CCTV Integration Hackathon Problem Statement

Index

PROBLEM STATEMENT — MODEL 1

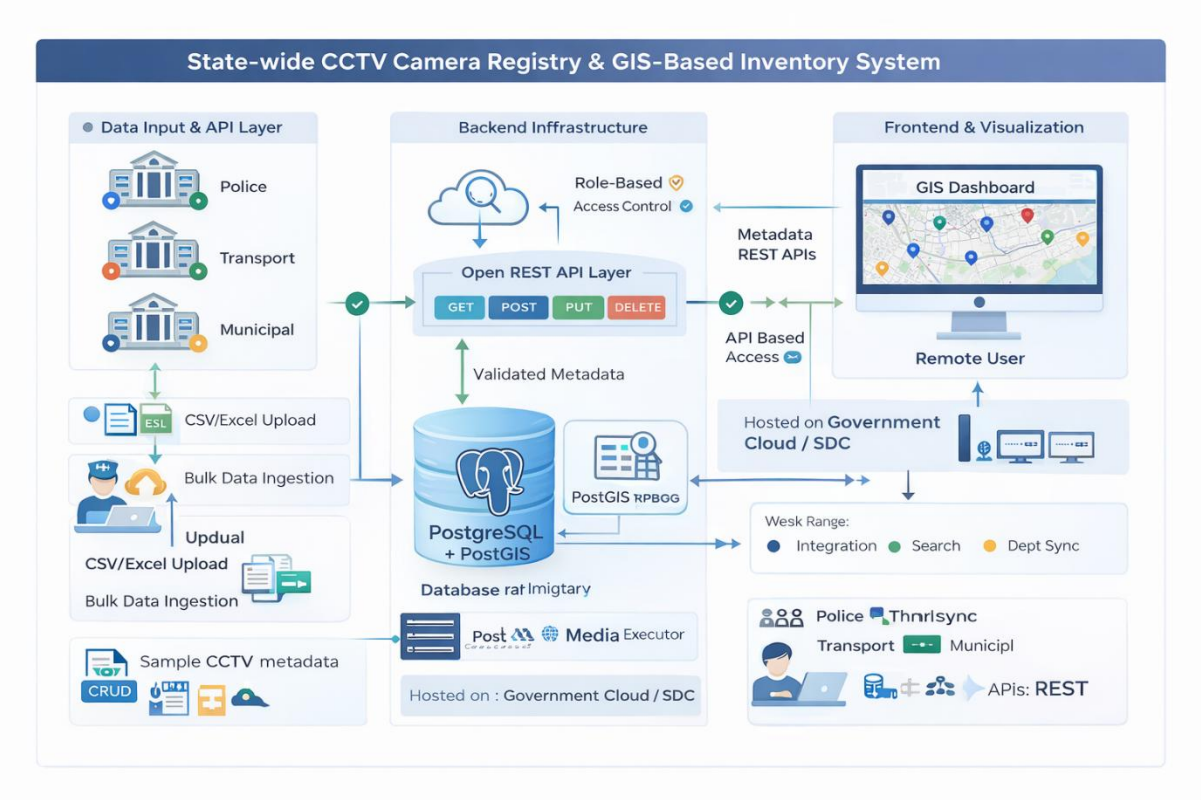

Fig 1

Tech Stack is illustrative, any open source may be used.

📌 Problem ID

- GOG-CCTV-01

📌 Problem Title

- Development of a State-wide CCTV Camera Registry and GIS-Based Inventory System

📌 Theme

- Smart Governance

📌 Category

- Software

📌 Organization / Ministry

- Government of Gujarat – Home Department

📌 Industry Type

- Government Department

📌 Domain Tags

- CCTV, GIS Mapping, Asset Registry, Smart City, Public Safety, Data Management

📌 Problem Statement (Description)

- Across the state, multiple departments such as Municipal Corporations, Transport Departments, Police, and various institutions have deployed CCTV cameras independently. However, there is currently no centralized mechanism to systematically identify, map, and manage these assets. This fragmentation results in limited visibility of the overall CCTV infrastructure and the absence of a unified GIS-based representation of camera locations.

  The lack of consolidation creates challenges in planning integration architecture and identifying monitoring gaps or redundancies. To address these issues, there is a need to develop a centralized CCTV registry system that captures metadata (without video streaming) and serves as a foundational layer for future integration, analytics, and decision-making.

📌 Problem Statement (Short Abstract)

- Develop a centralized platform to register, manage, and visualize CCTV camera metadata across departments using GIS mapping, enabling unified visibility and planning for smart infrastructure.

