Systems Thinking Hackathon 2025
Team Report
System Analysis- Website

● **Team Name**: Team 107
● **Team Members** (Full Names and Enrollment Numbers):
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● **Problem Domain**: Transport and Travel
● **Specific Problem Statement**: Boom in Domestic Air Travel, Bust in Rail Travel for Tier 2-3 Cities

1. Introduction to the Problem:

● Brief background of the selected problem

In India, particularly in Tier 2 and Tier 3 cities, there has been a rapid rise in domestic air travel over the past few years. This shift is largely driven by the **UDAN scheme** (Ude Desh ka Aam Nagrik), which aims to make flying **affordable** and improve **regional connectivity**. As a result, new regional airports have been developed, and more direct flight routes are now available from smaller cities. Meanwhile, rail travel which was once the dominant mode of intercity transport is now seeing a decline in preference, especially in these same regions. Many passengers face challenges such as outdated trains, infrequent services, inconvenience, poor cleanliness, and longer journey times. The contrast is stark: while flights are becoming faster and more convenient, rail travel often feels slow, uncomfortable, and unreliable. This has led to **a noticeable shift from rail to air**, especially among the growing middle class in these towns.

● Why is it an important/systemic issue in the Indian context?

This shift is not just about convenience—it's a **systemic issue** with far-reaching implications. India's transportation system is interconnected, and when one mode grows disproportionately at the cost of another, **imbalances** occur. While air travel is efficient for long distances, railways are still critical for affordable, high-volume travel, especially for economically weaker sections. If rail infrastructure in Tier 2–3 cities continues to be underfunded and underutilized, it could result in social inequality in access to mobility, urban-rural disconnects, and increased pressure on the aviation sector, which is not **environmentally** or **economically sustainable** for all types of travel. Moreover, this trend reflects how policy focus and public investment are influencing long-term behavior, and without a systems thinking approach, India risks widening the gap between different regions and population groups in terms of transport access.

2. Process Followed:
  ● **Analyzed** the problem statement to understand the core issue.
  ● **Researched** the problem in detail to explore causes and implications.
  ● **Discussed** key variables affecting outcomes in practical scenarios.
  ● Shagun and Divyanshi conducted **in-depth research**.
  ● Harshita created the **Figma design** for the website.
  ● Nakul and Aaryan worked on **website** development and coding.
  ● All members contributed to **CLD**, BOT, and **Stock and Flow** diagrams.
  ● **Report** was made with input from all members.
  ● Collaboratively worked on assigned topics and compiled the final assignment.
  ● **Submitted** the completed project after final review.

3. **Causal Loop Diagram (CLD):**

No.	Variable	Definition
1.	**Policy push for sustainable mode**	Specific regulations, subsidies, or programs (like UDAN) encourage growth of airline/ railways, keeping in mind the environmental factors.
2.	**Ridership**	Total number of passengers regularly using a particular mode (rail or air), indicating popularity and utility.
3.	**Carbon Footprint Awareness**	The total greenhouse gas emissions resulting from different modes of transport and awareness amongst the people about it.
4.	**Rail infrastructure**	The physical network and facilities of railways, including tracks, stations, and trains.
5.	**Rail revenue**	Earnings of Indian Railways from passengers
6.	**Rail usage**	Number of people choosing railways as their travel mode
7.	**Air travel**	Number of people opting for air transport
8.	**Commuter satisfaction**	The quality and comfort of the travel experience.
9.	**Airline revenue**	Income earned by airlines through ticket sales
10.	**Airline investment**	Financial expenditure into expansion, route development, and service quality by airline companies.
11.	**Air infrastructure**	Physical and operational facilities supporting air travel, like terminals, runways, and services.
12.	**More Air connectivity**	The availability of more direct and frequent flights to/from airports in smaller cities.
13.	**Accessibility**	How easily travelers can reach and use transport services
14.	**Railway investments**	Funding and upgrades allocated to rail infrastructure, safety, and services to improve rail attractiveness.
15.	**Fast travel demand**	The increasing need among travelers for quicker intercity transport options in urbanizing regions

4. Leverage Points Analysis:

S. no.	Leverage Points	Thinking in System	Why Important?	Expected impact?
1.	Awareness campaign for rail use	Information flows (#6)	To let people know and be aware about better alternative (in terms of accessibility)	High- draws attention of the users
2.	Airfare subsidies	Constants,Parameters, Numbers (#12)	Leads more people to choose air travel, making it harder for railways to compete fairly	Low – affects surface level behaviors
3.	Rail Infrastructure	Buffer (#11)	Enhances capacity and service in Tier 2–3 cities	Medium – improves access
4.	Public Perception	Paradigm (#2)	Influences modal preference; rail seen as outdated or inconvenient	High – shifts public choice
5.	Policy Goals	Goals of the System (#3)	Determines how resources and attention are distributed between both railways and airways	Very High – shapes long-term structural behavior
6.	Continue usage of airways	Reinforcing feedback loop (#7)	Tells the repetitive and amplifying behaviour of the system due to nature of users	High- continue systemic behavior

5. System Archetypes:

a. Success to the successful-

-This archetype is a **reinforcing loop** where those who are already successful gain more resources and opportunities, leading to further success and widens up the gap between the classes.

-**Positive Feedback Loop**: Air travel's success attracts more resources and investment, reinforcing its dominance, while underfunded rail continues to suffer.

-**Widening Gap**: As air travel becomes more efficient and accessible, it attracts more passengers thus reducing demand for rail and exacerbating the investment imbalance.

b. Growth and Underinvestment-

-This archetype describes a situation where rapid growth or demand in a particular area outpaces the necessary investment or development, leading to resource depletion and inefficiency in the underinvested sector. This imbalance creates a cycle where the growth of one area perpetuates while the other remains stagnant or worsens due to lack of attention and resources.

