TRAFFIC AND CAPACITY ANALYTICS FOR MAJOR PORTS

PROJECT REPORT

TEAM ID: PNT2022TMID23203

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Team Members:

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1.INTRODUCTION

ABSTRACT

- Ports have been a major resource for Indian Economy. The ports are congested as there are many resources. The traffic is heavy in the recent time. So this project aims at reducing and improving the traffic and capacity of ports.
- Data analytics is the process of analysing raw data in order to draw out meaningful, actionable insights, which are then used to inform and drive smart business decisions.
- A data analyst will extract raw data, organize it, and then analyse it, transforming it from incomprehensible numbers into coherent, intelligible information. Having interpreted the data, the data analyst will then pass on their findings in the form of suggestions or recommendations about what the company's next steps should be.
- A data analyst collects and processes data; he/she analyses large datasets to derive meaningful insights from raw data.
- Data analytics helps you to make sense of the past and to predict future trends and behaviours; rather than basing your decisions and strategies on guesswork, you're making informed choices based on what the data is telling you. Armed with the insights drawn from the data, businesses and organizations can develop a much deeper understanding of their audience, their industry, and their company as a whole—and, as a result, are much better equipped to make decisions and plan ahead.

1.1 PROJECT OVERVIEW

The Indian Railways has a capital base of about Rs. 100000 crores and is often referred to as the lifeline of the Indian economy because of its predominance in transportation of bulk freight and long distance passenger traffic. The network criss-crosses the nation, binding it together by ferrying freight and passengers across the length and breadth of the country. As the Indian economy moves into a high growth trajectory the Railways have also stepped-up developmental efforts and are preparing themselves for an even bigger role in the future. Therefore, our products and services are designed to help the Railways to respond to those immune challenged and ultimately turn them into strength.

1.2 PURPOSE

The purpose of this project is to improve the railway market share in some commodities and overcome the challenges and maintain sustainable growth in all its commodities. We also try to reduce the congestion on rail corridors and improving port connectivity. And lastly help in the development of dedicated freight corridor across Key ports. All of this is done by analysing already existing data or new data on Railway traffic and data on amount of capacity of passenger and goods a train carries from each port

2. LITERATURE SURVEY

1.Performance analysis of major ports in India: a quantitative approach
Author: Anindita Mandal, Soma Roychowdhury and Jhumoor Biswas
Abstract:

This paper examines the performance of 13 major ports of India in respect of key operational performance indicators. Following rapid economic growth India's share in international trade is escalating. This puts increased pressure on these ports, which handle a substantial portion of the trade to perform with optimal efficiency. The study presents a systematic analysis of different performance indicators for a ten-year time period (2003 to 2013) using a variety of statistical methods and evaluates status of each port in different categories of performance. This will enable the ports to gauge their own effectiveness and appraise reasons for their shortcomings. In this context, the work further develops an integrated composite performance index by relegating comparative weightages to different indicators, to assess the relative overall performance of different ports. The study underlines the need of such estimates to adjudge the consistency of performance, internal and across ports to enable planning and development of measures for enhanced performance.

2.Analytics for Decision Making at Ports
Author: Publishing India Group (PublishingIndia)
Abstract:

Ports serve as an important link in global supply chain. Worldwide more than 75 percent of cargo move by sea. Over the years, the Indian Union has endeavoured to invest on major ports of the country to meet up to the global standards. Yet the share of major ports under the government of India has decrease from 90 to 70 percentage of total sea borne cargo in the country. The major ports lost its share to the minor ports under the state governments. Two reasons could be hypothesized for the said problem.

One, the investments are not made in the right direction and other that the efficiency needs to be improved in functioning of the ports. In this paper an attempt has been made to identify the dimensions of port performance and the causality between the dimensions. It chooses to take average turn round time (ATRT) as an indicator of port performance. The paper proposes an analytical framework to identify the causality that would aid the decision makers. The causal approach has been based on identifying the dimensions (factors) using multi-variate data analysis, establishing the linear causal association between the ATRT and the factors, analyzing the relationship so obtained to propose an System Dynamics model for policy simulation by the decision makers.

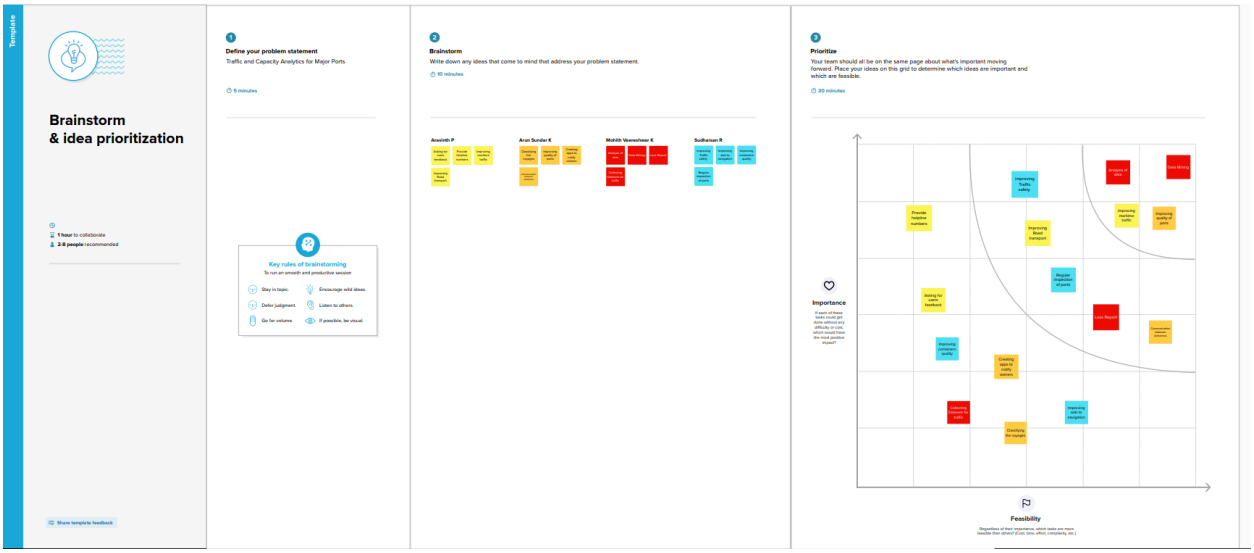
3.Using advanced analytics for port performance management (2019)
Abstract:

In this paper port performance measurement models many gaps have been detected. Tools used are Data mining, data collection. Technology used is Data Analytics.

3.IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

3.2 BRAINSTORMING



3.3 PROPOSED SOLUTION

1. PROBLEM STATEMENT (PROBLEM TO BE SOLVED)

To create a port management system for ports to reduce congestion on rail corridors and improve port connectivity.

2.IDEA / SOLUTION DESCRIPTION

Data analytics is implemented to analyse the rail traffic and port traffic. By deeply understanding the dataset, identifying pattern, relationships and connection using Data Analysis with python libraries using IBM Cognos analytics to build visualizations of traffic congestion and to create meaningful dashboards. The final dynamic dashboard helps rail operators by providing detailed traffic data and routes, easy categorization, capacity reports satisfying customer needs and meet variation in traffic data.

3.NOVELTY / UNIQUENESS

This solution involves analysing the traffic and determining the routes. It helps the people managing the port traffic such that it is helpful to avoid traffic congestion. Also it involves usage of IBM Cognos analytics tool for visualisation rather than using python libraries like matplotlib.

4.SOCIAL IMPACT / CUSTOMER SATISFACTION

Adequate resources will be provided.Consumers using port – rail connectivity

can be assured for their product transportation will be done on time

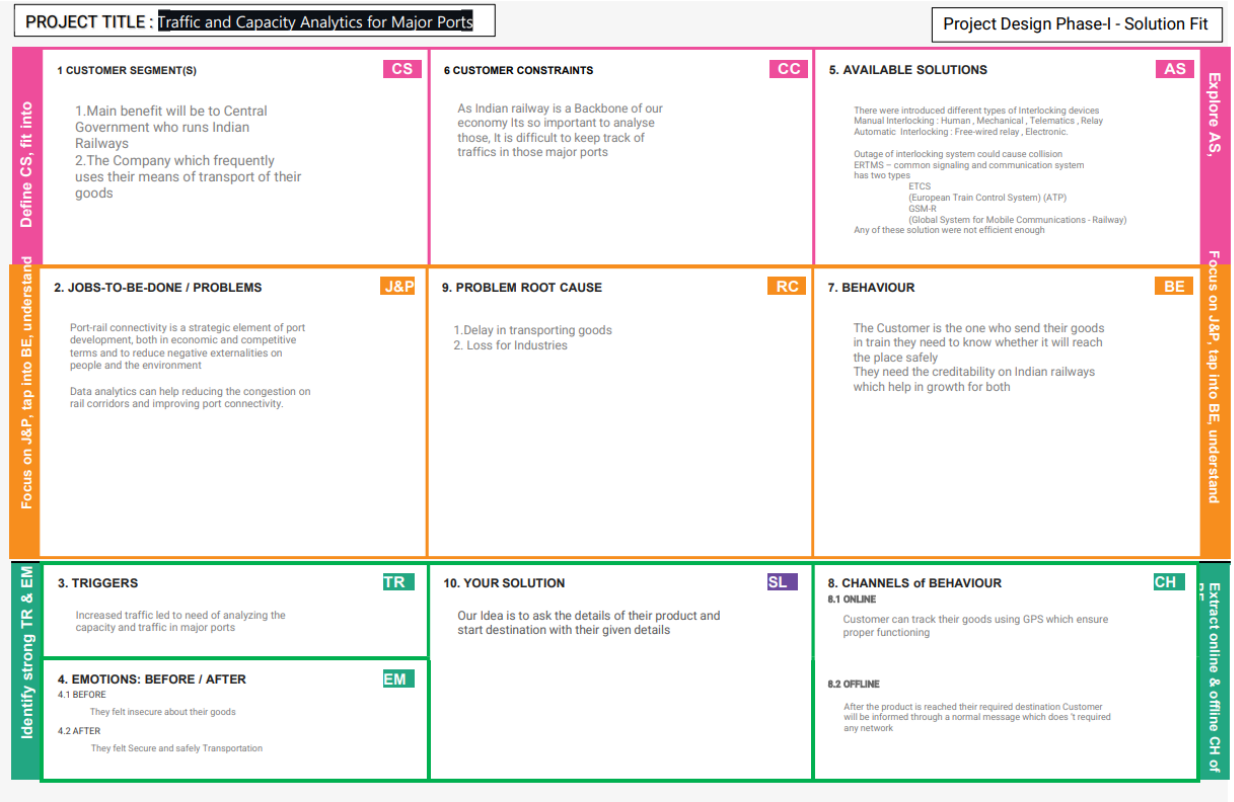
5.BUSINESS MODEL (REVENUE MODEL)