📌 Objectives

- Create a unified CCTV inventory across departments
- Enable GIS-based visualization of camera locations
- Standardize metadata formats
- Provide APIs for future integration

📌 Expected Solution / Deliverables

Participants should develop:

- Centralized CCTV metadata registry system
- GIS-based interactive dashboard
- Data management module (add/update/bulk upload)
- Open API layer for integration
- Role-based access control system

📌 Dataset / Inputs

- Sample CCTV metadata (synthetic/open datasets)

- GIS base maps
- Network/connectivity details (simulated)

📌 Constraints

- No video streaming or storage required
- Must support large-scale deployment
- Should follow open standards and interoperability
- Ensure data accuracy and validation

📌 Success Criteria

- Accurate and scalable CCTV registry
- Effective GIS visualization
- Easy on boarding of multiple departments
- Availability of APIs for future systems

📌 Expected Outcome

- Single source of truth for CCTV infrastructure
- Improved planning and decision-making
- Foundation for advanced CCTV integration models

📌 Suggested Technology Stack (Open Source Only)

- Frontend: React.js / Vue.js
- Backend: Python (Django/Flask) / Node.js
- Database: PostgreSQL + PostGIS
- GIS: Leaflet / OpenLayers
- APIs: REST
- Any other open-source technologies may also be used

📌 Use Case Scenarios

- State authorities mapping CCTV coverage
- Departments managing camera inventory
- Planning monitoring expansion

📌 Adoption / Deployment Readiness

- Deployable on State Data Center / Govt Cloud
- Scalable for statewide rollout
- Extendable for integration with AI and VMS systems

📌 Difficulty Level

- Medium

📌 Impact

- Strengthens monitoring planning
- Enables data-driven governance
- Serves as a foundational layer for smart city initiatives

SCORING RUBRIC — MODEL 1 (Out of 100 Marks)

Evaluation Criteria	Marks	Description / Justification
Data Accuracy & Registry Completeness	25	As this model is fundamentally a registry system, accuracy, completeness, and validation of CCTV metadata are critical to ensure reliability and usability as a single source of truth.
GIS Visualization & Usability	20	GIS mapping is a key output for identifying coverage gaps and supporting planning decisions; hence emphasis on clarity, interactivity, and usability of the dashboard.
API Design & Integration Readiness	20	The registry acts as a foundational layer for future integration; therefore, well-defined and scalable APIs are essential for interoperability with other systems (e.g., VMS, Analytics, IoT).
Scalability & Performance	20	The system must support large-scale deployment across the state (≥1 lakh cameras) with efficient performance, fast response times, and optimized data handling.
Security & Access Control	10	Sensitive infrastructure data requires robust authentication, authorization, role-based access control, and secure data handling practices.
Innovation & Value Addition	5	Limited weightage as the focus is on building a robust foundational system; however, any innovative features or enhancements that add value are encouraged.
TOTAL	100	

Fig 1.1

PROBLEM STATEMENT — MODEL 2

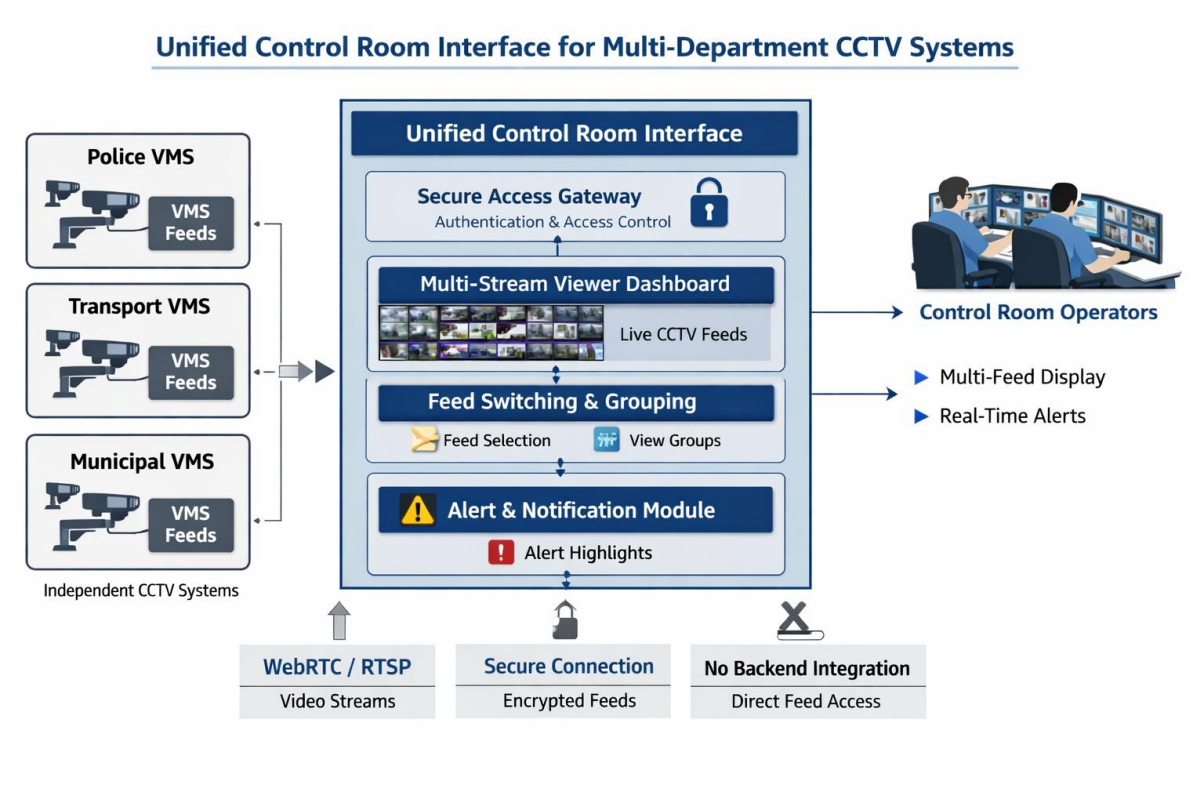

Fig 2

Tech Stack is illustrative, any open source may be used.

