

# Vande Bharat Express

## Vande Bharat Express: Pioneering India's High-Speed Rail Journey

### Team ID: PNT2023TMID591251

The Vande Bharat Express, also recognized as Train 18, is an intercity electric multiple unit train in India with semi-high-speed capabilities. It was designed and manufactured by the Integral Coach Factory (ICF) located in Chennai, India. The train derives its name from the Sanskrit phrase "Vande Mataram" which translates to "I salute thee, Mother." This patriotic song holds historical significance and is closely associated with India's struggle for independence. The choice of this name reflects the train's role as a symbol of India's advancement in railway technology and transportation. It is renowned for its modern amenities and high-speed features, representing a significant achievement in India's ongoing efforts to modernize its railway infrastructure.

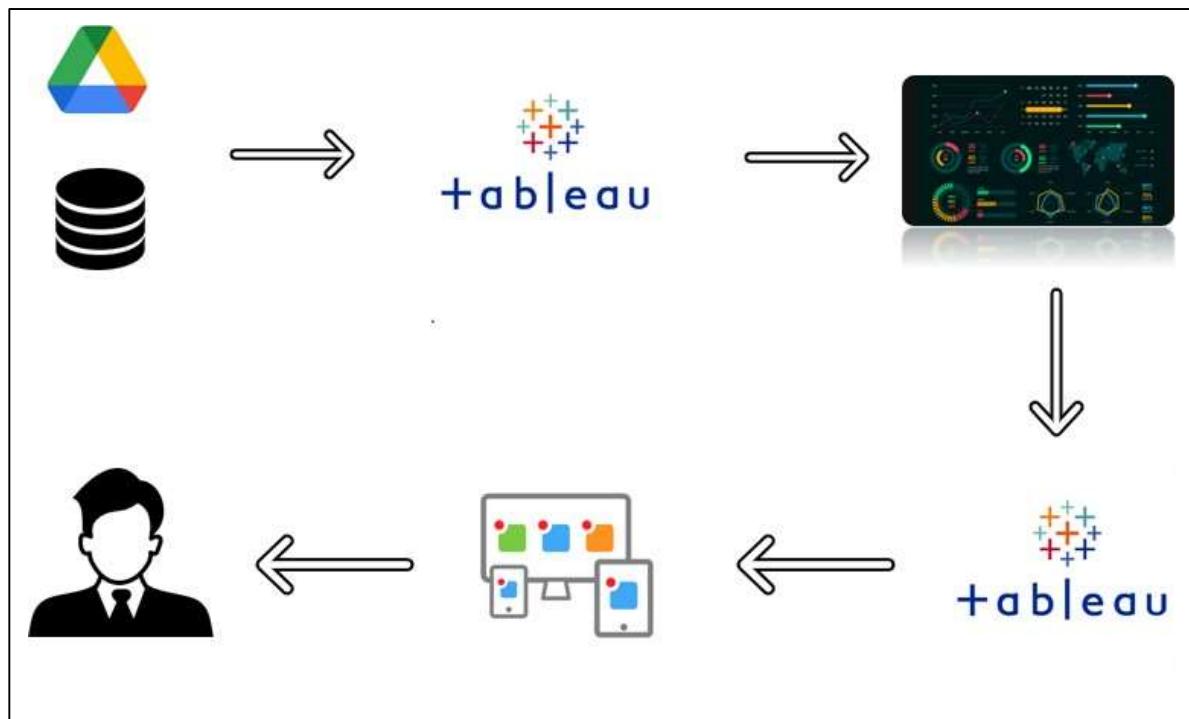
The key features of the Vande Bharat Express (Train 18) include:

1. Semi-High Speed: The train is designed for high-speed travel on Indian railroads, capable of reaching speeds of up to 160-180 km/h (99-112 mph), significantly reducing travel time on its routes.
2. Aerodynamic Design: The train's aerodynamic design reduces air resistance, contributing to its high-speed capabilities and energy efficiency.
3. Modern Interiors: Vande Bharat Express features modern and comfortable interiors with state-of-the-art facilities, including LED lighting, automatic doors, and plush seating.
4. Energy Efficiency: The train is equipped with regenerative braking systems that help in energy conservation and reduced carbon emissions.
5. On-Board Entertainment: Passengers can enjoy onboard infotainment systems, which include Wi-Fi, GPS-based passenger information, and LCD screens.
6. Bio-Toilets: The train is equipped with bio-toilets that are environmentally friendly and contribute to maintaining hygiene.
7. GPS-Based Tracking: The train uses GPS-based systems for real-time tracking and improved passenger information.
8. Improved Safety: Vande Bharat Express has enhanced safety features, such as emergency braking, fire and smoke detection, and anti-collision systems.
9. Noise Reduction: The train's design incorporates features to reduce noise and vibrations, resulting in a quieter and more comfortable ride.
10. Panoramic Windows: Passengers can enjoy scenic views through large panoramic windows in the train's carriages.

These features collectively make the Vande Bharat Express a symbol of modernization and innovation in the Indian railway system, providing passengers with a comfortable and efficient travel experience. The Vande

Bharat Express represents a leap in India's rail technology and infrastructure, offering passengers a modern and efficient mode of travel. It not only reduces travel times but also symbolizes India's commitment to technological advancement in the transportation sector.

## Technical Architecture:



## **Project Flow**

To accomplish this, we have completed all the activities listed below,

- Ideation
  - Empathize and Discover using Empathy Map
  - Brainstorm Ideas
  - Prioritize Ideas
- Project Designing
  - Proposed Solution
  - Solution Architecture
  - Business Requirements (Data Flow and User Stories)
- Project Planning
  - Technical Architecture
- Data Visualizations
  - No of Unique Visualizations
- Dashboard
  - Responsive and Design of Dashboard
- Story
  - No of Scenes of Story
- Web Integration
  - Dashboard and Story embed with UI
- Project Demonstration & Documentation
  - Record explanation Video for project end to end solution

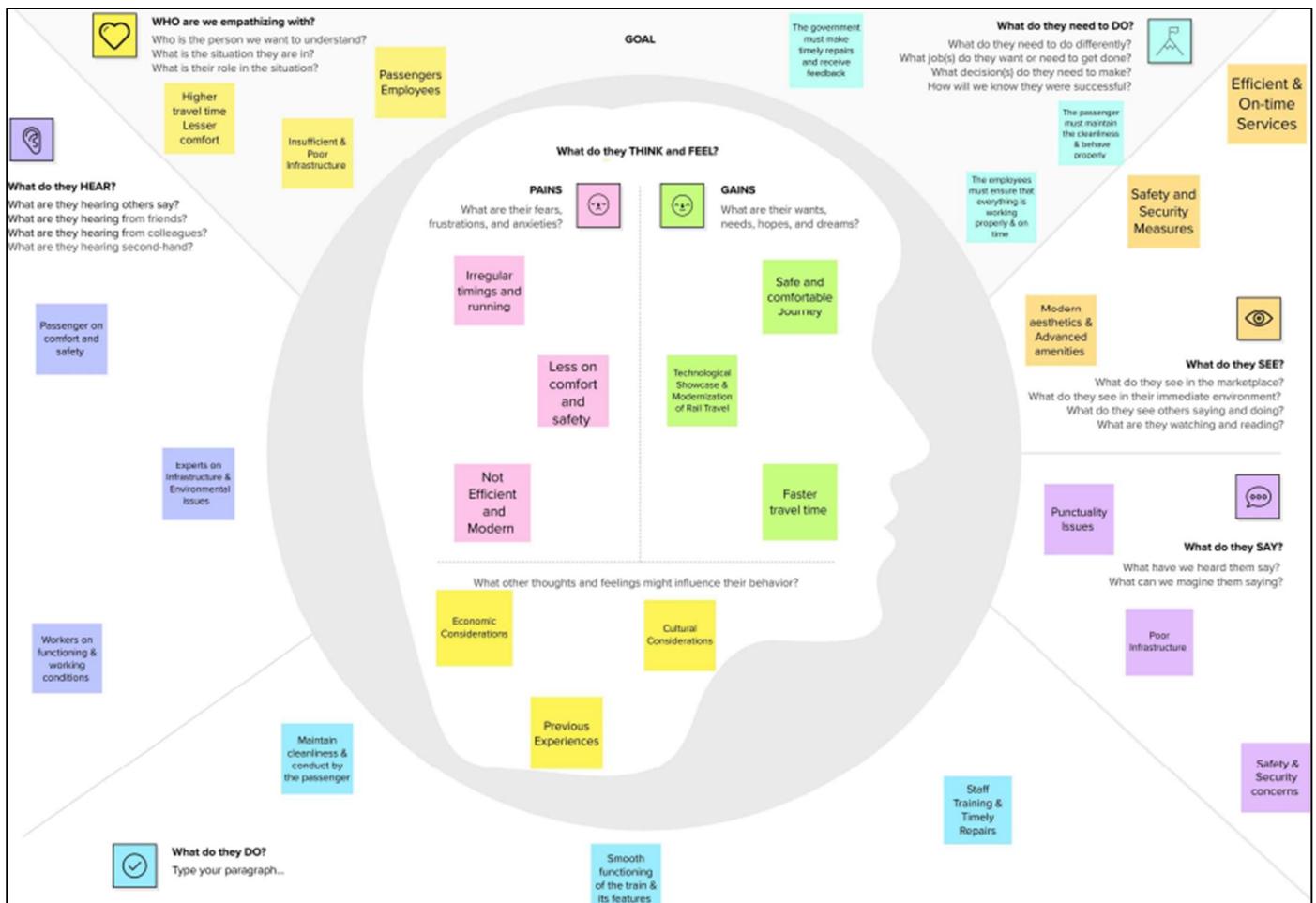
## Ideation Phase

### Empathize and Discover using Empathy map

A canvas empathy map is a visual tool for understanding and empathizing with users or consumers. It is a framework that assists teams in delving into the thoughts, feelings, actions, and requirements of the people for whom they are building. The canvas is divided into pieces that reflect various aspects of the user experience:

1. Says: This section contains direct quotes or phrases that correspond to what the user speaks out. It focuses on their vocalized needs, remarks, and expressions.
2. Thoughts: This section is for collecting the user's unsaid thoughts, considerations, and underlying worries. It investigates what the user is thinking or feeling within.
3. Does: In this section, you outline the user's actions and behaviors. This covers their visible activities, what they do in various settings, and how they interact.
4. Feels: This part focuses on the user's emotions and feelings. It records their emotional reactions, desires, and underlying feelings about their experiences.

Empathy map canvases are used in a variety of fields, particularly design thinking, marketing, and product development, to gain a comprehensive grasp of the user's point of view. This tool helps to develop empathy and a deeper understanding of the user's needs, which may then be used to create products, services, or experiences that are suited to those needs.



## Brainstorm and Prioritize Ideas

The solution focuses on implementing and solving for solutions to identify the train name, train number and the number of cars available involving to find the distance by the train and its average occupancy for statistical purposes and better performance of the Express. Brainstorming ideas is a creative process where a group generates a list of potential solutions, suggestions, or concepts for a specific problem or project. Voting in brainstorming involves participants selecting and prioritizing their favorite or most promising ideas from the list to determine which ones should be pursued further.

**Brainstorm**

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

**TIP**  
You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

⌚ 10 minutes

Person 1 - Dharshikha	Person 2 - Sindhupriya	Person 3 - Lakshman
Reduced Travel Time	Environmental Benefits	Advancements in Infrastructure
Elevated Passenger Satisfaction	Rising Passenger Numbers	Revamped Railway Journeys
Potential for Tech Export	Accessible travel for everyone	Initial stages of Emerging Technology

**Voting :**

Person 1 - Dharshikha	Person 2 - Sindhupriya	Person 3 - Lakshman
Reduced Travel Time (9)	Environmental Benefits (4)	Advancements in Infrastructure (6)
Elevated Passenger Satisfaction (3)	Rising Passenger Numbers (7)	Revamped Railway Journeys (5)
Potential for Tech Export (4)	Accessible travel for everyone (3)	Initial stages of Emerging Technology (4)

Idea prioritization is the process of ranking or assessing ideas based on specific criteria such as feasibility, impact, cost, or strategic importance to determine which ideas should be implemented or pursued first.

