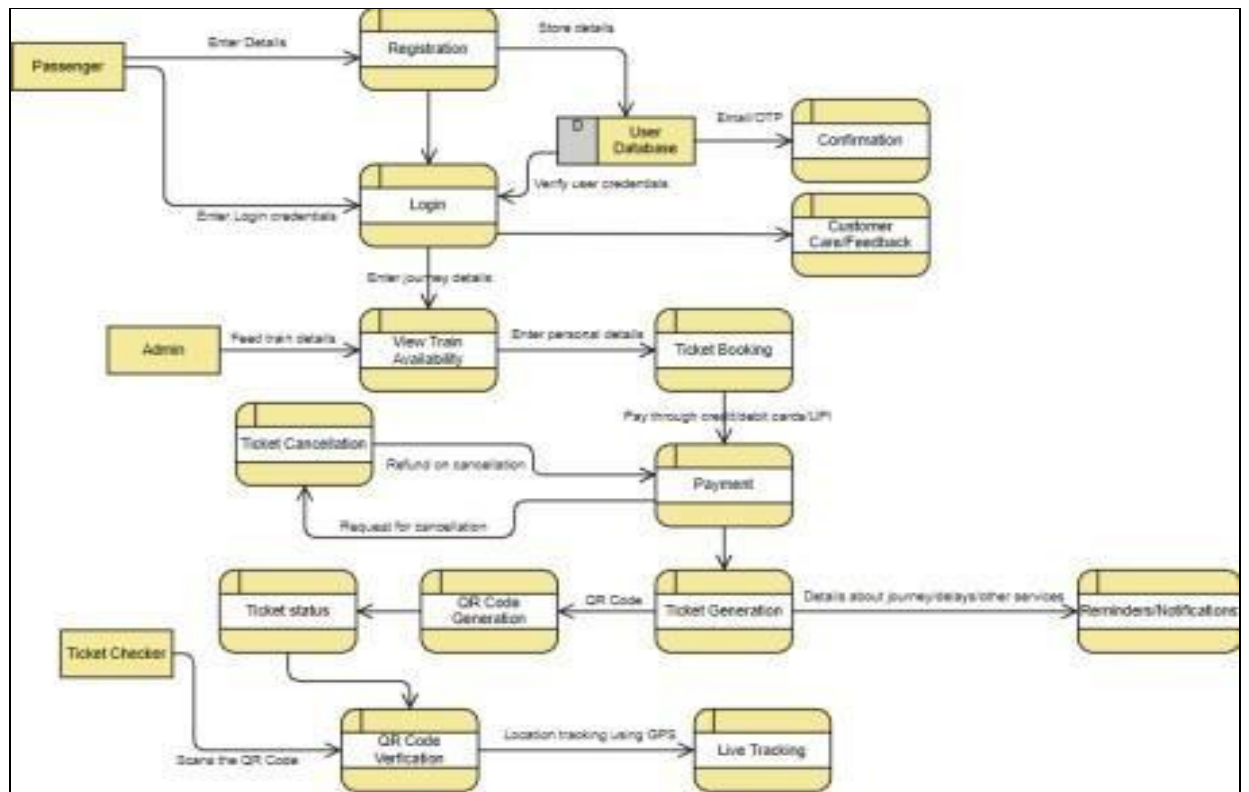


Figure – 5.1 Data Flow diagram

5.2. SOLUTION & TECHNICAL ARCHITECTURE:

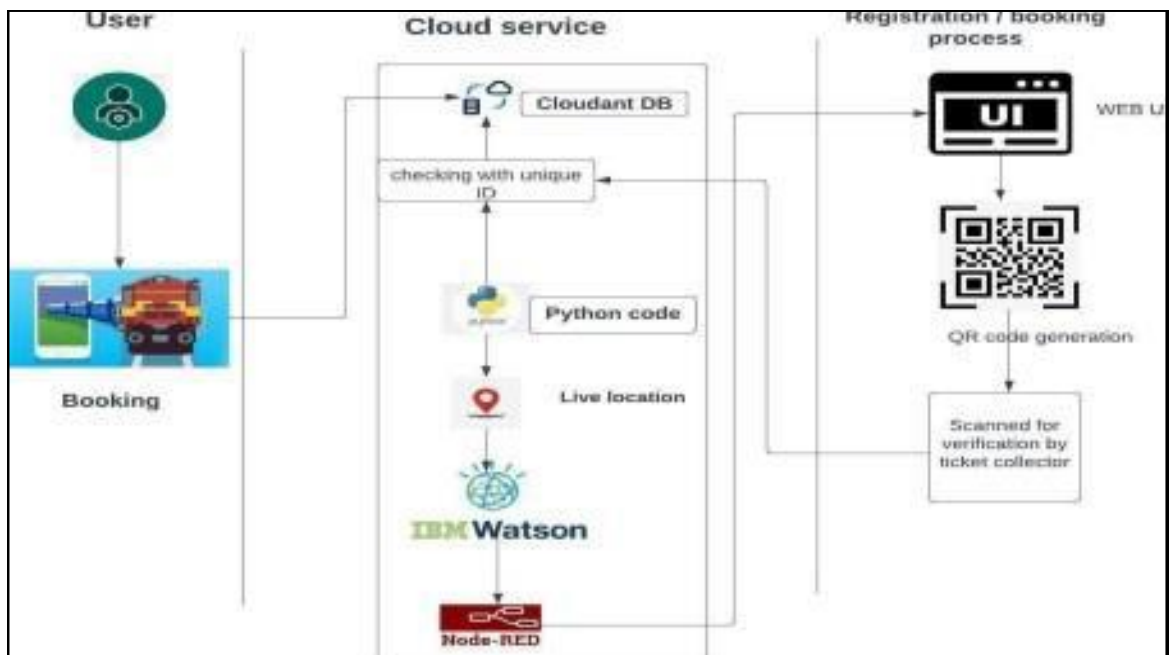


Figure – 5.2 Solution and Technical Architecture

5.3. USER STORIES:

Date	06 November 2022
Team ID	PNT2022TMID11527
Project Name	Project - Smart Solutions for Railways
Maximum Marks	4 Marks

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, 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

	Confirmation	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 registered 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 user, I can provide	I can view, modify or	High	Sprint-1

			the basic details such as name, age, gender etc.	confirm the details entered.		
		USN-7	As a user, I can choose the class, seat/berth. If a preferred seat/berth isn't available I can be allotted based on the availability.	I can view, modify or confirm the seats/class/berth selected	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	I can pay through the payment portal and	High	Sprint-1

			successful completion of payment I'll be redirected to the booking website.	confirm the booking. If any changes need to be done I can move back to the initial payment page.		
--	--	--	---	--	--	--

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
	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 constantly get the information and arrange alternate transport if the ticket isn't confirmed.	High	Sprint-1
	Reminders/Notification	USN-12	As a user, I get reminders 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 delays.	I can track the train and get to know about the delays and plan accordingly.	Medium	Sprint-2
	Ticket cancellation	USN-14	As a user, I can cancel my ticket if there's any change of plan.	I can cancel the ticket and get a refund based	High	Sprint-1

				on how close the date is to the commencement of the journey.		
--	--	--	--	--	--	--