📌 Problem ID

- GOG-CCTV-02

📌 Problem Title

- Unified Control Room Interface for Multi-Department CCTV Systems

📌 Theme

- Smart Governance

📌 Category

- Software

📌 Organization / Ministry

- Government of Gujarat – Home Department

📌 Industry Type

- Government Department

📌 Domain Tags

- CCTV Integration, Video Streaming, Control Room, Monitoring, Multi-System Access

📌 Problem Statement (Description)

- Multiple departments currently operate independent CCTV systems, each managed through their own Video Management Systems (VMS). Central command centres are required to access these feeds through multiple parallel viewer systems, which increases operational complexity and reduces efficiency in monitoring.

  To address this challenge, there is a need for a unified interface that enables seamless access to CCTV feeds from different systems through a single platform. This solution should allow centralized monitoring while ensuring that existing departmental systems remain unaffected and continue to operate independently.

📌 Problem Statement (Short Abstract)

- Develop a unified dashboard that enables centralized monitoring of CCTV feeds from multiple departmental systems without backend integration.

📌 Objectives

- Provide single interface for multi-source CCTV monitoring
- Reduce operational complexity
- Enable secure access across systems

📌 Expected Solution / Deliverables

- Unified multi-feed dashboard
- Secure authentication across VMS systems
- Feed switching and grouping system
- Basic alert highlighting mechanism

📌 Dataset / Inputs

- Simulated video streams
- Mock VMS endpoints

📌 Constraints

- No backend system integration
- Must support multiple concurrent streams
- Ensure low latency
- Feed switching latency < 1 second

📌 Evaluation Parameters

- UI/UX efficiency
- Feed latency and performance
- Security
- Scalability

📌 Success Criteria

- Seamless feed switching
- Stable multi-stream performance

📌 Expected Outcome

- Simplified control room operations
- Improved monitoring efficiency

📌 Suggested Technology Stack (Open Source Only)

- WebRTC / RTSP
- React.js
- Node.js / Python
- Any other open-source technologies may also be used

📌 Use Case Scenarios

- Police control room monitoring
- Emergency coordination

📌 Adoption / Deployment Readiness

- Deployable in CCC environments
- Compatible with existing systems

📌 Difficulty Level

- Medium–High

📌 Impact

- Improves operational efficiency
- Enables better coordination

SCORING RUBRIC — MODEL 2

(Out of 100 Marks)

EVALUATION CRITERIA	MARKS	DESCRIPTION / JUSTIFICATION
UI/UX Efficiency & Usability	25	As the solution is interface-driven, ease of use, intuitive layout, multi-feed visibility, and operator efficiency are critical for control room efffectiveness.
Stream Performance & Latency	25	Real-time video access is the core requirement; low latency (<1 sec), smooth playback, and stable multi-stream handling are essential.
Security & Access Control	20	Secure authentication across multiple VMS systems is crucial to prevent unauthorized access and ensure controlled visibility of feeds.
Scalability (Concurrent Streams Handling)	20	The system must support multiple simultaneous feeds across departments without performance degradation.
Alerting & Feed Management Features	10	Basic alert highlighting and feed grouping improve usability but are secendary to core streaming
TOTAL	100	