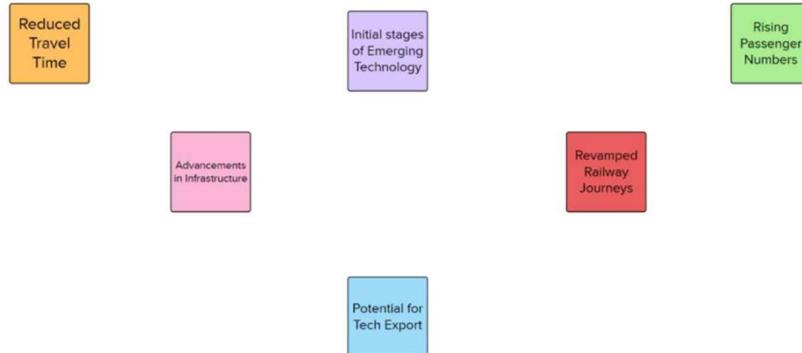
### Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

⌚ 20 minutes

#### TIP

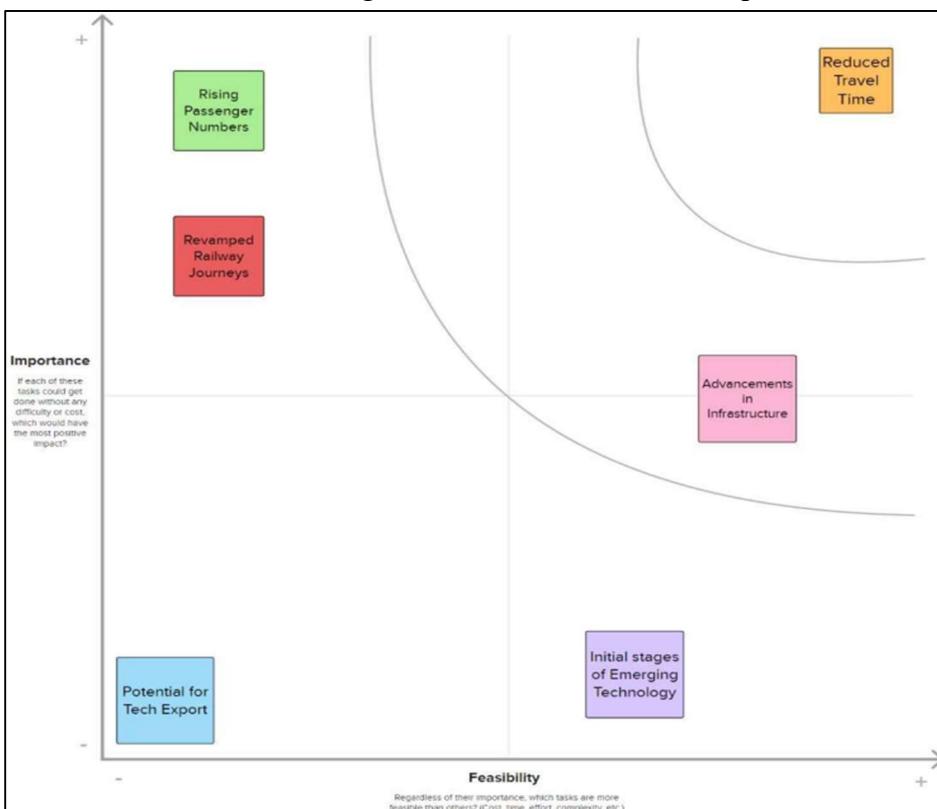
Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.



Here's a description to why we have selected these ideas over the other options: Prioritizing reduced travel time in the Vandhe Bharath Express is not only about creating a high-speed transportation system but also about generating a cascading impact on convenience, economic growth, environmental sustainability, safety, and overall national development.

It's a goal that aligns with the broader vision of improving the quality of life for citizens and enhancing the nation's global standing in the field of transportation and infrastructure. Reduced travel time directly translates to greater convenience for passengers. By significantly cutting down the time it takes to travel between destinations, Vandhe Bharath Express becomes an attractive and time-efficient mode of transportation.

Passengers can reach their destinations faster, saving them precious hours that can be used for other activities. This can lead to higher productivity and greater work-life balance for individuals. Faster journeys can help alleviate congestion on roadways and at airports. By diverting travellers to the high-speed train, Vandhe Bharath Express reduces the strain on existing transportation infrastructure, which can lead to a smoother, less congested, and safer overall transportation network.



## Project Designing

### **Proposed Solution**

S. No.	Parameter	Description
1.	Problem Statement	<p>The problem at hand revolves around optimizing the operational efficiency and user experience of the Vande Bharat Express which is a high-speed intercity electric train in India.</p> <p>The identified challenges include potential technical issues, infrastructure compatibility, safety concerns, operational costs, public acceptance, and regulatory hurdles. Addressing these challenges is crucial for ensuring the seamless operation, safety, and economic viability of the high-speed train.</p>
2.	Idea / Solution description	<p>The solution involves implementing a comprehensive project that encompasses data collection, preparation, visualization, and web integration using tools like Tableau and Flask. By leveraging data analytics, the project aims to provide insights into various aspects of the Vande Bharat Express, from its technical performance to passenger-related metrics. The integration of a responsive and visually appealing dashboard, coupled with a storytelling approach, enhances the communication of information about the train's key features and impact.</p>
3.	Novelty / Uniqueness	<p>The uniqueness lies in the combination of data analytics, visualization, and web integration to comprehensively address challenges associated with a high-speed train project. The utilization of tools like Tableau and Flask adds a modern and interactive layer to the solution, allowing stakeholders and the public to engage with the information seamlessly. The emphasis on storytelling through visualizations provides a novel way of communicating complex data, making it more accessible to a broader audience.</p>
4.	Social Impact / Customer Satisfaction	<p>The project acknowledges the potential social impact of the Vande Bharat Express, emphasizing reduced travel times, enhanced passenger experience, economic benefits for regions served, and environmental sustainability. By showcasing these impacts through visualizations and stories, the project aims to increase awareness and contribute to overall customer satisfaction. The focus on modernizing rail travel aligns with societal expectations for advanced, efficient, and eco-friendly transportation options.</p>
5.	Business Model (Revenue Model)	<p>The provided information does not explicitly detail a revenue model for the project. However, the potential business model could involve offering the developed analytics and visualization solution as a service to other high-speed rail projects or transportation entities. Monetization strategies may include licensing the use of the dashboard and associated tools or providing custom analytics services based on specific project requirements.</p>
6.	Scalability of the Solution	<p>The scalability of the solution is contingent on its adaptability to different high-speed rail projects and transportation systems.</p> <p>The use of widely accessible tools like Tableau and Flask, coupled with a structured project development procedure, suggests that the solution can be scaled to accommodate diverse data sets and project requirements. The modular nature of the project components allows for flexibility and scalability in addressing the analytics needs of various transportation initiatives.</p>

## Solution Architecture:

### Finding the Best Tech Solution:

The project utilizes a solution architecture that incorporates data analytics, visualization, and web integration tools such as Tableau and Flask. This aligns with the goal of finding the best tech solution to address the existing business problems associated with the Vande Bharat Express. By leveraging these technologies, the project aims to optimize the operational efficiency and user experience of the high-speed train.

### Describing Structure and Characteristics:

In the context of the project, the solution architecture describes the structure and characteristics of the software components used for data collection, preparation, visualization, and web integration. It outlines how these components interact to provide a comprehensive view of the Vande Bharat Express, including technical performance metrics and passenger-related data.

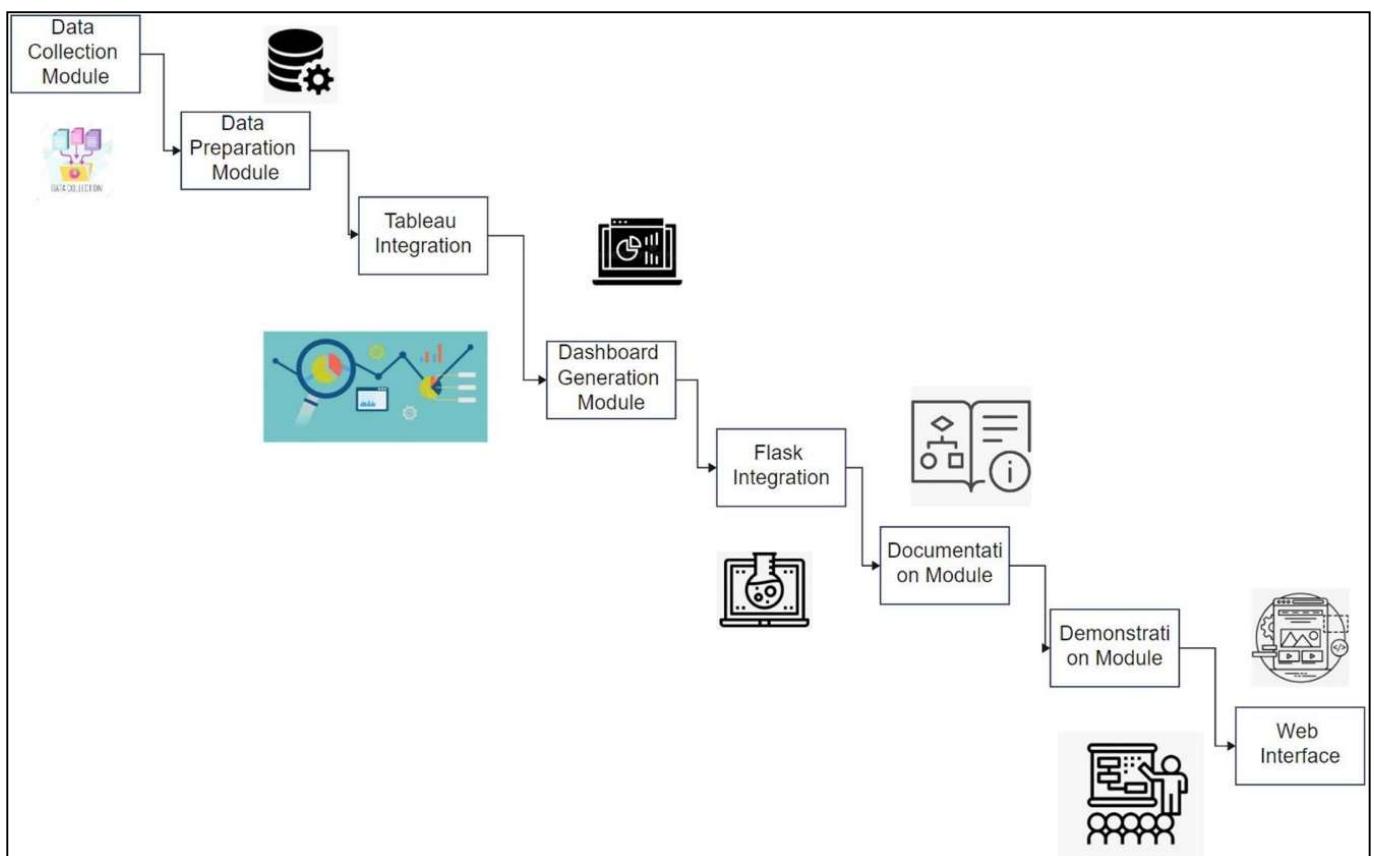
### Defining Features, Development Phases, and Requirements:

The solution architecture plays a crucial role in defining the features and development phases of the project. It outlines the various activities such as data collection, preparation, visualization creation, web integration, and documentation. Additionally, it sets forth the specific requirements that need to be addressed to achieve the project's goals, including considerations for data accuracy, completeness, and user interaction.

### Providing Specifications for Solution Management:

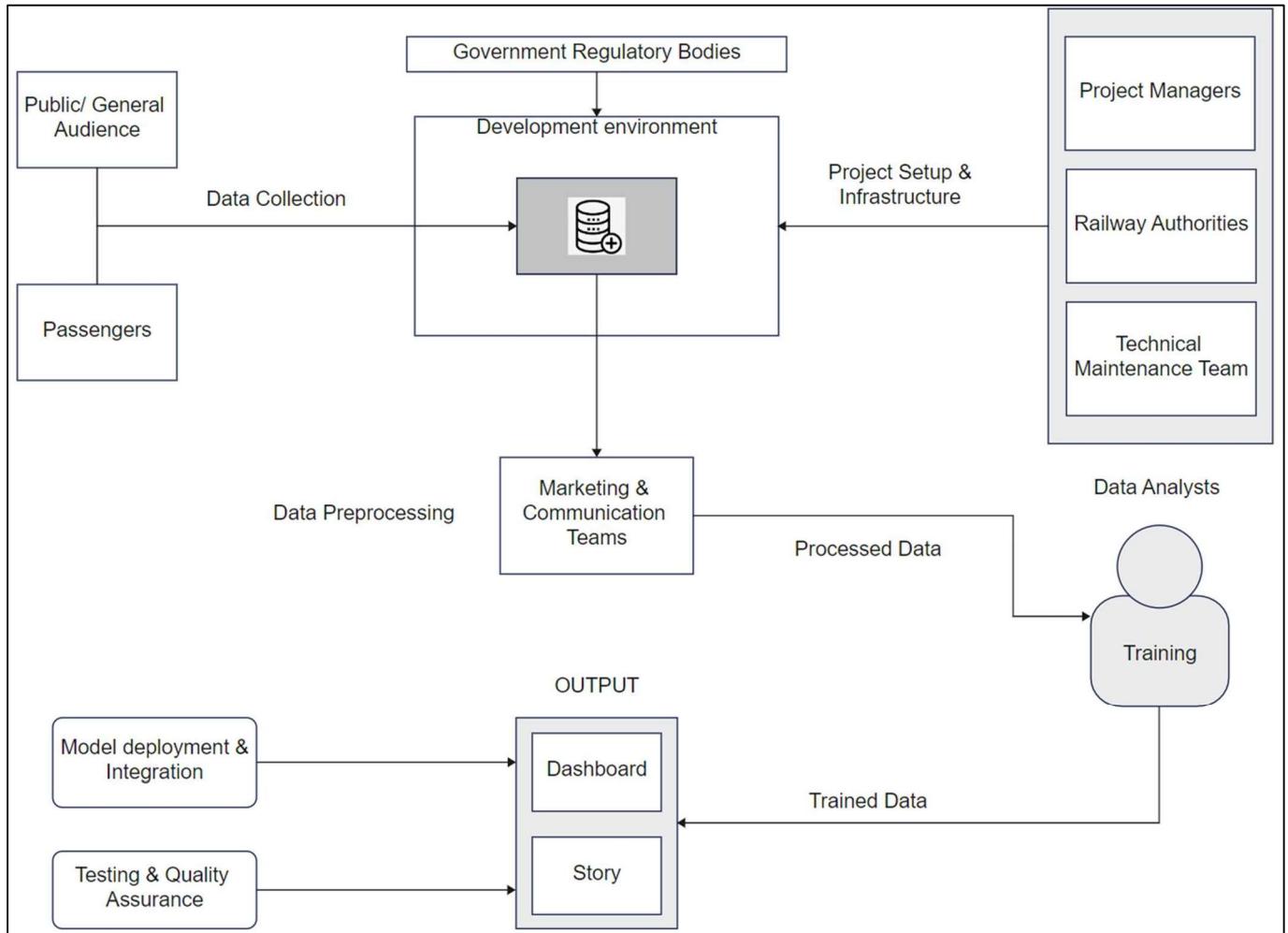
The solution architecture provides specifications that guide the management and delivery of the project. This includes defining the steps involved in each milestone, specifying the tools and technologies to be used, and outlining the overall project development procedure. These specifications serve as a roadmap for the project team, ensuring a structured and well-managed approach to the implementation of the solution.

