Smart Solutions For Railways

Team ID : PNT2022TMID03174

Team Leader : SANJAY T

Team member : SANJANA R

Team member : SANJAY S

Team member : SARAVANAMUTHU G

1.INTRODUCTION

1.1 PROJECT OVERVIEW

SMART SOLUTIONS FOR RAILWAYS is to manage Indian Railways is the largest railway network in Asia and additionally world's second largest network operated underneath a single management. Due to its large size it is difficult to monitor the cracks in tracks manually. This paper deals with this problem and detects cracks in tracks with the help of ultrasonic sensor attached to moving assembly with help of stepper motor. Ultrasonic sensor allows the device to moves back and forth across the track and if there is any fault, it gives information to the cloud server through which railway department is informed on time about cracks and many lives can be saved. This is the application of IoT, due to this it is cost effective system. This effective methodology of continuous observation and assessment of rail tracks might facilitate to stop accidents. This methodology endlessly monitors the rail stress, evaluate the results and provide the rail break alerts such as potential buckling conditions, bending of rails and wheel impact load detection to the concerned authorities.

1.2 PURPOSE

Internet is basically system of interconnected computers through network. But now its use is changing with changing world and it is not just confined to emails or web browsing. Today's internet also deals with embedded sensors and has led to development of smart homes, smart rural area, e-health care's etc. and this introduced the concept of IoT. Internet of Things refers to interconnection or communication between two or more devices without human-to-human and human-to-computer interaction. Connected devices are equipped with sensors or actuators perceive their surroundings. IOT has four major components which include sensing the device, accessing the device, processing the information of the device, and provides application and services. In addition to this it also provides security and privacy of data . Automation has affected every aspect of our daily lives. More improvements are being introduced in almost all fields to reduce human effort and save time. Thinking of the same is trying to introduce automation in the field of track testing. Railroad track is an integral part of any company's asset base, since it provides them with the necessary business functionality. Problems that occur due to problems in railroads need to be overcome. The latest method used by the Indian railroad is the tracking of the train track which requires a lot of manpower and is time-consuming.

2. LITERATURE SURVEY

2.1. EXISTING SYSTEM

In the Existing train tracks are manually researched. LED (Light Emitting Diode) and LDR (Light Dependent Resister) sensors cannot be implemented on the block of the tracks]. The input image processing is a clamorous system with high cost and does not give the exact result. The Automated Visual Test Method is a complicated method as the video color inspection is implemented to examine the cracks in rail track which does not give accurate result in bad weather. This traditional system delays transfer of information. Srivastava et al., (2017) proposed a moving gadget to detect the cracks with the help of an array of IR sensors to identify the actual position of the cracks as well as notify to nearest railway station . Mishra et al., (2019) developed a system to track the cracks with the help of Arduino mega power using solar energy and laser. A GSM along with a GPS module was implemented to get the actual location of the faulty tracks to inform the authorities using SMS via a link to find actual location on Google Maps. Rizvi Aliza Raza presented a prototype in that is capable of capturing photos of the track and compare it with the old database and sends a message to the authorities regarding the crack detected. The detailed analysis of traditional railway track fault detection techniques is explained in table.

2.2 REFERNECES

S.NO	PAPER NAME	ADVANTAGES	DISADVANTAGES	CONCEPTS
1.	Automatic Water level monitoring and Seat	Water management is used for water	High performance	Water sensor, IR sensor,

	availability details in train using Wireless Sensor Network.	monitoring. IR sensor for seat availability		wireless network.
2.	5G key technologies for smart railways.	5G based technologies for spatial modulation	Low communication latency	5G edge, hybrid multicloud.
3.	Remote sensors	Used for extension of railroad systems.	Redesigning not possible. Advancement is not applicable	Remote sensors, RFID.
4.	Internet of things in high- speed railway	High speed railway to access multiple technologies.	Environmental sensing of IOT service.	MIOT, Transceiver.
5.	Railway experiment on point electric heating system	Simplicity and efficient	Requires manual application for switching	Pulse width modulation
6.	Smart railway feasibility and applications	Low power consumption and high reliability	Requires various transmission and reception schemes	Long range radios.

