ITS INDIA CONGRESS 2026

Citizen-Centric Intelligent Transportation Systems for Viksit Bharat 2047

AI, Digital Enforcement and ITS Roadmap for Safe, Sustainable and Efficient Mobility

Vijay Khuspe

Director, SenSen Networks Ltd. (ASX-listed)

Director, SmartLeaven Technologies Pvt. Ltd.

Executive Director, IRAVAN Technologies

Doctoral Researcher, AI-Driven Governance Transformation

A CANDID FRAMING

Build the 2047 vision by 2035

2026 → 2035 · PLANNABLE

What we can commit to

- Technologies already proven at pilot scale
- Legal foundations that are already in force
- Institutions we can redesign within two plan cycles
- Measurable targets: fatalities, travel time, uptime, appeal resolution

2035 → 2047 · SCENARIOS

What we should be humble about

- AI capability may change by orders of magnitude
- Autonomy, connectivity and vehicle ownership remain uncertain
- Cities, climate and work patterns will shift
- So we build open, upgradeable foundations, not fixed predictions

We can engineer the next decade. We can only prepare for the one after it.

2047 · EXTRAPOLATING, NOT FORECASTING

Six scenarios worth preparing for

Sensing everywhere

Every pole, vehicle and phone is a potential sensor. The question shifts from coverage to governance.

AI that reasons about roads

Multimodal models understand scenes, intent and context, not just objects and plates.

Mixed autonomy

Human, assisted and autonomous vehicles share roads; right-of-way is negotiated digitally.

Compliance by design

Vehicles and infrastructure exchange rules directly; enforcement becomes the exception, not the workload.

Network digital twins

Cities test signal plans, bus lanes and parking reforms in simulation before building them.

Federated intelligence

States and cities share models, schemas and lessons without centralising every byte of data.

The 2035 foundations should keep **every one** of these futures open, and lock none of them out.

THE BIG QUESTION

A 2026 problem, a 1990s operating model

India has changed

- Vehicle volumes have multiplied
- Corridors are longer and more complex
- Cameras and sensors are everywhere
- Digital payments and services are normal
- Electronic records are legally recognised
- AI can observe 24×7, at scale

Enforcement largely hasn't

1. Manpower
2. Observation
3. Stopping the vehicle
4. Paperwork
5. Discretion

Technology changes the economics

- One camera observes continuously
- One AI system processes thousands of events
- One digital workflow standardises evidence
- One platform covers the whole corridor

The question is no longer *“Can technology enforce traffic rules?”* It is **“Why is enforcement still designed around manpower?”**

THE THESIS

Legislative reform has created the **permission**.

Technology has created the **capability**.

Administrative reform must create the **operating model**.

India's ITS bottleneck is no longer technology. It is the institutional adoption of technology.

LEGISLATIVE REFORM

The legislative transition has begun

Instrument	What it enables for ITMS
Motor Vehicles Act §136A · CMVR Rule 167A	Electronic enforcement of road safety; rules on devices, notices, records
Bharatiya Sakshya Adhiniyam 2023 · §61, §63	Electronic records admissible, subject to certification and integrity
Bharatiya Nagarik Suraksha Sanhita 2023	Digital evidence and electronic processes built into criminal procedure
DPDP Act 2023 · DPDP Rules 2025	Lawful, purpose-limited processing of personal data; phased compliance
MeitY / STQC CCTV security requirements	Connected cameras treated as security-tested, certifiable devices
BIS IS 19413:2025	Indian standard for smart traffic signalling system components

Electronic enforcement is not just a technology proposal. **It already has a statutory foundation.**

Sources: India Code; MoRTH; MeitY; STQC; BIS. Verify section references before publication.

THE MISSING REFORM

Law alone does not run a system

Law has enabled

- Electronic evidence
- Electronic monitoring
- Digital procedure
- Secure connected devices

The next reform is not another camera. It is a new **operating model**.

Administration still has to answer

Who owns the system?	Who runs it 24×7?	Who validates evidence?
Who maintains the cameras?	Who updates AI models?	Who handles appeals?
Who audits false positives?	Who answers when it fails?	Who uses the data to redesign roads?

WHERE CITIZENS ACTUALLY LOSE TIME

The problem sits between the junctions

Where ITMS looks today

- Signalised junctions
- Red-light violation detection and ANPR
- Adaptive signals, junction by junction

Where micro-congestion forms

- Mid-block parking, loading, bus stops without bays
- School and hospital drop-offs, market encroachment
- Queue spillback, erratic merging, lane blocking

