SMART SOLUTIONS FOR RAILWAYS USING IoT PROJECT BASED LEARNING

NALAIYA THIRAN PROJECT BASED LEARNING ON PROFESSIONAL READLINESS FOR INNOVATION, EMPLOYNMENT AND ENTERPRENEURSHIP.

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ABSTRACT

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 railtracks 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.

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CHAPTER1

INTRODUCTION

1.1 PROJECT OVER VIEW

This project aims at development of a Railway Reservation System that facilitates the Railway customers to manage thei reservations and the Railway administrators to modify the backend databases in a User-Friendly manner.
This project includes the following functions:

1) Create newdatabase
2) Add new Record
3) Modify
4) Displayrecord
5) Ticket reservation
6)Ticket Modification
7)Ticket Cancellation
8) Ticket printing
9)Traintracking.

Our project introduces railway reservation system to makethe reservation system more efficient,easier and fast.This project explores how computer technology can be used to solve theproblem ofuser. Themain objectives provided bythis softwareare as follows: We can enquire about availability of trains We can reserve and cancel their seats We can modify the information related to Trains , Timetable, Train Name , Train Number, Ticket Fare. This project is dedicated to model existing railway reservation systems that aim at development of Railway Reservation System that facilitates the railway customer To manage their reservations and the railway administrator to modify the backend database in a user-friendly manner.

In this emerging world of computers, almost all-manual system has switched to automated and computerized system. Therefore, we are developing the software for “Railway Reservation System” to model the present system and to remove the drawbacks of the present system. This project explores how computer technology can be used to solve the problem of user. This being a big step in terms of improvement in the railway system it is widely accepted across the country rather than designing manually, we have made use of computer.

1.2 Purpose

The purpose of this sof twarenis to describe the Railway Reservation System which provides the rail timing details, reservation, enquiry,billing and cancellation on various types of reservation namely:

1.Confirm reservation for confirm seat

2.OnlinePayments

3.Traintracking

4.Reservation against cancellation

This project is dedicated to model the existing railway reservation system that aims at development of Railway Reservation System that facilitates the railway customer to manage their reservations and the railway administrator to modify the backend database in auser-friendly manner. The customer and the railway administrator are two parties that interact with the database, who have different ‘viewlevel schemas’ to the database information. The software provides acomprehensive set of features to enhancethe operational limits. Now one can easily plan the journey comfortably as the process is efficient and fast with being easy to access. The efficiency of the railway will increase result of computerization.

CHAPTER2

LITERATURE SURVEY

2.1 Existing problem

The biggest obstacle is poor connectivity in the net. When that is the case, it is advisable to stop trying at all. Because even if somehow you almost book the desired ticket, the payment part can frustrate the whole activity. Then your ticket as well as money is stuck. There are in numerable problems with Tatkal in busy season on busy routes.There is no way to beat the agents because they use every available legal and other way to get you the ticket. You should learn ways to save time, and you should try to plan in advance. That is the real alternative.Some times your money will get stuck even when everything is ok .Then the problem is with your bank's server. Here again there is little you can do.Now, it seems to bea challenge to develop an online booking system that offers multiple types of bookings on a single platform.It's always been challenging to manage online booking cancellations.If you provide the booking cancellation option to customers, you will frequently receive tons of booking cancellation requests from the customers that are too complex to manage. On the otherhand, if you will not provide the cancel booking option to your customers,you will be flooded with bookings or probably start receiving spams. This may also resultin a large number of no-shows if the customers find no option to cancel bookings.It's quite complex to manually set up a different price for each booking slot.In order to have a flexible price for each booking,your online booking system should be capable enough to show a different slot price of the same booking product on different dates.If you are in a Commerce business,you have to deal with customer complaints. Your customer may have a bad experience with your service but the main challenge dfis to handle such situations with grace.

