# 📑 Project Report: Smart Training Analytics Platform

## 🏆 Smart India Hackathon (SIH 2023)

### Problem Statement ID: **1719**

**Title:** Monitoring System for Classroom Session in Skill Training Programme  
**Organization:** Ministry of Social Justice and Empowerment  
**Department:** Statistics Division, Department of Social Justice and Empowerment  
**Category:** Software  
**Theme:** Smart Education

## 1. Introduction

The Smart Training Analytics Platform is an AI-powered monitoring system developed as part of the **Smart India Hackathon (SIH)** to address **Problem Statement ID 1719**. The challenge is to create an automated classroom monitoring solution that assesses training effectiveness in real time, ensuring early detection of below-average training institutions.

This solution leverages **Computer Vision, Deep Learning, and Generative AI** to analyze classroom sessions from video streams, providing insights into student engagement, trainer effectiveness, infrastructure compliance, and overall training quality.

## 2. Objectives

* Develop a robust monitoring system capable of analyzing classroom training sessions.
* Provide **real-time insights** into training effectiveness, student attention, and engagement.
* Evaluate infrastructure and training compliance against defined benchmarks.
* Detect underperforming training institutions for early intervention.
* Generate structured, AI-driven reports with improvement recommendations.

## 3. System Architecture

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│ IP Camera │───▶│ Flask Server │───▶│ Web Dashboard │  
│ (Mobile/Webcam) │ │ │ │ │  
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 │ AI Processing │  
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 │ • DeepFace │  
 │ • Google Gemini │  
 │ • OpenCV │  
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## 4. Technical Components

### Core Technologies

* **Flask (Python)** – Web framework for backend and APIs.
* **OpenCV** – Real-time video capture and frame processing.
* **DeepFace** – Facial emotion detection and attention analysis.
* **Google Gemini AI** – Advanced contextual video analysis.
* **NumPy, Requests, dotenv** – Supporting libraries for computation and environment handling.

### AI Models Used

* **DeepFace**: Pre-trained CNN models for emotion recognition.
* **Gemini 1.5 Flash**: Provides structured analysis, risk classification, and compliance insights.

## 5. Features & Monitoring Metrics

### Real-Time Metrics

* **Attention Level** (0-10) → Based on detected emotions.
* **Engagement Score** (0-10) → Derived from attention and interaction.
* **Training Quality** (0-10) → Aggregated measure of classroom effectiveness.
* **Infrastructure Compliance** (0-10) → Assesses classroom environment.
* **Student Interaction** (0-10) → Trainer-student and peer interactions.
* **Equipment Usage & Space Utilization** → Measures training resource optimization.

### Risk Classification

* **GREEN**: Meets standards.
* **YELLOW**: Needs improvement.
* **RED**: Immediate intervention required.

## 6. System Workflow

1. **Video Capture** – Live stream from IP camera or mobile webcam.
2. **Frame Processing** – Extracts frames for analysis using OpenCV.
3. **Emotion Analysis** – Detects facial emotions, calculates attention.
4. **AI Insights** – Gemini AI evaluates session effectiveness every 30 seconds.
5. **Compliance Monitoring** – Flags violations in infrastructure or delivery.
6. **Web Dashboard** – Displays live video, metrics, and AI-driven insights.

## 7. Web Dashboard Features

* **Live Video Feed** with overlayed metrics.
* **Metrics Cards** (attention, engagement, compliance).
* **AI Insights Panel** with improvement suggestions.
* **Compliance Status Panel** (real-time compliance check).
* **Performance Trends** (historical data visualization).

## 8. Use Cases

* **Training Centers** → Monitor quality and compliance of training sessions.
* **Educational Institutions** → Evaluate classroom delivery and engagement.
* **Corporate Training** → Optimize employee training programs.
* **Government Agencies** → Ensure adherence to skill development policies.

## 9. Security & Privacy

* Local video processing to ensure privacy.
* No permanent storage of video data (auto-deletion enabled).
* Aggregated metrics used instead of personal identifiers.
* GDPR-compliant design.

## 10. Future Enhancements

* Multi-camera integration.
* Cloud deployment for scalability.
* Automated report generation.
* Integration with Learning Management Systems (LMS).
* Advanced analytics with predictive modeling.

## 11. Impact

* Provides **real-time, AI-driven monitoring** of classroom training.
* Enables early detection of poor-quality training institutions.
* Supports **data-driven decision-making** for policymakers.
* Enhances the **effectiveness and efficiency** of skill development programs.

## 12. Conclusion

The Smart Training Analytics Platform addresses the Ministry of Social Justice and Empowerment’s problem statement by creating a scalable, AI-driven monitoring system for classroom sessions. By combining **computer vision, deep learning, and generative AI**, it ensures transparency, accountability, and continuous improvement in skill training programs.

**Screenshots of Results:**

**A screenshot of a computer

AI-generated content may be incorrect.**

**Statistical Responses:**

**A screenshot of a computer

AI-generated content may be incorrect.**