PROJECT REPORT

TEAM ID	**PNT2022TMID29193**
PROJECT NAME	**Smart Solutions for Railways**
Domain Name	**Internet of Things(IOT)**
Team Lead	**Swedha R**
Team Members	**Kanimozhi S** **Abirami M** **Pavithra J**
Mentor	**Suganya J**
College Name	**Mailam Engineering College**
Department	**Electronics and Communication Engineering**

1. INTRODUCTION

1.1 PROJECT OVERVIEW

People use Indian Railways to travel even on daily basis and if the railways are not secure and prone to accident then life of many A lot of people in India travel to other places using railways and some people are at risk. A lot of railway accidents occur at level crossing that is the point of intersection of road and railway track and the reason in most of the cases in human error. So, to avoid the accidents caused due to human failure this model is to make level crossing unmanned and smart than can reduce the chances of accidents manifold. In this proposed paper we have implemented ideas such as pre-crashing using RFID senser. This model automatically closes the gates of railway crossing when the train is arriving near the crossing before a safe interval of time so that there is no chance of human error. Also, our model keeps a track of the train passed from the particular crossing along with exact time of passing so that the data is maintained that too without human effort.

1.2 PURPOSE

Railways have to continually ensure that the rolling stock and infrastructure are in good condition, with high resilience against failures. There are number of challenges in planning of high-quality maintenance that has to be organized on efficient and cost effective manner. We wanted to be a part of our surrounding with some change and advancement. So that it can bring the better life of the middle class and lower class people to travel in high security. The train is one and only most widely used transportation and not only for this they are used for goods transportation also .Indian railways are not able to facilitate the customer properly due to crowded amount of people. Statistics show that the leading cause of death by injury in railways traffic accidents(two train collision each other). There are number of causes for which an accident can occur, some of them are; lack of

training for driving or less experiensed, use of mobile phone while driving, unskilled drivers, driving while intoxicated, bad railway tack condition, overloading in tain and negligence traffic management. In this survey paper, we briefly review selected railway accidents detection techniques and propose a solution. Rear end crashes occur mainly due to obstracle and crack in tracks. According to recent statistics, a major percentage of train accident happen due to not proper survillance of railway track The existing system in semi automated railway accidents are occuring at frequently, consideration this in mind we want to bring some change and make it effective so that it becomes a compulsory and law for practice.

- Its application increases safety, efficiency and ease of use with train management systems. Control and surveillance systems reduce the risk of collisions and regulate speed. Advanced consumer technologies help maximize connectivity and allow passengers to continue their activities on smart devices while travelling.
- IoT technologies help railways successfully manage passenger safety, operational efficiency, and the passenger experience
- Smart sensors can be used to track important assets, manage passenger flow, and enable predictive maintenance
- Connect people, sensors, trains and automated train systems with the highest security. Transform your communications and operations from departure to destination and beyond. Secure communications. Enhancing overall service. Lower operational cost IoT applications.
- The Corporate aim of the Indian Railways is to commit itself to ensuring that all its activities are managed to the highest level of safety which is pragmatic and reasonably practicable to achieve.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

Most of the public transportation infrastructure in European cities is easily accessible. The majority of the tram/train stations are located in an open and "gate-free" environment, easy available to everyone and hence introduces potential malfunctions in the system. This is why fare dodging (hopping on the tram/train without paying for a ticket) is simple. This paper suggests a conceptual framework and architecture to capture free riders (fare dodgers) in an early stage by using a RFID distance scan combined with people counting techniques as a tool to locate andmonitor passengers. As a case study this paper uses the ticketing system in The Netherlands. It is a RFID-based ticketing system which uses a smartcard called OV-Chip card. It explains the current setup in The Netherlands, systems and architectures used and shows where possible problems and improvements could be achieved.

An experiment is done to measure certain basic distance read ranges in different situations and locations. The results show that by making use of a different system architecture (RFID technology and People Counting Techniques) an improvement in catching free rides (faredodgers) in a much earlier stage is inspectors.

2.2 REFERENCES

1. INTERNET OF THINGS FOR SMART

RAILWAYSAuthors: Ohyun Jo, Yong-Kyu Kim,

Juyeop Kim

Date of Publication: 06 September 2017

Project Description:

The explosively growing demand of Internet of Things (IoT) has rendered broad scale 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 introduces a cost-effective IoT solution consisting of 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 networkarchitecture of 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.

2. SMART TRAIN DETECTOR USING IoT APPROACH

Authors: Payal Srivastava, Rana Majumdar, Bonny Paulose, Sunil Kumar Chowdhary, Abhishek Srivastava