## Solution Architecture Diagram



In summary, the solution architecture for this project aligns with the overarching goals of finding the best tech solution, describing software structure and characteristics, defining features and development phases, and providing specifications for effective solution management and delivery.

## Data Flow Diagram:



## User Stories:

User Type	Functional Requirement (Epic)	User Story No	User Story / Task	Acceptance criteria	Priority	Release
Railway Authorities	Operations and management	USN-1	Access to performance metrics, operational data, and safety-related information for effective decision-making and planning.	Project setup and Infrastructure	High	Sprint 1
Technical Maintenance Team	Maintenance and technical aspects	USN-1	Detailed technical data, maintenance schedules, and insights into any potential issues affecting the train's performance.	Project setup and Infrastructure	High	Sprint 1
Project Managers	Overseeing the development and implementation	USN-1	Progress reports, project documentation, and insights into the effectiveness of the implemented solution.	Project setup and Infrastructure	High	Sprint 1
Government Regulatory Bodies	Compliance with safety and regulatory standard	USN-2	Access to safety reports, compliance data, and information on any incidents or issues that may impact the regulatory landscape.	Development environment	High	Sprint 1
Public/ General Audience	Interested stakeholders, public, or enthusiasts.	USN-3	Access to publicized visualizations, dashboards, and stories about the Vande Bharat Express's impact and performance.	Data Collection	High	Sprint 2
Passengers	Actual users of the service	USN-3	Information on travel times, occupancy rates, amenities, and any real-time updates affecting their journey.	Data Collection	High	Sprint 2
Marketing & Communication Teams	Communicating the achievements & impact	USN-4	Engaging visual content, success stories, and key performance indicators for promotional purposes.	Data Preprocessing	High	Sprint 2
Data Analysts	Analyzing and interpreting data	USN-5	Access to raw and processed data, visualization tools, and analytical reports for performance assessment.	Training	Medium	Sprint 3
	Model deployment & Integration	USN-6	Make the dashboard available as a web service to grant users' easy access. Seamlessly integrate the model's API into a user-friendly web interface, ensuring users can effortlessly obtain the necessary output.	We could check the scalability	Medium	Sprint 4
	Testing & quality assurance	USN-7	Conduct extensive testing on both the dashboard and visualizations to detect and report any issues. To fine tune the hyperparameters and enhance performance by incorporating user feedback and testing results.	We could create web application	Medium	Sprint 5

# Project Planning

## Product Backlog, Sprint Schedule, and Estimation

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Project setup and Infrastructure	USN-1	Prepare the project by configuring the development environment with the necessary tools and frameworks.	1	High	Sindhu
Sprint-1	Development environment	USN-2	Curate a varied dataset for Vandhe Bharat trains, encompassing a range of details such as Source, Destination, Distance, Time Taken, Average Speed, and Frequency. This dataset will serve as the training foundation for the deep learning model.	1	High	Dharshikha
Sprint-2	Data Collection	USN-3	Refine the gathered dataset through preprocessing, which involves formatting the data and dividing it into distinct training and validation sets.	2	High	Lakshman
Sprint-2	Data Preprocessing	USN-4	Explore and assess various deep learning architectures to select the most fitting model for this specific project.	3	High	Lakshman
Sprint-3	Training	USN-5	Incorporate data augmentation techniques, such as rotation and flipping, to enhance the model's resilience and accuracy.	4	Medium	Dharshikha
Sprint-4	Model Deployment and Integration	USN-6	Make the dashboard available as a web service to grant users easy access. Seamlessly integrate the model's API into a user-friendly web interface, ensuring users can effortlessly obtain the necessary output.	2	Medium	Sindhu
Sprint-5	Testing & Quality Assurance	USN-7	Conduct extensive testing on both the dashboard and visualizations to detect and report any issues. To fine tune the hyperparameters and enhance performance by incorporating user feedback and testing results.	2	Medium	Sindhu

## Project Tracker, Velocity & Burndown Chart:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	2	2 Days	21 Oct 2023	23 Oct 2023	15	23 Oct 2023
Sprint-2	5	3 Days	24 Oct 2023	27 Oct 2023		27 Oct 2023
Sprint-3	4	5 Days	28 Oct 2023	02 Nov 2023		
Sprint-4	2	2 Days	03 Nov 2023	05 Nov 2023		
Sprint-5	2	3 Days	06 Nov 2023	09 Nov 2023		

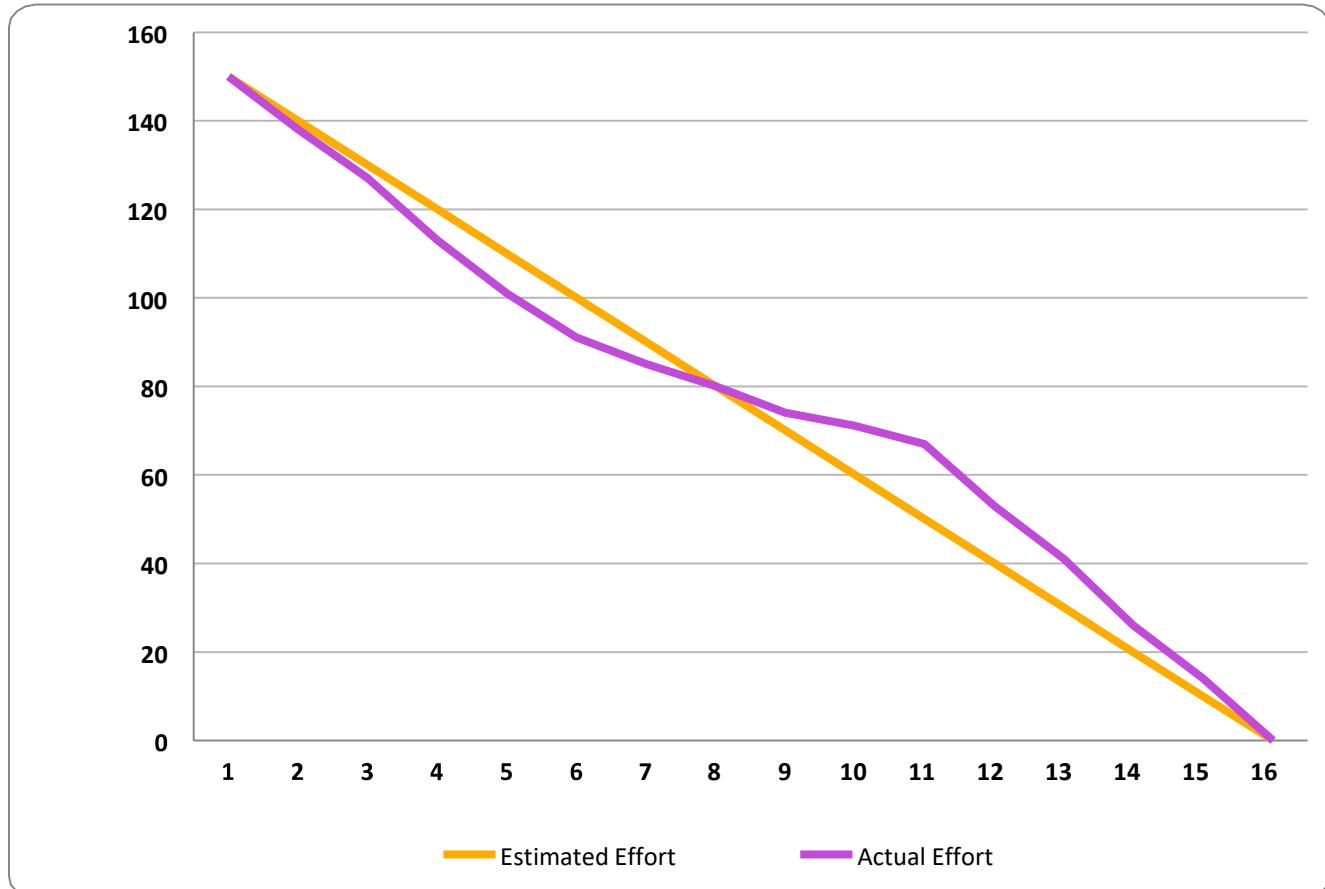
### Velocity:

We have a 15-days sprint duration, and the velocity of the team is 15 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{\text{sprint duration}}{\text{velocity}}$$

$$AV = 15/15 = 1$$

### Burndown Chart:



## Board section.

We have completed sprint 1 and 2 and we are working on sprint 3. We can notice that the remaining tasks on board.

The screenshot shows the Jira Board section for the 'Vandhe Bharat' project. The board is divided into three columns: 'TO DO', 'IN PROGRESS', and 'COMPLETED'. Each column contains several tasks with their descriptions, due dates, and status indicators.

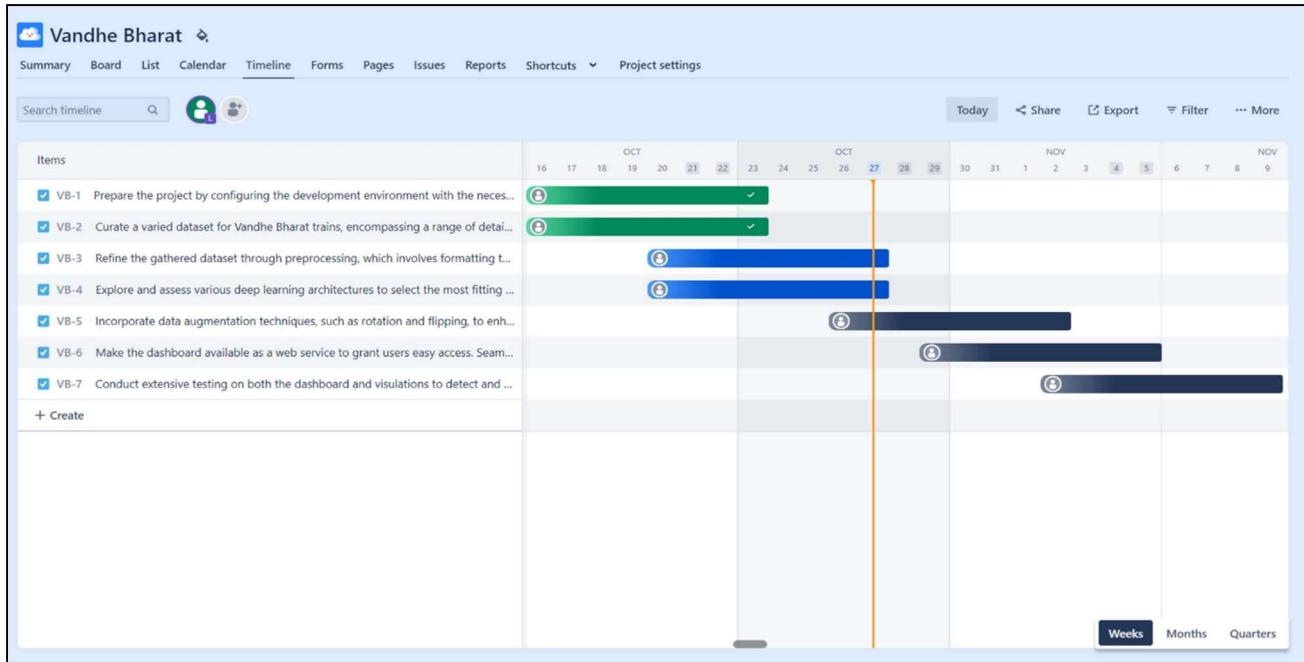
Column	Task Description	Due Date	Status
TO DO	Incorporate data augmentation techniques, such as rotation and flipping, to enhance the model's resilience and accuracy.	02 NOV	TO DO
	Make the dashboard available as a web service to grant users easy access. Seamlessly integrate the model's API into a user-friendly web interface, ensuring users can effortlessly obtain the necessary output.	05 NOV	TO DO
IN PROGRESS	Refine the gathered dataset through preprocessing, which involves formatting the data and dividing it into distinct training and validation sets.	27 OCT	IN PROGRESS
	Explore and assess various deep learning architectures to select the most fitting model for this specific project.	27 OCT	IN PROGRESS
COMPLETED	Prepare the project by configuring the development environment with the necessary tools and frameworks.	23 OCT	COMPLETED
	Curate a varied dataset for Vandhe Bharat trains, encompassing a range of details such as Source, Destination, Distance, Time Taken, Average Speed, and Frequency. This dataset will serve as the training foundation for the deep learning model.	23 OCT	COMPLETED

## List Section

The screenshot shows the Jira List section for the 'Vandhe Bharat' project. It displays a table of tasks with columns for Type, Key, Summary, Status, Priority, and Due date.