Businesses using railway ports can easily track. Government can use data analytics dashboard to ensure less traffic on the ports.

6.SCALABILITY OF THE SOLUTION

This solution is applicable for all the ports located in India, from smaller to bigger ports. It can also analyse wide range of datasets and different types of visualisations can be done.

3.4 PROBLEM SOLUTION FIT



4. REQUIREMENTS ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

1. User Registration
    - Registration through Form
    - Registration through Gmail
    - Registration through LinkedIN
2. User Confirmation
    - Confirmation via Email
    - Confirmation via OTP
3. User Login
    - Login via Email and password
4. User uploading data (administrative)
    - To store the data set through the Cloud
5. End user benefits
    - Getting higher state of efficiency and also to know entire data analysis

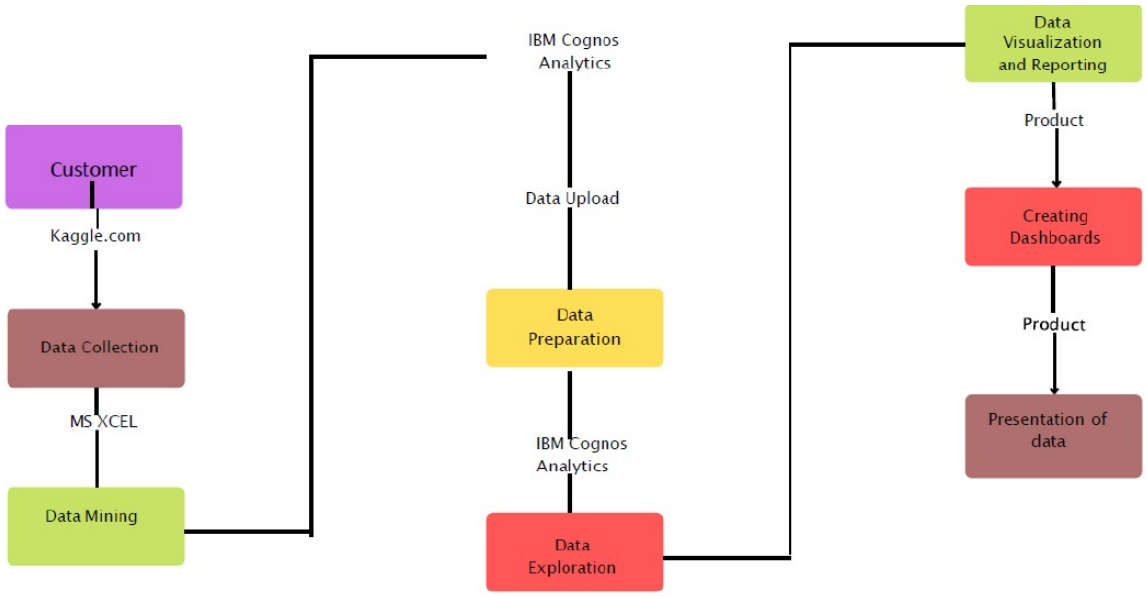
4.2 NON-FUNCTIONAL REQUIREMENTS

1. Usability
    - Visualizations are easy to make and easy to use for analysis
2. Security
    - Application has Sign in only for updating data in site.
3. Reliability
    - Able to predict easily for analysis. Also, able to view visualizations if the server is still running.
4. Performance
    - Application runs fast as long as internet is fast

5. PROJECT DESIGN

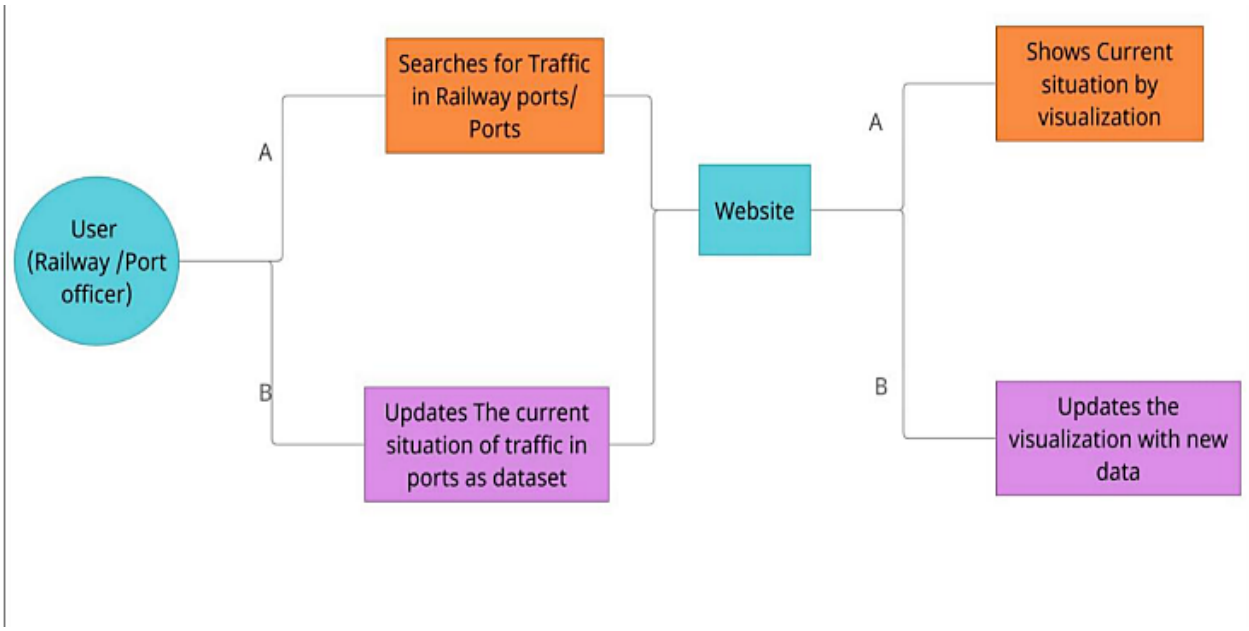
5.1 DATA FLOW DIAGRAMS

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 enters and leaves the system, what changes the information, and where data is stored.