Date of Publication: January 2019

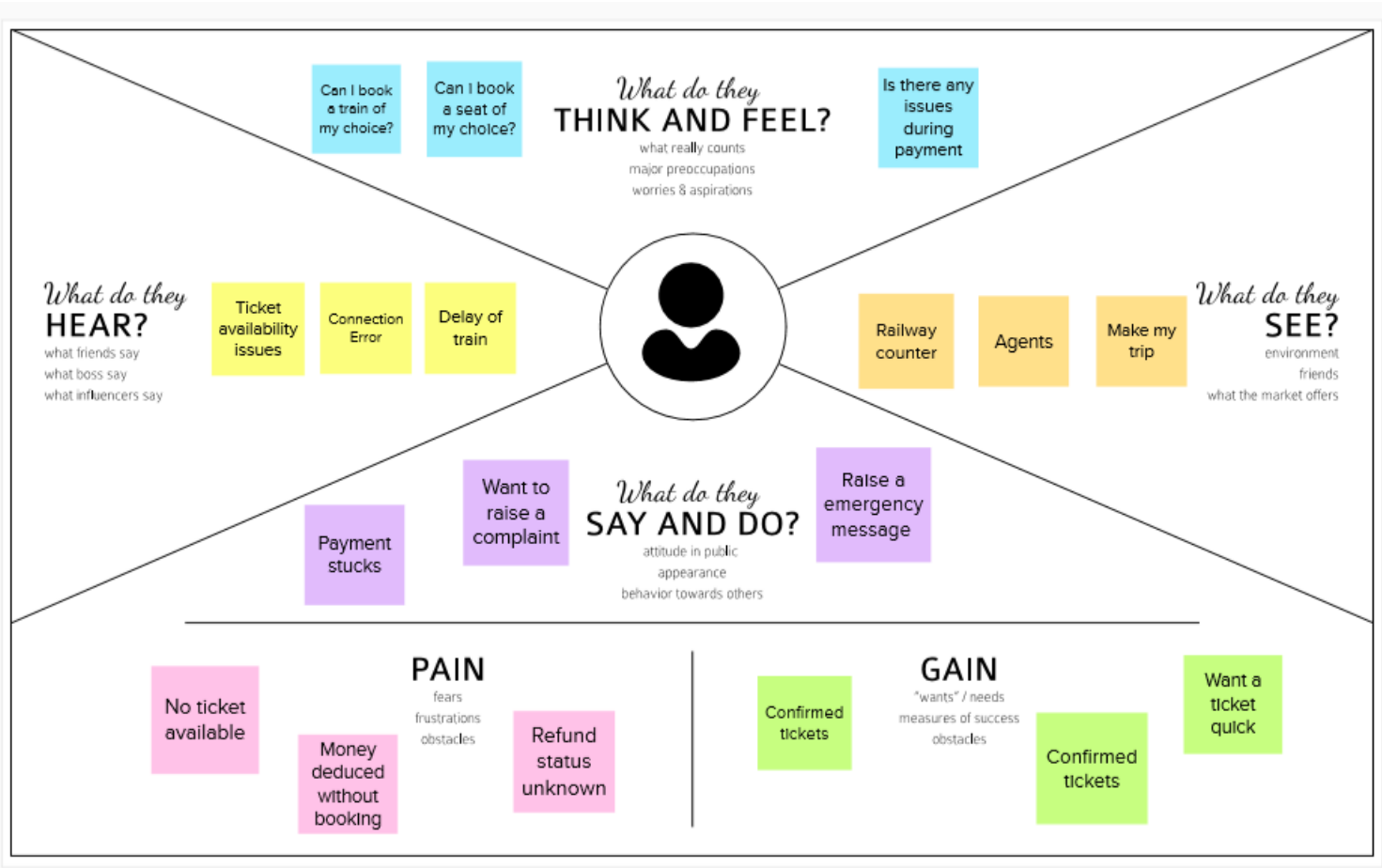
Project Description:

Only metal detection in railway tracks to indicate the movement of train is not sufficient. The sensors present in the railway tracks can detect any metal object,be it a train or mere a coin. Thus, in order to make the working more foolproof, introduction of another parameter, i.e., weight on the railway track is necessary.

This paper describes an approach to collaborate metal detection with weight detection in railway tracks to detect the train movement using the principle of IoT, using the load cells along with the metal sensors.

3 .IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAINSTROMING

Step-1: Team Gathering, Collaboration and Select the Problem Statement

Define your problem statement

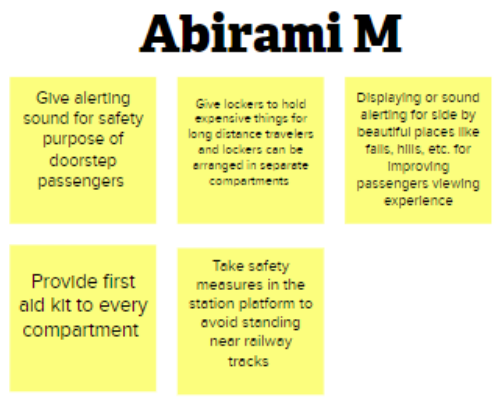
What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