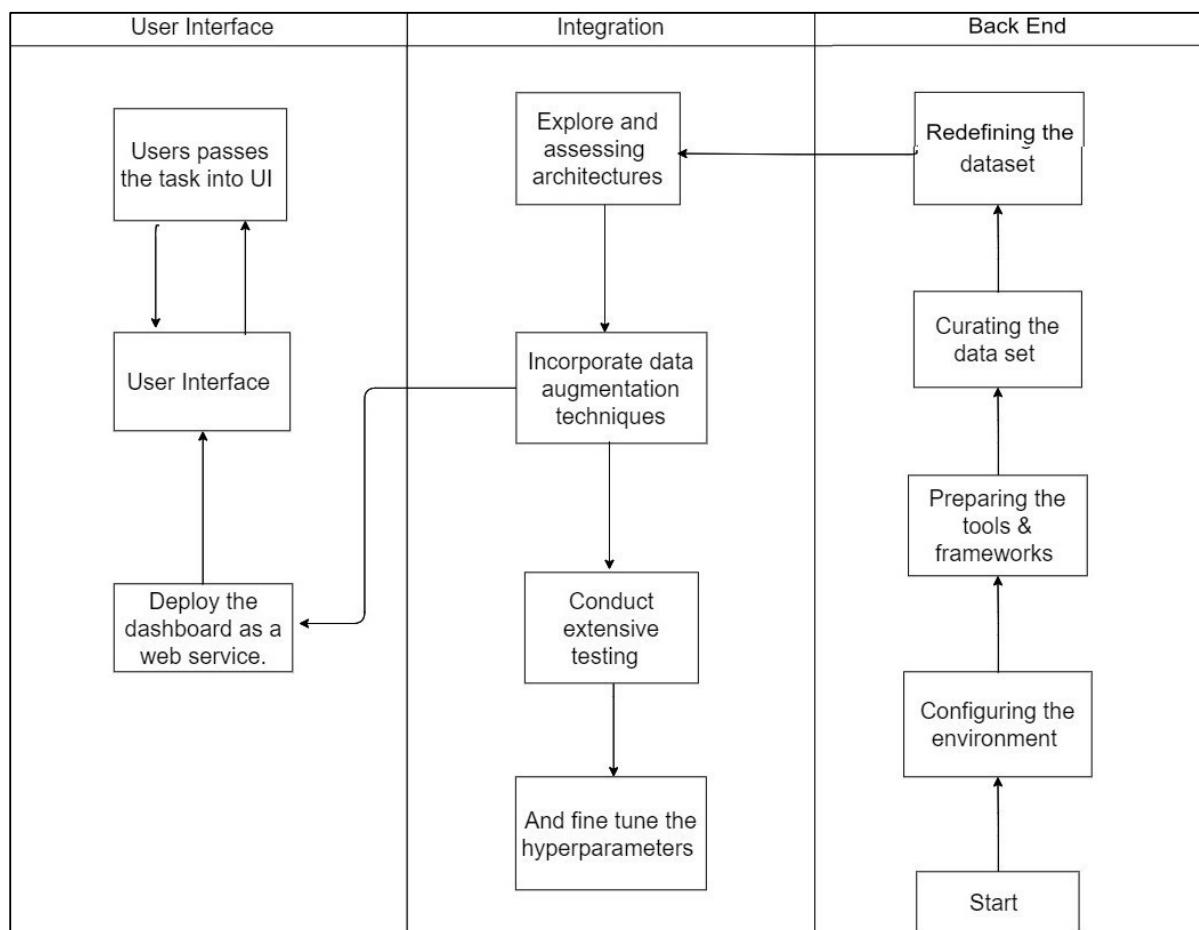
Type	Key	Summary	Status	Priority	Due date
	VB-1	Prepare the project by configuring the development environment with the necessary tools and frameworks.	COMPLETED	High	Oct 23, 2023
	VB-2	Curate a varied dataset for Vandhe Bharat trains, encompassing a range of details such as Source, Destination, Distance, Time Taken, Average Speed, and Frequency. This dataset will serve as the training foundation for the deep learning model.	COMPLETED	High	Oct 23, 2023
	VB-3	Refine the gathered dataset through preprocessing, which involves formatting the data and dividing it into distinct training and validation sets.	IN PROGRESS	Medium	Oct 27, 2023
	VB-4	Explore and assess various deep learning architectures to select the most fitting model for this specific project.	IN PROGRESS	Medium	Oct 27, 2023
	VB-5	Incorporate data augmentation techniques, such as rotation and flipping, to enhance the model's resilience and accuracy.	TO DO	Low	Nov 2, 2023
	VB-6	Make the dashboard available as a web service to grant users easy access. Seamlessly integrate the model's API into a user-friendly web interface, ensuring users can effortlessly obtain the necessary output.	TO DO	Low	Nov 5, 2023
	VB-7	Conduct extensive testing on both the dashboard and visualizations to detect and report any issues. To fine tune the hyperparameters and enhance performance by incorporating user feedback and testing results.	TO DO	Medium	Nov 9, 2023

# Timeline



## Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2



## **Guidelines:**

1. Include all the processes (As an application logic / Technology Block)
2. Provide infrastructural demarcation (Local / Cloud)
3. Indicate external interfaces (third party API's etc.)
4. Indicate Data Storage components / services

**Table-1: Components & Technologies:**

S. No	Component	Description	Technology
1.	User Interface	How user interacts with application	Tableau Dashboard
2.	Application Logic	Logic for a process in the application	Python
3.	Software	To make changes and visualize the data	Tableau
4.	Database	Data Type, Configurations etc.	MySQL
5.	Cloud Database	Database Service on Cloud	Google Cloud SQL
6.	File Storage	File storage requirements	Storage Service or Local File system

**Table-2: Application Characteristics:**

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture	Technology used
4.	Availability	Justify the availability of application	Technology used
5.	Performance	Design consideration for the performance of the application	Technology used

# Data Visualizations

Data visualization is the process of creating graphical representations of data in order to help people understand and explore the information. The goal of data visualization is to make complex data sets more accessible, intuitive, and easier to interpret. By using visual elements such as charts, graphs, and maps, data visualizations can help people quickly identify patterns, trends, and outliers in the data.

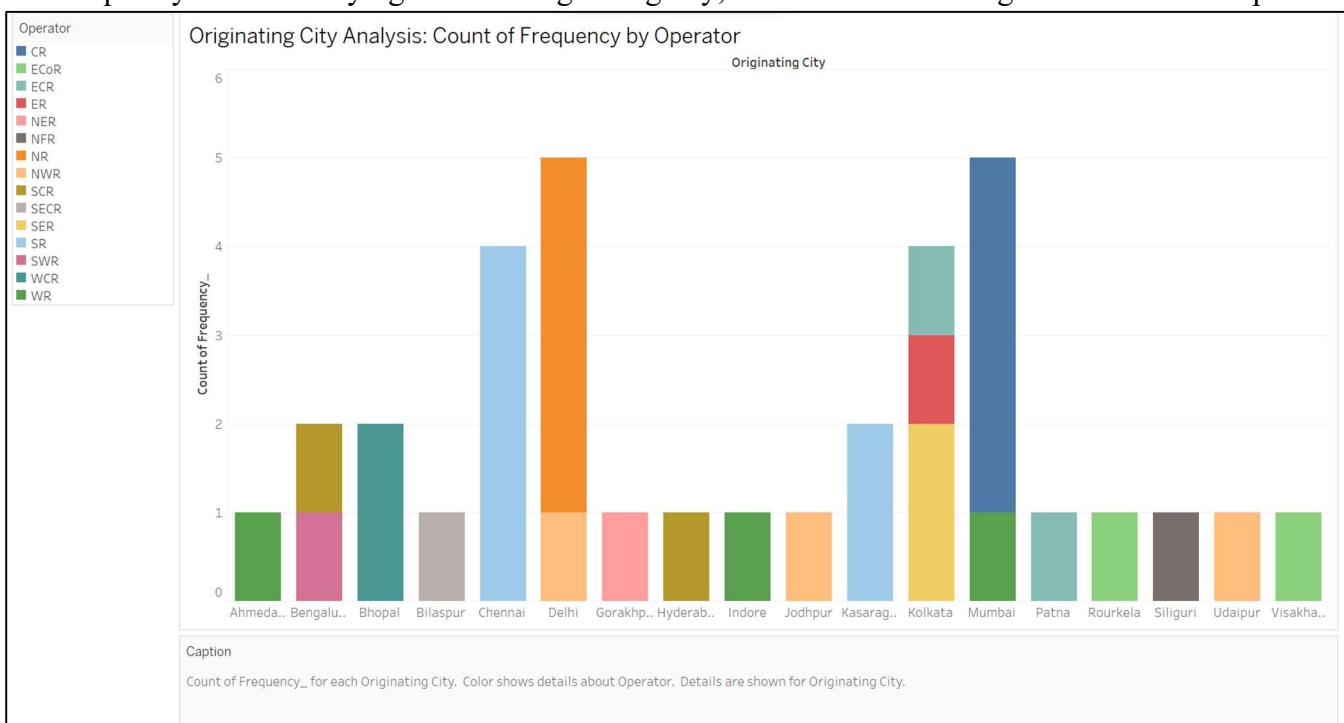
## Visualization 1: Comparison of Trains and Their Average Speeds

The average speed varying for each train, with the colour representing details about the operator of the train



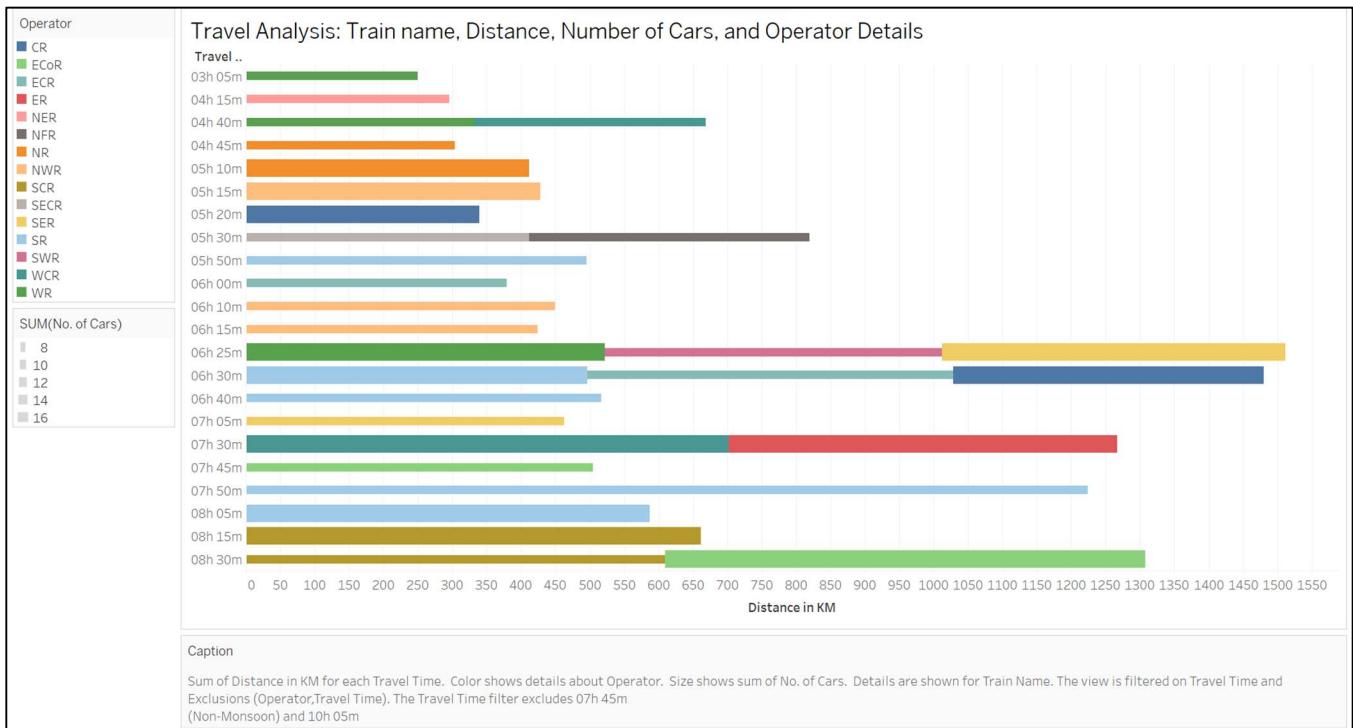
## Visualization 2: Originating City Analysis: Count of Frequency by Operator

The frequency of trains varying for each originating city, with colour indicating details about the operator.



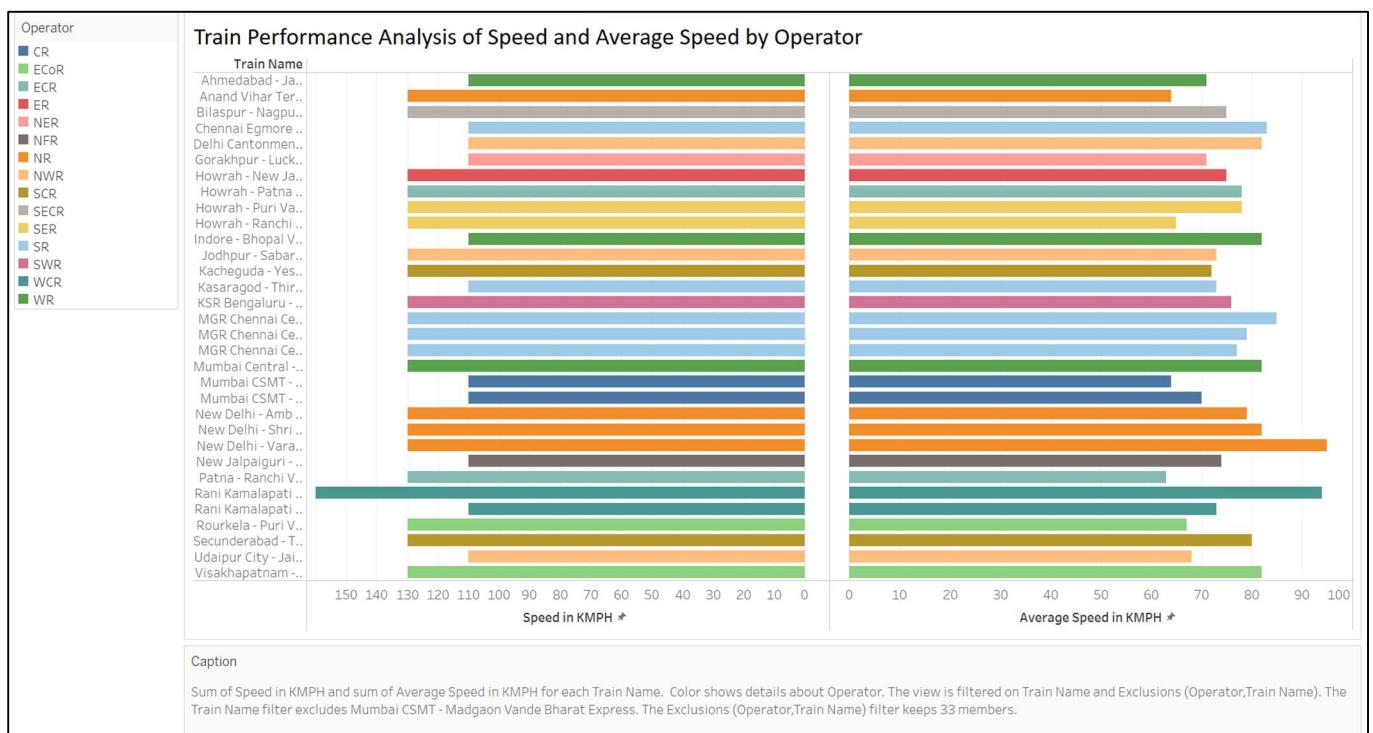
## Visualisation 3: Travel Analysis: Train name, Distance, Number of Cars, and Operator Details

The relationship between the total distance travelled, train name, travel time, and the number of cars. The colour indicates details about the operator, and the size represents the sum of the number of cars.



