

## Hackathon Title: Real-Time Image Restoration in Automotive Systems

### Objective

Develop a responsive, embedded dashboard that displays real-time restoration status, environmental data, and insights derived from the restored images, allowing for efficient monitoring and intervention when necessary.

### Dashboard Features

#### 1. Real-Time Image Restoration Feed

Display: A live feed showing the input image, deteriorated image, and restored image side by side.

Quality Metrics: Overlay real-time quality metrics (e.g., SSIM, PSNR, perceptual loss score) to measure the restoration effectiveness for each frame.

Attention Overlay: Highlight areas where the model's attention mechanism is focusing, giving operators a visual indicator of key regions being restored.

#### 2. Sensor Integration and Environmental Data

Embedded Sensors: Integrate data from sensors to provide contextual information, including:

- Light Sensor: Measures ambient light, which could indicate low-visibility conditions like fog or nighttime.
- Temperature Sensor: Monitors temperature, as extreme temperatures could affect camera performance.
- Humidity Sensor: Detects moisture, helping to identify potential rain or fog conditions that might require different restoration parameters.

Dashboard Display:

- Real-time readings for each sensor.
- Indicators or alerts for conditions that may reduce image quality (e.g., very low light, high humidity).

Auto-Adjustment Alerts: Notify when sensor readings trigger automatic adjustments in the model (e.g., switching to a "low-light" mode).

#### 3. Image Restoration Statistics and Analytics

Key Metrics:

- Restoration Time per Frame: Display average time spent on processing each frame for insight into model efficiency.

- Error Rate: Track error rates or cases where the model struggled to restore certain elements (e.g., blurred text on signs).
- Fidelity Scores: Display metrics like color accuracy and text clarity scores to gauge the model's fidelity in restoration.

#### Historical Data Analysis:

- Allow comparison over time to identify patterns, like performance drop in specific weather conditions or at particular times of day.

Threshold Alerts: Trigger alerts if certain metrics fall below a set threshold, signaling the need for intervention.

### 4. Automated Model Adaptation and Configuration

Auto-Mode Switching: Based on sensor readings, the model can adjust parameters (e.g., enhancing contrast in low-light conditions or reducing blur in rainy conditions).

#### Customization Panel:

- Operators can manually adjust restoration parameters, like brightness, contrast, or filter strength, based on specific needs or feedback from the dashboard.

Adaptive Learning Log: Track when and how auto-mode switching occurs, providing insight into the model's adaptability and helping improve future tuning.

### 5. Incident Reporting and Logging

Event Detection: Detect anomalies in restored images, such as unreadable road signs, and log them as incidents for further inspection.

Data Logging: Save raw, deteriorated, and restored images with timestamps, sensor data, and restoration metrics to analyze model performance.

Reporting Interface: Create and export reports detailing restoration quality, conditions affecting performance, and any sensor-triggered adjustments for further review.