	Raise queries	USN-15	As a user, I can raise queries through the query box or via mail.	I can view my previous queries.	Low	Sprint -2
Customer Care Executive	Answer the queries	USN-16	As a user, I will answer the queries /doubts raised by the customers.	I can view the queries and mark 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 correctness of the information fed.	High	Sprint -1

CHAPTER – 6

6. PROJECT PLANNING & SCHEDULING:

6.1. SPRINT PLANNING & ESTIMATION:

Date	18 October 2022
Team ID	PNT2022TMID27787
Project Name	Smart Solutions For Railways
Maximum Marks	8 Marks

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Dashboard	USN-4	Displaying User the Services we provide in Application	2	Medium	Overall Team
Sprint-2	Overall UI	USN-5	Non functional overall UI developed for User convenience	2	High	Overall Team
Sprint-2	Backend development and QRcode generation	USN-6	Giving User the semi functional UI of the Application	2	High	Overall Team

Sprint-2	Connecting Application with Cloud	USN-7	User can experience the semi functional working of the data(from cloud) with Application	2	Medium	Overall Team
Sprint-3	Connecting Devices/Gate ways with Cloud	USN-8	User can experience the semi functional working of IoTdevice connected with Application	2	Medium	Overall Team
Sprint-3	Full functional UI	USN-9	Giving User the full functional UI of the Application with supported backend	2	High	Overall Team
Sprint-4	Debug and Testing	USN-10	Testing has been done for finding debugs	2	High	Overall Team
Sprint-4	Testing and Deployment	USN-11	Final Testing for Deployment	2	High	Overall Team

Project Tracker (4 Marks)

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	6	6 Days	25 Oct 2022	29 Oct 2022	6	29 Oct 2022
Sprint-2	6	6 Days	30 Oct 2022	07 Nov 2022	6	07 Nov 2022
Sprint-3	4	6 Days	09 Nov 2022	12 Nov 2022	6	12 Nov 2022
Sprint – 4	4	6 Days	14 Nov 2022	22 Nov 2022	6	22 Nov 2022