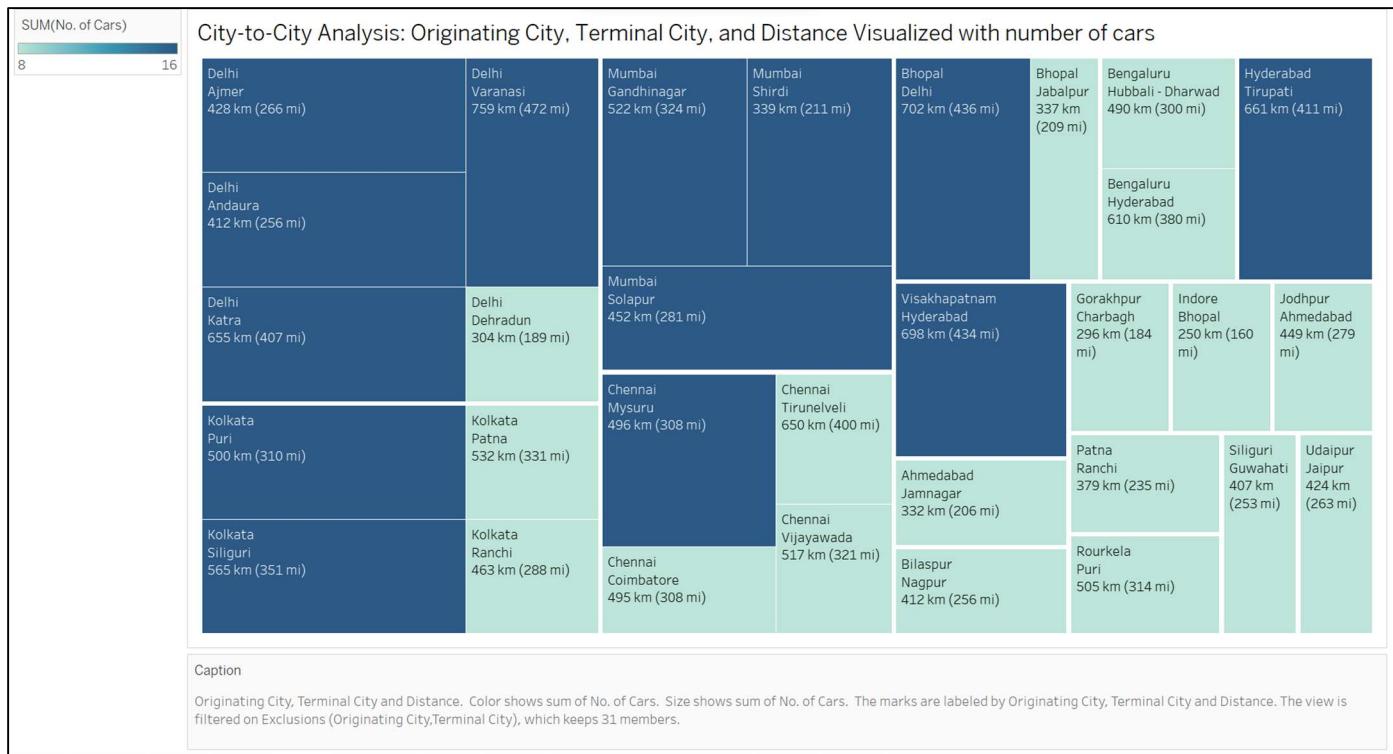
## Visualisation 4: Train Performance Analysis of Speed and Average Speed by Operator

The variations in speed and average speed across different trains. The colour represents details about the operator.



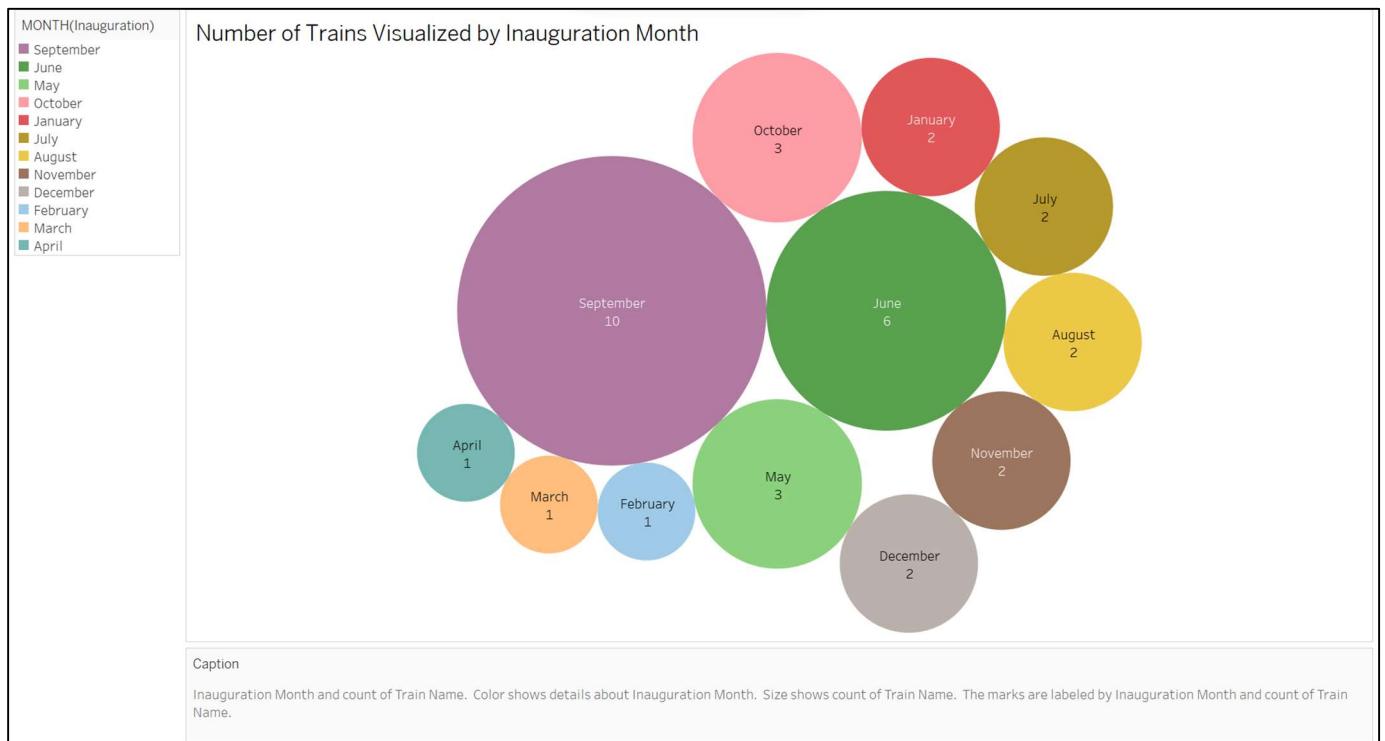
## Visualisation 5: City-to-City Analysis: Originating City, Terminal City, and Distance Visualized with number of cars

The connection between the originating city, terminal city, and distance, with colour and size denoting the total number of cars

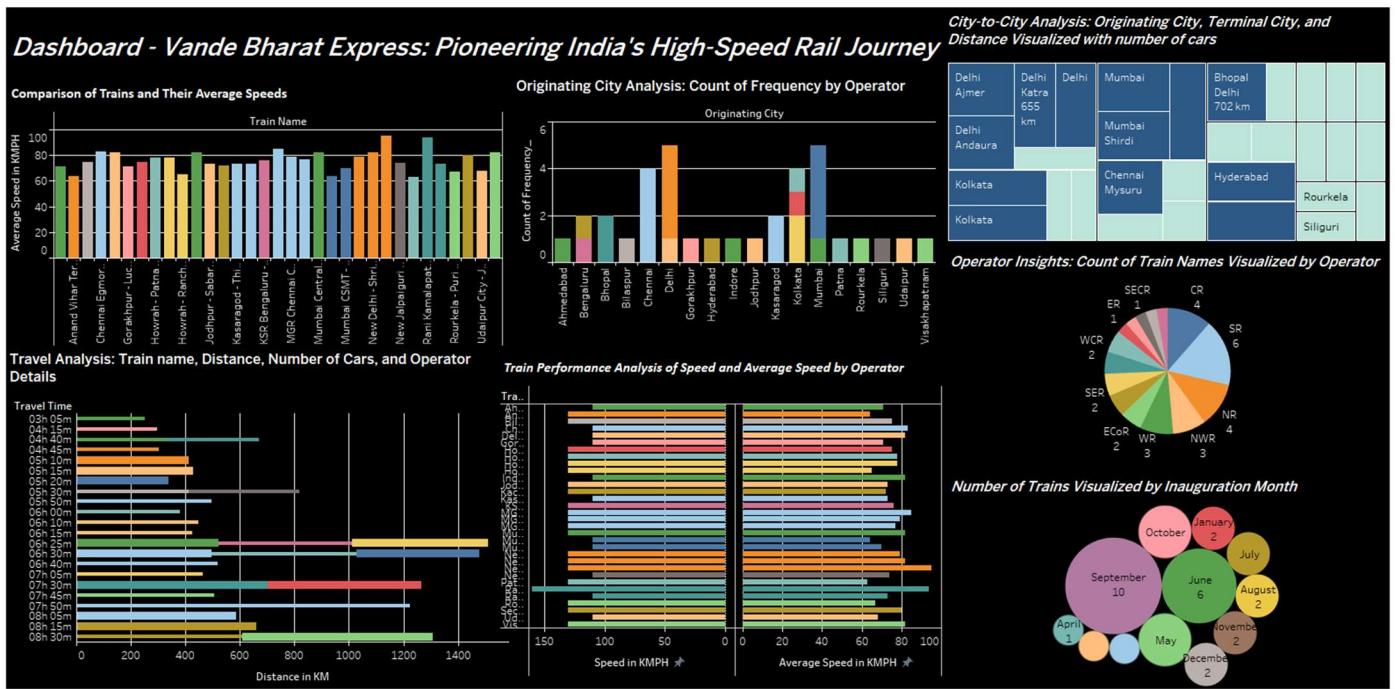


## Visualisation 7: Number of Trains Visualized by Inauguration Month

The relationship between the number of trains and their inauguration months using a bubble chart, where colour signifies the inauguration month and bubble size corresponds to the number of trains