7.	Railway ticketing with GPS as ticket checker	It helps in ticket checking facility.	GPS can disable automatically due to manual errors.	Advanced communicat ion control and computing technologie s
8.	Passenger monitoring model for easily accessible public trains	It helps passengers travel using a transportation card.	It is applicable only for	It is used in reading ticket control, monitors passenger, RFID ticket inspection
9.	High speed railway control and communicatio n system	Feasibility of cellular network for high- speed railway	Unnecessary handovers can be caused.	Cellular networks
10.	Failure management strategies for IOT based railway system	Reliability, security and solution to failure in management	Failure can occur in communication channel	Internet of things
11.	Train collision avoidance by using RFID	The control room can identify and avoid the collision before hand	It is not considered as much safe because of improper communication.	RFID tag, GSM module controller and android device.

2.3 PROBLEM STATEMENT DEFINITION

Among the various modes of transport, railways is one of the biggest modes of transport in the world. Though there are competitive threats from airlines, luxury buses, public transports, and personalized transports the problem statement is to answer the question "What are the problems faced by the passengers while travelling by train at station and on board".

3. IDEATION AND PROPOSED SOLUTON

3.1 EMPATHY MAP CANVAS

3.2 IDEATION & BRAINSTORMING

not sitting in the same room.

- 10 minutes to prepare
- 1 hour to collaborate
- 2-8 people recommended

Learn how to use the facilitation tools

Use the Facilitation Superpowers to run a happy and productive session.

Open article

Key rules of brainstorming

To run an smooth and productive session

Stay in topic

Encourage wild ideas

Defer judgment

Listen to others

Go for volume

If possible, be visual

② Brainstorm

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

🕐 10 minutes

SANJAY T

Announcement before destination	Live positions
smart crowd checking and notifying.	Maintaining suitable journey time through machine learning
Monitoring air quality	Advanced lighting system

SANJANA R

Automatic sand checking for braking	Additional details to QR
Constant destination time update	Receiving feedback to improve facility
Fingerprint in addition to QR code	Initializing traffic control system

SANJAY S

Luggage safety	Automated train
Ticket price based on situations	Personal space
Checking cleanliness	sharing reviews about selected train

SARAVANA MUTHU

Checking disturbances in rails	Seat Update based on availability
Internet connectivity	Constant checking of water
Prevent noise for passenger statisfaction	ensuring safety

Group ideas

Take turns sharing your ideas while clust... all
sticky notes have been grouped, give ea...
bigger than six sticky notes, try and see...

⏱ 20 minutes

Additional
details to
QR

Constant
checking of
water

Live
workers

Receiving
feedback to
improve
facility.

Monitoring
air quality

Constant
destination
time update

Luggage
safety

Ticket price
based on
situations

Automatic
send
checking for
braking

Internet
connectivity

Announcement
before
destination

TIP

Add customizable tags to sticky
notes to make it easier to find,
browse, organize, and
categorize important ideas on
themes within your mural.

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

⏱ 20 minutes

Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

Live positions

Additional details to OR

Constant checking of water

Monitoring air quality

Receiving feedback to improve facility

constant destination time update

Automatic send checking for braking

Ticket price based on situations

Announcement before destination

Luggage safety

Internet connectivity

TIP

Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the H key on the keyboard.

Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

Share the mural
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

Export the mural
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint
Define the components of a new idea or strategy.
Open the template →

Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience.
Open the template →

Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template →

Share template feedback

3.3 PROPOSED SOLUTION

S.NO	PARAMETERS	DESCRIPTIONS
1	Problem Statement (Problem to be solved	In order to satisfy the passengers, the Railways provides various services to its passengers But, the passengers can face some problems.
2	Idea / Solution description	The idea is to minimize the ticket booking problems among the passengers by providing Online mode of booking rather than papers. . In queues in front of the ticket counters in railway stations have been drastically increased over the time.
3	Novelty / Uniqueness	Online mode of booking is most common and so ease of access to everyone that makes more efficient uniqueness of utilizing the technique. People can book their ticket through online and they get a QR code through SMS.
4	Social Impact / Customer Satisfaction	Customers for sure they get satisfied as they are in the fast roaming world this technique makes more easier for travelling passengers. A web page is designed in which the user can book tickets and will be provided with the QR code, which will be shown to the ticket collector and by scanning the QR code the ticket collector will get the passenger details.
5	Business Model (Revenue Model)	A web page is designed in which the user can book tickets and will be provided with the QR code, which will be shown to the ticket collector and by scanning the QR code the ticket collector will get the passenger details. The booking details of the user will be stored in the database, which can be retrieved any time.
6	Scalability of the Solution	The scalability of this solution is most feasible among the passengers who are willing to travel. No need of taking printout Counter ticket has to be handled with care, but SMS on mobile is enough. No need to taking out wallet and showing your ticket to TTR just tell your name to TTR that you are a passenger with valid proof.

3.4 PROBLEM SOLUTION FIT

1. CUSTOMER SEGMENT(S) `CS`

Passenger

Ticket collector

6. CUSTOMER CONSTRAINTS `CC`

Reducing the paper work of customer

5. AVAILABLE SOLUTIONS `AS`

A web page is designed in which the user can book tickets and will be provided with the QR code, which will be shown to the ticket collector and by scanning the

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

In their busy schedule as fast roaming world public in need of online booking process. In queues in front of the ticket counters in railway stations have been drastically increased over the time.

9. PROBLEM ROOT CAUSE `RC`

The main reason for the problem but has occurred due to lack of technology earlier. Since the passengers find it difficult to book the ticket and track the location of train.

7. BEHAVIOUR `BE`

By listening to the customer we can provide genuine empathy for the problem regarded

3. TRIGGERS `TR`

Save paper and workload

4. EMOTIONS: BEFORE / AFTER `EM`

No need of taking printout

Counter ticket has to be handled with care, but SMS on mobile is enough.

No need to taking out wallet and showing your ticket to TTR just tell your name to TTR that you are a passenger with valid proof

10. YOUR SOLUTION `SL`

A web page is designed in which the user can book tickets and will be provided with the QR code, which will be shown to the ticket collector and by scanning the QR code the ticket collector will get the passenger details.

The booking details of the user will be stored in the database, which can be retrieved any time.

8. CHANNELS of BEHAVIOUR `CH`

8.1 ONLINE

People can book their ticket through online and they get a QR code through SMS

8.2 OFFLINE

In web application passenger details are stored and the ticket collector can view their details at any time.