6.2. SPRINT DELIVERY SCHEDULE

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc.	28 SEPTEMBER 2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements.	24 SEPTEMBER 2022
Ideation	List the by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & Importance.	25 SEPTEMBER 2022
Proposed Solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	23 SEPTEMBER 2022
Problem Solution Fit	Prepare problem - solution fit document.	30 SEPTEMBER 2022
Solution Architecture	Prepare solution Architecture document	28 SEPTEMBER 2022

Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application.	20 OCTOBER 2022
Functional Requirement	Prepare the functional requirement document.	8 OCTOBER 2022
Data Flow Diagrams	Draw the data flow diagrams and submit for review.	9 OCTOBER 2022
Technology Architecture	Prepare the technology Architecture diagram	10 OCTOBER 2022
Prepare Milestone & Activity List	Prepare the milestones & activity list of the project.	22 OCTOBER 2022
Project Development - Delivery of Sprint - 1, 2, 3 &4	Develop & submit the developed code by testing it.	14 OCTOBER 2022

6.3. JIRA SOFTWARE:

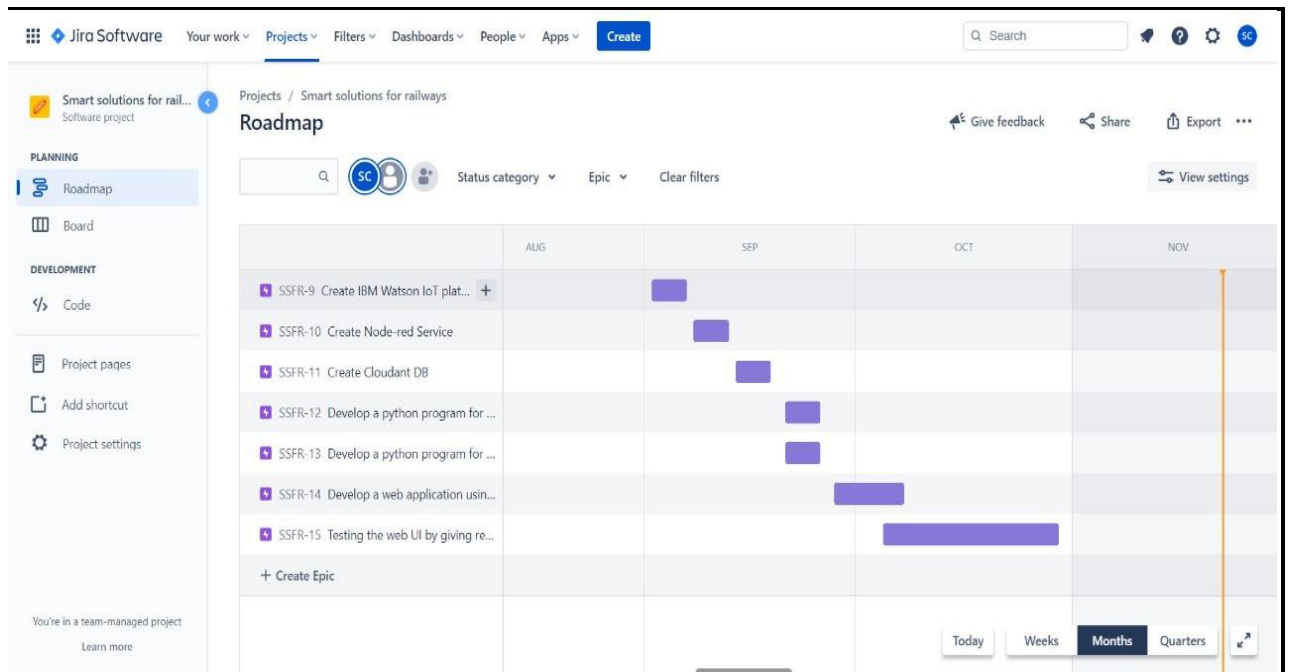


Figure – 6.3 : Workflow Journey in JIRA Software

CHAPTER – 7

7. CODING & SOLUTIONING:

7.1. FEATURE 1 (WEB APP USING NODE-RED):

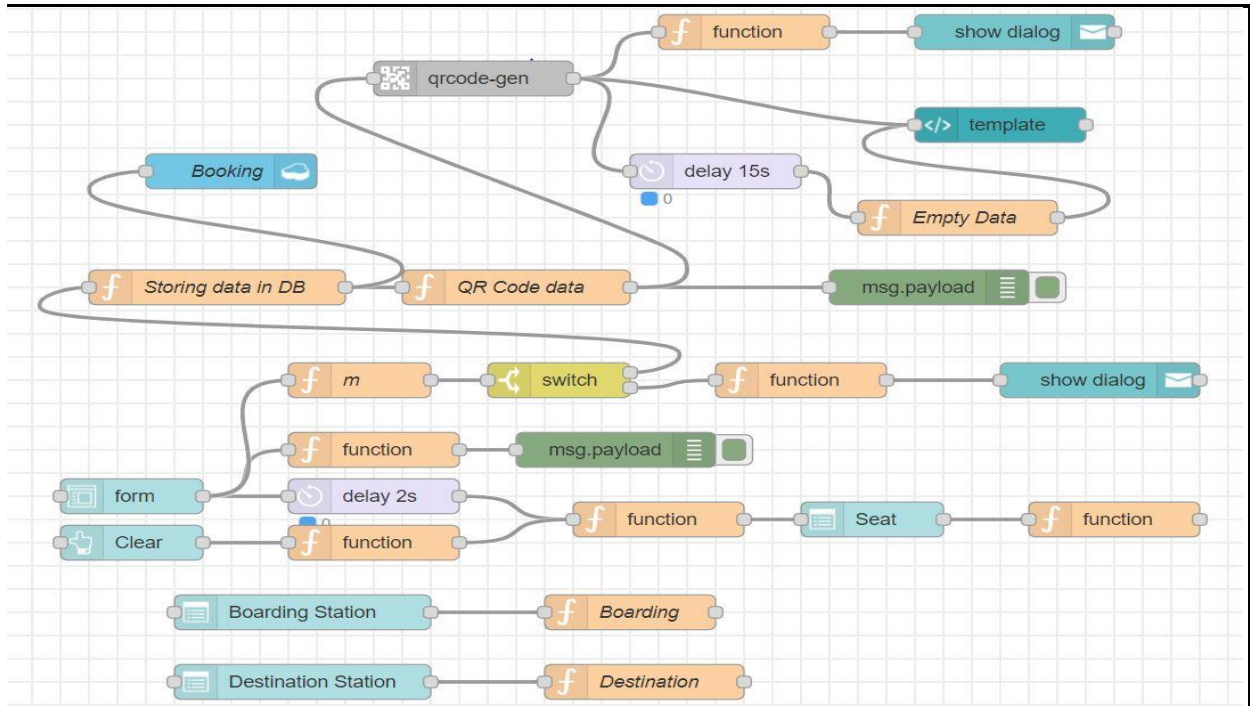


Figure – 7.1.1 : Node flow in Node-red

The screenshot shows a web application interface with a blue header bar labeled 'nodemcu'. The main content area is white and contains a form with the following elements:

- A text input field with the value '1234'.
- A dropdown menu for 'Boarding Station' with 'Chennai' selected.
- A dropdown menu for 'Destination' with 'Goa' selected.
- A dropdown menu for 'Seat' with 'Select option' selected.
- Text input fields for 'Name *', 'Age *', and 'Mobile No. *'.
- Two buttons: 'SUBMIT' and 'CANCEL'.
- A 'CLEAR' button at the bottom.