Fig 2.1

PROBLEM STATEMENT — MODEL 3

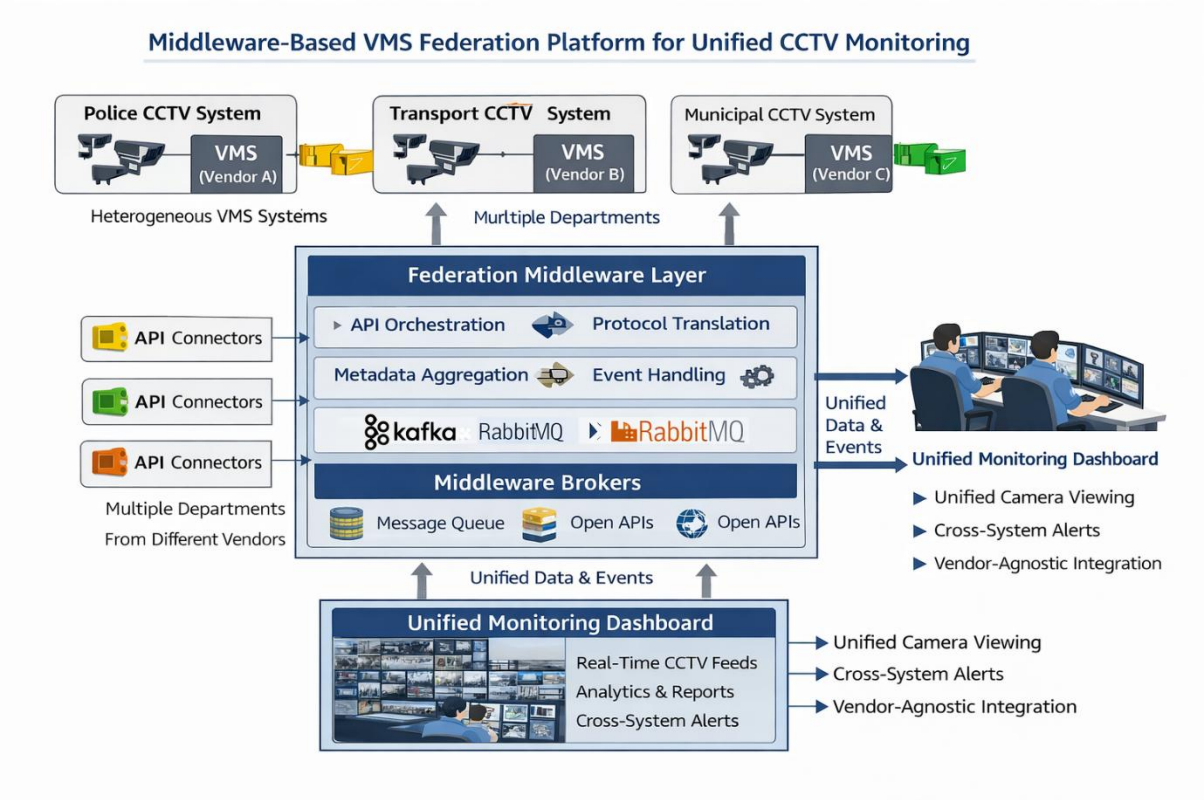

Fig 3

Tech Stack is illustrative , any open source may be used.

📌 Problem ID

- GOG-CCTV-03

📌 Problem Title

- Middleware-Based VMS Federation Platform for Unified CCTV Monitoring

📌 Theme

- Smart Governance / Interoperability

📌 Category

- Software

📌 Organization / Ministry

- Government of Gujarat – Home Department

📌 Industry Type

- Government Department

📌 Domain Tags

- VMS Federation, Middleware, API Integration, Interoperability, Multi-Vendor

📌 Problem Statement (Description)

Different departments across the state use heterogeneous CCTV systems supplied by multiple vendors, resulting in a fragmented monitoring ecosystem. This diversity in platforms and standards makes direct integration challenging and limits the ability to achieve a unified monitoring framework.

As outlined in Model 3 – VMS Federation, there is a need for a middleware layer that can aggregate metadata and facilitate unified viewing across systems without requiring replacement of existing infrastructure. Such an approach enables interoperability while preserving departmental autonomy and investments in current systems.

📌 Problem Statement (Short Abstract)

- Develop a middleware-based platform to integrate multiple VMS systems and provide a unified monitoring dashboard.

📌 Objectives

- Enable interoperability
- Provide unified monitoring
- Support vendor-agnostic integration

📌 Expected Solution / Deliverables

- API-based middleware layer
- Protocol translation system
- Unified dashboard
- Plug-and-play connectors

📌 Dataset / Inputs

- Multi-vendor simulated APIs
- CCTV metadata
- Integration with ≥ 3 different VMS APIs

📌 Constraints

- Must support heterogeneous systems
- Departments retain control

📌 Evaluation Parameters

- Integration capability
- Scalability
- Real-time synchronization

📌 Success Criteria

- Multi-VMS integration
- Unified dashboard functionality

📌 Expected Outcome

- Seamless cross-department integration
- Reduced vendor lock-in

📌 Suggested Technology Stack (Open Source Only)

- Kafka / RabbitMQ
- Node.js / Python
- PostgreSQL
- Any other open-source technologies may also be used

📌 Use Case Scenarios

- Multi-department coordination
- Legacy system integration

📌 Adoption / Deployment Readiness

- Deployable at state level
- Extendable architecture

📌 Difficulty Level

- High

📌 Impact

- Enables scalable integration
- Supports interoperability

SCORING RUBRIC — MODEL 3

(Out of 100 Marks)

EVALUATION CRITERIA	MARKS	DESCRIPTION / JUSTIFICATION
Standardization & Protocol Conversion	20	Core of this model—accurate, lossless, and reliable conversion to standard protocols (RTSP/ONVIF) is essential for seamless integration.
Hardware Design & Performance	20	The transponder/encoder must be stable, compatible, compact, and suitable for field deployment with diverse legacy devices.
System Integration & Interoperability	20	Converted feeds must work seamlessly with downstream systems of all other Hackathon models (VMS, CCC platforms) across brands and formats.
Latency & Stream Quality	20	Real-time performance with minimal added latency and good video quality is critical for operational use.
Security	10	Secure boot, authenticated access, encrypted streaming, and device-level security are necessary for safe deployment
Innovation & Deployment Readiness	10	Value-added features (health monitoring, remote config, scalability, PoE support, rugged design) encouraged.
TOTAL	100	