-**Demand and Infrastructure Imbalance**: Air travel's growth leads to increased demand, but rail infrastructure doesn't improve at the same pace, making rail less competitive and inefficient.

-**Resource Drain**: Resources are diverted to the successful air travel sector, further neglecting rail, causing a reinforcing loop system where air travel thrives, and rail stagnates.

6. Event → Pattern → Structure Analysis:

Layer	Analysis
Event	1. Launch of the **UDAN scheme** making air travel more affordable and accessible in Tier 2–3 cities. 2. **Rapid increase in regional airports** and direct flight routes from smaller cities. 3. **Policy-level subsidies and investment** poured into air infrastructure and private airlines. 4. **Stagnation in rail infrastructure**—old trains, fewer services, and poor user experience. 5. **Shift in user behavior**: Middle-class and upper-middle-class passengers increasingly choosing flights over trains. 6. **Government reports higher air travel growth**, while railway ridership stagnates or falls in smaller cities
Pattern	1. **Reinforcing investment loop** in air travel: As more users shift to airways, airline revenue grows, justifying more investment and infrastructure improvement. 2. **Decline in rail usage** due to sustained neglect and underfunding in Tier 2–3 city railways. 3. **Socio-economic divide** in access to mobility widens: those who can afford to fly, while others are left with deteriorating rail options. 4. **Public perception shift**: Air travel seen as aspirational and modern, rail as outdated and inefficient. 5. **Environmental neglect**: Despite higher carbon footprint, no corrective behavior toward sustainable choices. 6. **Patterns of convenience, speed, and prestige** increasingly influence modal preference.
Structure	1. The **success-to-the-successful archetype** dominates: Increased air travel → higher revenue → better services → more users → repeat. Rail suffers an opposite loop. 2. **Policy and investment priorities** structurally favor air travel, creating a bias in infrastructural development. 3. **Feedback loops** reinforce modal dominance (air) and decline (rail): Public dissatisfaction with rail leads to less usage, less revenue, and even worse services. 4. **Lack of systems perspective**: No balancing feedback or integrative transport strategy exists to stabilize rail and air growth. 5. **Short-term goals override systemic equity**: Policies are driven by growth optics rather than sustainable, inclusive mobility. 6. **Behavioral paradigms** (status, aspiration) further entrench preference toward air, closing off opportunities to recover the rail system.

7. Stock and Flow Diagram:
The stock and flow diagram represents dynamics of transportation choices between air travel and railways in response to factors like infrastructure, policy, investment, and user experience.

a. Stocks-
-***Population traveling through airways / trains***: Represent the number of users choosing each mode.
-***People adopting air travel / opting for railways***: Reflect the flow of preference toward a mode.
-***Demand for transportation***

b. Flows-
-People switching from airways to railways
-People switching from railways to airways
-People leaving air travel
-People leaving railway travel
-Increase in travel
-Decrease in travel through airways, railways

c. Auxiliary Variables-
-**Privatization** → positively influences *airline revenue and investment*
-**Airline revenue and investment** → leads to *infrastructure expansion, investment* in air travel
-**Infrastructure expansion, investment (Air)** → encourages more people to adopt air travel
-**Policy support** → increases *rail revenue and investment*
-**Rail revenue and investment** → leads to *infrastructure expansion, investment, govt. policies* for railways
-**Infrastructure expansion (Rail)** → encourages more people to opt for railways
-**Delays, inconvenience, old infrastructure** → cause people to leave air travel
-**Poor facilities, travel time, no maintenance** → drive people away from railway travel
-**Customer satisfaction** → influences retention or switching between modes
-**Government prioritisation** → affects support for rail vs air
-**Fast travel demand** → boosts preference for airways
-**Push for sustainable mode** → supports rail travel preference
-**Disposable income** → fuels the *increase in travel*
-**Work, occasion, leisure** → drive overall *demand for transportation*
-**Poor experience, hassle of public transport, buying of private vehicles** → lead to *decrease in travel through airways and railways*
-**Global connectivity** → further influences shift toward air travel

d. Overall System Behavior:
-A **reinforcing loop** fuels both air and rail usage when investment and infrastructure keep up.
-However, delays, poor service, and policy neglect can lead to users abandoning rail transport altogether.

8. Behaviour Over Time Graph (BoT):
Key Variables Tracked:
-Air Travel Population (in millions)
-Rail Usage Population (in millions)
Understanding-
In the beginning, there was a significant gap between the usage of railways and air travel. However, over time, this gap narrowed considerably as government schemes and public policies made domestic air travel more affordable and enhanced connectivity. The model reveals the need for timely balancing feedback through sustainable infrastructure and policy shifts to stabilize the system.

9. Additional Insights

Psychological Point of View (PoV) of the users that continues to widen this problem-

As disposable incomes rise and affordable flight options become more available, many middle-class travelers in India are psychologically drawn to air travel not just for speed and convenience, but also for the social status and aspirational identity it represents. Air travel is increasingly seen as a modern, prestigious, and efficient choice, **reinforcing a cognitive bias** that associates flying with upward mobility and progress. In contrast, railways are often perceived as outdated and inconvenient, leading to a decline in emotional and practical engagement with the system. Despite the fact that air travel has a significantly higher carbon footprint, limited public awareness and weak environmental consciousness mean that sustainability is not yet a meaningful factor in travel decisions. This reflects a broader attitudinal inertia, where short-term comfort and image outweigh long-term ecological considerations in the minds of travelers.

10. References

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