# Gray Mobility – AI/ML Engineer Intern Assignment

Role: AI/ML Engineer – Internship
Domain: Smart Ambulance | Time-Series ML | Decision Support
Location: Bangalore
Duration: 6 Months

This assignment is designed to evaluate real-world machine learning skills, engineering judgment, and the ability to work with safety-critical, noisy data. It cannot be completed using AI prompts, AutoML tools, low-code/no-code platforms, or shortcuts.

## Submission Details

- Submission timeline: 7 days from receiving this assignment
- Expected effort: ~20–25 hours
- Submission format: GitHub repo (or ZIP) + short report (PDF/MD)
- Late or incomplete submissions will not be considered

## IMPORTANT NOTE

This assignment intentionally involves ambiguity and imperfect data.
We are not evaluating perfect accuracy — we are evaluating thinking, execution, and judgment. Submissions relying purely on generic notebooks or black-box tools will be rejected.

## PART 1 – Realistic Time-Series Problem (Mandatory)

You are working on Gray's Smart Ambulance platform. Patient vitals are streamed every second:

- Heart Rate (HR)
- $SpO_2$
- Blood Pressure (Systolic/Diastolic – simulated)
- Motion/Vibration signal (vehicle + patient movement)

### Task 1A: Data Generation or Sourcing

Choose ONE option:

Option A (Preferred): Generate synthetic but realistic time-series data for at least 30 minutes per patient, including normal transport, distress scenarios, and sensor artifacts.

Option B: Use a public physiological dataset (e.g., PhysioNet) and adapt it to an ambulance context.

You must document assumptions, signal meanings, and limitations.

### Task 1B: Artifact Detection

Implement explicit artifact handling before anomaly detection.
Examples: motion-induced $SpO_2$ drops, HR spikes due to bumps, missing data segments.
Show before vs after plots.

## PART 2 – Anomaly Detection & Risk Signals

### Task 2A: Anomaly Detection Model

Build an anomaly detection model that detects early warning signals, not just threshold breaches. You may use statistical methods, classical ML, or deep learning (optional).
Explain windowing, features, and false positives.

### Task 2B: Risk Scoring Logic

Design a simple triage or risk score combining multiple vitals, trends, and a confidence score.
Explain why alerts trigger or are suppressed.

## PART 3 – Alert Quality Evaluation

### Task 3A: Metrics Definition

Report precision, recall, false alert rate, and alert latency.
Explain which errors are acceptable in an ambulance and which are not.

### Task 3B: Failure Analysis

Analyze at least 3 failure cases.
Explain what failed, why, and how you would improve it.

## PART 4 – Mini ML Service (Engineering)

### Task 4A: API Service

Expose your model via a simple API (FastAPI/Flask).
The API must accept vitals and return anomaly flag, risk score, and confidence.

### Task 4B: Reproducibility

Provide clear folder structure, requirements.txt, training & inference scripts, and README.

## PART 5 – Safety-Critical Thinking (Written)

Answer briefly (max 2 pages):
1. Most dangerous failure mode of your system
2. How to reduce false alerts without missing deterioration
3. What should never be fully automated in medical AI systems

## Bonus (Optional – Strong Signal)

Any ONE of the following:
• Green corridor ETA logic

• Explainability plots
• Drift detection concept
• Dockerized service

## Evaluation Criteria

We evaluate:
• Ability to work with noisy time-series data
• ML reasoning and evaluation discipline
• Code quality and reproducibility
• Safety and engineering judgment

## Disqualification Criteria

• Pure notebook dumps
• No artifact handling
• Black-box models with no explanation
• Generic AI-generated answers

## Final Note to Candidate

This internship involves building intelligence for life-critical systems. If this assignment felt challenging, that's expected. If it felt exciting, you belong at Gray Mobility.