Figure – 7.1.2 : Web app UI

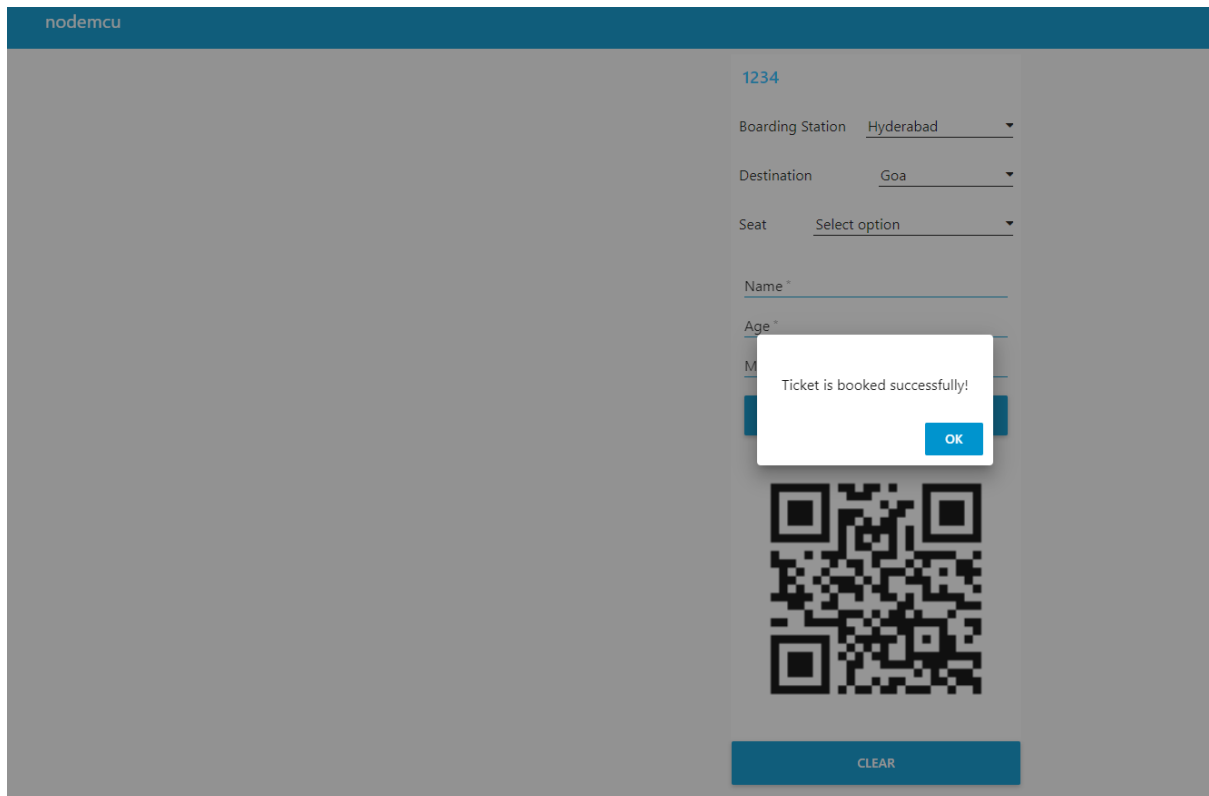


Figure – 7.1.3 : Ticket booking using web app

7.2. FEATURE 2 (QR CODE SCANNER SIMULATION)

7.2.1. PYTHON PROGRAM:

```
import cv2
import numpy as np
import time
import pyzbar.pyzbar as pyzbar
from ibmcloudant import CouchDbSessionAuthenticator
from ibmcloudant.cloudant_v1 import CloudantV1
from ibm_cloud_sdk_core.authenticators import BasicAuthenticator

authenticator = BasicAuthenticator('apikey-v2-
158dum3biyje1ogl3xx8ak4gdtl739kbb0bdj5gl9tym',
'dbe223e16f360ab830899e26012ec79d')
service = CloudantV1(authenticator=authenticator)
service.set_service_url('https://apikey-v2-
158dum3biyje1ogl3xx8ak4gdtl739kbb0bdj5gl9tym:dbe223e16f360ab830899e26012ec7
9d')

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

while True:
    _, frame = cap.read()
```



```

        decodedObjects = pyzbar.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='booking', 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()
client.disconnect()