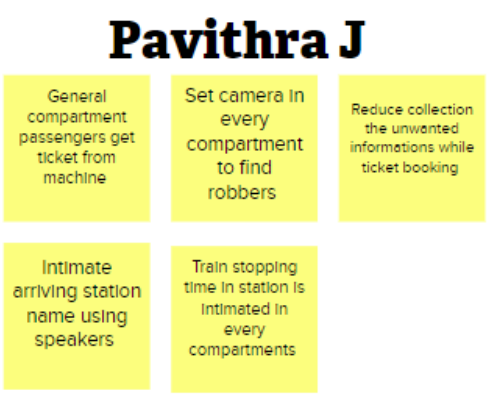
5 minutes

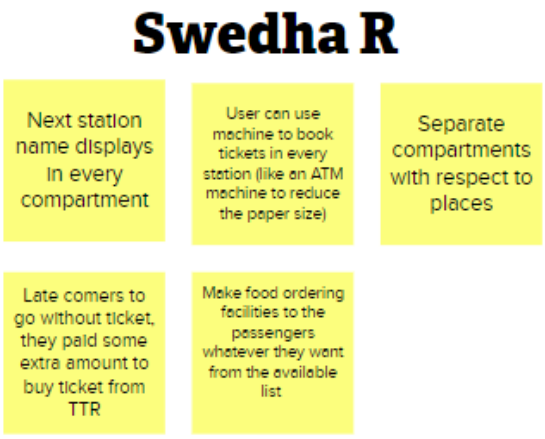
PROBLEM

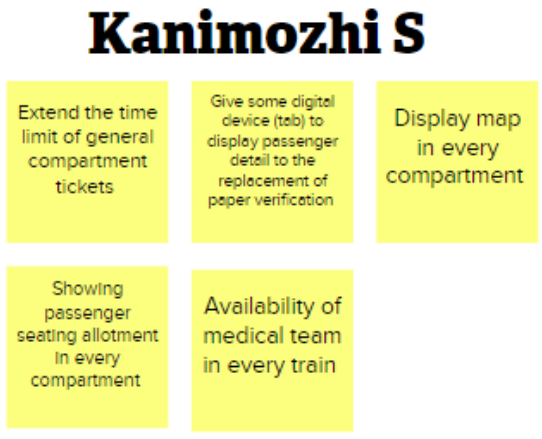
Reduce the word load of the user and also the use of paper

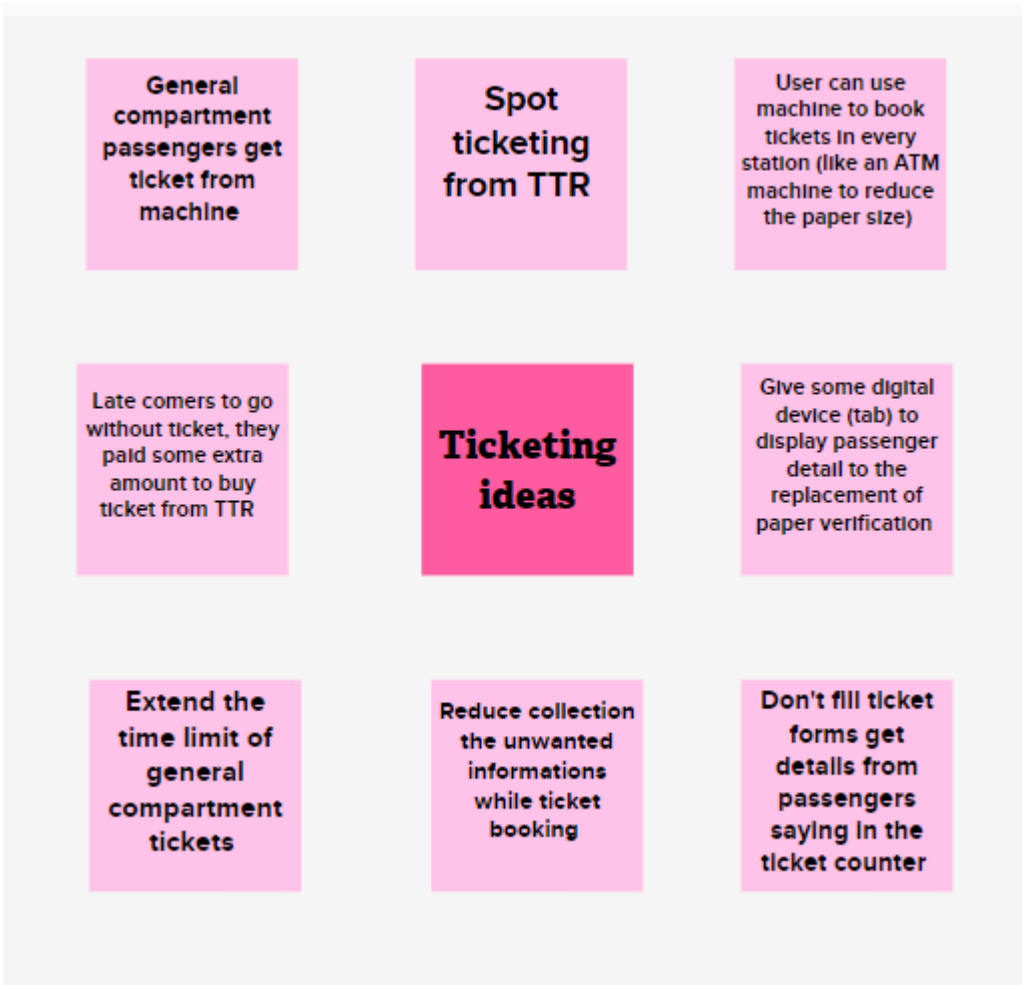
Step-2: Brainstorm, Idea Listing and Grouping