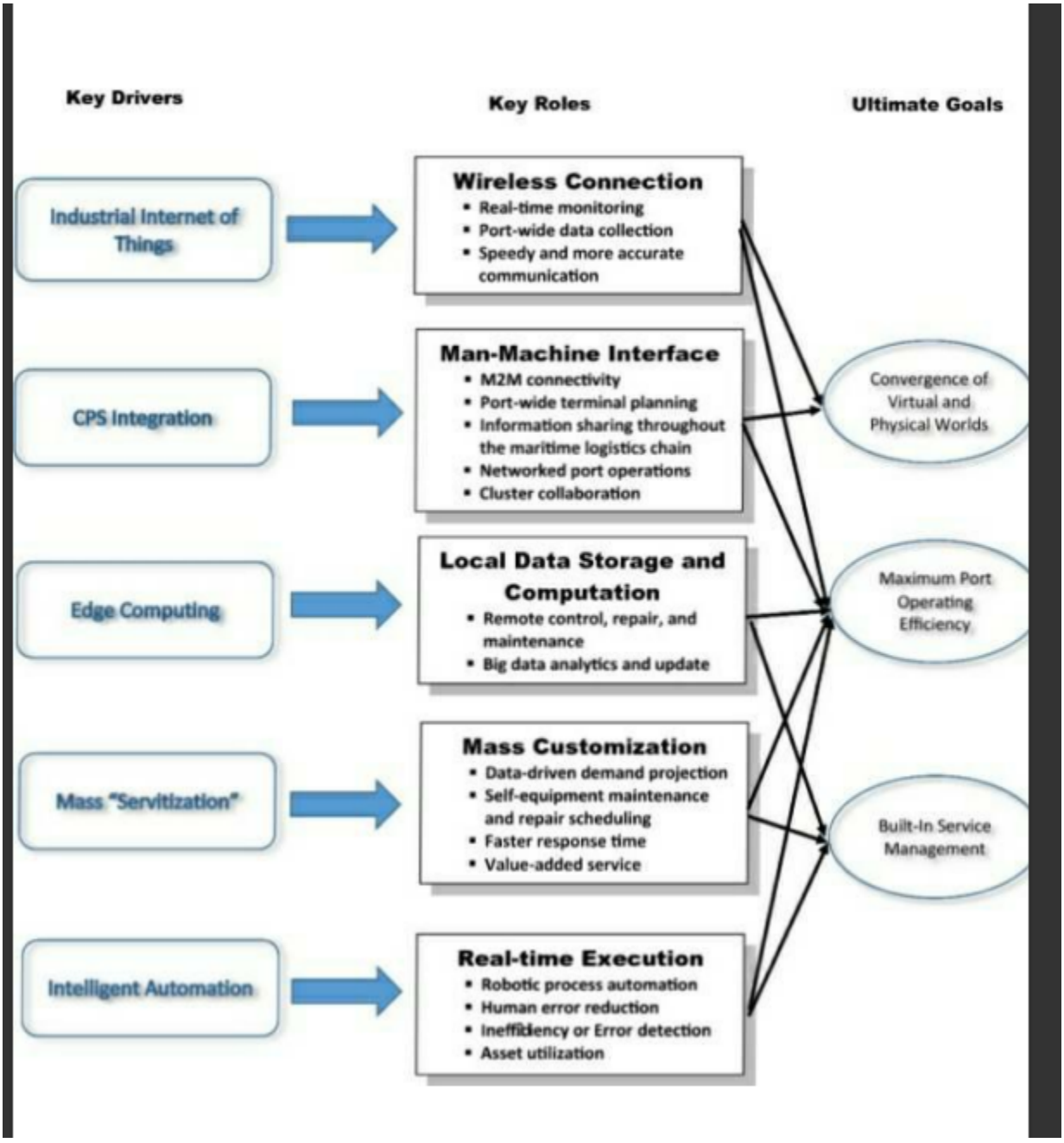


5.2 SOLUTION AND TECHNICAL ARCHITECTURE

SOLUTION ARCHITECTURE



TECHNICAL ARCHITECTURE



COMPONENTS AND TECHNOLOGIES

1. USER INTERFACE

- How user interacts with application e.g.Web UI, Mobile App, Chatbot etc.
- HTML, CSS, JavaScript ,Excel

2. APPLICATION LOGIC 1
   - Logic for a process in the application
   - IBM Watson STT service ,Python

3.APPLICATION LOGIC 2
   - Logic for a process in the application
   - IBM Watson Assistant

4. DATABASE
   - Data Type, Configurations etc.
   - MySQL, NSQL

5. CLOUD DATABASE
   - Database Service on Cloud
   - IBM DB2, IBM Cloudant

6. FILE STORAGE
   - File storage requirements
   - IBM Block Storage or Other Storage Service or Local File system

7. EXTERNAL API
   - Purpose of External API used in the application
   - IBM Weather API

8. EXTERNAL API-1
   - Purpose of External API used in the application
   - Aadhar API

9. INFRASTRUCTURE(SERVER/CLOUD)
   - Application Deployment on Local System/Cloud: Local Server Configuration, Cloud Server Configuration
   - Local, Cloud Foundry

APPLICATION CHARACTERISTICS

1. OPEN SOURCE FRAMEWORKS
   - List the open-source frameworks used
   - Technology of Open-source framework

2. SECURITY IMPLEMENTATIONS
   - List all the security / access controls implemented, use of firewalls etc.
   - e.g. SHA-256, Encryptions, IAM Controls, OWASP

3. SCALABLE ARCHITECTURE
   - Justify the scalability of architecture (3 – tier, Micro-services)
   - Cognos Used

4. AVAILABILITY

- Justify the availability of application (e.g. use of load balancers, distributed servers etc.)
- AWS used

5. PERFORMANCE

- Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.
- Dashboard ,Reports, stories

5.3 USER STORIES

User Stories

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
Business People	Monitoring	USN-1	As a user, I can view the dashboard to see the port status.	I can visualize the port status in dashboard	High	Sprint-1
	Tracking	USN-2	As a user, I can track the goods.	I can track the goods by its arrival/departure time	High	Sprint-1
Govt Sector People	Viewing	USN-1	As a user, I can view the port status regularly	I can able to know the port status	Low	Sprint-2
	Predicting	USN-2	As a user, I will reduce the congestion ports by predicting the port congestion through dashboard.	I can able to predict the congestion in future	High	Sprint-2
Passengers	Tracing	USN-1	As a user, I can trace the arrival/departure time of rail in ports	I can able to track the correct time of rail.	High	Sprint-2

6. PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

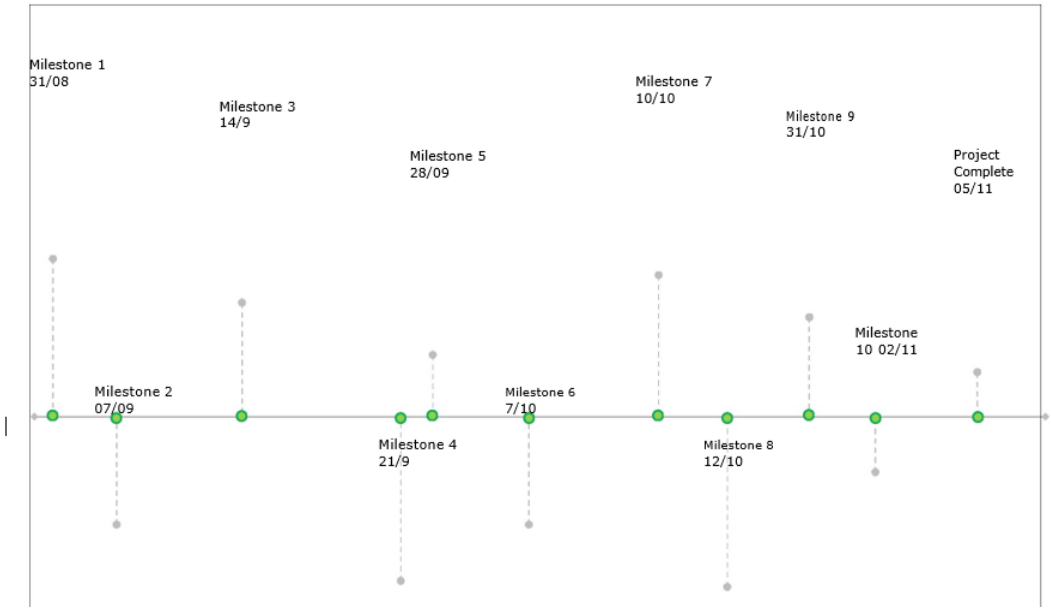
DATE	MILESTONE	ASSIGNEE	STATUS	DESCRIPTION
31/08	Data Collection-Download dataset	Sudharsan R Aravinth P Arun Sundar K Mohith Veereshwar K	Completed	The datasetfor Traffic and Capacity Analytics is to be collected.The datasetwhich is considered will have the port information
7/09	Data Pre-processing 1.Renaming the coloumn names2.Preparing calculations 3.Checking for NULL values 4.Checking for ouliers 5.Summarization of dataset 6.Label Encoding	Sudharsan R Aravinth P Arun Sundar K Mohith Veereshwar K	Completed	Preprocessing involves renaming the existing coloumn names into meaningful one,preparing calculations such as calculating trafficpercent,checking for NULL values in the dataset.
14/09	Visualizing the dataset	Sudharsan R Aravinth P Arun Sundar K Mohith Veereshwar K	In-Progress	Visulaizing the dataset involves plotting thedataset using various plots and doing analysis on that.
21/09	Model Building 1. Building the model using suitable machinelearning algorithm 2. Training and testing the model	Sudharsan R Aravinth P Arun Sundar K Mohith Veereshwar K	In - Progress	Using certain algorithms to build the model.

28/09	Dashboard Creation	Sudharsan R Aravinth P Arun Sundar K	completed	Dashboard for visualizing the port statuswill be developed.

