Problem Statement :

Railway stations in India witness massive daily footfall, yet lack proactive systems to detect passenger distress, discomfort, or abnormal emotional states. Security teams often rely on manual observation or post-incident analysis. This limitation leads to missed early warnings, poor crisis response, and inadequate support for vulnerable individuals, such as the elderly, children, or mentally distressed passengers. A real-time, scalable emotion detection system can play a crucial role in enhancing passenger safety and satisfaction.

Target Audience & Context

The primary beneficiaries are **passengers**, especially those traveling alone, the **railway security and operations teams**, and **station managers**. The system will function in crowded platforms, waiting rooms, and surveillance zones. In particular, it will support better handling of lost children, distressed women, or potentially dangerous situations (e.g., aggression). Indian Railways, managing over 23 million daily passengers, needs intelligent systems to meet modern public safety expectations.

Gen-AI Use Case

We propose leveraging **Generative AI-powered emotion detection** through facial expression analysis using video feed from CCTV cameras at railway stations. A lightweight model trained on diverse datasets (e.g., FER+, AffectNet) can classify emotions such as fear, anger, sadness, confusion, or distress. Gen-AI models can adapt to regional and cultural facial nuances using **transfer learning**, ensuring accurate results in Indian contexts. Moreover, Gen-AI can generate alerts or recommend responses (e.g., notify security, display calming messages, call staff) in real time, making the system responsive and human-aware.

Solution Framework / Workflow

1. Input Layer:
Live video streams from existing CCTV cameras.

2. Face & Emotion Detection:
Use real-time face detection and Gen-AI emotion classification models (like a fine-tuned FER transformer or LLaVA for visual understanding).

3. Response Trigger Module:

- Log emotion data anonymously
- Trigger alerts for extreme or unusual emotional expressions
- Integrate with station display boards, mobile alerts for staff

4. Dashboard:
Admin panel to visualize emotional heatmaps, passenger mood trends, and alerts.

(Include a simple block diagram if possible.)

Expected Impact

- **Increased Passenger Safety:** Early intervention in distress or aggressive behavior
- **Better Customer Experience:** More empathetic, responsive service environments
- **Data-Driven Insights:** Emotion analytics help understand passenger sentiment over time
- **Scalable & Adaptable:** Deployable across stations using existing infrastructure

Feasibility & Execution

The proposed system is feasible using existing tools and frameworks. Real-time facial emotion detection can be implemented using OpenCV, TensorFlow, or PyTorch with pre-trained emotion recognition models like FER+, VGGFace2, or MTCNN for face tracking. Integrations with current railway CCTV systems require minimal hardware adjustments. The system will be trained on multi-ethnic emotion datasets and fine-tuned using synthetic data generated via Gen-AI to match Indian demographics. Edge deployment on local servers at stations will reduce latency and enhance privacy.

Scalability & Impact

This solution can be rolled out initially in major Tier 1 railway stations as a pilot and scaled to smaller stations. Its modular architecture allows deployment in metro rail systems, airports, and bus terminals. Long-term, the emotion analytics could inform station design, crowd control strategies, or even predict service dissatisfaction. With India's smart city push and increasing investments in AI for public infrastructure, this solution aligns with government priorities and has high growth potential.

Conclusion & MLP (Minimum Lovable Product)

Our MLP is a deployable prototype that detects facial emotions in real-time from CCTV feeds and generates alerts for three high-priority emotional states: **distress, aggression, and confusion**. The alerts are sent to a web dashboard accessible by station staff and security officers. This simple, focused version offers immediate public safety benefits, requires minimal training, and provides high impact with low friction—making it a lovable starting point with strong business potential.