Fig 3.1

PROBLEM STATEMENT — MODEL 4

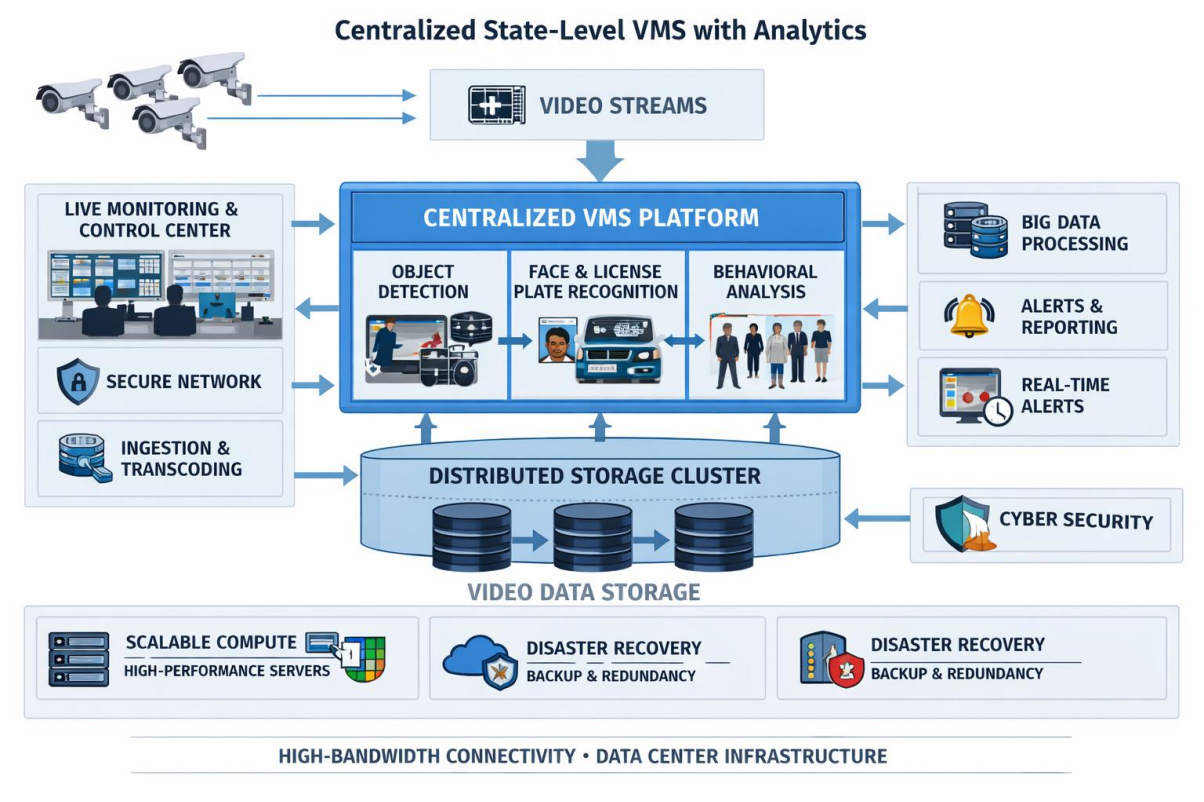

Fig 4

Tech Stack is illustrative , any open source may be used.

📌 Problem ID

- GOG-CCTV-04

📌 Problem Title

- Centralized State-Level Video Management System (VMS) with Analytics

📌 Theme

- Smart Governance / Advanced Monitoring

📌 Category

- Software + System Design

📌 Organization / Ministry

- Government of Gujarat – Home Department

📌 Industry Type

- Government Department

📌 Domain Tags

- Centralized VMS, Video Analytics, AI Monitoring, Big Data, Smart City

📌 Problem Statement (Description)

As outlined in Model 4 – Central VMS, all CCTV cameras are integrated into a single centralized platform that enables unified monitoring, management, and advanced analytics. This approach provides a consolidated view of monitoring across departments, improving coordination and decision-making.

However, such centralization requires robust infrastructure, including high-capacity storage, reliable network connectivity, and scalable system architecture. Ensuring performance, availability, and security at scale becomes critical to support large volumes of video data and real-time processing needs.

📌 Problem Statement (Short Abstract)

- Develop a centralized VMS platform integrating CCTV feeds with storage, monitoring, and AI-based analytics.

📌 Objectives

- Centralize monitoring
- Enable analytics
- Ensure scalability

📌 Expected Solution / Deliverables

- Central VMS platform
- Distributed storage system
- AI analytics module

- High availability design

📌 Dataset / Inputs

- Video streams
- Open AI datasets
- Video processing throughput benchmark (e.g., 100+ streams simultaneously)

📌 Constraints

- High infrastructure requirements
- Must ensure security

📌 Evaluation Parameters

- Performance
- Analytics capability
- Reliability

📌 Success Criteria

- Stable centralized system
- Accurate analytics

📌 Expected Outcome

- Unified monitoring ecosystem
- Enhanced decision-making

📌 Suggested Technology Stack (Open Source Only)

- TensorFlow / PyTorch
- FFmpeg / GStreamer
- Kubernetes
- Any other open-source technologies may also be used