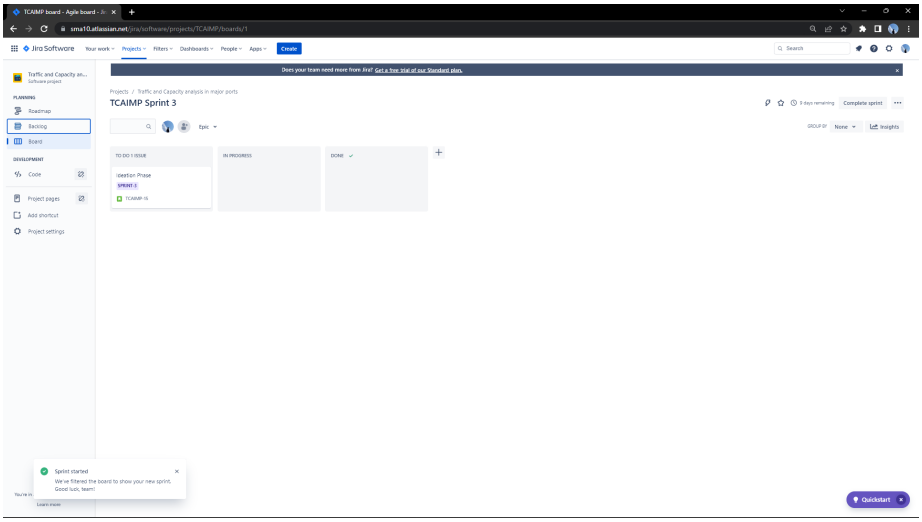
		Mohith Veereshwar K		
7/10	Ideation Phase 1. Litreature surveyon the selected project andinformation gathering. 2. Prepare the empathy map. 3. Ideation	Sudharsan R Aravinth P Arun Sundar K Mohith Veereshwar K	Completed	Start the ideation process
10/10	Project DesignPhase -1 1. Proposed solution. 2. Prepared fit solution 3. Solution Architecture	Sudharsan R Aravinth P Arun Sundar K Mohith Veereshwar K	Completed	Prepare the proposed solution document, which includesthe novelty, feasibility of idea, businessmodel, social impact,scalability of solution, etc.
12/10	Project DesignPhase -2 1. Customer journey. 2. Functional requirements 3. Data flow diagram. 4. Technology architecture	Sudharsan R Aravinth P Arun Sundar K Mohith Veereshwar K	Completed	Prepare the customer journeymaps to understand the user interactions & experiences with the application (entry to exit) ,Functional requirements and construct architecture
31/10	Project PlanningPhase 1.Milestone ActivityList2.Sprint Delivery plan	Sudharsan R Aravinth P Arun Sundar K Mohith Veereshwar K	Completed	Prepare milestone activity list and sprintdelivery plan for outlineof work flow
02/11	Project Development Phase 1.Sprint -1 2.Sprint-2 3.Sprint-3 4.Sprint-4	Sudharsan R Aravinth P Arun Sundar K Mohith Veereshwar K	In-Progress	Plan of each task sprintto be developed.

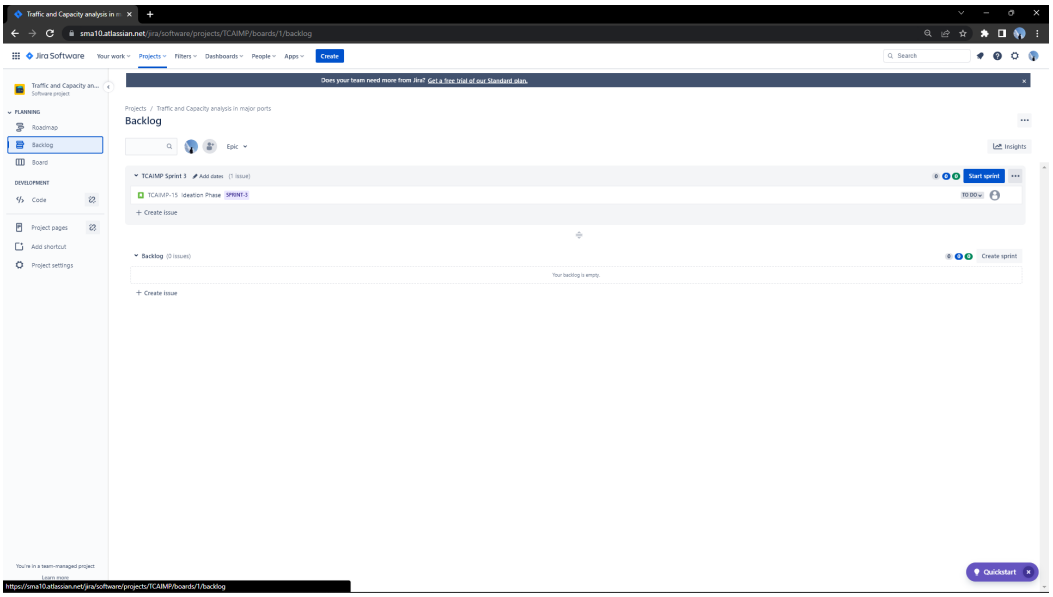
6.2 SRINT DELIVERY SCHEDULE

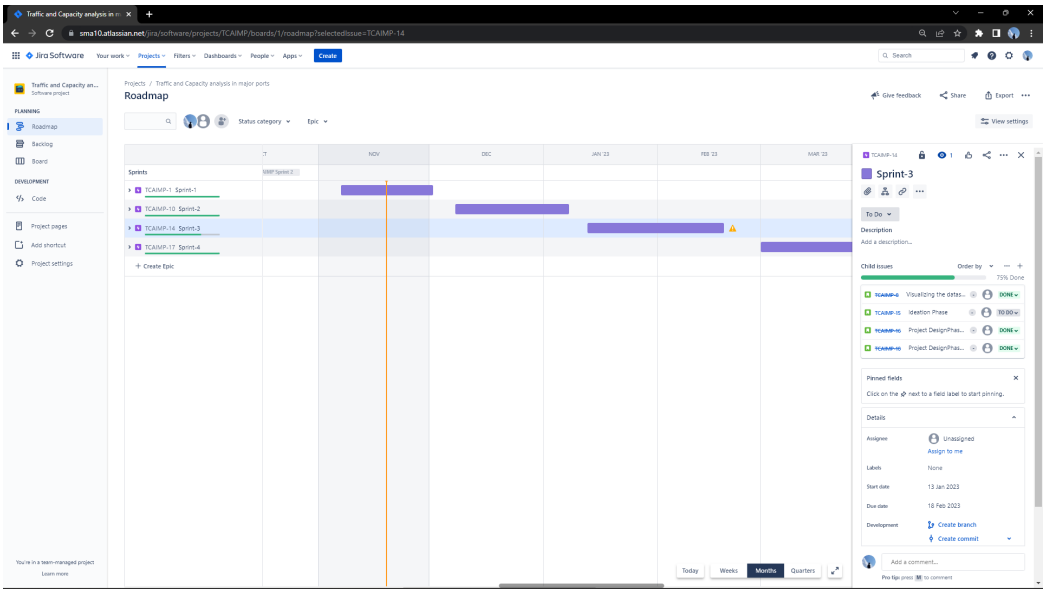
A milestone schedule, or milestone chart, is a timeline that uses milestones to divide a project schedule into major phases. A milestone chart is a way to visualize the most important steps of our project. Each milestone the team achieves brings us closer to completing the project. As a result, milestones provide a sense of accomplishment and show the team how the work they're doing contributes to the overarching project objective.



6.3 REPORT FROM JIRA







7. CODING & SOLUTION

7.1 Feature 1

```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Sign In...</title>
    <link rel="stylesheet" href="./logi.css">
```

```
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.15.3/css/all.min.css" />
</head>

<body>
    <div class="wrapper">
        <h1>Port Analysis</h1>
            <form action="#">
            <div class="field email">
                <div class="input-area">
                    <input type="text" placeholder="Email">
                    <i class="icon fas fa-envelope"></i>
                    <i class="error error-icon fas fa-exclamation-circle"></i>
                </div>
                <div class="error error-txt">Email is required!!</div>
            </div>
            <div class="field password">
                <div class="input-area">
                    <input type="password" placeholder="Passcode">
                    <i class="icon fas fa-lock"></i>
                    <i class="error error-icon fas fa-exclamation-circle"></i>
                </div>
                <div class="error error-txt">Password is required!!</div>
            </div>
            <div class="pass-txt"><a href="#">Forgot password?</a></div>
            <input type="submit" value="Login">
        </form>
        <div class="sign-txt"> Not registered yet!! <a href="#">Signup </a></div>
    </div>

    <script src="./logi.js"></script>

</body>

</html>
```

css :

```
@import
url('https://fonts.googleapis.com/css2?family=Poppins:wght@400;500;600&display=swa
p');
* {
    margin: 0;
    padding: 0;
    box-sizing: border-box;
    font-family: "Gill Sans Extrabold",sans-serif;
}

body {
    margin: 50px;
    display: flex;
    align-items: center;
    justify-content: start;
    background-image: url("./../port.jpg");
    /* background-repeat: no-repeat; */
    background-position: center;
    background-size: contain;
}
::selection {
    color: #fff;
    background: #53f0e3;
}

.wrapper {
    width: 380px;
    padding: 40px 30px 50px 30px;
    background: linear-gradient(rgba(224, 123, 64,.7),rgba(230, 86, 86, 0.7),rgb(90, 87,
87));
    border-radius: 5px;
    text-align: center;
    box-shadow: 10px 10px 15px rgba(0, 0, 0, 0.1);
}

.wrapper header {
```