2.2 References

SI NO	YEAR	AUTHOR	PAPPER NAME	CONCEPT	ADVANTAGES	DISADVANT
1.	2006	M.singh, J.Hempshall	Autonomous Rail Track Inspection using Vision Based System .	Image processing, rail track inspection .	Automatically find clips in video sequences and therea fter recognize .	Disconnected pix which are imposs link together as a cohesive clip.
2.	2009	Roman khoeblal, Roungsan chaisrichar oen	Passenger Monitoring Model for Easily Accessible Public City Trams/Trains	public transportation, train, passenger monitoring, passenger control, RFID distance Reading, ticket control, RFID ticket inspection.	It's possible to travel cross country with a single public transportation card, using Transport systems of several transport operators.	Applicable only f passenger monito
3.	2011	M.Hassan, S.Bruni	Crack Detection in Railway Axle Using Horizontal and Vertical Vibration Measurements	Investigations are carried out to assess the possible use of vibration measurements to identify the presence of a fatigue crack in railway axles.	effect of various sources of disturbance, namely wheel out-of roundness, can be more easily dealt.	High harmonic di
.4.	2012	Gourav Saha, V.Vai dehi	Robust Railway Crack Detection Scheme (RRCDS) Using LED-LDR ASSEMBLY	robust solution to the problem of railway crack detection utilizing.	cost effective.	In this range IR s very less.

5.	2013	Chaoyong peng,Yufei	Way-side wheel crack detecting using arrayed ultrasonic probes	It will detect the wheel crack by using ultrasonic rays.	It will eliminate the failure risks of wheels.	No cost effective.
6.	2015	Abbas, P.Sharma and N.Singh	Automatic Railway Track Crack Detection System	Addressing the issue by developing an automatic railway track crack detection system integrating an infrared red (IR) crack sensing module.	Crack is detected.	It is not fully auto
7	2015	V.Muralidharan, V.Dinesh, P.Manikandan	An Enhanced Crack Detection System for Railway track	To detect the railway crack.	Obstacle detection.	This process take time.
8.	2016	Sengudu	Review on railway track crack detection using IR transmitter and receiver	The defect information can be wirelessly transferred to railway safety management centre using a GSM module.	Cost of the unit is less when compared to other , No fire hazard problem due over loading.	It cost is very hig sometimes signal not properly.
9.	2017	Sopanharit h Sam,Joby titus	Automotiv e Crack Detection for Railway Track Using Ultrasonic Sensors.	Ultrasonic sensor is used to detect the crack in the railway track by measuring distance from track to sensor.	The auto crack detection method is more efficient in the technical field , Quick response is achieved.	IR Sensor range i 300 Micrometers.

10.	2017	Kazaz	Localizati on of an Unmanne d Aerial Vehicle for Crack Detection in Railway Tracks.	Localization of a UAV and how it can be applied for detecting cracks in a railway track using the concepts of image processing.	It find exact location of the crack.	Technique used h long process were time interval is no sufficient .

2.3 Problem Statement Definition

Online railway reservation is an efficient way to reserve tickets not by standing in the railway station queue.Now all railways has their own website for online reservation provide better customer service. The manual filling of reservation form cannot be changed once the details had bee nentered. The goal of online railway reservation is easing the task of railway activity.

Initially the customer has to create an ID in the Appropriate website, so that the user can login to the system for doing further activities.An online manager will maintain a database. Todo login process the customer has to fill a registration form that contains the username, password, first name and last name etc. After submitting the form to the server a customer ID is created with username and password thereby the customer with only the appropriate ID can reserve the tickets.

RESERVATION : The customer can reserve ticket by filling the reservation form present In the website. The reservation form present contain passenger name, sex, age, address, credit no, bank name, class through which the passenger is to travel etc. The online manager will verify the detail and provide PNR number to the customers who reserve the ticket.

CANCELLATION : The user can also perform cancellation of the ticket which he/she had reserved earlier by entering PNR no. This PNR no will be checked with the PNR no in the database.If it exists then it will be cancelled. After cancellation process the conformation message will be send by the server.