📌 Use Case Scenarios

- Smart cities
- State Monitoring

📌 Adoption / Deployment Readiness

- State data center deployment

📌 Difficulty Level

- Advanced

📌 Impact

- Centralized governance
- AI-driven insights

SCORING RUBRIC — MODEL 4

(Out of 100 Marks)

EVALUATION CRITERIA	MARKS	DESCRIPTION / JUSTIFICATION
System Architecture & Integration Depth	25	Measures how well the solution integrates Cameras, Registry (M1) and Control Room (M2) into a unified, scalable, and maintainable ecosystem.
Core Functional Modules & Workflow Automation	25	End-to-end automation—discovery, connectivity, status, health, uptime, and alerting—are critical for real operational utility.
Reliability, Performance & Scalability	20	The platform must handle large-scale, real-time operations with high accuracy and stability, **ensuring** use of pre-tested data instead of live production data.
Security & Access Control	20	The platform must handle large-scale, real-tine operations, with high accuracy and stability, **ensuring** use of pre-tested data instead of live production data.
Innovation & Intelligence	5	Secure device onboarding, encrypted communication, robust authentication, and audit trailis are essential.
API Ecosystem & Extensibility	5	Well-designed, documented APIs enable easy integration with future systems (Analytics, VMS).
TOTAL	100	

Fig 4.1

Pertaining to all Model Hackathon Problem Statements

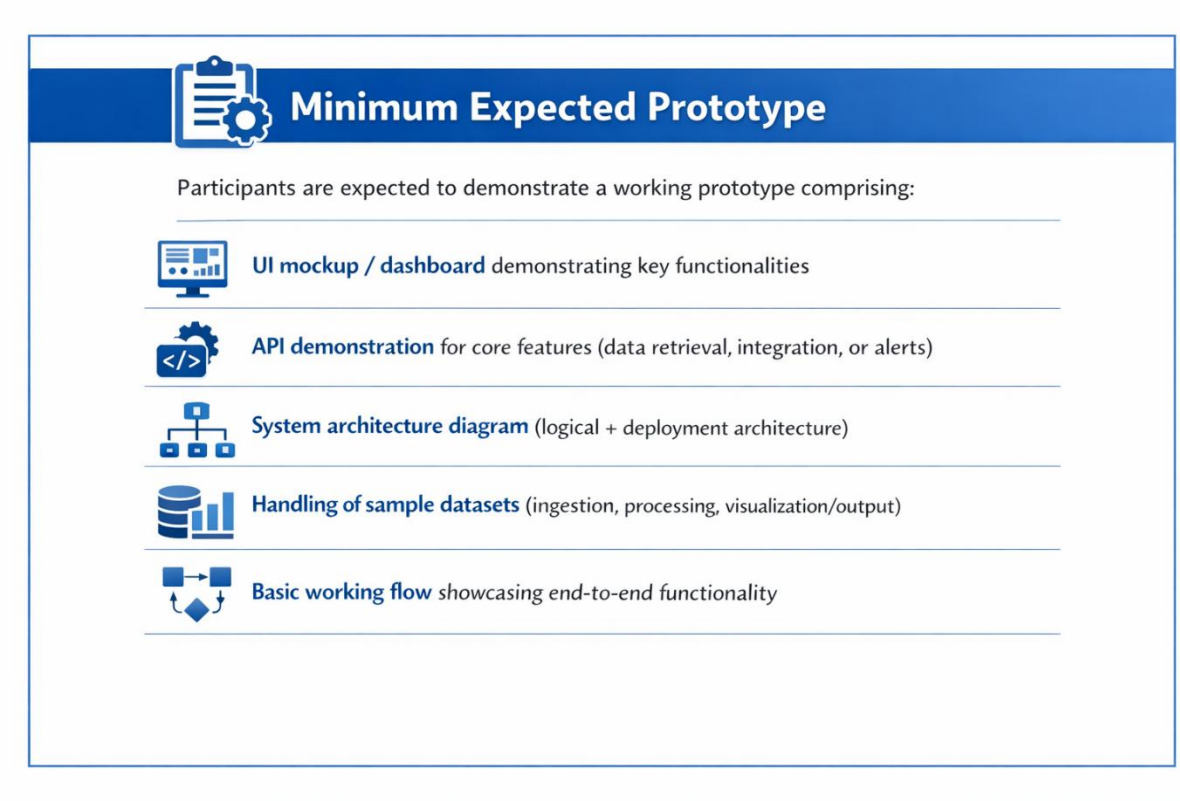

Fig 5


Bonus Evaluation Criteria
Additional weightage may be given for:
Innovation Beyond Problem Scope
Creative solutions extending beyond the defined problem
AI & Machine Learning Integration
Use of AI/ML for intelligent processing & automation
Scalability for State-Level Deployment
Designed for large-scale and statewide implementation
Optimized for Low Bandwidth
Efficient in resource-constrained environments
User-Centric Design
Easy adoption & intuitive user experience

Fig 5.1


AI/ML Applications on CCTV Feeds (Bonus Section)
This section focuses on AI/ML-based video analytics aligned with real-world government needs such as public safety, monitoring. and operational efficiency.
Key use cases include (not limited to):
ABC 1234
ANPR: Vehicle identification & tracking
Crowd Analysis: Crowd monitoring & safety
Suspicious Activity: Detect unusual behavior
Weapon Detection: Identify threats in real-time
Face Recognition: Identify persons of interest
Fire/Smoke Detection: Early hazard alerts
Animal Detection: Monitor stray/wild animals
Teams are encouraged to go beyond these use cases and propose innovative, scalable AI solutions.