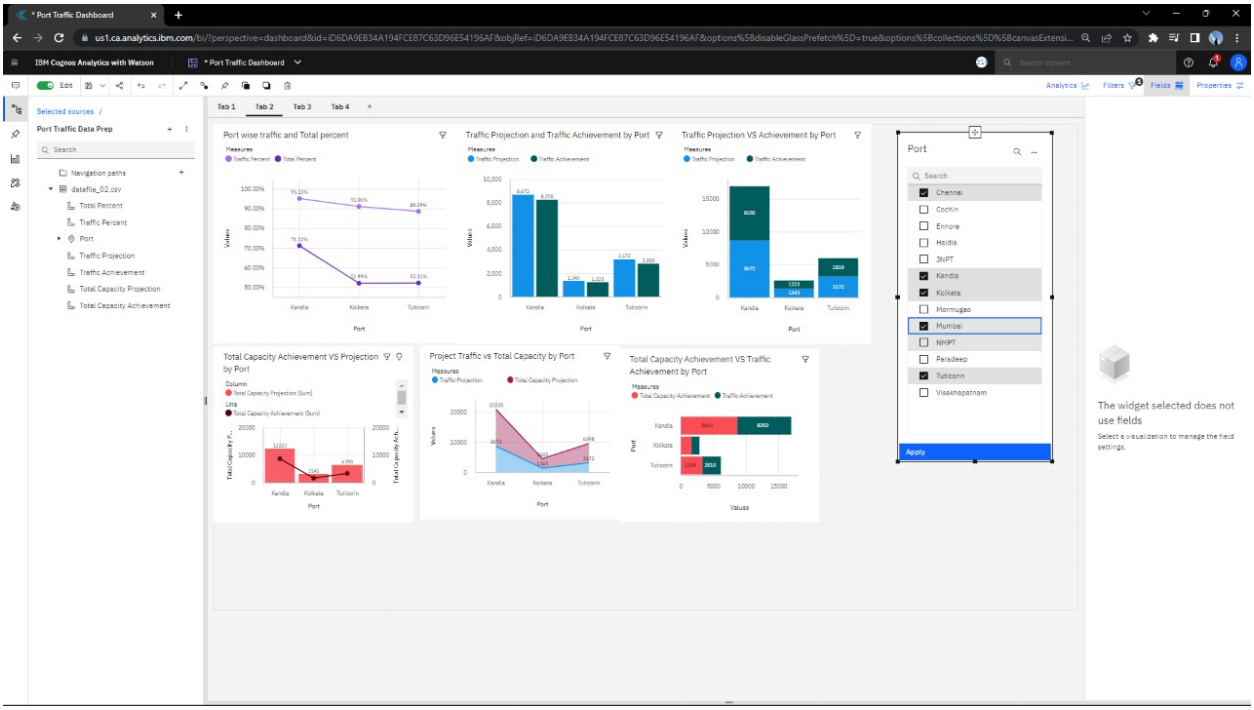
```
    font-size: 35px;
    font-weight: 600;

}

.wrapper form {
    margin: 40px 0;
}

form .field {
    width: 100%;
    margin-bottom: 20px;
}

form .field.shake {
    animation: shake 0.2s ease-in-out;
}

@keyframes shake {
    0%,
    100% {
        margin-left: 0px;
    }
    20%,
    80% {
        margin-left: -12px;
    }
    40%,
    60% {
        margin-left: 12px;
    }
}

form .field .input-area {
    height: 50px;
    width: 100%;
    position: relative;
```

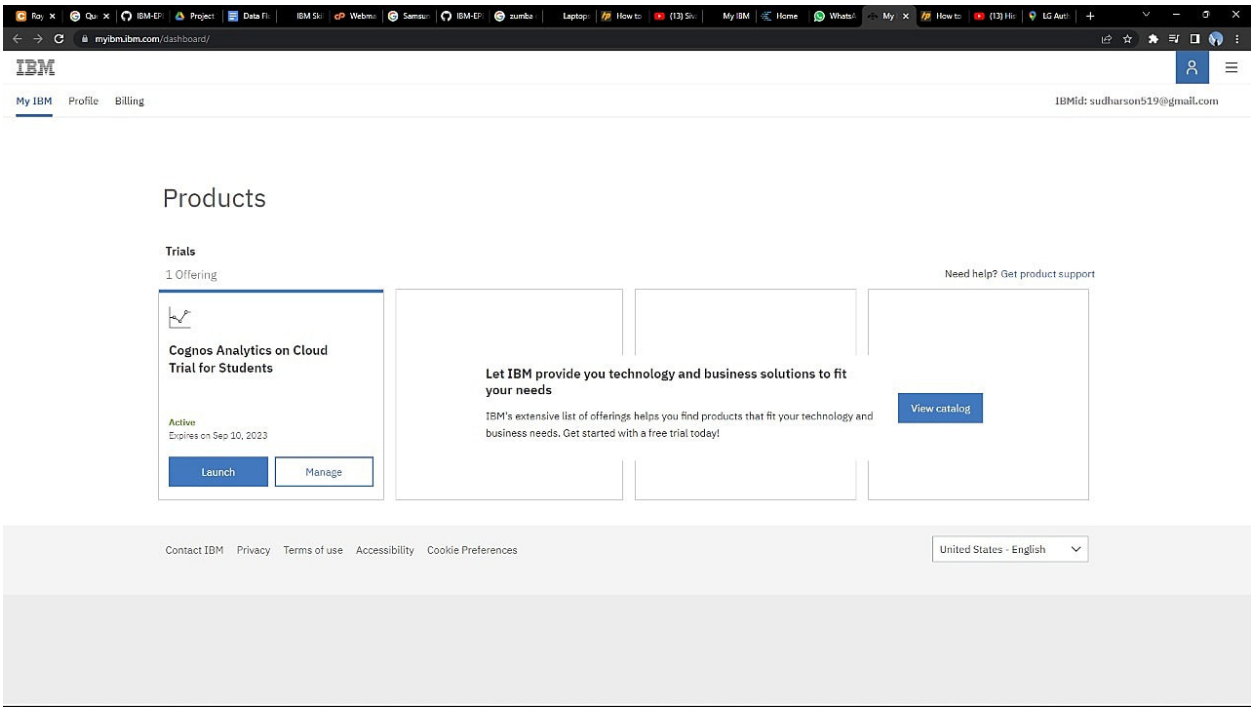
```
}

form input {
    width: 100%;
    height: 100%;
    outline: none;
    padding: 0 45px;
    font-size: 20px;
    background: none;
    caret-color: #eb6122;
    border-radius: 5px;
    border: 1px solid #bfbfbf;
    border-bottom-width: 2px;
    transition: all 0.2s ease;
}

form .field input:focus,
form .field.valid input {
    border-color: #f06b53;
}

form .field.shake input,
form .field.error input {
    border-color: #242121;
}

.field .input-area i {
    position: absolute;
    top: 50%;
    font-size: 20px;
    pointer-events: none;
    transform: translateY(-50%);
}

.input-area .icon {
    left: 15px;
    color: #bfbfbf;
```

```
    transition: color 0.2s ease;
}

.input-area .error-icon {
    right: 15px;
    color: #d8b9bc;
}

form input:focus~.icon,
form .field.valid .icon {
    color: #3d3e42;
}

form .field.shake input:focus~.icon,
form .field.error input:focus~.icon {
    color: #bfbfbf;
}

form input::placeholder {
    color: #bfbfbf;
    font-size: 18px;
}

form .field .error-txt {
    color: #130608;
    text-align: left;
    margin-top: 5px;
}

form .field .error {
    display: none;
}

form .field.shake .error,
form .field.error .error {
    display: block;
}
```

```
form .pass-txt {
    text-align: left;
    margin-top: -10px;
}

.wrapper a {
    color: #110804;
    text-decoration: none;
}

.wrapper a:hover {
    text-decoration: underline;
}

form input[type="submit"] {
    height: 50px;
    margin-top: 30px;
    color: #fff;
    padding: 0;
    border: none;
    background: #d49278;
    cursor: pointer;
    border-bottom: 2px solid rgba(0, 0, 0, 0.1);
    transition: all 0.3s ease;
}

form input[type="submit"]:hover {
    background: #0d4c5f;
}
```

8. TESTING


Port wise traffic and Total percent
Traffic Projection and Traffic Achievement by Port
Traffic Projection VS Achievement by Port
Total Capacity Achievement VS Projection by Port
Project Traffic vs Total Capacity by Port
Total Capacity Achievement VS Traffic Achievement by Port
Port
Apply
The widget selected does not use fields