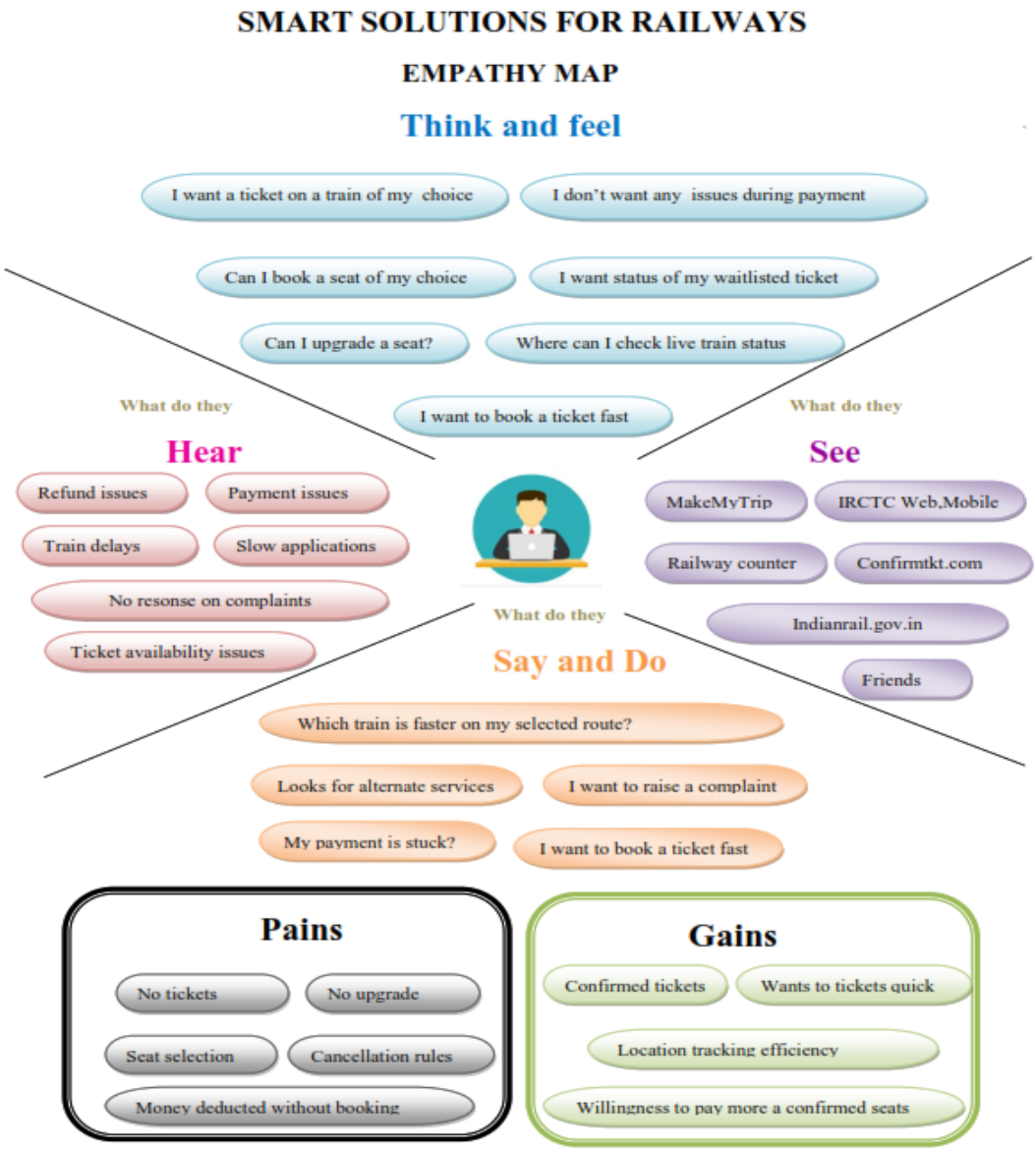
TICKET STATUS : The customer can also view the ticket status by entering the PNR number on the ticket status icon. To view the train details the user should click the train details icon in the homepage.

TRAIN DETAILS : It provide information about arrival and departure trains along with information about stations through which it passes search about train passing through stations can be obtained either by means of train no, train name or specifying the source and destination station. While displaying information about train it has to provide following information. Stations through which train passes along with arrival and departure time.Availabilityof seats in different classes along with waiting list. Before Issuing ticket the amount from customer has to be transferred to the railway account. Thus this has simplified the task of reservation, cancellation of tickets in railways.