4.REQUIREMENT ANALYSIS

4.1. FUNCTIONAL REQUIREMENTS

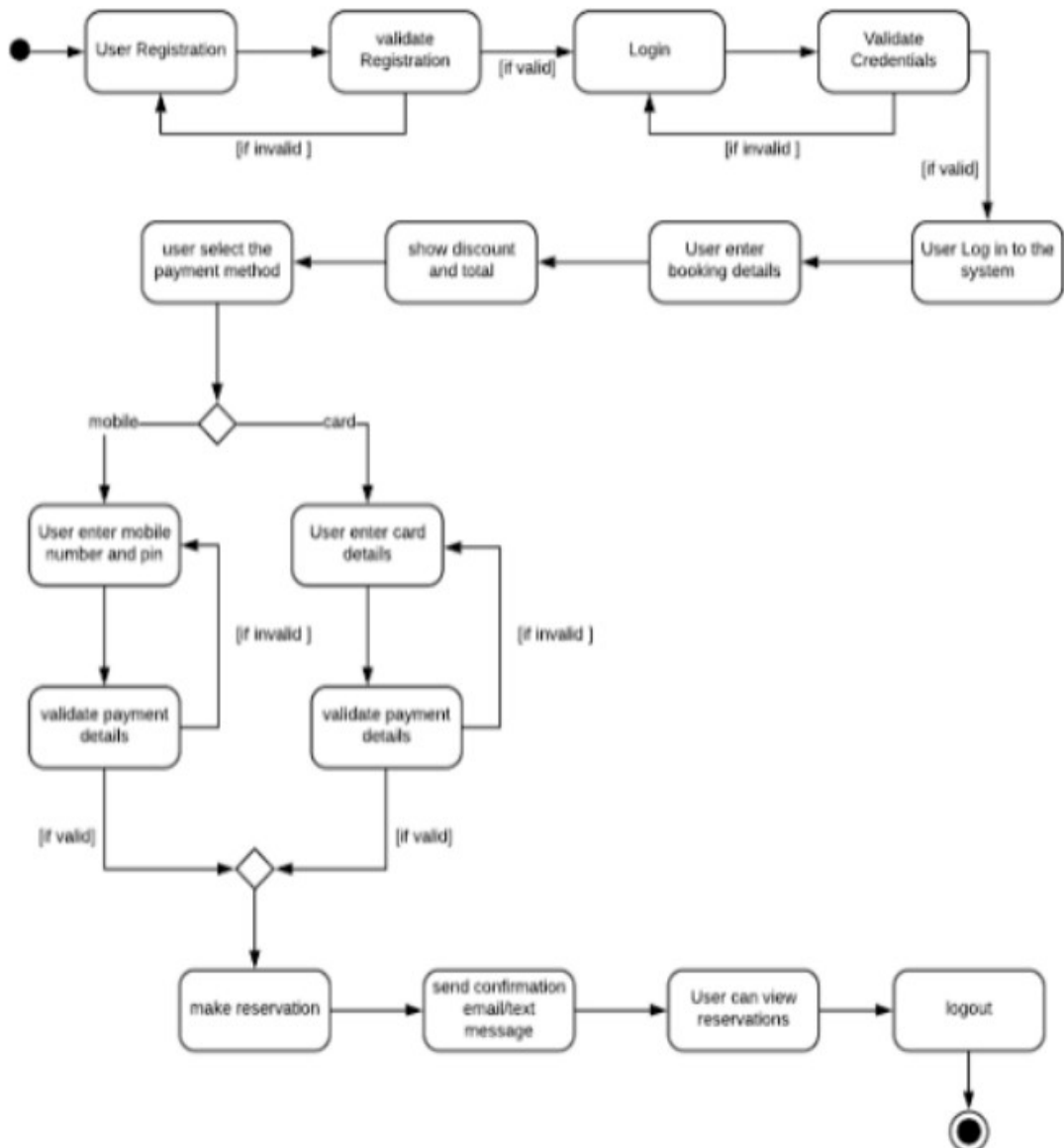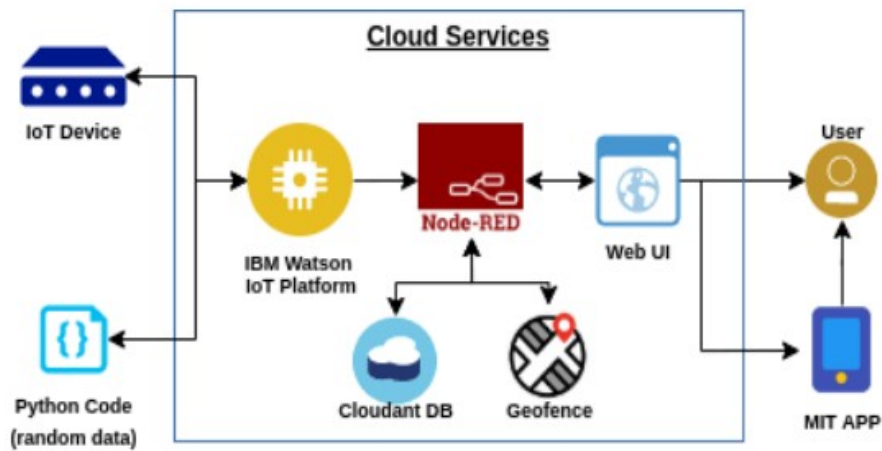| FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Unique accounts	Every online booking needs to be associated with an account. One account cannot be associated with multiple users.
FR-2	Booking options	Search results should enable users to find the most recent and relevant booking options
FR-3	Mandatory fields	System should only allow users to move to payment only when mandatory fields such as date, time, location has been mentioned
FR-4	Synchronization	System should consider timezone synchronisation when accepting bookings from different timezones
FR-5	Authentication	Booking confirmation should be sent to user to the specified contact details