IBM
My IBM
Profile
Billing
IBMid: sudharson519@gmail.com
Products
Trials
1 Offering
Need help? Get product support
Cognos Analytics on Cloud Trial for Students
Active
Expires on Sep 10, 2023
Launch
Manage
Let IBM provide you technology and business solutions to fit your needs
IBM's extensive list of offerings helps you find products that fit your technology and business needs. Get started with a free trial today!
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Accessibility
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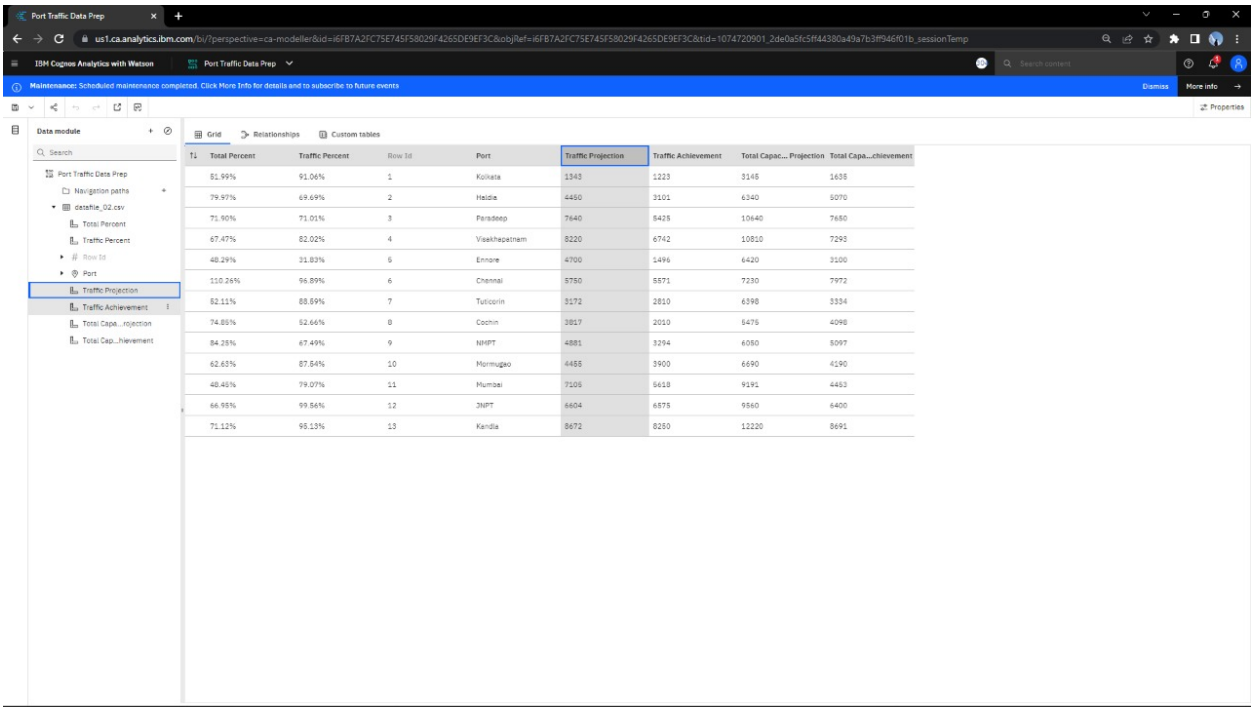
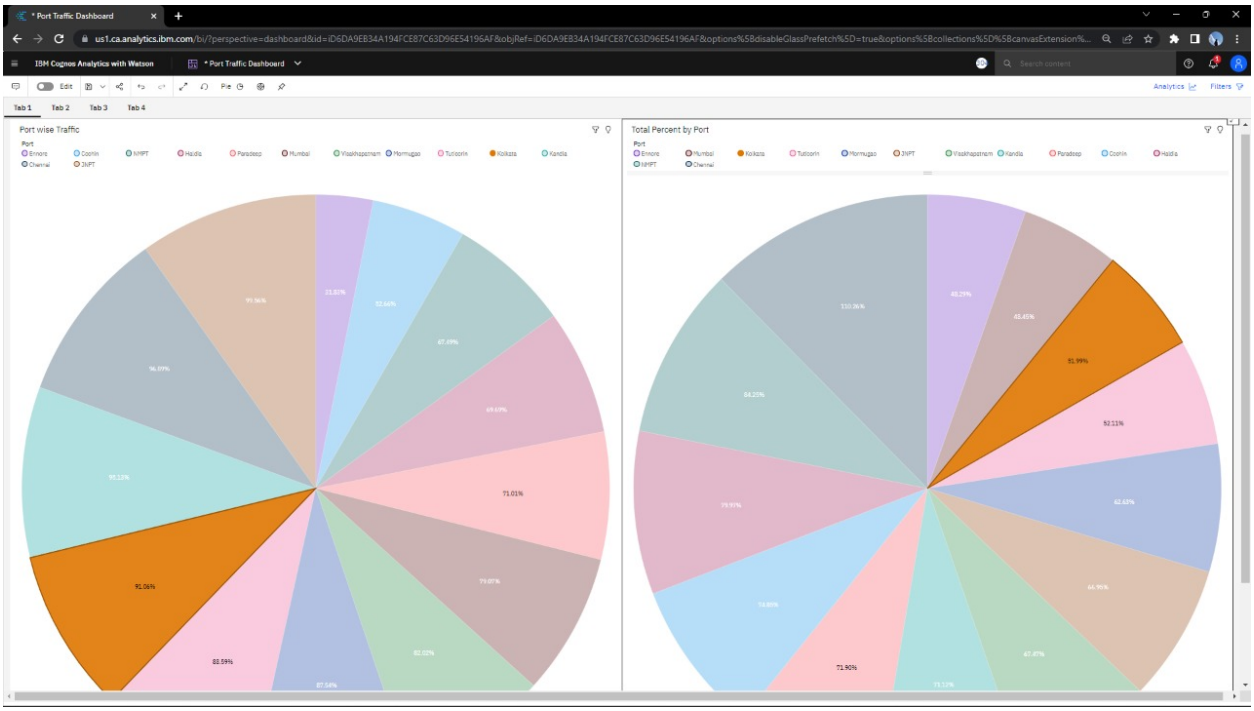
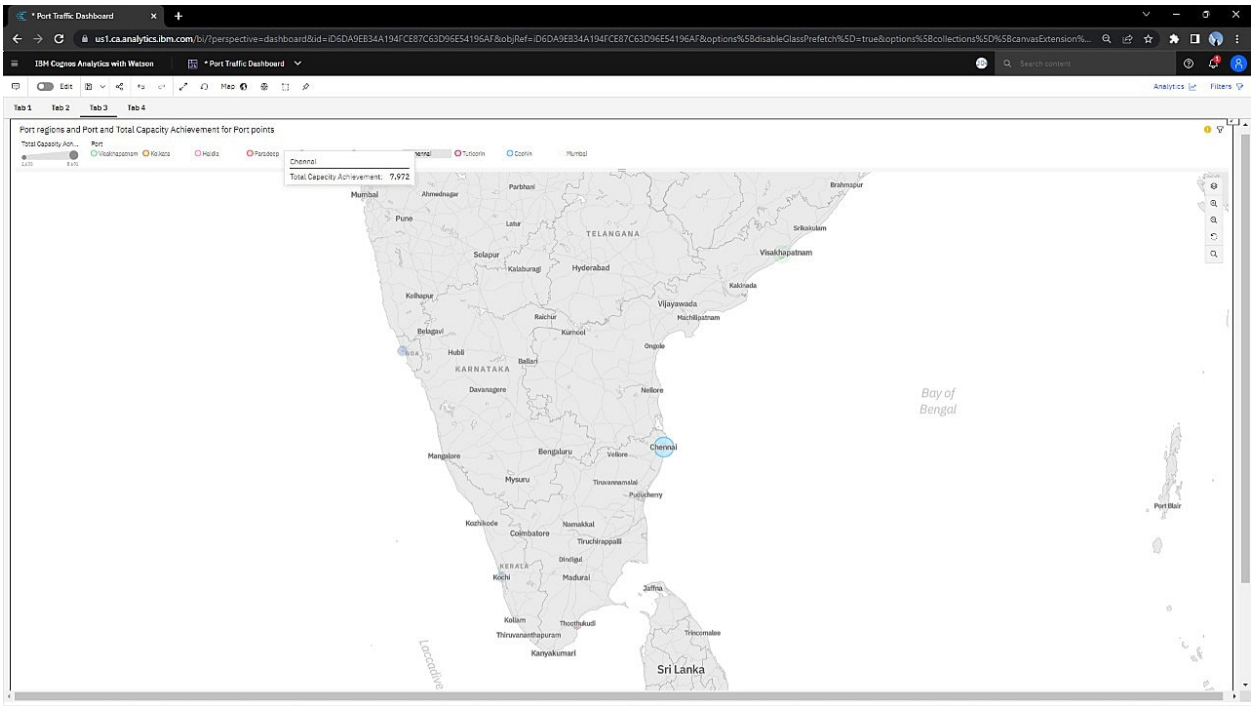
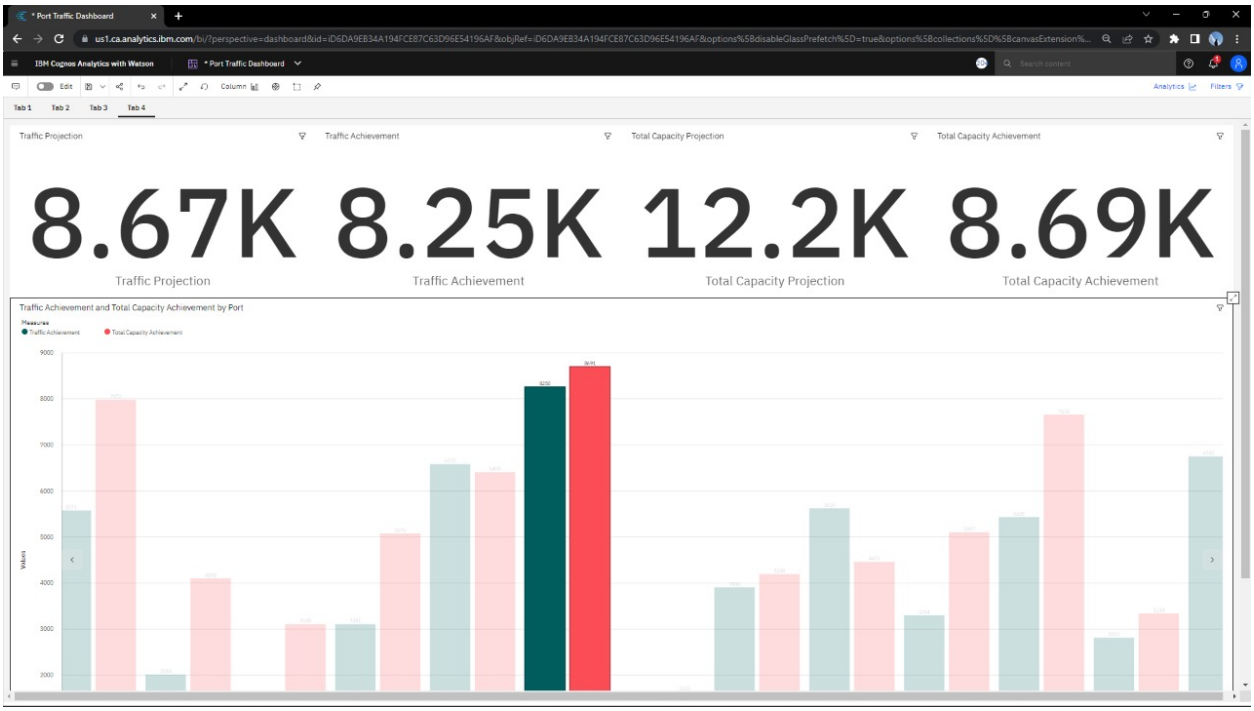
United States - English