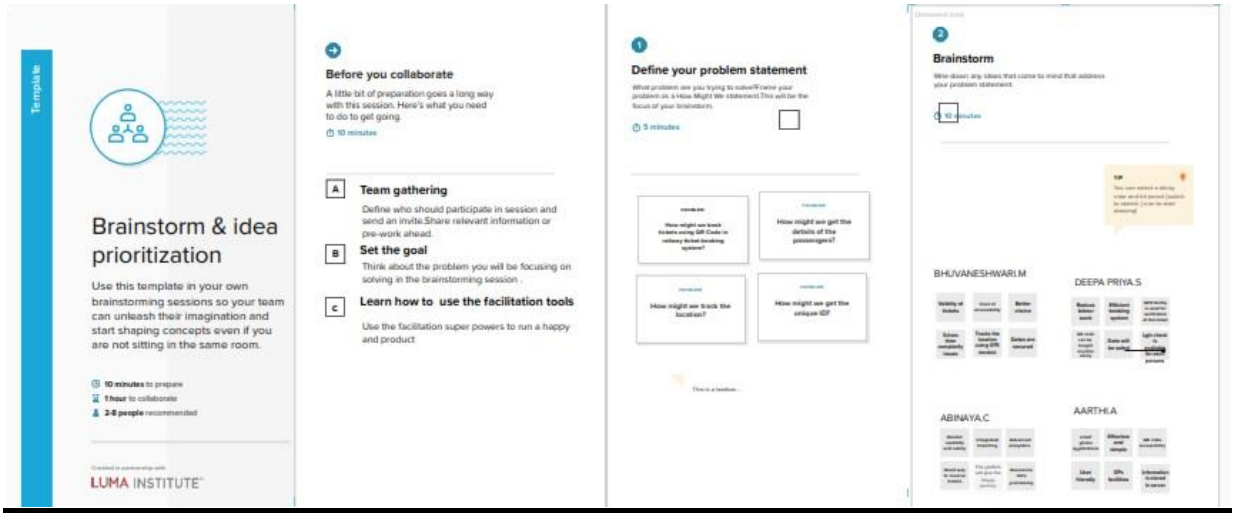
CHAPTER-3

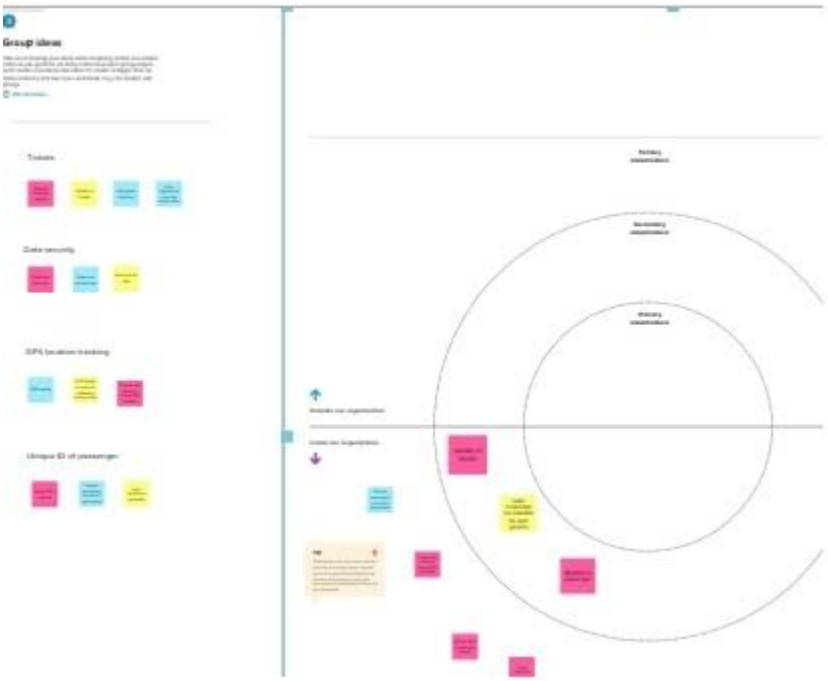
IDEATION & PROPOSED SOLUTION

3.1 EmpathyMap Canvas



3.2 Ideation & Brainstorming





3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	• Smart Solutions for railways is designed to reduced 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	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	• 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	• The booking tickets is 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. • One can manage online ticket booking and apply for a cancellation in case of any 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)	• with this solution - By using this application, the customer can schedule their destination, view availability of the seat, view interactive seat map and select their seat for their convenience. Moreover, it enables your customers to 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 to ticket collector.