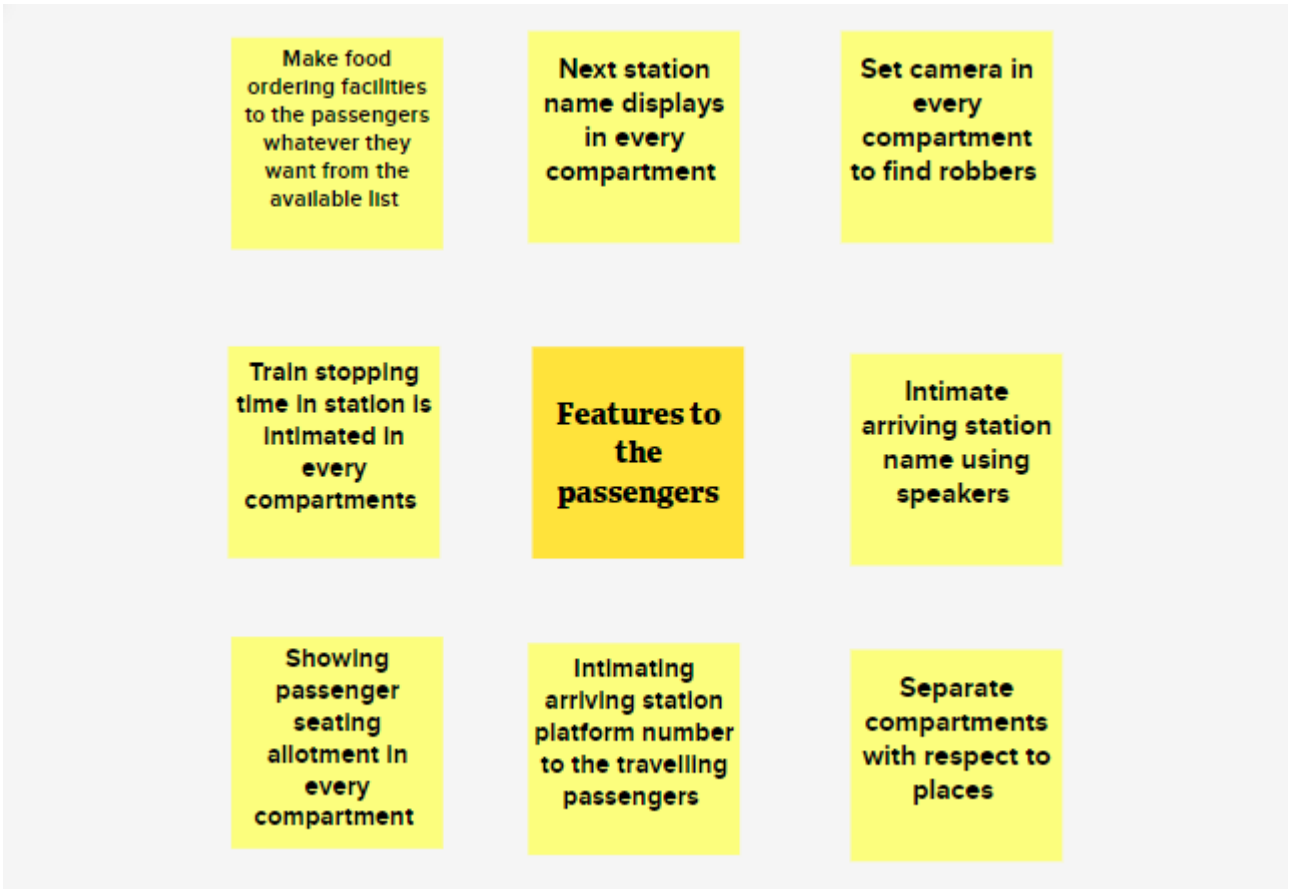








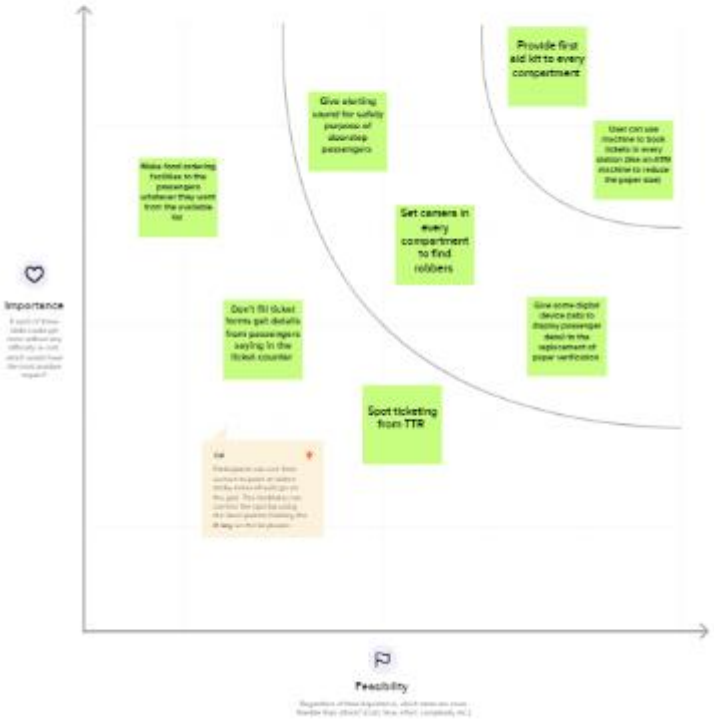




Step-3: Idea Prioritization

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



3.3 PROPOSED SOLUTION

Transportation systems are complex with respect to technology and operations due to the involvement of a wide range of human actors, organizations and technical solutions. There is a need to apply intelligent computerized systems for the operation and control of such complex environments, such as computerized traffic controlsystems for coordinating advanced transportation.