Fig 5.2


Deployment Constraints
Government Infrastructure Compatibility
GSWAN
State /Data Center
• GSWAN, State Data Center, Govt Cloud
Govt Cloud
Govt Cloud
Network Constraints (Low Bandwidth & High Latency)
API
XML
JSON
Efficient data
• transmission & lightweight architecture
Interoperability & Open Standards
Adhere to open standards & lightweight architectures
Data Security & Access Control
• Strong encryption & access controls
Modular & Scalable Deployment
• Flexible & scalable architecture

Fig 5.3

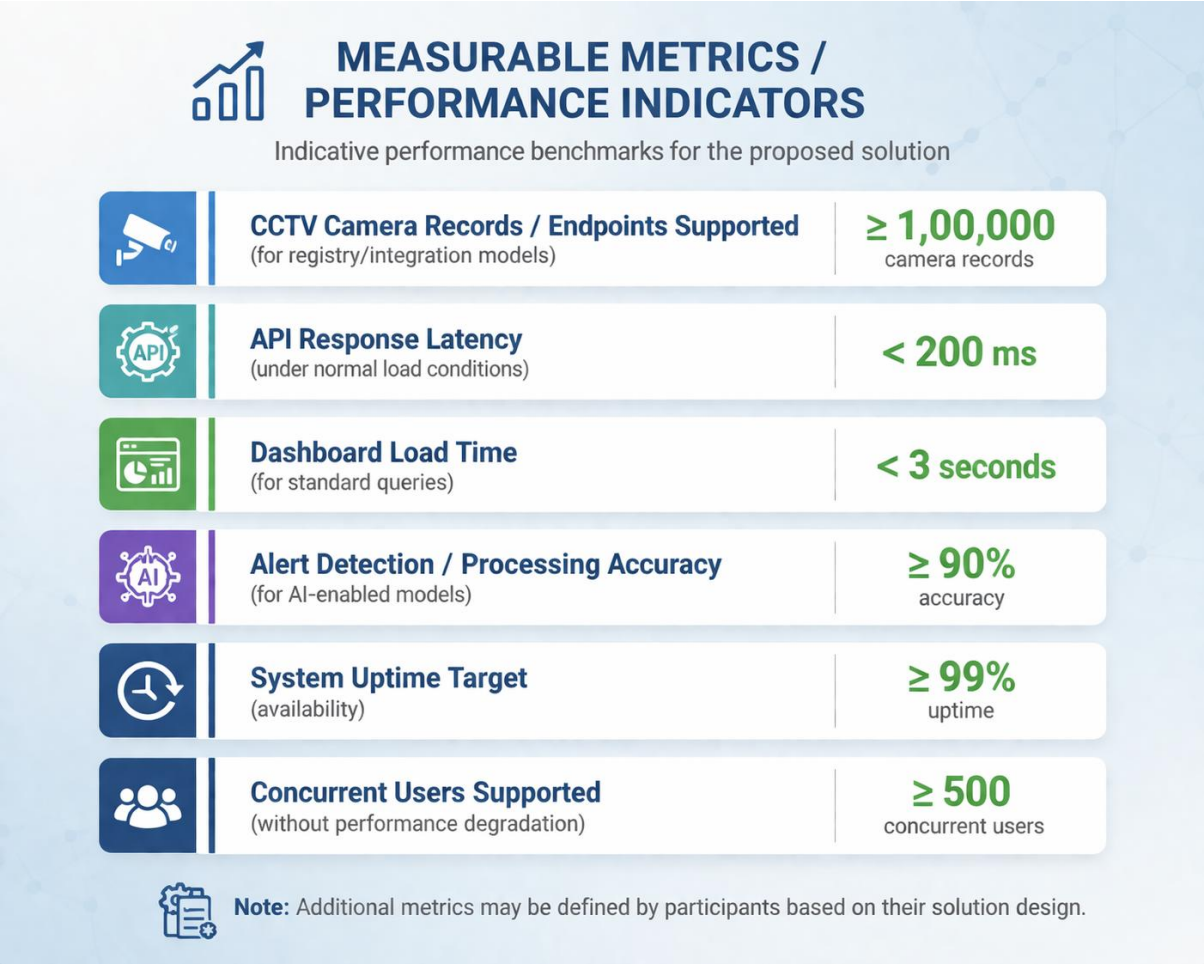
MEASURABLE METRICS / PERFORMANCE INDICATORS
Indicative performance benchmarks for the proposed solution
CCTV Camera Records / Endpoints Supported
(for registry/integration models)
≥ 1,00,000
camera records
API Response Latency
(under normal load conditions)
< 200 ms
Dashboard Load Time
(for standard queries)
< 3 seconds
Alert Detection / Processing Accuracy
(for AI-enabled models)
≥ 90%
accuracy
System Uptime Target
(availability)
≥ 99%
uptime
Concurrent Users Supported
(without performance degradation)
≥ 500
concurrent users
Note: Additional metrics may be defined by participants based on their solution design.