6.	Scalability of the Solution	• No need of taking print out. Counter ticket has to be handled with care, but SMS on mobile is more than enough. • You are becoming environment friendly and contributing for greener planet by ignoring printout . • No need of taking out wallet and showing your ticket to TTR, just tell your name to TTR that you are passenger with a valid proof. • While booking counter ticket you had to carry cash and while booking E- ticket you are paying through online directly from bank which makes work more easy for you.

3.4 Problem Solution Fit

Problem solving is the act of defining a problem; determining the cause of the problem; identifying, prioritizing, and selecting alternatives for a solution; and implementing a solution. In order to effectively manage and run a successful organization, leadership must guide their employees and develop problem-solving techniques. Finding a suitable solution for issues can be accomplished by following the basic four-step problem-solving process and methodology outlined below.

CHAPTER4

REQUIREMENT ANALYSIS

4.1 Functional Requirement

Following are the functional requirements of the proposed solution:

FR No.	Functional Requirement (Epic)	SubRequirement (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 sended through the email id.
FR-2	User Verification	The verification code is sended 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 from and to option.We must enter the details then after that we can able to see the number of trains availability and seats availability.We can select the particular train and particular seats which we need and click the confirm option.
FR-5	Payment process	After entering all the details select the payment option like google pay,phone pay,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 to the ticket collector when the QR code is scanned booking details will be shown .

4.2 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 sended 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 obtain..

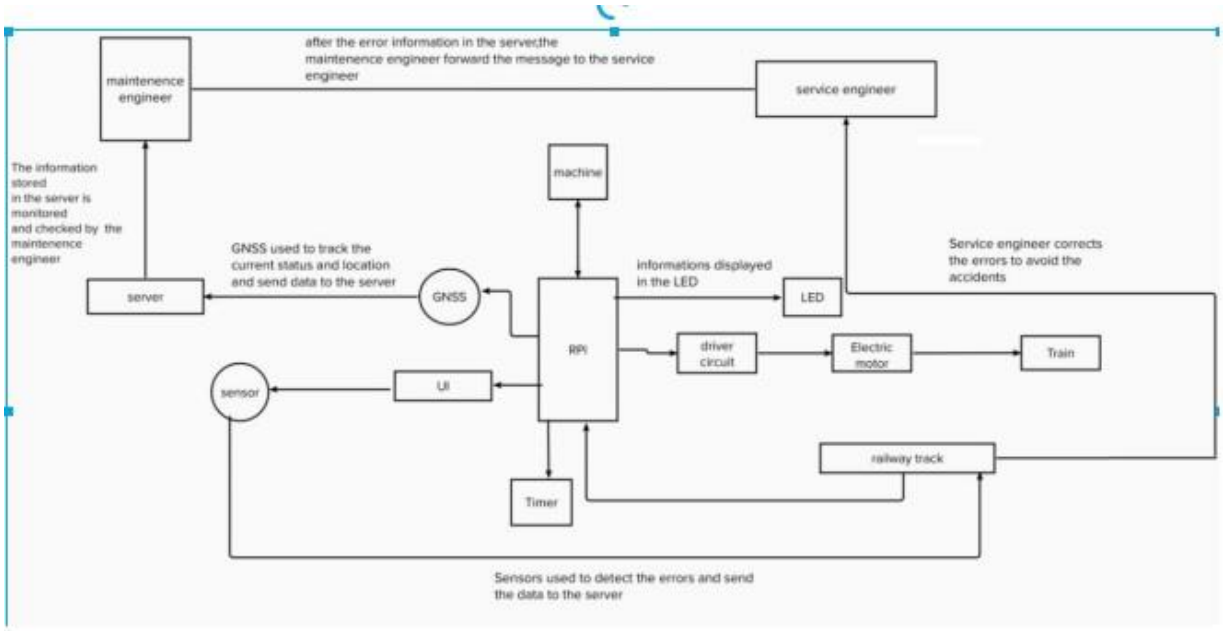
CHAPTER-5

PROJECT DESIGN

5.1 DataFlow Diagram

A DataFlow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically.It shows how data enters and leaves the system, what changes the information, and wheredatais stored.

Data flow diagram:



5.2 User Stories

(1) Information collection module In order to realize the real-time collection and update of the information and ensure the accuracy of the information, the existing internet of things equipment such as monitoring, smoke feeling, fire control sign and so on are used to collect the field information and efficiently understand the situation on the spot.