4.2. NON-FUNCTIONAL REQUIREMENTS

NFR No.	Non-Functional Requirement (Epic)	Description
NFR-1	Usability	Search results should populate within acceptable time limits.
NFR-2	Security	System should visually confirm as well as send booking confirmation to the user's contact.
NFR-3	Reliability	System should accept payments via different payment methods, like PayPal, wallets, cards, vouchers, etc.
NFR-4	Performance	Search results should populate within acceptable time limits.
NFR-5	Performance	User should be helped appropriately to fill in the mandatory fields, incase of invalid input.
NRF-6	Scalability	Use of captcha and encryption to avoid bots from booking tickets.

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS
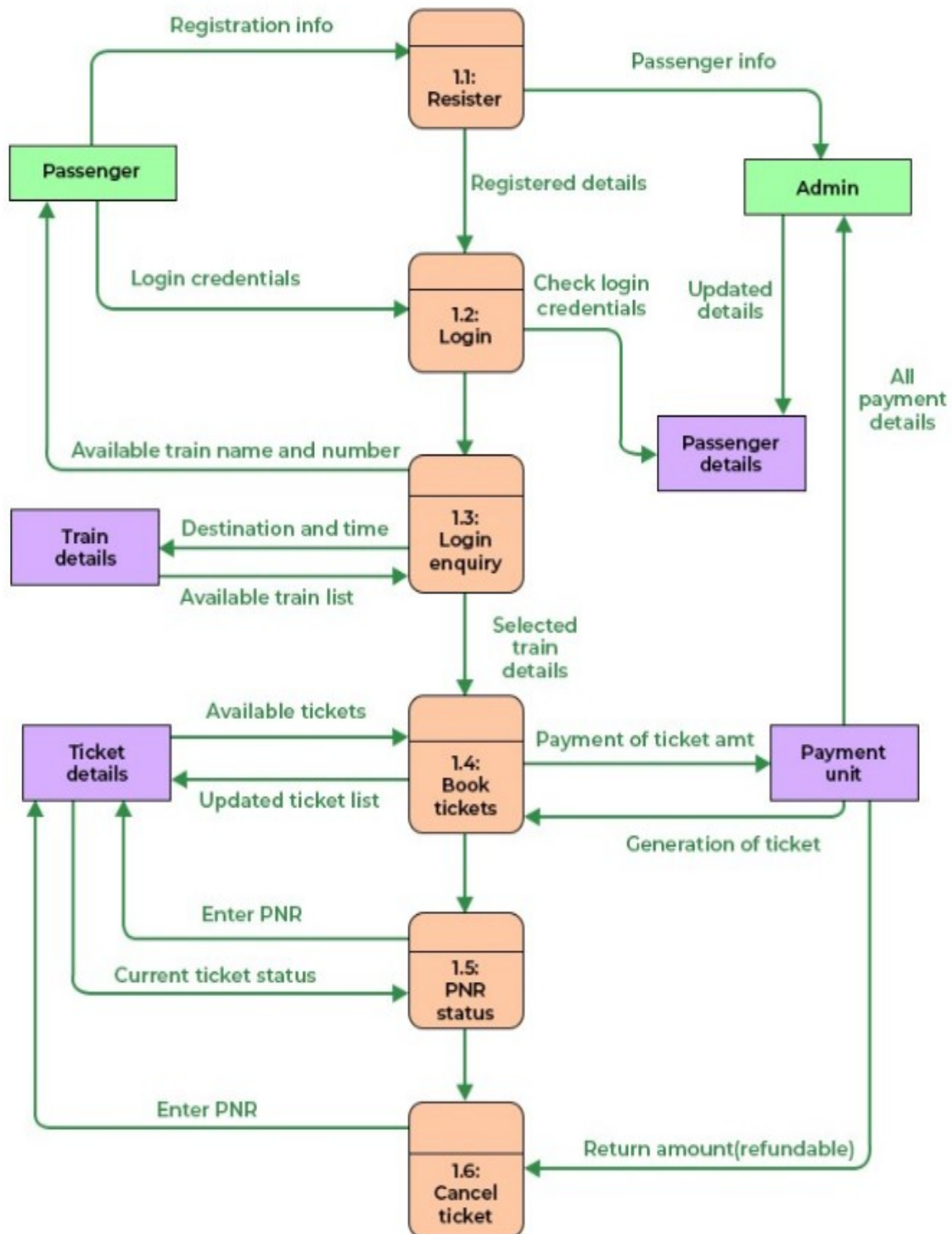
5.2 SOLUTION & TECHNICAL ARCHITECTURE