Industry 4.0 is enabled by smart systems and Internet-based solutions. Maintenance is one of theapplication areas of self-learning, and smart systems can predict failure and trigger maintenance by making use of the Internet of things(IoT).

There is no established path for success of any emerging technology, but creatinga roadmap can help the rail and aviation industries to bring a more digital and connected future. The need for these industries to be smart is there because Industry 4.0, or the fourth generation of industrial activity, ensures reliability and safety to these sectors.

With automation of the manufacturing industry, these sectors will realise efficiency, capacity and cost benefits of Industry 4.0. Enhanced industry-wide condition monitoring will also help reduce unplanned maintenance. Both sectors are in constant search for improvements to deliver better and secure customer experience.

3.4 PROPOSED SOLUTION FIT

The digital railway program is focused mainly on digital signaling technology, which aims to enhance safety and speed up train movement in a congested network. If all data from signaling, rolling stock and passenger traffic control systems is brought together on a common platform, the entire network will be able to communicate seamlessly and instantaneously. The key to digitalization is the interoperability of systems while retaining a critical approach to data security. Rail service information could even be integrated with other transport modes, such as bus and taxi services, to guide passengers through smooth door-to-door journeys. Holistic data management could lead to the transformational change in real-time intelligent traffic management and in-cab signaling. This could improve customer satisfaction, with station information systems and personalized messagingproviding passengers with all the relevant information they need.

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Checking	Checking via Email Checking for Conformation
FR-4	User Approval	Approval for Finalization

4.2 NON-FUNTIONAL REQUIREMENTS

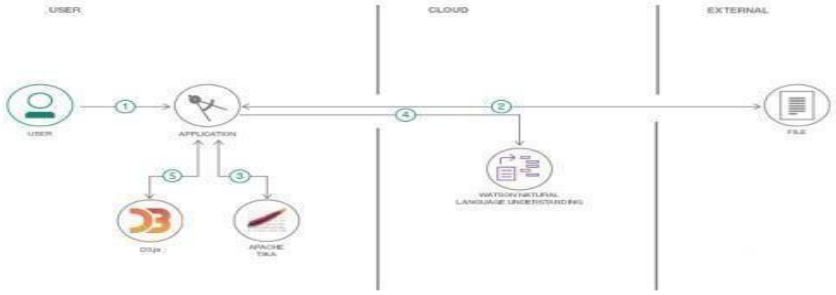
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Usually, such sources as the above-mentioned BABOK list non-functional requirements in an isolatedmanner. We grouped some of them since the approaches to documenting these requirements overlap and some can't be estimated without the other ones.
NFR-2	**Security**	Security is a non-functional requirement assuring all data inside the system or its part will be protected against malware attacks or unauthorized access. Butthere's a catch. The lion's share of security non- functional requirements can be translated into concrete functional counterparts. If you want to protect the admin panel from unauthorized access, you would define the login flow and different user roles as system behavior or user actions.
NFR-3	**Reliability**	**Reliability** specifies how likely the system or its element would run without a failure for a given periodof time under predefined conditions. Traditionally, thisprobability is expressed in percentages. For instance, if the system has 85 percent reliability for a month,this means that during this month, under normal

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

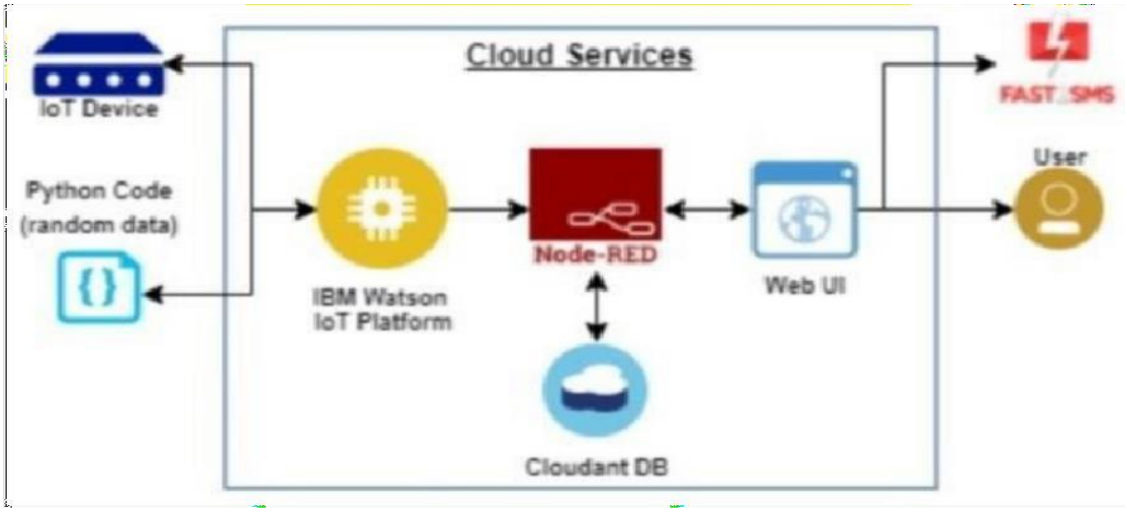
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enter and leavesthe system, what changes the information, and where data is stored.