```

7.2.2. : OUTPUT SIMULATION

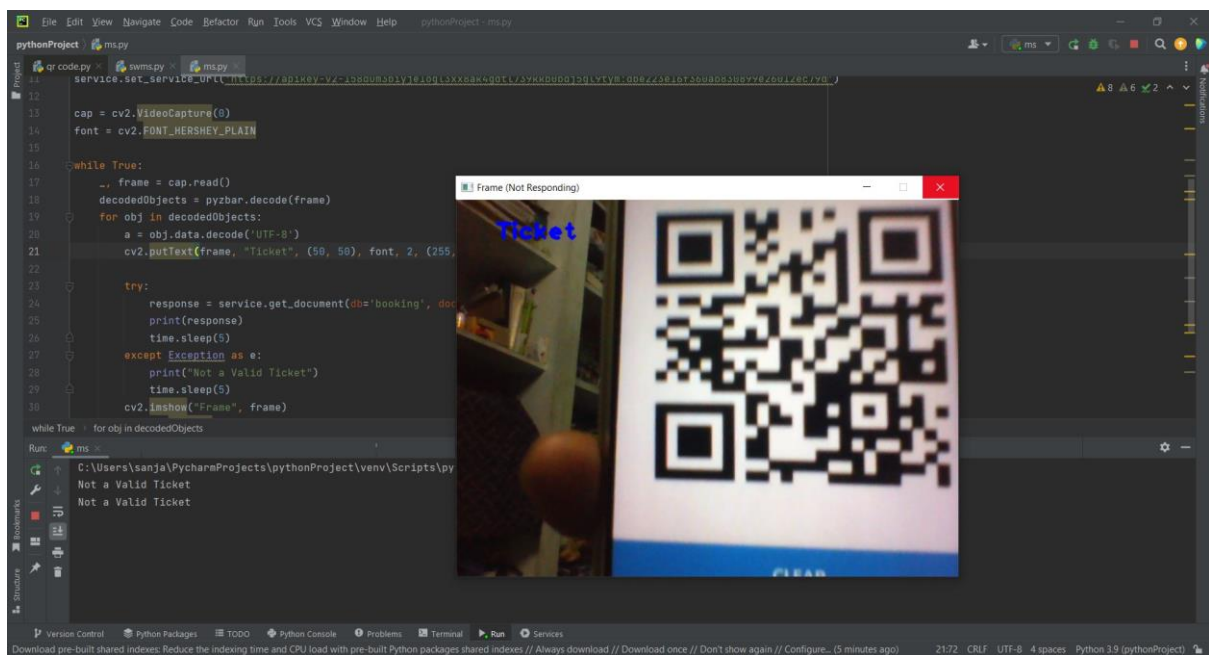


Figure - 7.2.2.: Output Simulation of QR code program

7.3. FEATURE 3 (TRAIN TRACKING SIMULATION)

7.3.1 : PYTHON PROGRAM:

```
import wiotp.sdk.device
import time
import random

myConfig = {
    "identity":{
        "orgId": "7ci8ka",
        "typeId": "nodeMCU",
        "deviceId": "control_room"
    },
    "auth": {
        "token": "1234567890"
    }
}

def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" %
cmd.data['command'])
    m = cmd.data['command']

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

def pub(data):
    client.publishEvent (eventId="status", msgFormat="json", data=myData,
qos=0, onPublish=None)
    print("Published data Successfully: %s", myData)

while True:
    myData={'name': 'Train1', 'lat': 17.6387448, 'lon': 78.4754336}
    pub(myData)
    time.sleep(3)
    # myData={'name': 'Train2', 'lat': 17.6387448, 'lon': 78.4754336}
    # pub (myData)
    # time.sleep (3)
    myData = {'name': 'Train1', 'lat': 17.6341908, 'lon': 78.4744722}
    pub(myData)
    time.sleep(3)

    myData = {'name': 'Train1', 'lat': 17.6340889, 'lon': 78.4745052}
    pub(myData)
    time.sleep(3)

    myData = {'name': 'Train1', 'lat': 17.6248626, 'lon': 78.4720259}
    pub(myData)
    time.sleep(3)

    myData = {'name': 'Train1', 'lat': 17.6188577, 'lon': 78.4698726}
    pub(myData)
    time.sleep(3)

    myData = {'name': 'Train1', 'lat': 17.6132382, 'lon': 78.4707318}
    pub(myData)
    time.sleep(3)
```

```
client.commandCallback = myCommandCallback(myData)
client.disconnect()
```

7.3.2 : OUTPUT SIMULATION

```
def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
    "identity": "typoid"
```

```
2022-11-25 20:36:41,787 wiotp.sdk.device.client.DeviceClient INFO Connected successfully: d:7ci8ka:nodeMCU:control_room
Published data Successfully: %s {'name': 'Train1', 'lat': 17.6387448, 'lon': 78.4754336}
Published data Successfully: %s {'name': 'Train1', 'lat': 17.6341988, 'lon': 78.4744722}
Published data Successfully: %s {'name': 'Train1', 'lat': 17.6340889, 'lon': 78.4745852}
Published data Successfully: %s {'name': 'Train1', 'lat': 17.6248626, 'lon': 78.4720259}
Published data Successfully: %s {'name': 'Train1', 'lat': 17.6188577, 'lon': 78.4698726}
Published data Successfully: %s {'name': 'Train1', 'lat': 17.6132382, 'lon': 78.4787318}
Published data Successfully: %s {'name': 'Train1', 'lat': 17.6387448, 'lon': 78.4754336}
Published data Successfully: %s {'name': 'Train1', 'lat': 17.6341988, 'lon': 78.4744722}
```

Figure – 7.3.2 : Location data of train is being published to the IBM Watson IoT platform