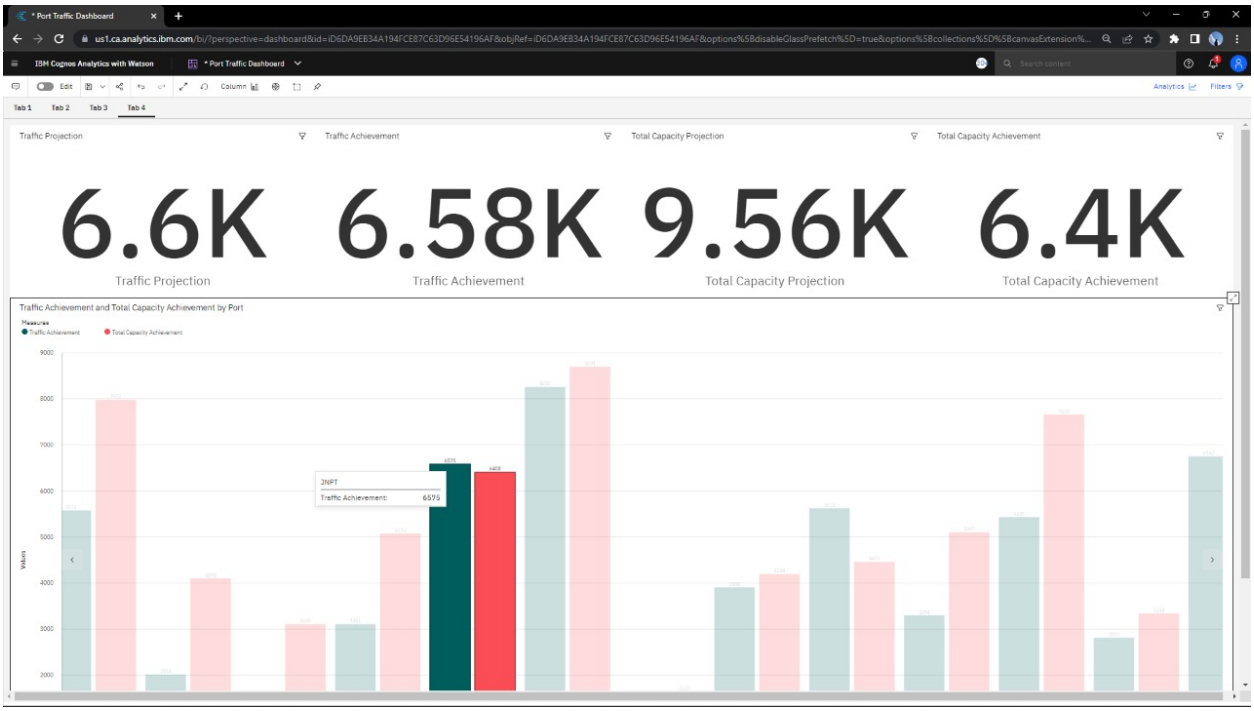


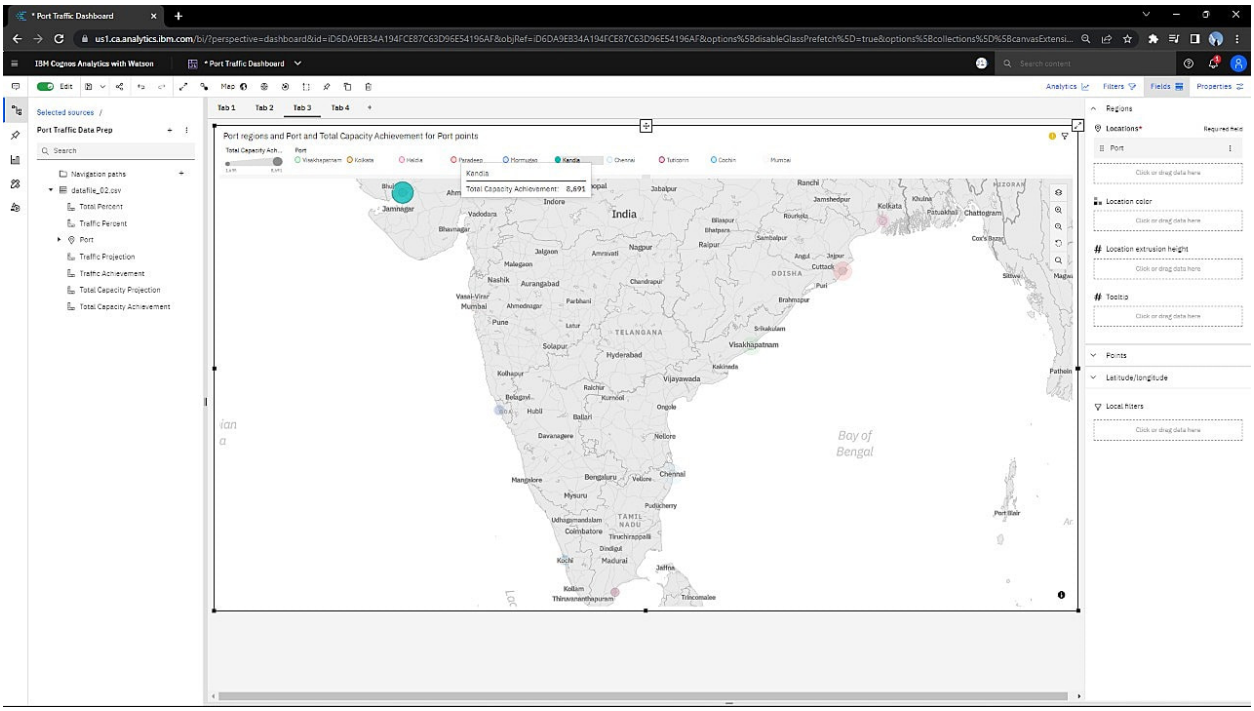
Total Percent	Traffic Percent	Row Id	Port	Traffic Projection	Traffic Achievement	Total Capac... Projection	Total Capa...chievement
81.99%	91.06%	1	Kolkata	1343	1223	3145	1635
79.97%	69.69%	2	Haldia	4450	3101	6340	5070
71.90%	71.01%	3	Paradeep	7640	5425	10640	7650
67.47%	82.02%	4	Visakhapatnam	8220	6742	10810	7293
48.29%	31.83%	5	Ennore	4700	1496	6420	3100
110.26%	96.89%	6	Chennai	5750	5571	7230	7972
52.11%	88.89%	7	Tuticorin	3172	2810	6398	3334
74.85%	52.66%	8	Cochin	3817	2010	5475	4098
84.28%	67.49%	9	NMPT	4881	3294	6080	5097
62.63%	87.64%	10	Mormugao	4455	3900	6690	4190
48.46%	79.07%	11	Mumbai	7105	5618	9191	4453
66.95%	99.56%	12	JNPT	6604	6575	9560	6400
71.12%	95.13%	13	Kandla	8672	8260	12220	8691


* Port Traffic Dashboard
IBM Cognos Analytics with Watson
Tab 1
Tab 2
Tab 3
Tab 4
Port wise Traffic
Total Percent by Port


* Port Traffic Dashboard
IBM Cognos Analytics with Watson
Tab 1
Tab 2
Tab 3
Tab 4
Port regions and Port and Total Capacity Achievement for Port points
Chennai
Total Capacity Achievement: 7,972
TELANGANA
KARNATAKA
KERALA
Bay of Bengal
Sri Lanka


* Port Traffic Dashboard
IBM Cognos Analytics with Watson
Tab 1
Tab 2
Tab 3
Tab 4
Traffic Projection
Traffic Achievement
Total Capacity Projection
Total Capacity Achievement
8.67K
8.25K
12.2K
8.69K
Traffic Projection
Traffic Achievement
Total Capacity Projection
Total Capacity Achievement
Traffic Achievement and Total Capacity Achievement by Port