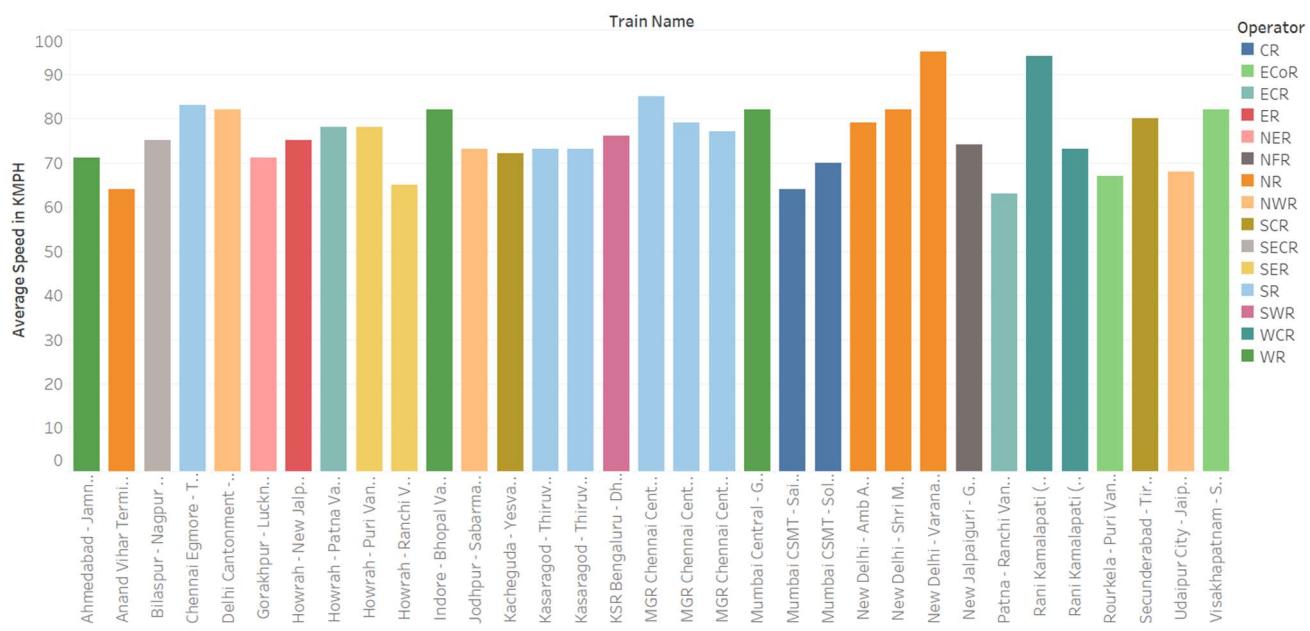
## Dashboard



# Story

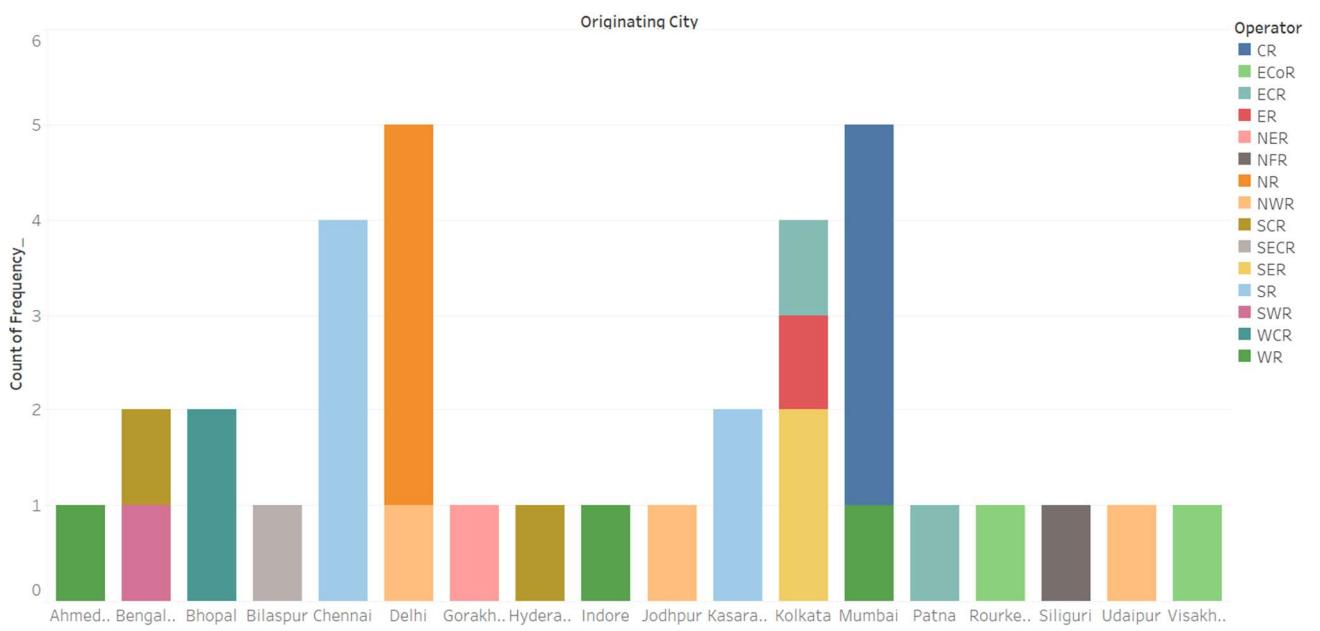
## Story - Vande Bharat Express: Pioneering India's High-Speed Rail Journey

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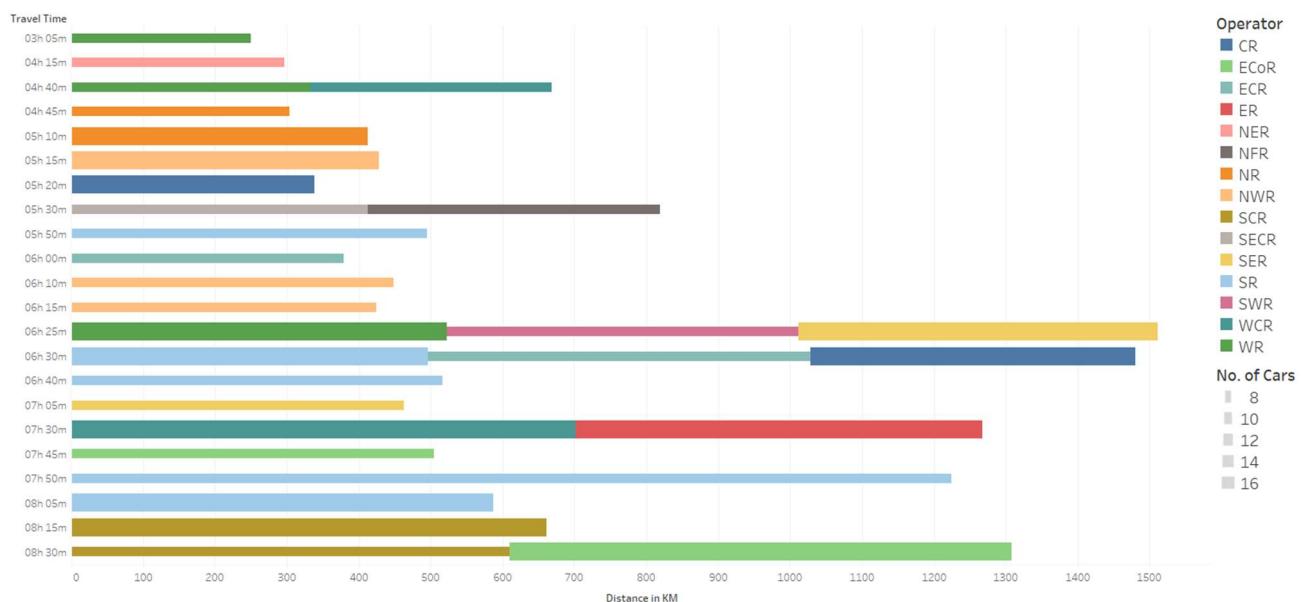
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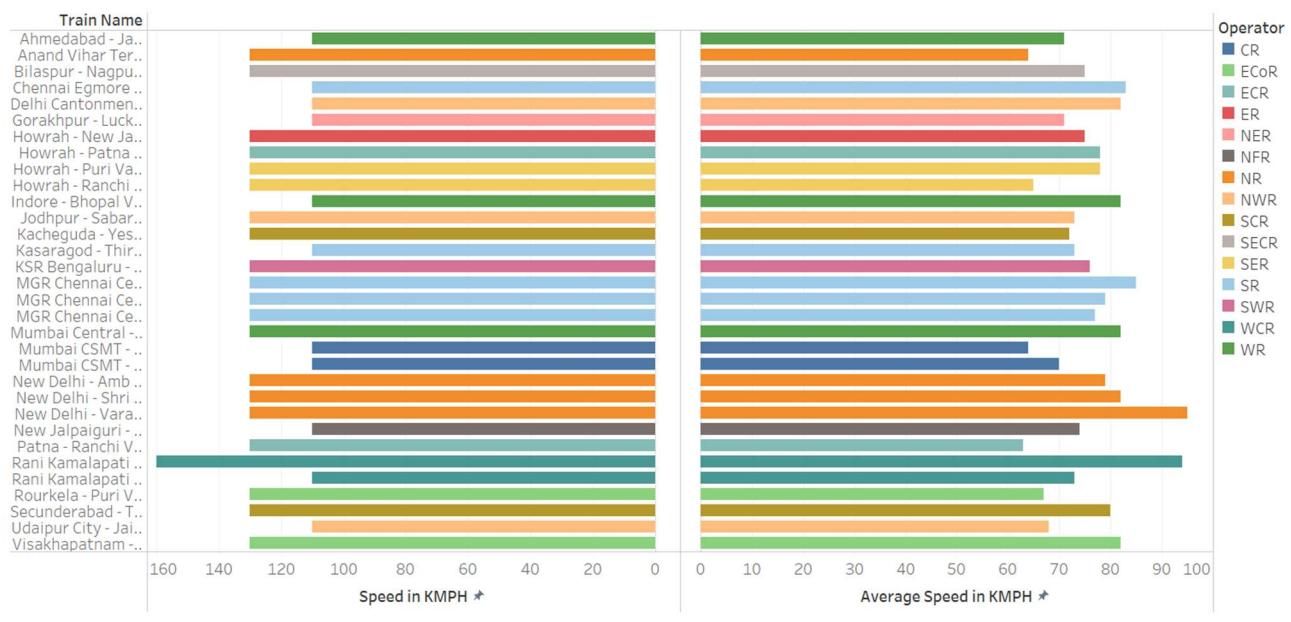
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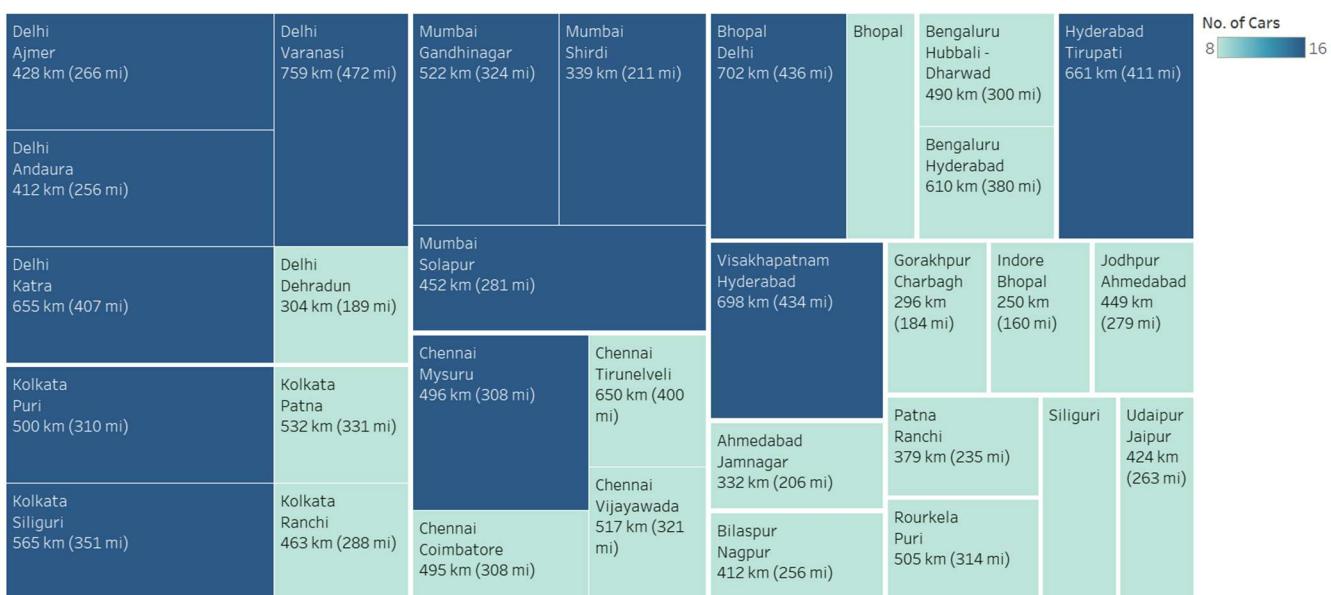
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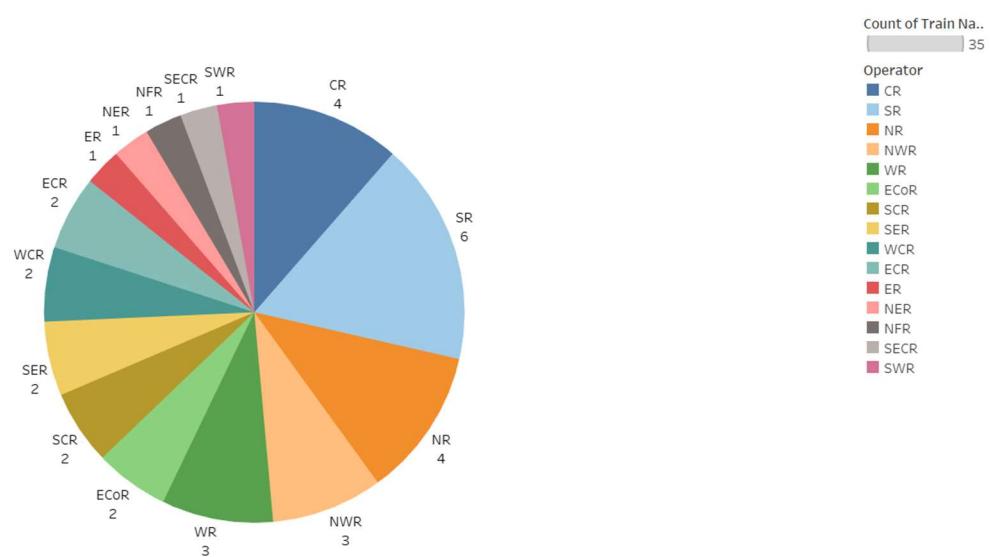
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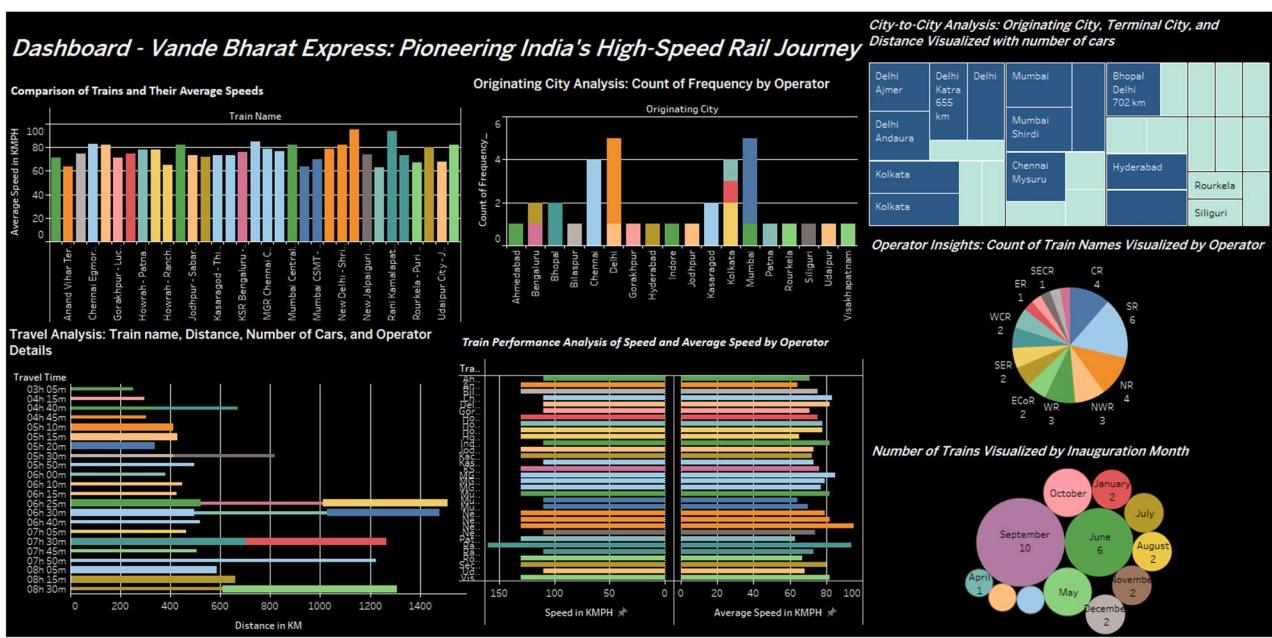
## Story - Vande Bharat Express: Pioneering India's High-Speed Rail Journey