Flow



1. User configures credentials for the Watson Natural Language Understanding service and starts the app.
2. User selects data file to process and load.
3. Apache Tika extracts text from the data file.
4. Extracted text is passed to Watson NLU for enrichment.
5. Enriched data is visualized in the UI using the D3.js library.

5.2 SOLUTION AND 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 confirmingmy password.	I can access my account /dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation emailonce I haveregistered for the application	I can receive confirmationemail & click confirm	High	Sprint-1
		USN-3	As a user, I canregister for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I canregister for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email &password		High	Sprint-1
	Dashboard					

Custom er (Webus er)	IoT technologies help		Smart sensors can be used to track importantasset s,	data as an asset trusted networks and environment	High	Sprint-1

			manage passenger flow, and enable predictive maintenance			
Customer Care Executive	Toll Free Customer helpline number 138		The helpline will address complaints relating to cleanliness, food and catering, coach maintenance, medical emergency, linen etc. Toll Free telephone No.	Its head office is in the North-East Railway Compound in Lucknow. As of 2019	High	Sprint-2
Administrator	AGM is the Director, Public Grievances of the Zonal Railway.		The system is made up of elements such as IBM‘s new customer-centric reservation system, more efficient operations control and smart vision, and parts of it are already operational within some railnetworks.	Acceptance criteria should betestable. ... Criteria should be clear andconcise. ... Everyone must understand your acceptance criteria. ...	Low	Sprint-1

6.PROJECT PLANNING & SCHEDULE

6.1 SPRINT DELIVERY SCHEDULE

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a passenger, I want to create a login credentials so I can securely access myselfservice online account.	15	High	Swedha R Kanimozhi S Abirami M Pavithra J

Sprint-1	Ticket Confor mation	USN-2	As a passenger, I want to check my ticket whether it is conformed or not.	5	Medium	Swedha R Kanimozhi S Abirami M Pavithra J
Sprint-2	Payment	USN-3	As a passenger, I want to pay my ticket cost inonline payment	15	High	Swedha R Kanimozhi S Abirami M Pavithra J
Sprint-3	Booking Status	USN-4	As a passenger, I want to check my ticket onceit is conformed.	5	Medium	Swedha R Kanimozhi S Abirami M Pavithra J
Sprint-4	Updat ing Train Infor matio n	USN-5	As an admin, I want to check the trains details like when will train reach stations and updateTrain information.	10	Medium	Swedha R Kanimozhi S Abirami M Pavithra J

7. CODING & SOLUTIONING

7.1 Features Work

- IoT technologies help railways successfully manage passenger safety, operational efficiency, and the passenger experience.
- Smart sensors can be used to track important assets, manage passenger flow, andenable predictive maintenance.
- Operators that modernize their core technology and transportation infrastructure and integrate Internet of Things (IoT) technology, artificial intelligence (AI), and deep learning capabilities will benefit from rich data and insights that can help tackle the challenges of today—increasing demand, legacy infrastructure capacity limitations, and growing passenger experience expectations.
- Today, railways are more important than ever as country and city governments are being asked to find innovative ways to safely get back to business post- COVID, meet the changing needs of their citizens, address urban population increases, and reduce their environmental impact.

CODE

GRP-LOCATION.PY

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
import requests
import json
#Provide your IBM Watson Device Credentials
organization = "pnf2ld"
```

```
deviceType = "NodeMCU"     #Credentials of Watson IoT sensor simulator
deviceId = "12345"
authToken = "12345678"
# Initialize the device client.
L=0
try:
        deviceOptions = {"org": organization, "type": deviceType, "id":
deviceId, "auth-method":authMethod, "auth-token": authToken}
        deviceCli = ibmiotf.device.Client(deviceOptions)
        #.....


except Exception as e:
        print("Caught exception connecting device: %s" % str(e))
        sys.exit()
# Connect and send a datapoint "hello" with value "world" into the cloud as
an event of type"greeting" 10 times
deviceCli.connect()
while True:
    overpass_url = "http://overpass-api.de/api/interpreter"
    overpass_query = """
    [out:json];area[name="India"];(node[place="village"](area););out;
    """
    response = requests.get(
    overpass_url,
    params={'data': overpass_query}
    )
    coords = []
    if response.status_code == 200:
        data = response.json()
        places = data.get('elements', [])
```