7.4. DATABASE SCHEMA

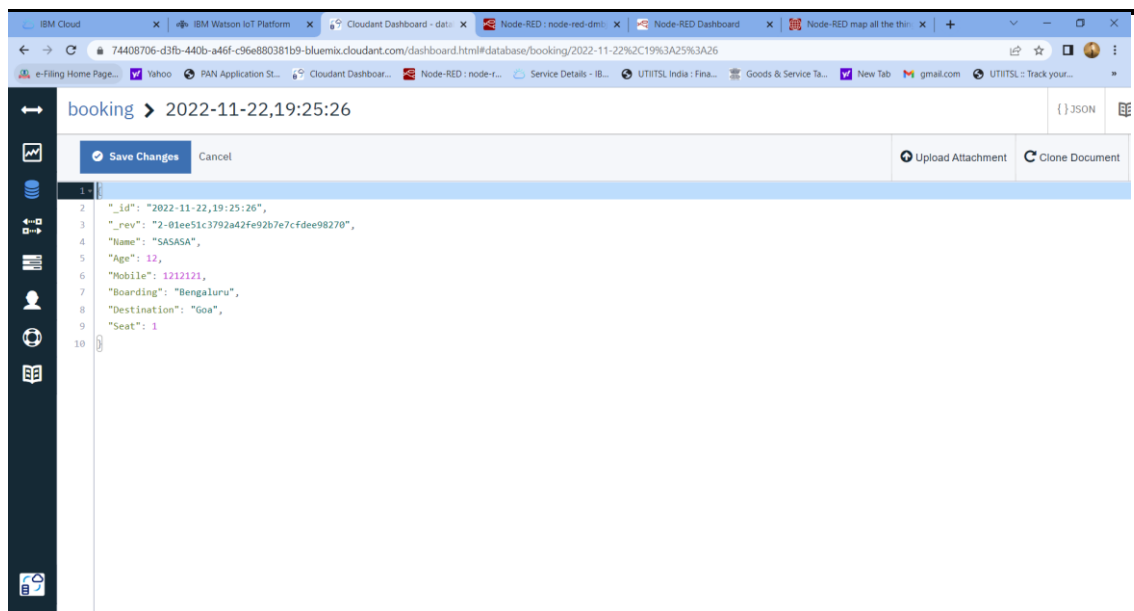


Figure – 7.4 : Passenger details getting uploaded to the IBM CloudantDB after booking train ticket

CHAPTER – 8

8. TESTING:

8.1 :TEST CASES:

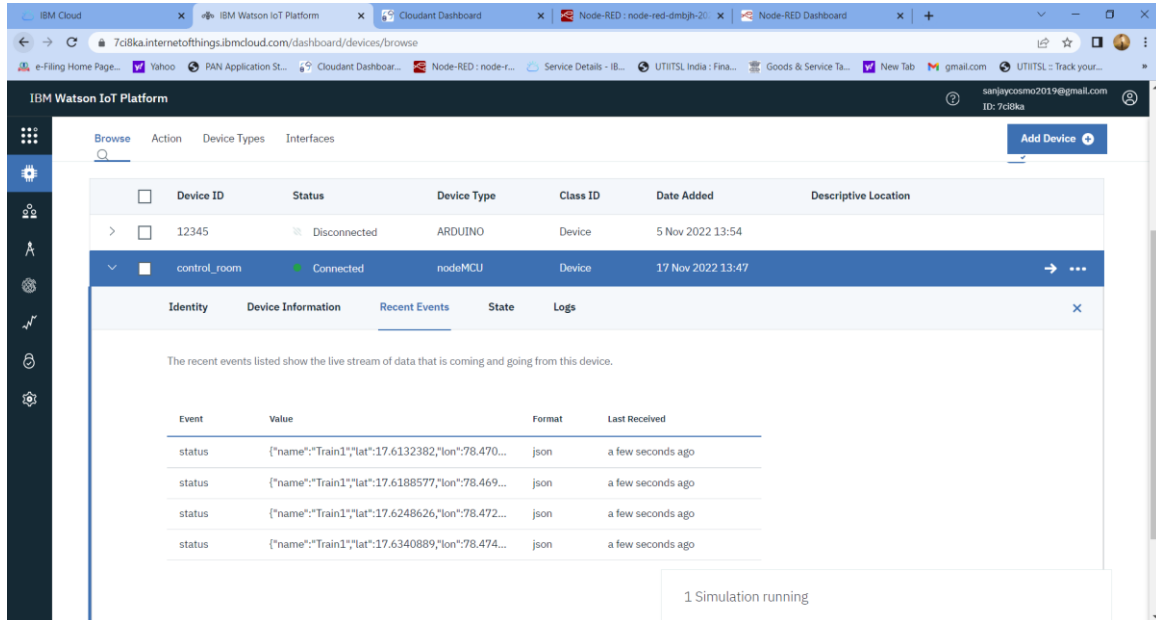


Figure – 8.1.1 : Publishing of Location data to IBM Watson IoT platform

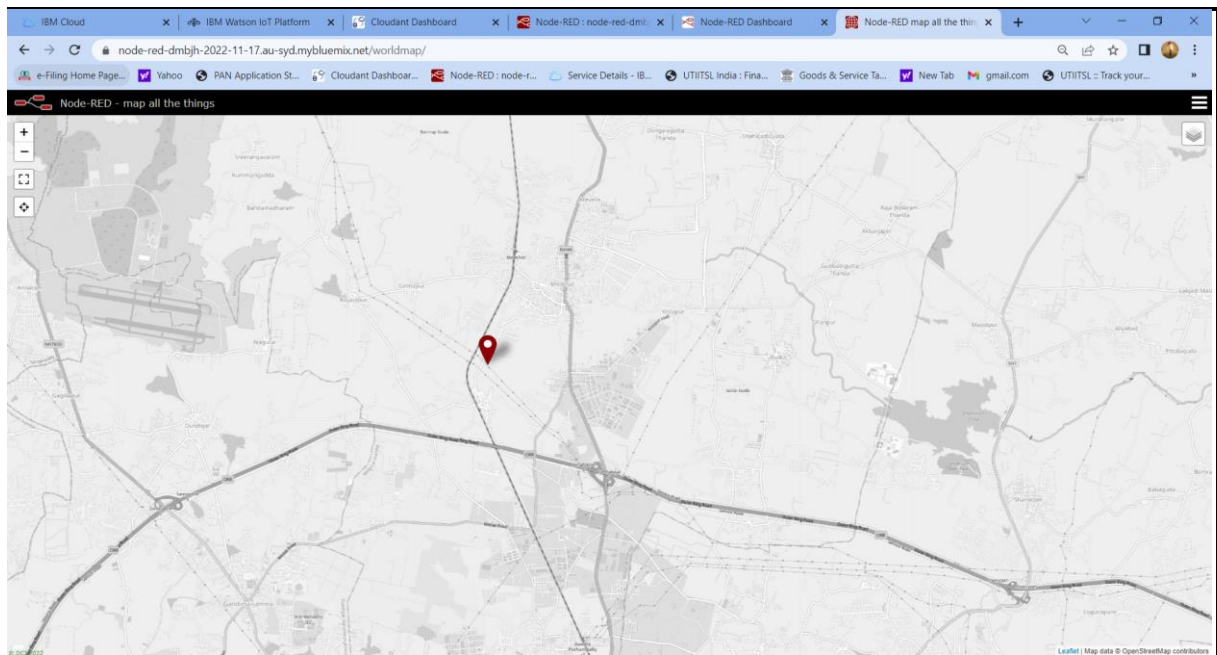


Figure – 8.1.2 : Train tracking Simulation

8.2. USER ACCEPTANCE TESTING:

Date	10 November 2022
Team ID	PNT2022TMID11549
Project Name	Smart Waste Management System for Metropolitan Cities – IOT
Maximum Marks	4 Marks

1. PURPOSE OF DOCUMENT

The purpose of this document is to briefly explain the test coverage and open issues of the Smart Waste Management System project at the time of the release to User Acceptance Testing (UAT).

2. 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	10	4	3	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	78

3. TESTCASE ANALYSIS:

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

Section	Total Cases	Not Tested	Fail	Pass
Python installation	7	0	0	7
Launch IBM Watson	45	0	5	40
IBM Watson and python integration	2	0	0	2
Install Node red	13	0	7	6
Interconnecting IBM Watson and Node red	19	0	10	9
Web UI dashboard	14	0	0	14
Tracking train in Worldmap	5	0	0	5
Totals	105	0	22	83

CHAPTER – 9

9.1. RESULTS:

We have implemented “Smart Solutions for Railways” project by using the web app to book tickets which is built using Node-red and uploaded the passenger details to IBM cloudantDB and verified the qr code by running the python code that scans the qrcode and fetches the passenger details from the cloud database. Also, we have simulated the live location tracking of train by running python program and have seen the location of train in worldmap using Node-red.

CHAPTER – 10

ADVANTAGES :

- **Easy to book ticket.**
- **No need to carry any proof of documents.**
- **Easy to handle and user friendly.**
- **Saves time.**
- **Needs less effort.**

DIS-ADVANTAGES :

- **Without smartphone no one can utilize these features.**

CHAPTER – 11

CONCLUSION:

Cloud and IoT technology helps people to book train tickets via online in an easy manner and works fast in receiving QR code after successful reservation of a ticket. It saves time and effort of people for reservation of ticket.

CHAPTER – 12

FUTURE SCOPE:

Online Railway ticket booking system is structured into the data access layer, business logic layer and business exterior layer. We implement customer registration, customer cancellation, ticket inquiries, online booking, online ticket refund in the system . Business process design and database design is the focus of this system which are clearly and effectively designed by the business process diagrams and database ER diagrams. Real-time tickets messages will be feedbacked to customers by the online railway booking system. The efficiency of booking is improved,

manual booking errors is reduced, the management of railway passenger transport and customer booking is facilitated.

CHAPTER – 13

GITHUB : <https://github.com/IBM-EPBL/IBM-Project-26232-1660021932>

PROJECT DEMO LINK:

<https://www.youtube.com/watch?v=MGeFjygJjTE>