(2) Model module The BIM model of the building is established by using BIM technology. The model includes the information of all the components in the building, the information of water, electricity and gas and all the information of fire extinguishing equipment, thus which can provide data support for indoor escape and rescue of building firefighting.

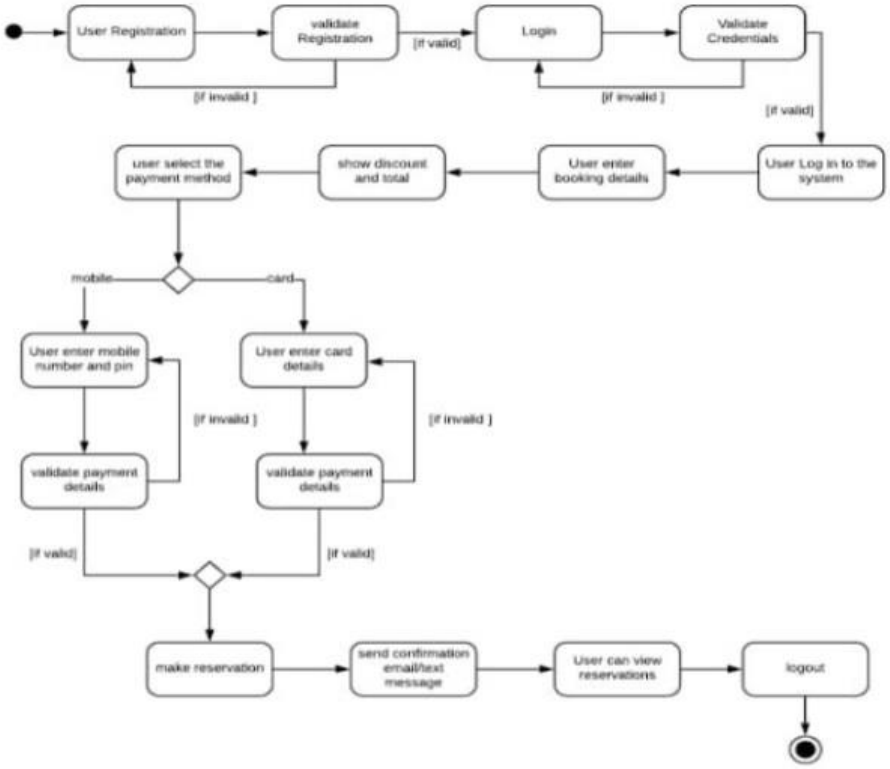
(3) Intelligent processing module The intelligent processing module can automatically plan the rescue path, rescue tools, indoor escape path, and modify the contents of fire protection sign by synthetically processing the data of the information collection module and the model module.

(4) Decision module The rescue center reads the information on the equipment and models of internet of things, and other information through the decision module, and issues the emergency evacuation command, at the same time, which chooses the outdoor rescue routes and rescue tools, and sends rescue orders to the rescue teams.

(5) Information feedback module After the decision is made, the information feedback module automatically releases the best escape route to the survivors, and indicates the location of the fire rescue tools nearby, besides provides the best rescue route, rescue ways, rescue tools and other information to the rescuers, and relieves the alarm in time after the rescuing.

(6) Escape terminal APP module.

5.3 Solution &Technical Architecture



CHAPTER-6

PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

Sprint planning is an event in scrum that kicks of the sprint. The purpose of sprint planning is to define what we can deliver in the sprint and how that work will be achieved. Sprint planning is done in collaboration with the whole scrum team

Project Planning Phase
Milestone and Activity List

Date	24 October 2022
Team ID	PNT2022TMID36769
Project Name	Industry-specific intelligent fire management system