```
            coords.append((place['lat'], place['lon']))
        print ("Got %s village coordinates!" % len(coords))
        print (coords[0])
    else:
    i = random.randint(1,100)
    L = coords[i]
    #Send random gprs data to node-red to IBM Watson
    data = {"d":{ 'Latitude' : L[0], 'Longitude' : L[1]}}
    #print data
    def myOnPublishCallback():
        print("Published gprs location = ", L, "to IBM Watson")
    success = deviceCli.publishEvent("Data", "json", data, qos=0,
on_publish=myOnPublishCallback)
    time.sleep(12)
    if not success:
        print("Not connected to IoTF")
    time.sleep(1)
    deviceCli.disconnect()
```

QR Scanner

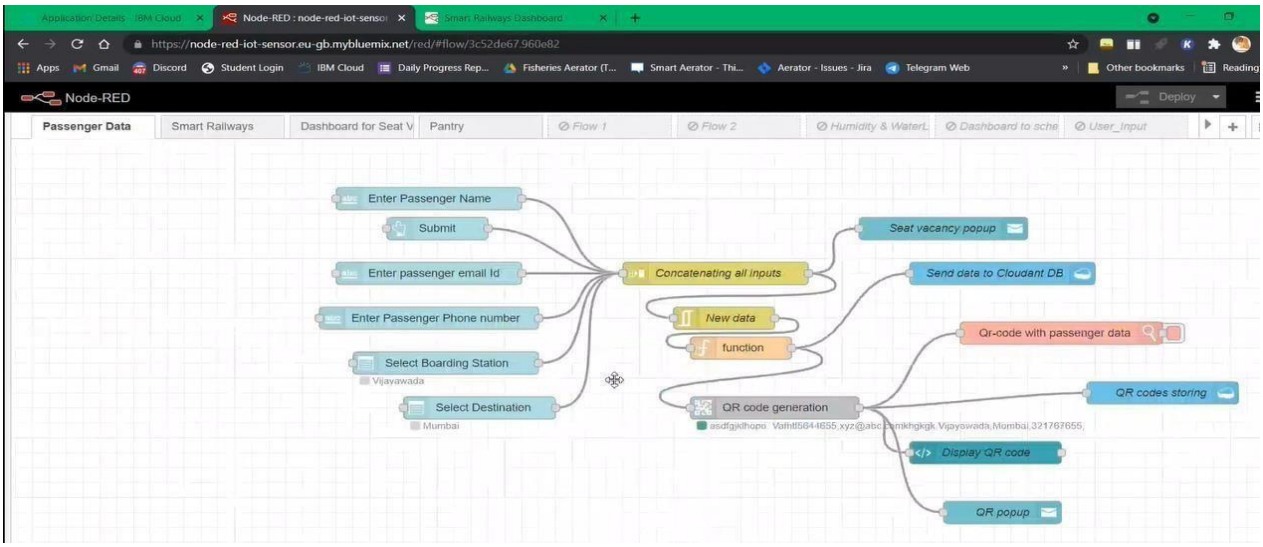
```
            from ibmcloudant import couchDbsessionAuthenticator
            from ibm_cloud_sdk_core.authenticators import
            BasicAuthenticator
          authenticator = BasicAuthenticator('apikey-v2-
            16u3crmdpkghhxefdikvpssoh5fwezrmuup5f
            v5g3ubz','b0ab119f45d3e6255eabb978)
            service=Cloudantv1(authenticator=authentic
            ator)
            service.set_service_url('https://apikey-v2-
            16u3crmdpkghhxefdikvpssoh5fwezrmuup
            5fv5g3ubz:b0ab119f45d3e6255eabb978
            cap=cv2.videoCapture(0)
```