* Port Traffic Dashboard
IBM Cognos Analytics with Watson
Tab 1
Tab 2
Tab 3
Tab 4
Traffic Projection
Traffic Achievement
Total Capacity Projection
Total Capacity Achievement
6.6K
6.58K
9.56K
6.4K
Traffic Projection
Traffic Achievement
Total Capacity Projection
Total Capacity Achievement
Traffic Achievement and Total Capacity Achievement by Port
JNPT
Traffic Achievement: 6575


* Port Traffic Dashboard
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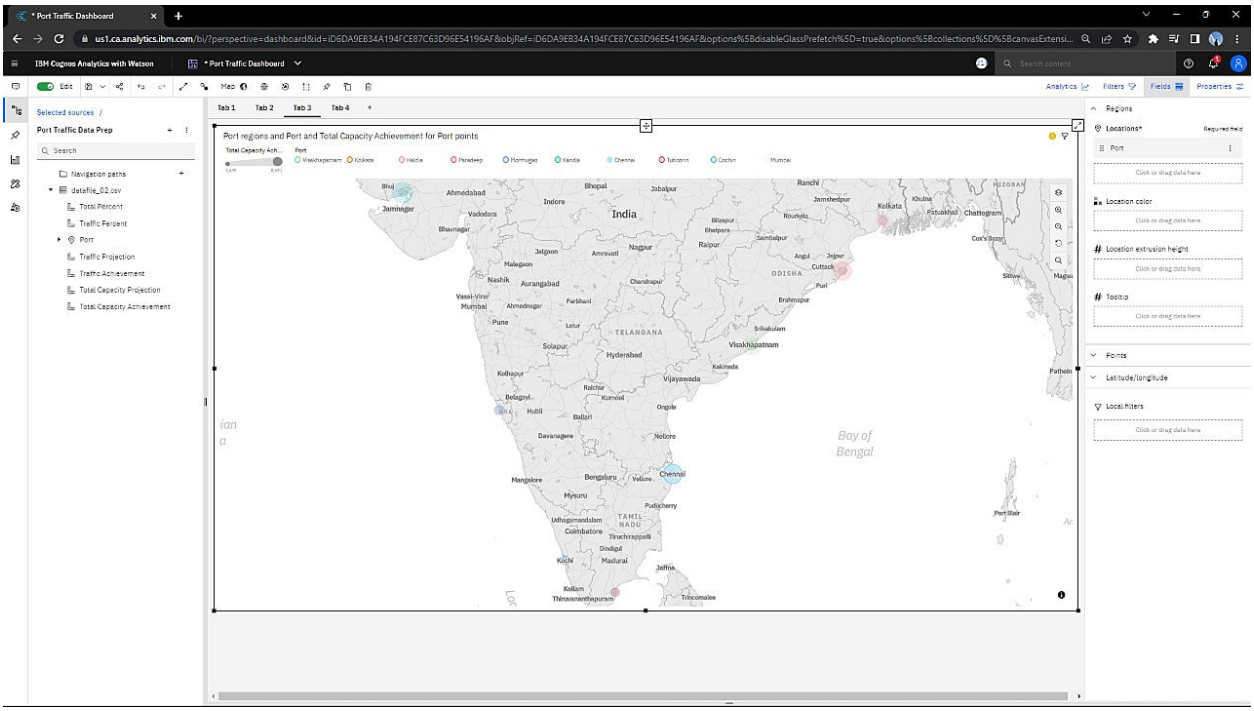
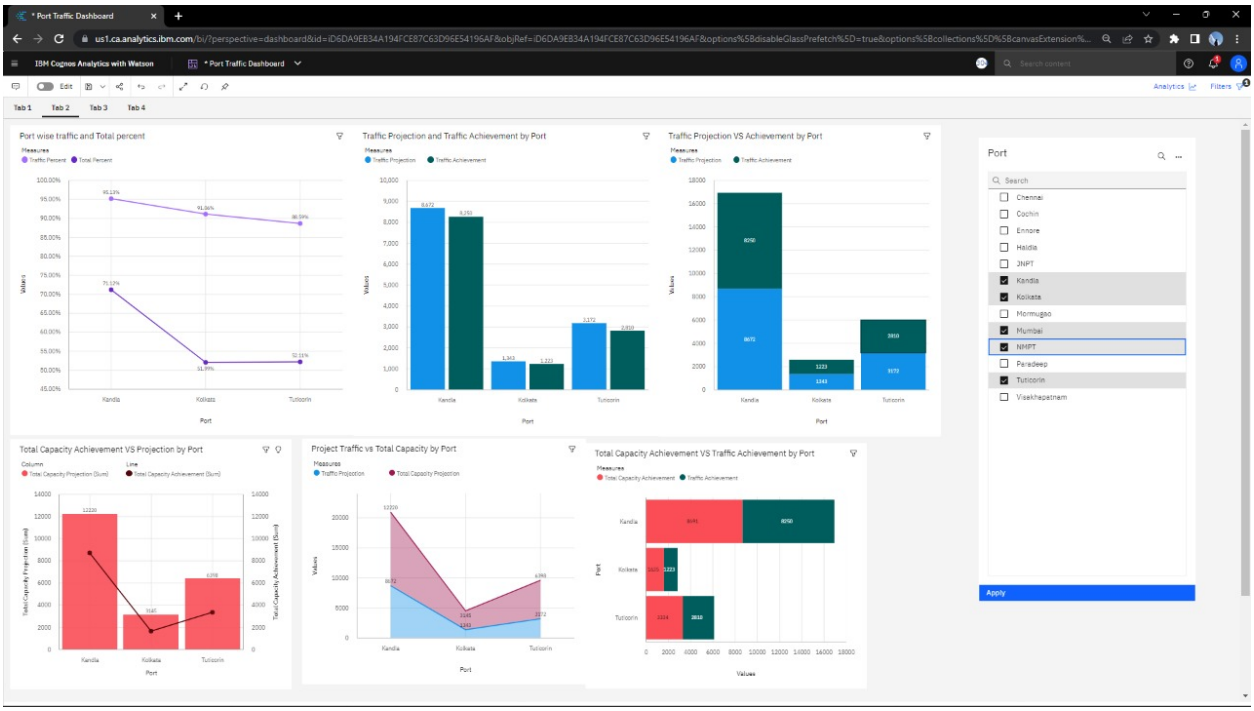
IBM Cognos Analytics with Watson
* Port Traffic Dashboard
Edit
Analytics
Filters
Fields
Properties
Selected sources /
Port Traffic Data Prep
Search
Navigation paths
datafile_02.csv
Total Percent
Traffic Percent
Port
Traffic Projection
Traffic Achievement
Total Capacity Projection
Total Capacity Achievement
Tab 1
Tab 2
Tab 3
Tab 4
Port regions and Port and Total Capacity Achievement for Port points
Total Capacity Ach...
Port
Kandla
Total Capacity Achievement: 8,691
India
Bay of Bengal
Regions
Locations*
Required field
Port
Click or drag data here
Location color
Location extrusion height
Tooltip
Points
Latitude/longitude
Local filters


* Port Traffic Dashboard
us1.ca.analytics.ibm.com/bi/?perspective=dashboard&id=iD6DA9EB34A194FCE87C63D96E54196AF&objRef=iD6DA9EB34A194FCE87C63D96E54196AF&options%5BdisableGlassPrefetch%5D=true&options%5Bcollections%5D%5BcanvasExtensi...
IBM Cognos Analytics with Watson
* Port Traffic Dashboard
Edit
Analytics
Filters
Fields
Properties
Selected sources /
Port Traffic Data Prep
Search
Navigation paths
datafile_02.csv
Total Percent
Traffic Percent
Port
Traffic Projection
Traffic Achievement
Total Capacity Projection
Total Capacity Achievement
Tab 1
Tab 2
Tab 3
Tab 4
Port regions and Port and Total Capacity Achievement for Port points
Total Capacity Ach...
Port
India
Bay of Bengal
Regions
Locations*
Required field
Port
Click or drag data here
Location color
Location extrusion height
Tooltip
Points
Latitude/longitude
Local filters



9. RESULTS

9.1 PERFORMANCE METRICS

S.NO	PARAMETER	VALUES
1	Dashboard design	No of Visualizations / Graphs - 19
2	Data Responsivenes	Positive
3	Amount Data to Rendered (DB2 Metrics)	Two data were rendered: Traffic Percentage and Total Capacity Percentage
4	Two data were rendered: Traffic Percentage and Total Capacity Percentag	1 filter was used in Dashboard for Collage tab
5	Effective User Story	No of Scene Added – 4 Scenes
6	Descriptive Reports	No of Visualizations / Graphs - 5 graphs

10. ADVANTAGES AND DISADVANTAGES

Advantages

• Really simple to make virtualization
• Easier to analyse Data
• Easy to predict using visualizations
• Easy to understand by anyone
• Helps in constructing plan for foreseeable future

Disadvantages

• Need to have an Account to upload data and create new Virtualizations
• Virtualization needs to be updated regularly
• Real-time Live update is not possible yet
• If the uploaded data is wrong the virtualization might be wrong

11. CONCULSION

To conclude the project is able to do the required analysis to predict Traffic and capacity, and is able to do it in a more simple and easy way. The Project can still be improved in many ways, and will be don in future subsequent updates

12. FUTURE SCOPE

In the future subsequent updates, the project can be made so that the data can be updated in Real-Time. Further UI updates can also be made to make it more presentable and user friendly. More utilities can be added to the website.