TITLE	DISCRIPTION	DATE
Literature Survey& Information Gathering	Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc.	03 SEPTEMBER 2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list ofproblem statements	07 SEPTEMBER 2022
Problem Statement	Prepare Problem statement of Industry-specific intelligent firemanagement system	10 SEPTEMBER 2022
Ideation	List the by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	16 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.	26 SEPTEMBER 2022
Solution Architecture	Prepare solution architecture document.	30 SEPTEMBER 2022
Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit).	8 OCTOBER 2022
Functional Requirement	Prepare the functional requirement document.	11 OCTOBER 2022
Data Flow Diagrams	Draw the data flow diagrams and submit for review.	14 OCTOBER 2022
Technology Architecture	Prepare the technology architecture diagram.	16 OCTOBER 2022
Prepare Milestone & Activity List	Prepare the milestones & activity list of the project.	24 OCTOBER 2022
Sprint Schedules	Prepare the sprint plan and divided tasks according to agile method.	24 OCTOBER 2022
Project Development-Delivery Sprint - 1	Develop & submit the developed code by testing it.	29 OCTOBER 2022 IN PROGRESS.
Sprint - 2	Develop & submit the developed code by testing it.	05 NOVEMBER 2022 IN PROGRESS.
Sprint - 3	Develop & submit the developed code by testing it.	12 NOVEMBER 2022 IN PROGRESS.
Sprint - 4	Develop & submit the developed code by testing it.	19 NOVEMBER 2022 IN PROGRESS.

6.2 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned EndDate)	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	05 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Oct 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	15 Oct 2022

CHAPTER – 7

CODING & SOLUTIONING

7.1 Feature-1

- IBM Watson Platform
- NodeRed
- Cloudant DB
- Ticket Cancellation
- AddingQueries

7.2 Feature-2

Registration

Login

Verification

Ticket Booking

Payment

CHAPTER-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
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
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 otp number	Working as expected	pass
3	Functional	OTP verification	Verify user otp using mail		1.Enter gmail id and enter password 2.click submit	Username: abc@gmail.com password: Testing123	OTP verified is to be displayed	Working as expected	pass
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
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: Testing12367868678687	A user can view about the available trains to enter start and destination details	Working as expected	fail

t case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status
1	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
2	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
3	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
4	Functional	Redirection	user can be redirected to the selected		1.After payment the usre will be redirected to the previous page		After payment the usre will be redirected to the previous page	Working as expected	pass

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status
1	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 displaged	Working as expected	Pas
2	UI	Ticket status	a user can 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	pas
3	Functional	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	pas
4	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	pas

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status
1	Functional	Ticket cancellation	user can cancel my tickets there's any Change of plan		1.tickets to be cancelled		Tickets booked to be cancelled	Working as expected	Pas s
2	UI	Raise queries	user can raise queries through the query box or via		1.raise the queries		raise the queries	Working as	pass
3	Functional	Answer the queries	user will answer the questions/doubts Raised by the customers.		1.answer the queries		answer the queries	Working as expected	pass
4	Functional	Feed details	a user will feed information about the trains delays and add extra seats if a new compartment is added		1.information feeding on trains		information feeding on trains	Working as expected	pass

CHAPTER-9

RESULTS

9.1 Performance Metrics

We have successfully used to built a web based UI and integrated all the servies using Node RED web Application: https://node-red-brcrj-2022-11-18.eu-gb.mybluemix.net/red/#flow/e9522b9f8417b54d

CHAPTER 10

ADVANTAGES & DISADVANTAGES

10.1 ADVANTAGES

- Openness– compatibility between different system modules.
  Potentially from different vendors.
- Orchestration – abilityto manage large numbers of devices, withfull visibility over them.
- Dynamicscaling–abilityto scale the system according to the application needs, through resource virtualization and cloud operation.
- Automation– abilityto 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 sendingof that data to the cloud, for further processing.
- Onlinedata processing systems, for real- time monitoring, using emerging communication technologies.
- Integrated, interoperable, and scalable solutions for railway systems preventive maintenance.

CHAPTER – 11

CONCLUSION

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

CHAPTER 12

FUTURE SCOPE

If anyone wants to extend this project then he/she can make an additional database of Train Fare And database for updated availability of seats which is available after the cancellation of ticket on that specifictrain etc. He/she can also add some more command buttons in the existing software and extend working of the existing software. Implementations of this project idea are in industrial use. Hence, this can be used for suggesting improvements in design, performance end greater usability.Apart from the industrial applications, it is a research-oriented project as well, the task of performance evaluation of different database designs, for efficiency, is in this spirit. He/she also add some online payments method into this project.