Fig 5.4


Integrating Non-IP Cameras into IP-Based Systems
The solution should support integration of non-IP (analog) CCTV cameras into the IP-based system using encoders/transponders and protocol conversion. This will enable seamless interoperability, cost-effective implementation, and gradual transition to a unified IP-based architecture.
Non-IP (Analog) CCTV
IP (Digital) CCTV
RTSP
H.264
Encoders / Transponders
Protocol Conversion
VMS
Video Encoder/ Decoder
Seamless Interoperability
Cost-effective Implementation
Gradual Transition to Unified IP-Based Architecture

Fig 5.5

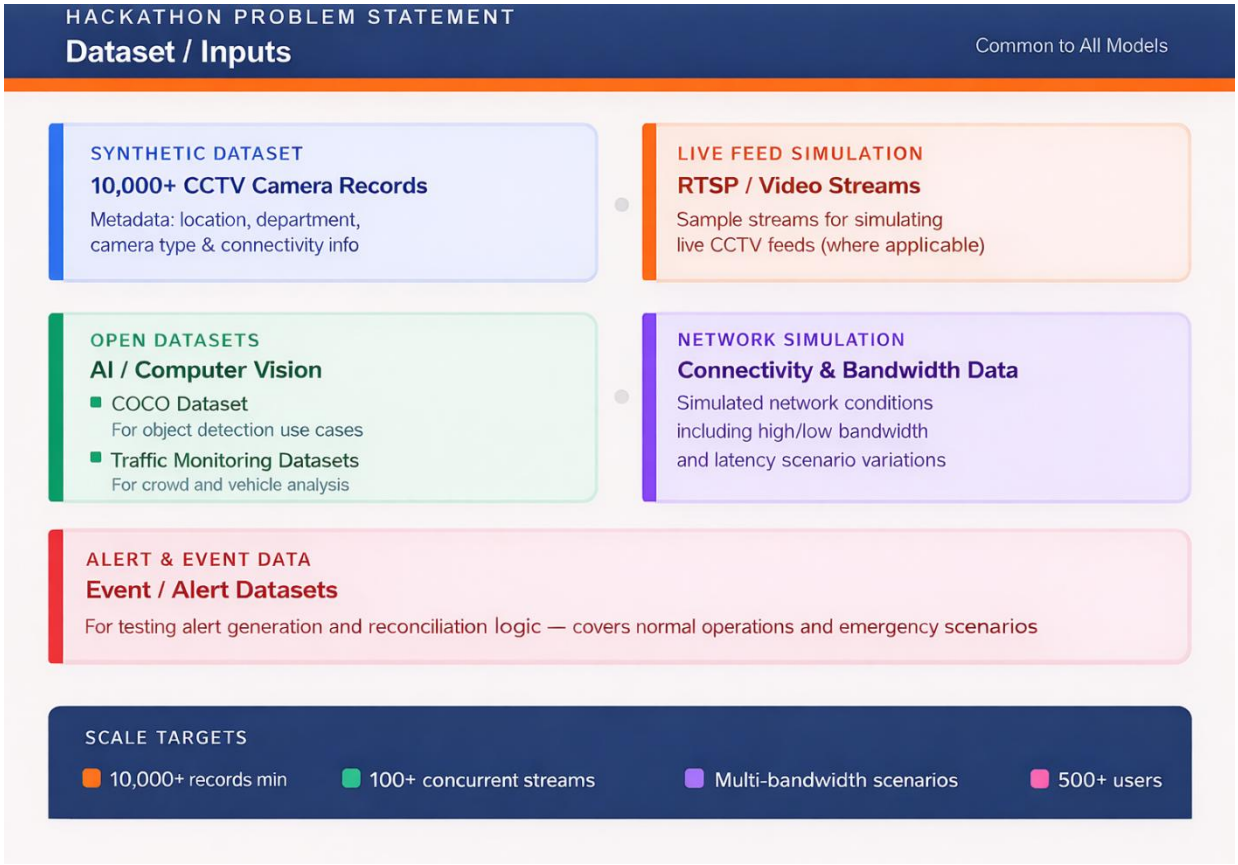
HACKATHON PROBLEM STATEMENT
Dataset / Inputs
Common to All Models
SYNTHETIC DATASET
10,000+ CCTV Camera Records
Metadata: location, department, camera type & connectivity info
LIVE FEED SIMULATION
RTSP / Video Streams
Sample streams for simulating live CCTV feeds (where applicable)
OPEN DATASETS
AI / Computer Vision
COCO Dataset
For object detection use cases
Traffic Monitoring Datasets
For crowd and vehicle analysis
NETWORK SIMULATION
Connectivity & Bandwidth Data
Simulated network conditions including high/low bandwidth and latency scenario variations
ALERT & EVENT DATA
Event / Alert Datasets
For testing alert generation and reconciliation logic — covers normal operations and emergency scenarios
SCALE TARGETS
10,000+ records min
100+ concurrent streams
Multi-bandwidth scenarios
500+ users

Fig 5.6