The average speed varying | The frequency of trains | The relationship | The variations in speed and the connection | The distribution of the relationship | The relationship | Dashboard



Story - Vande Bharat Express: Pioneering India's High-Speed Rail Journey

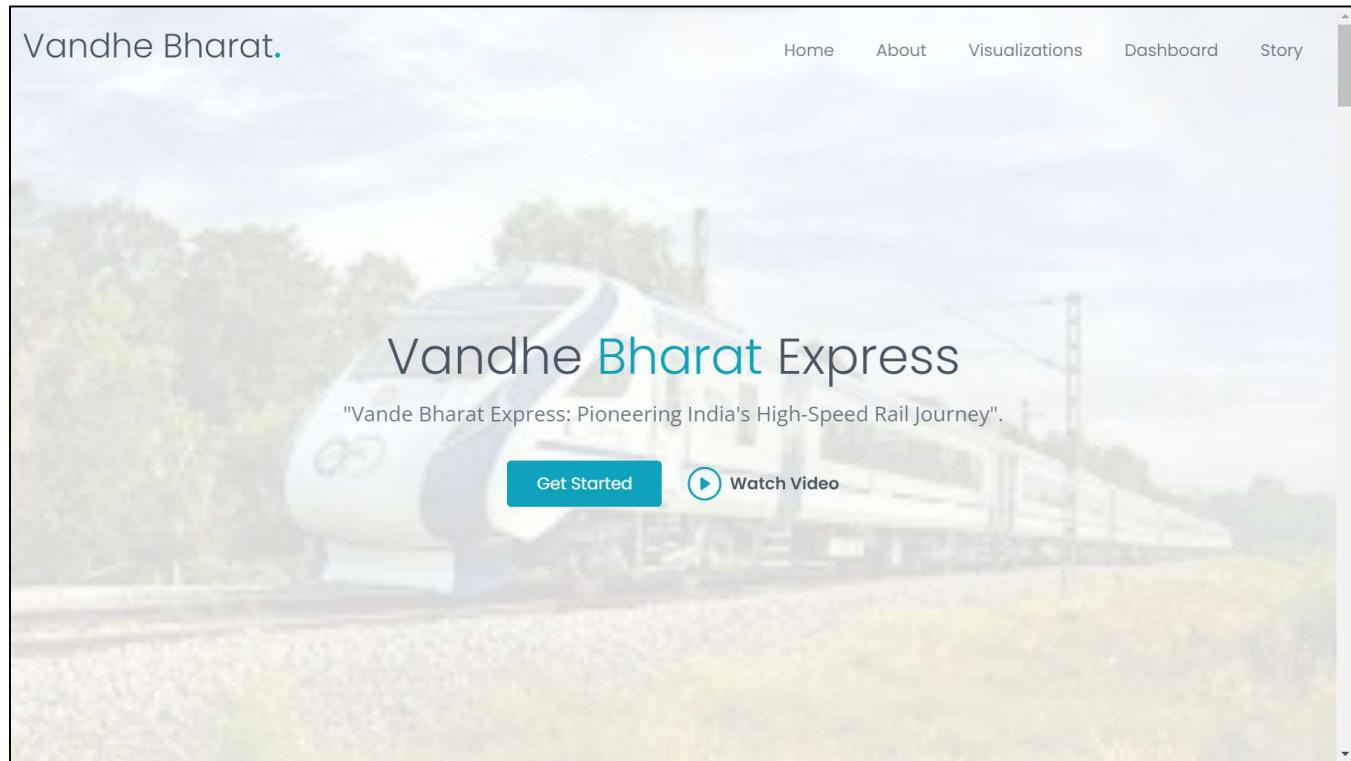
The average speed varying The frequency of trains The relationship The variations in speed and The connection The distribution of The relationship Dashboard



## Web integration

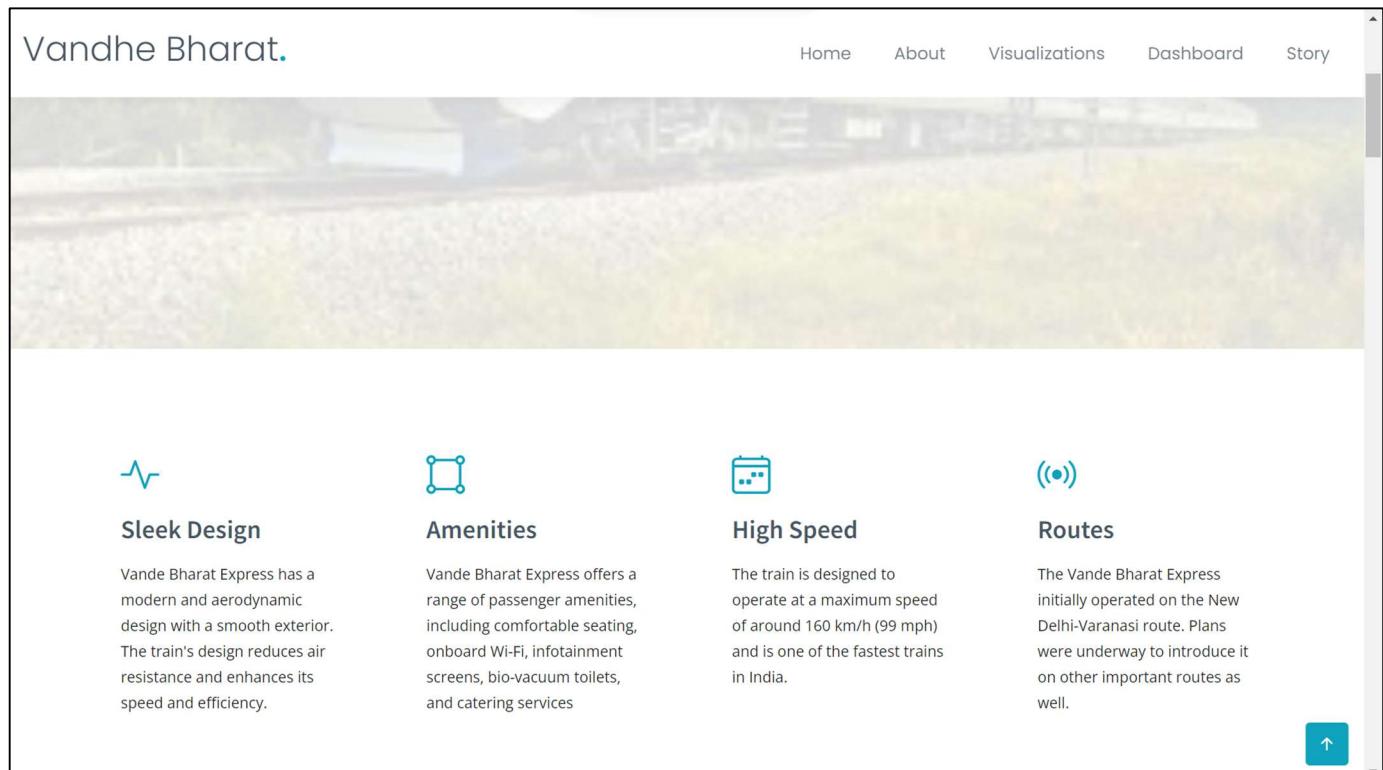
Publishing helps us to track and monitor key performance metrics, to communicate results and progress. help a publisher stay informed, make better decisions, and communicate their performance to others.

### Homepage



The screenshot shows the homepage of the Vande Bharat Express website. At the top left is the logo "Vandhe Bharat.". At the top right are navigation links: Home, About, Visualizations, Dashboard, and Story. The main title "Vandhe Bharat Express" is centered in a large, bold, dark blue font. Below it is a subtitle in a smaller, lighter blue font: "Vande Bharat Express: Pioneering India's High-Speed Rail Journey". There are two buttons at the bottom: a teal "Get Started" button and a white "Watch Video" button with a play icon. The background of the page is a blurred image of a high-speed train in motion.

### Some Advantages



The screenshot shows a page titled "Some Advantages" of the Vande Bharat Express website. At the top left is the logo "Vandhe Bharat.". At the top right are navigation links: Home, About, Visualizations, Dashboard, and Story. The page features four sections with icons and titles: "Sleek Design" (with a train icon), "Amenities" (with a room icon), "High Speed" (with a calendar icon), and "Routes" (with a map icon). Each section contains a brief description. A teal "Get Started" button is located at the bottom right of the page.

Icon	Title	Description
Train icon	Sleek Design	Vande Bharat Express has a modern and aerodynamic design with a smooth exterior. The train's design reduces air resistance and enhances its speed and efficiency.
Room icon	Amenities	Vande Bharat Express offers a range of passenger amenities, including comfortable seating, onboard Wi-Fi, infotainment screens, bio-vacuum toilets, and catering services.
Calendar icon	High Speed	The train is designed to operate at a maximum speed of around 160 km/h (99 mph) and is one of the fastest trains in India.
Map icon	Routes	The Vande Bharat Express initially operated on the New Delhi-Varanasi route. Plans were underway to introduce it on other important routes as well.

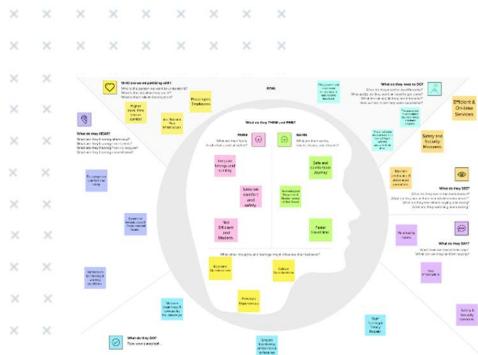
## ABOUT:

Vandhe Bharat.

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## About

The Vande Bharat Express, also known as Train 18, is an Indian semi-high speed intercity electric multiple unit train. It was designed and developed by the Integral Coach Factory (ICF) in Chennai, India. The solution focuses on implementing and solving to identify the train name, train number and the number of cars available involving to find the distance by the train and its average occupancy for statistical purposes and better performance of the Express.



### Business Problem

*Some potential problem areas that could arise with the project Vande Bharat Express*

#### ✓ Technical Issues

High-speed trains like the Vande Bharat Express require intricate engineering and maintenance to ensure their smooth operation.

#### ✓ Public Acceptance and Demand

While the Vande Bharat Express was designed to enhance passenger experience, if it fails to meet the expectations of travellers or if the fares are not competitive, it might not achieve the desired ridership.

#### ✓ Regulatory and Political Hurdles

The successful operation of high-speed trains requires coordination with various regulatory bodies and government agencies. Political and bureaucratic hurdles could delay approvals, funding, and project implementation.

### Business Problem

### Business requirements

### Impact

*A general overview of the requirements that were important for the development of the Vande Bharat Express*

#### ✓ High Speed Capability

One of the primary requirements was to create a train that could operate at high speeds, up to around 160 km/h (99 mph) or more. This requirement aimed to significantly reduce travel time between cities and compete with other modes of transport like airplanes.

#### ✓ Energy Efficiency

The train's design emphasized energy efficiency and environmental sustainability. It needed to be powered by electricity, preferably electric multiple units (EMU), to reduce emissions and reliance on fossil fuels.

#### ✓ Efficient Space Utilization

Efficient space utilization was essential to maximize passenger capacity without compromising on comfort. Interior layouts had to balance seating arrangements, storage, and amenities.

### Business Problem

### Business requirements

### Impact

*Some of the potential impacts that the Vande Bharat Express has created*

#### ✓ Modernization of Rail Travel

The train's advanced features, including comfortable seating, onboard Wi-Fi, infotainment screens, and improved amenities, have contributed to modernizing the passenger rail experience in India.

#### ✓ Enhanced Passenger Experience

The train's focus on passenger comfort and amenities has enhanced the overall travel experience. Passengers benefit from more comfortable seating arrangements, cleaner restrooms, and improved facilities compared to traditional trains.

#### ✓ Reduced Travel Time

One of the primary goals of the Vande Bharat Express was to reduce travel time between cities. By operating at higher speeds, the train aimed to provide a competitive alternative to air travel on certain routes, making rail travel a more attractive option.

# Visualizations

Vandhe Bharat.