5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	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)	Registration	USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
Customer (Mobile user)	Registration	USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2

Customer (Mobile user)	Login	USN-4	As a user, I can log into the application by entering email & password	I can log in to the application by entering email & password	High	Sprint-1
Customer (Mobile user)	Dashboard	Users	The details will be stored safely	I can access it using database	Medium	Sprint-3
Customer (Web user)	Reserving ticket	User	Enter the details and click submit button to book ticket	I can use the QR code which is been generated	High	Sprint-4
Customer Care Executive	Connecting the service provider	Customer	Connects with the service by logging in	Can get connected with the server	Medium	Sprint-3
Administrator	Provides the services	Admin	The data is given by the user	Can add or update the data provided by the user	High	Sprint-4

6. PROJECT PLANNING AND SCHEDULING

6.1. SPRINT PLANNING& ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a Passenger, I can register for the application by entering my email, password, and confirming my password.	7	High	SANJAY T
Sprint-1		USN-2	As a Passenger, I will receive confirmation email once I have registered for the application	7	High	SANJANA R
Sprint-1	Login	USN-3	As a Passenger, I can log into the application by entering email & password	6	High	SANJAY T, SANJANA R
Sprint-2	Books Ticket	USN-4	I can select the Train and the train route to be travelled.	4	Medium	SANJAY S, SARAVANA MUTHU G
Sprint-2		USN-5	I provide the basic details such as name, age, mobile number, etc.	6	High	SANJAY S, SARAVANA MUTHU G
Sprint-2	Selecting the Seat	USN-6	After providing the basic information, I can	4	Medium	SANJANA R

			select the desired seat I wanted if it is in available state.			
Sprint-2	*QR Code Generation*	USN-7	At last the QR Code is generated which contains the unique id through which the passenger information can be retrieved.	6	High	SANJAY T
Sprint-4	*Tracking the location of Train*	USN-8	As a Passenger, I can track the exact current location of the train.	13	Medium	SANJANA R, SANJAY T, SANJAY S, SARAVAN A MUTHU G
Sprint-3	*Login*	USN-9	As a Administrator, I can log into the application by entering email & password	6	Medium	SANJANA R, SANJAY S, SARAVAN A MUTHU G
Sprint-4	*Cancel the Booking*	USN-10	As a Administrator, I can Cancel the Ticket if the information of the passenger is inappropriate.	7	Low	SANJAY T, SANJANA R, SARAVAN A MUTHU G, SANJAY S
Sprint-3	*TTR Verifies the Passenger*	USN-11	As a Ticket Checker, I can scan the QR Code shown by the passenger.	7	High	SANJAY T, SANJAY S, SARAVAN MUTHU G

6.2. SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	5 Nov 2022
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-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov2022

7. CODING AND SOLUTIONING

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

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	Commnets	TC for Automati	BUG	Executed By
1	Functional	Registration	Registration through the form by Filling 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				keerthika
2	UI	Generating 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 oto number	Working as expected	pass				Pandiselvi
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 verifed is to be displayed	Working as expected	pass				Buvaneshwari
4	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Enter into log in page 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter valid password in password text box 5.Click on login button	Username: abc@gmail password: Testing123	Application should show 'Incorrect email or password ' validation message.	Working as expected	pass				viji
5	Functional	Display Train details	The user can view about the available train details		1.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: Testing1236786867868676876	A user can view about the available trains to enter start and destination details	Working as expected	fail				priya

Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
Functional	Booking	user can provide the basic details such as a name, age, gender etc		1.Enter method of reservation 2.Enter name,age,gender 3.Enter how many tickets wants to be booked 4.Also enter the number member's details like name,age,gender		Tickets booked to be displayed	Working as expected	Pass				Buvaneshwari
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 are available		known to which the seats are available	Working as expected	pass				Viji
Functional	Payment	user, I can choose to pay through credit Card/debit card/UPI.		1.user can choose payment method 2.pay using tht 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				keerthika
Functional	Redirection	user can be redirected to the selected		1.After payment the usre will be redirected to the previous		After payment the usre will be redirected to the previous page	Working as expected	pass				priya

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisit	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Autom	BUG ID	Executed By
10	Functional	Ticket generation	a user can download the generated e ticket for my journey along with the QR code which is used for authentication during my journey.		1.Enter method of reservation 2.Enter name,age,gender 3.Enter how many tickets wants to be booked 4.Also enter the number member's details like name,age,gender		Tickets booked to be displayed	Working as expected	Pass				pandiselvi
11	UI	Ticket status	a usercan see the status of my ticket Whether it's confirmed/waiting/RAC		1.known to the status of the tivkets booked		known to the status of the tivkets booked	Working as expected	pass				Viji
12	Functional	Remainder notification	a user, I get remainders about my journey A day before my actual journey		1.user can get reminder nofication		user can get reminder nofication	Working as expected	pass				buvaneshwari
13	Functional	GPS tracking	user can track the train using GPS and can get information such as ETA, Current stop and delay		1.tracking train for getting information		tracking process through GPS	Working as expected	pass				keerthi

9.RESULTS

9.1.PERFORMANCE METRICS

10. ADVANTAGES &DISADVANTAGES

10.1. ADVANTAGES

- ◆ Openness – compatibility between different system modules, potentially from different vendors;
- ◆ Orchestration – ability to manage large numbers of devices, with full visibility over them.
- ◆ Dynamic scaling – ability to scale the system according to the application needs, through resource virtualization and cloud operation.
- ◆ Automation – ability to automate parts of the system monitoring application, leading to better performance and lower operation costs.

10.2.DISADVANTAGES

- ◆ Approaches to flexible, effective, efficient, and low-cost data collection for both railway vehicles and infrastructure monitoring, using regular trains;
- ◆ Data processing, reduction, and analysis in local controllers, and subsequent sending of that data to the cloud, for further processing.
- ◆ Online data processing systems, for real-time monitoring, using emerging communication technologies.
- ◆ Integrated, interoperable, and scalable solutions for railway systems preventive maintenance.

11.CONCLUSION

Accidents occurring in Railway transportation system cost a large number of lives. So this system helps us to prevent accidents and giving information about faults or cracks in advance to railway authorities. So that they can fix them and accidents cases becomes less. This project is cost effective. By using more techniques they can be modified and developed according to their applications. By this system many lives can be saved by avoiding accidents. The idea can be implemented in large scale in the long run to facilitate better safety standards for rail tracks and provide effective testing infrastructure for achieving better results in the future.

12.FUTURE SCOPE

In future CCTV systems with IP based camera can be used for monitoring the visual videos captured from the track. It will also increase security for both passengers and railways. GPS can also be used to detect exact location of track fault area, IP cameras can also be used to show fault with the help of video. Locations on Google maps with the help of sensors can be used to detect in which area track is broken.

13.APPENDIX

13.1. SOURCE PROGRAM

Node-Red Link : http://169.51.194.24:32439/red/#flow/102e93f0b4463fc5

13.2.GIT HUB LINK

https://github.com/IBM-EPBL/IBM-Project-10381-1659175438