APPENDIX

Source code

```
#include<WiFi.h>//library for wifi
#include<PubSubClient.h>//library for MQtt
#include"DHT.h"// Library for dht11
#define DHTPIN 15// what pin we're connected to
#define DHTTYPE DHT22   // define type of sensor DHT 11
#define LED 2
DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin and typr of dht
connectedvoid callback(char* subscribetopic, byte* payload, unsignedintpayloadLength);
//-------credentials of IBM Accounts------

#define ORG "zbgr67"//IBM ORGANITION ID
#define DEVICE_TYPE "fershidevicetype"//Device type mentioned in ibmwatson IOT
Platform
#define DEVICE_ID "fershideviceid"//Device ID mentioned in ibmwatson IOT
Platform
#define TOKEN "fershiageona"//TokenString
data3;

float t;

//-------- Customise the above values --------char server[] = ORG
".messaging.internetofthings.ibmcloud.com";// Server Namecharpublishtopic[] = "iot-
2/evt/Data/fmt/json";// topic name and type of event perform and format in which data to be
send
charsubscribetopic[] = "iot-2/cmd/command/fmt/String";// cmd  REPRESENT command type
AND COMMAND IS TEST OF FORMAT STRINGcharauthMethod[] = "use-token-auth";//
authentication methodchar token[] = TOKEN; charclientId[] = "d:" ORG ":" DEVICE_TYPE
":" DEVICE_ID;//client id

//---------------------------------------
WiFiClientwifiClient; // creating the instance for wificlient
PubSubClient client(server, 1883, callback ,wifiClient); //calling the predefined client id by
passing parameter like server id,portandwificredentialvoidsetup()// configureing the ESP32
{
Serial.begin(115200);
dht.begin();
pinMode(LED,OUTPUT);
delay(10);
 Serial.println();
```

```
 wificonnect();
  mqttconnect();
}
  voidloop()// Recursive Function
{

  t = dht.readTemperature();
Serial.print("temperature:");
Serial.println(t);

PublishData(t);
delay(1000);
if (!client.loop())
 {
  mqttconnect();
  }
}



/*.....retrieving to
Cloud.....*/
voidPublishData(float temp) {
mqttconnect();//function call for connecting to ibm
/*     creating the String in in form JSon to update the data to ibm cloud  */
String payload = "{\"temperature\":";
payload += temp;   payload += "}";


Serial.print("Sending payload: ");
Serial.println(payload);

if (client.publish(publishTopic, (char*) payload.c_str()))
 {
Serial.println("Publish ok");// if it sucessfully upload data on the cloud then it will print
publish ok in Serial monitor or else it will print publish failed
  }
Else
 {
Serial.println("Publish failed");
  }
   }
voidmqttconnect()
 {
if (!client.connected())
```

```
 {
Serial.print("Reconnecting client to ");
   Serial.println(server);
while (!!!client.connect(clientId, authMethod, token))
{
 Serial.print(".");       delay(500);
    }
initManagedDevice();
Serial.println();
  }
}
voidwificonnect() //function defination for wificonnect
{
Serial.println();
Serial.print("Connecting to ");

WiFi.begin("Wokwi-GUEST", "", 6);//passing the wifi credentials to establish the
connectionwhile (WiFi.status() != WL_CONNECTED)
{
 delay(500);
Serial.print(".");
  }
Serial.println("");
Serial.println("WiFi connected");
Serial.println("IP address: ");
Serial.println(WiFi.localIP());
}
 voidinitManagedDevice()
 {
if (client.subscribe(subscribetopic))
{
  Serial.println((subscribetopic));
Serial.println("subscribe to cmd OK");
  }
 else
{
Serial.println("subscribe to cmd FAILED");
  }
}
void callback(char* subscribetopic, byte* payload, unsignedintpayloadLength)
{

Serial.print("callback invoked for topic: ");
Serial.println(subscribetopic);
 for (inti = 0; i<payloadLength; i++)
```

```
 {
  //Serial.print((char)payload[i]);
   data3 += (char)payload[i];
  }

Serial.println("data: "+ data3);
if(data3=="lighton")
   {
Serial.println(data3); digitalWrite(LED,HIGH);

  }
else
  {
Serial.println(data3);
digitalWrite(LED,LOW);
   }
data3='';


}
```

GitHub & Project demo link

GitHub Link - https://github.com/IBM-EPBL/IBM-Project-50068-1660891485

Demo link - https://youtu.be/G8nMPdCmm4Q