Home About Visualizations Dashboard Story

## Visualizations

Graphical representations of data in order to help people understand and explore the information better



### Trains and Their Average Speeds

The average speed varying for each train, with the colour representing details about the operator of the train



### Originating City Analysis

The frequency of trains varying for each originating city, with colour indicating details about the operator



### Travel Analysis

The relationship between the total distance travelled, train name, travel time, and the number of cars



### Train Performance Analysis

The variations in speed and average speed across different trains. The color represents details about the operator



### City-to-City Analysis

The connection between the originating city, terminal city, and distance, with colour and size denoting the total number of cars

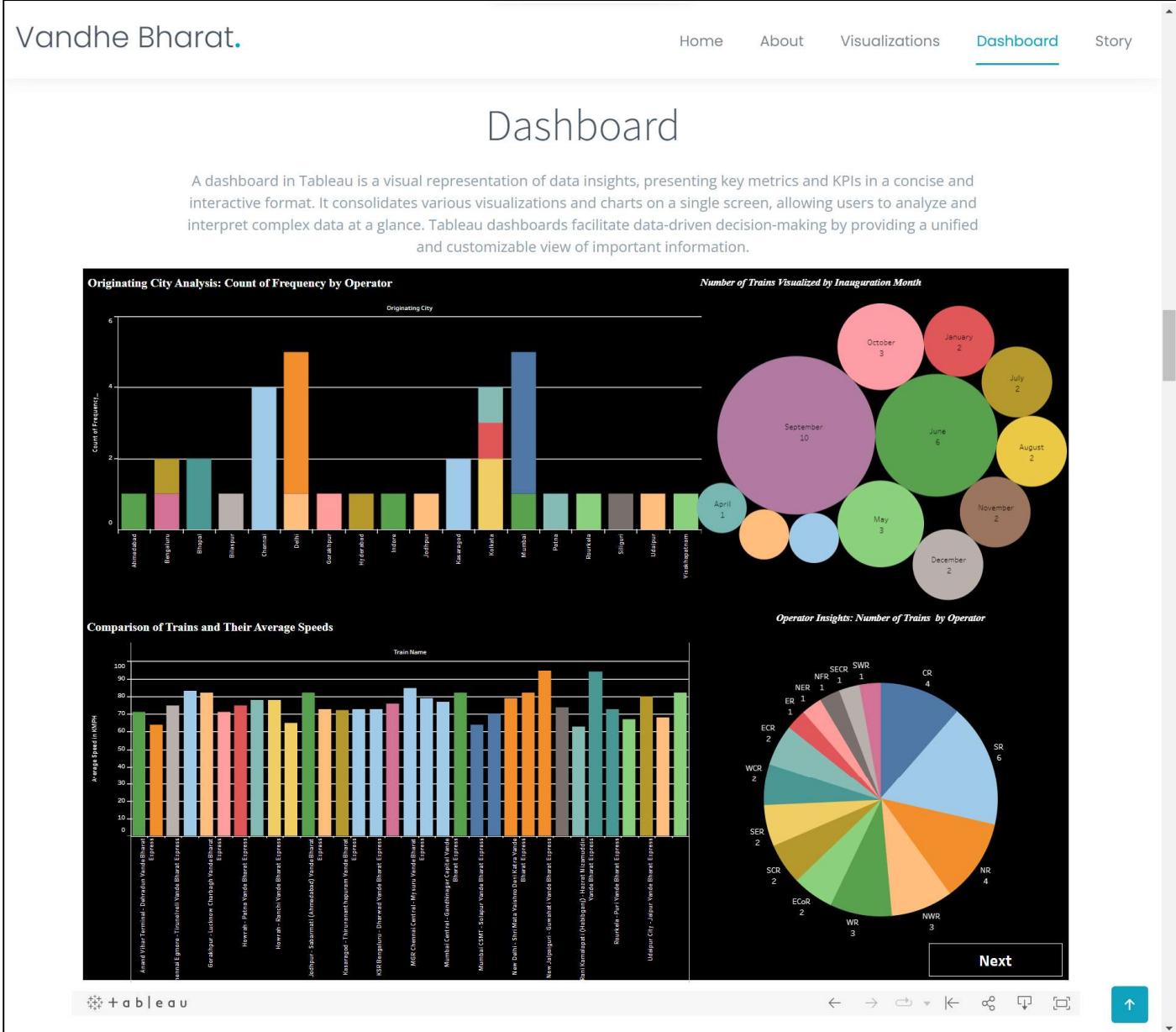


### Trains Visualized by Inauguration Month

The relationship between the number of trains and their inauguration months using a bubble chart

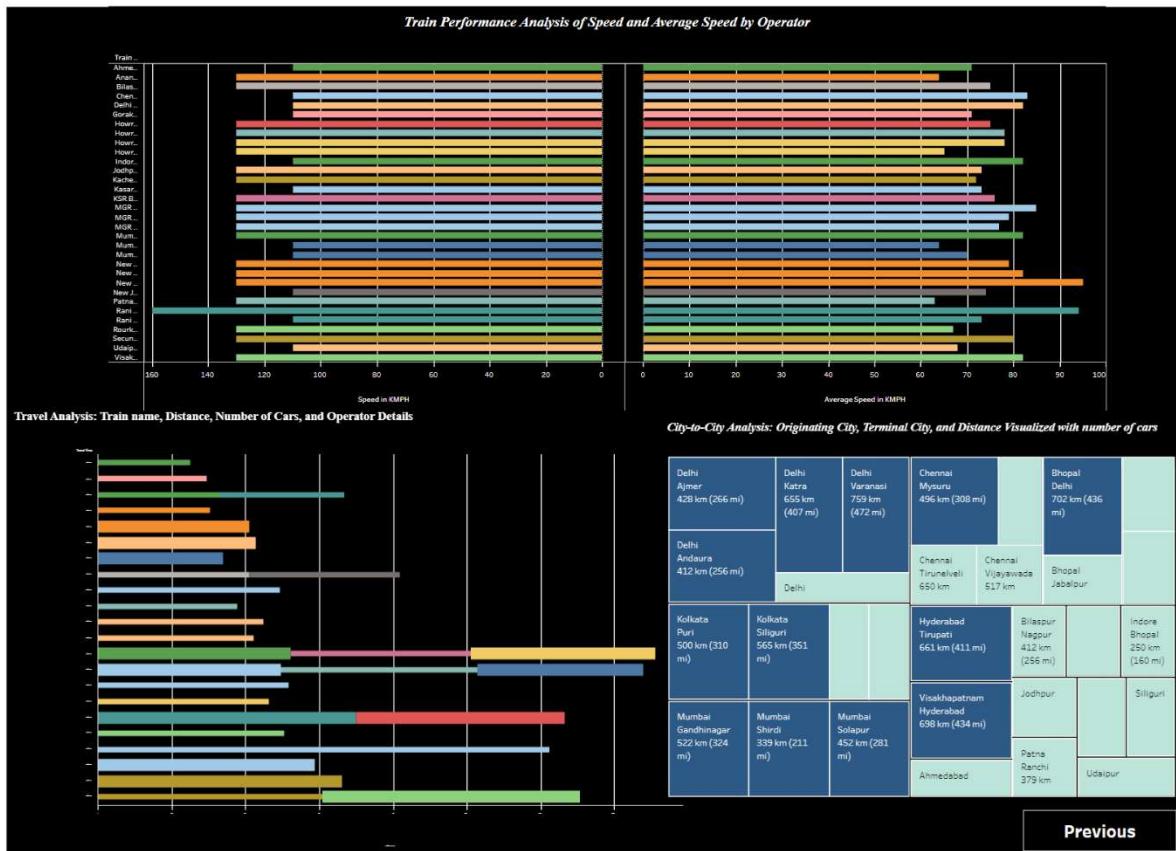


## Dashboard



## Dashboard

A dashboard in Tableau is a visual representation of data insights, presenting key metrics and KPIs in a concise and interactive format. It consolidates various visualizations and charts on a single screen, allowing users to analyze and interpret complex data at a glance. Tableau dashboards facilitate data-driven decision-making by providing a unified and customizable view of important information.



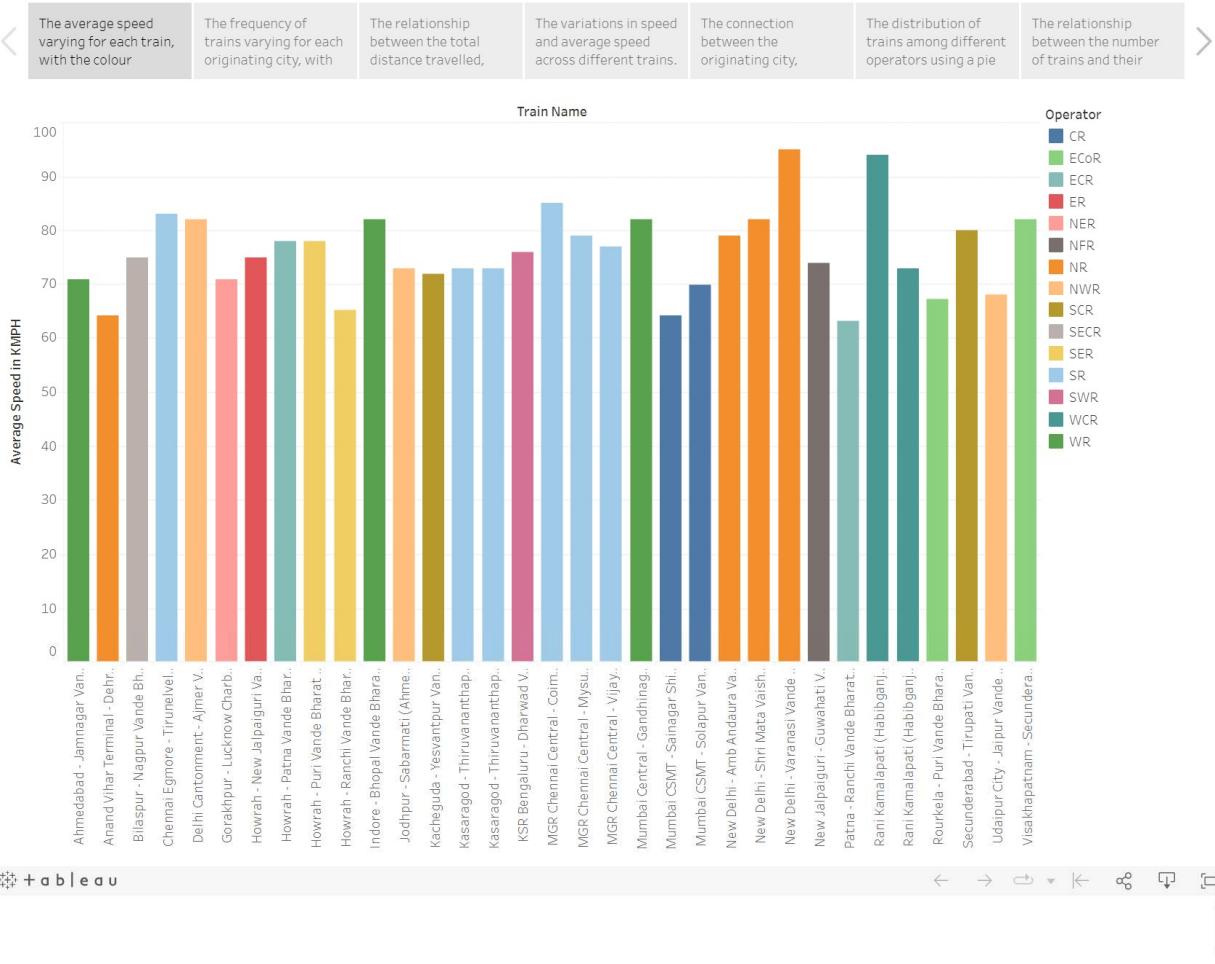
# Story

Vandhe Bharat.

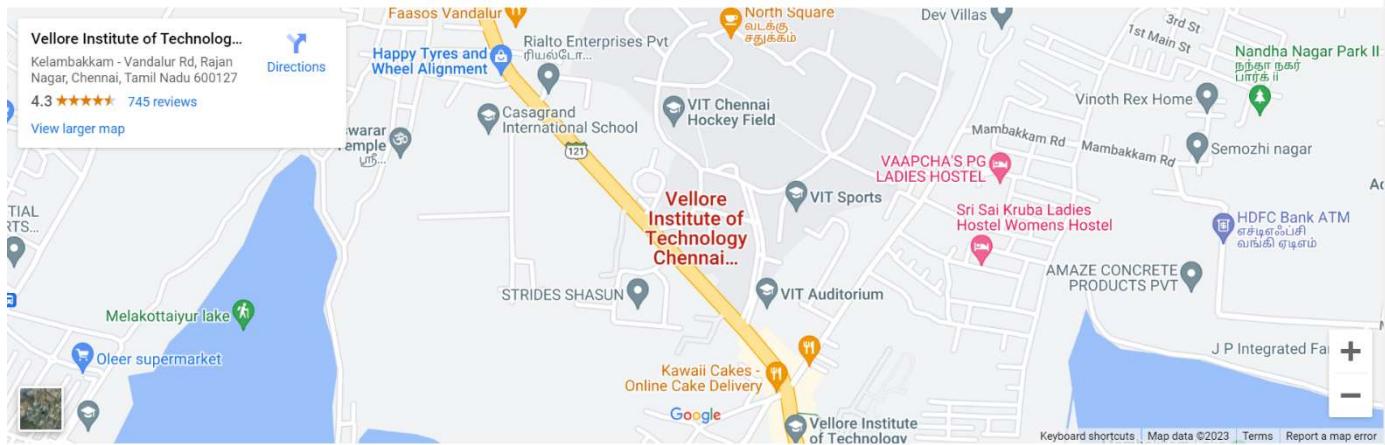
Home About Visualizations Dashboard Story

## Story

In Tableau, a story is a sequence of sheets or dashboards that work together to convey a data-driven narrative. It allows users to create a compelling data story by arranging visualizations in a logical order, adding annotations, and providing context to guide the audience through a data-driven narrative. Tableau stories enhance communication and understanding by presenting data insights in a cohesive and storytelling manner.



## Contact Us

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**Useful Links**

- > Home
- > About
- > Visualizations
- > Dashboard
- > Story