My Role in the SIH Hackathon Team

I am glad to be part of our Smart India Hackathon team. While I am still learning, I am ready to contribute wherever possible and quickly pick up any required skills.

My Skills/Courses:

- Basics of Cryptography
- Basics of Game Theory
- Basics of Optimization
- Algebra, Linear Algebra
- Basics of Probability

My Interests:

I am interested in Artificial Intelligence, Machine Learning, and mathematical problem-solving. I want to contribute in areas related to data analysis, optimization ideas, or AI-based approaches. And I'll help with anything if anyone does require my help.

How I Can Help:

- Assist with basic research and understanding of concepts needed for the solution.
- Help in preparing notes, documentation, and presentation material.
- Support in simple coding tasks or testing as I learn during the hackathon.
- Contribute ideas during brainstorming and discussions.
- Learn quickly whatever tools for optimization/AI/ML is required for the hackathon since currently I have a lot to learn.

Detailed Tools & Libraries for the Project

Python

Python is the main programming language to be used. It is beginner-friendly, widely adopted in hackathons, and has a rich ecosystem of libraries for optimization, AI, data analysis, and simulation. It allows the whole team to collaborate easily and build prototypes quickly.

pandas & numpy

These libraries are essential for handling railway timetable data, train delays, and schedules. pandas helps in cleaning, filtering, and organizing data, while numpy provides mathematical tools to perform calculations efficiently. They form the foundation for all data analysis tasks.

matplotlib & seaborn

These libraries are used for visualizing train schedules, congestion, and performance metrics. Clear visualizations will help the team understand delays, conflicts, and improvements in our model.

scikit-learn

This is a beginner-friendly machine learning library that provides algorithms for prediction and classification. It can be used to predict train delays, classify conflict situations, or create simple models to improve decision-making.

XGBoost / LightGBM

These are advanced machine learning libraries that improve accuracy and performance over scikit-learn for larger datasets. They are useful if we want stronger predictive models for train delays or disruptions.

PuLP

PuLP is a Python library for formulating and solving linear and integer programming problems. We can use it to create optimization models for deciding train order, scheduling, and minimizing delays.

Google OR-Tools

OR-Tools is a powerful optimization library from Google that can solve complex scheduling and routing problems. For our hackathon, it can be used to build conflict-free train schedules and optimize track and platform usage.

NetworkX

NetworkX is a graph library that helps model the railway network (stations, tracks, junctions). It allows us to represent the problem visually and run algorithms to detect congestion or bottlenecks.

SimPy

SimPy is a simulation library for modeling real-world systems. It can simulate trains moving along tracks, waiting at signals, or being delayed, which is valuable for testing our optimization and AI models under realistic conditions.

PyTorch / TensorFlow

These libraries are used for deep learning. They are more advanced but could be applied if we explore reinforcement learning to dynamically optimize train scheduling in real time.

stable-baselines3

This is a reinforcement learning library built on PyTorch. It can be used if we decide to experiment with training an AI agent to learn train precedence rules by interacting with a simulated railway environment.

FastAPI / Flask

These frameworks are useful for turning our solution into a working API. For example, we can deploy a service that takes in train data and outputs optimized schedules or predictions, which the frontend team can connect to.

Dash / Plotly

These tools are for building dashboards and visual interfaces. They can help us demonstrate train schedules, conflict resolution, and performance improvements visually in the hackathon demo.