```
font=cv2.FONT_HERSHEY_PLAIN
whileTrue:
_,frame=cap.read(0)
decodeObjects=pyzbar.decode(frame)
for obj in decodeObjects:
    #print("Data",obj.data)
    a=obj.data.decode('UTF-8')
    cv2.putText(frame,"Ticket",(50,50),font,2,(255,0,0),3)
    #print(a)
    try:
responce=service.get_document(db='booking',doc_id=
                                        a).get_result()
        print(response)
        time.sleep(5)
    except Exception as e:
        print("Not valid Ticket")
        time.sleep(5)
 cv2.imshow("Frame",frame)
 if cv2.waitKey(1) & 0xFF==ord('q'):
    break
cap.release()
cv2.destroyAllWindows()
client.disconnect()
```

8. TESTING

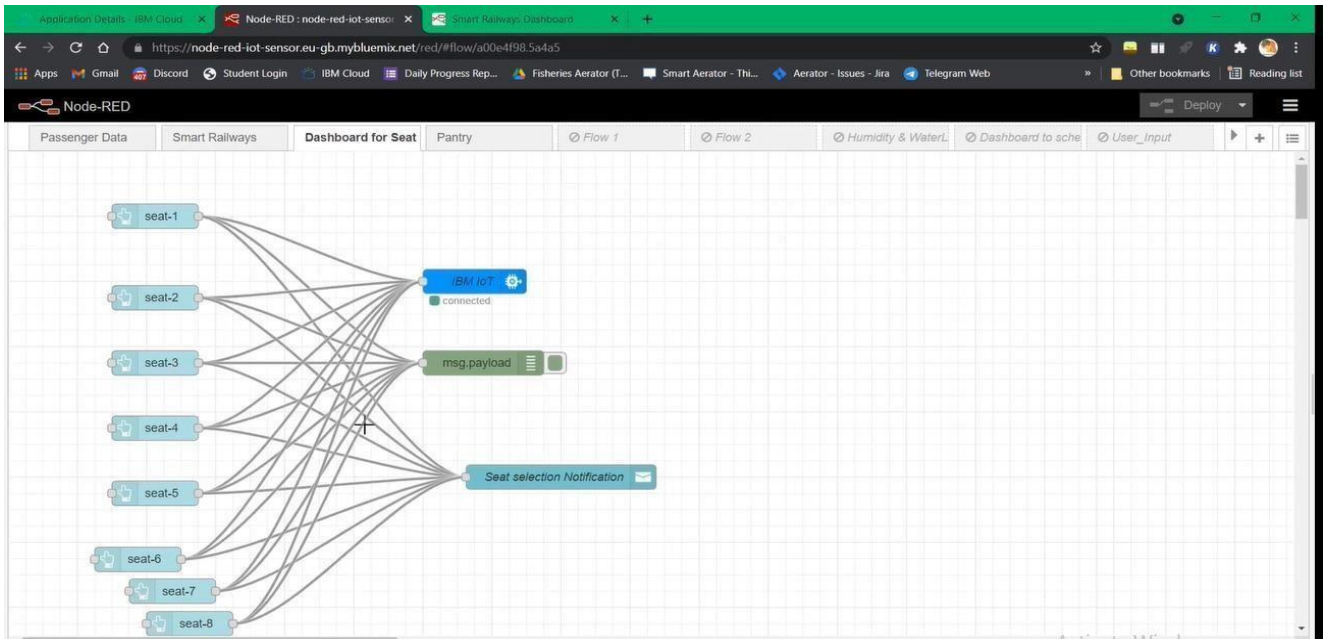
8.1 TEST CASES

PASSENGER DATA:

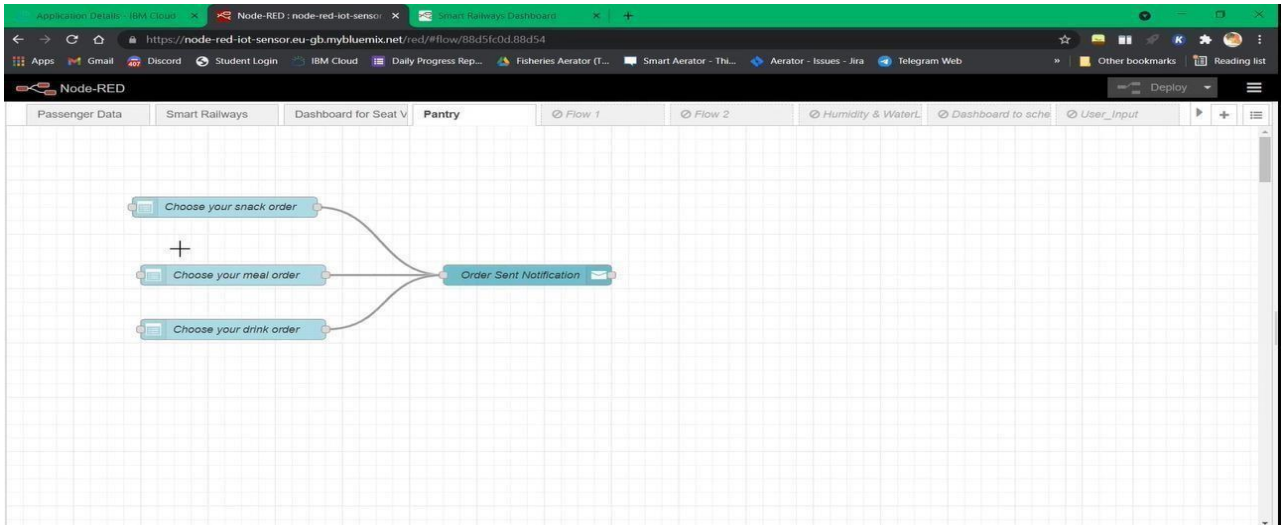


Smart railways:

Dashboard for seat vacancy:



Pantry:



9. RESULTS

9.1 PERFORMANCE METRICS

Encouraged by the results of deployment of OMRS, including some critical detection which could have potentially been cause of an accident, not otherwise detectable by normal maintenance procedure, Indian Railways is now going ahead with greater adoption of track side based maintenance systems with an aim towards predictive maintenance.

Further, moving towards predictive maintenance practices in yards, Indian Railways is envisaging to convert its ‘freight examination yards’ into technology driven ‘Smart Yards’ for automatic detection of faults/defects/deficiencies in freight wagons.

These Smart Yards will predict anomalies like Hot Wheel Hot Axle, defective bearings, defective wheels, hanging/loose/missing parts etc.

Long before any failure actually happens. Smart Yards will be equipped with various automated technology driven systems including OMRS, Hot Box Detector, Wheel Profile Recorder and Machine Vision Equipments etc.

10. ADVANTAGES :

- Increased efficiency
- Reduced downtime
- Enhanced safety
- Increased passenger satisfaction

DISADVANTAGES :

- To establish the entire network it is quite a costly task. Since these are the issues of the government cost doesn't matter a lot.
- The Arduino board is a delicate device so it has to be handled carefully.

11. CONCLUSION

The railway industry is on its way to integrate predictive maintenance and Big Data. Recent advancements in sensors and condition monitoring technologies have led to continuous data collection and evaluation, significantly minimisingthe number and cost of unscheduled maintenance.

Most significant improvements have been evidenced by more informative and user-friendly websites, mobile applications for real-time information about vehicles in motion, and e-ticket purchases and timetable information implementedat stations and stops. With the rise of Industry 4.0, railway companies can now ensure that they are prepared to avoid the surprise of equipment downtime.

12.FUTURE SCOPE

Adoption of Big Data and Internet of Things (IoT) in railways are expected to deliver smart travel and trade solutions in the coming decade. Equipped with real-time monitoring and schedule updates, end users are expected to benefit from efficient cargo movement with error-tracking.

GitHub – https://github.com/IBM-EPBL/IBM-Project-30379-1660145580

Project Demo Link :

https://drive.google.com/file/d/1ecw9rmpENPGgvFhLFuTL9tn9qcPiUODG/view?usp=drivesdk