Yesterday's unit
Junction

→

Today's unit
Corridor

→

Tomorrow's unit
Mobility network

Watch, Detect, Enforce: Pune’s Scalable AI-Powered Traffic Sentinel

Date: 22 July 2025


FC Road
Rupali to
Vaishali Hotel
200m
Fergusson College Rd
Chhatrapati Sambhaji Garden
Deccan Gymkhana
PMC
Image © 2025 Airbus
MILLENNIUM MOBILITY
TATA



aster title style

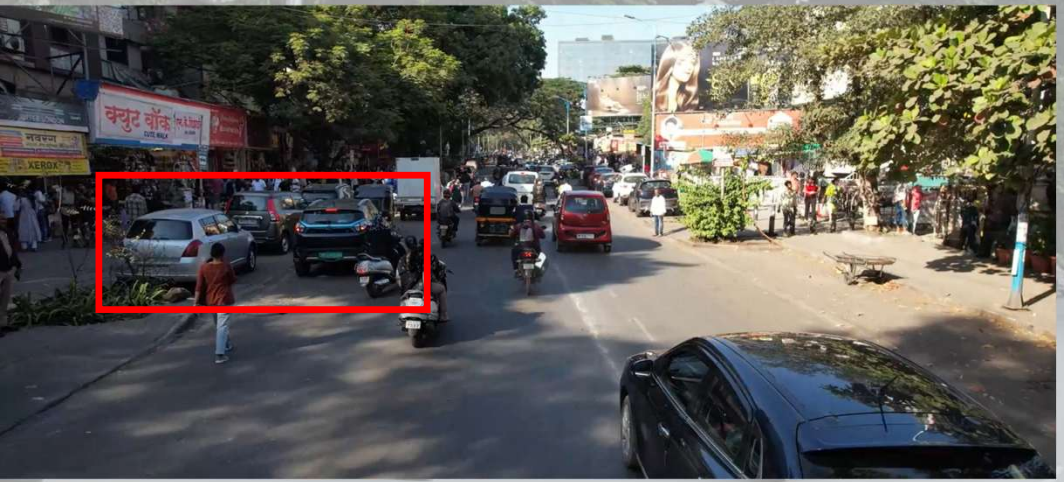
AI-enabled traffic enforcement on **200m stretch of FC Road**

Detects **no-parking, double parking, triple seat riding and wrong-side driving**

Real-time violation detection and e-challan issuance








FEEL THE MAGIC OF 9 LAKH SAVINGS

Objective

Traffic Management Improvement Process

Minimize Confrontations

Reduce direct interactions between officers and violators

Identify Traffic Violations

Recognize common traffic violations

Ensure Fair Enforcement

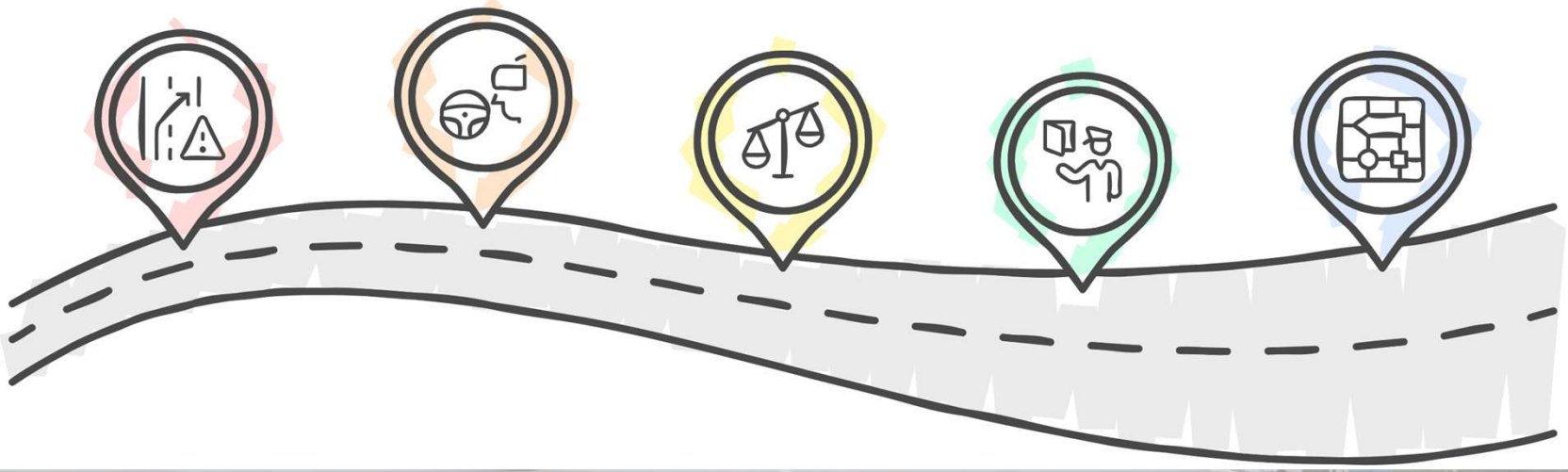
Implement consistent and evidence-based enforcement

Free Manpower

Reallocate resources for critical traffic duties

Establish Scalable Model

Create a replicable model for other areas



Key benefits to Public & Government

Quantifying benefits from qualitative to measurable improvements.

Reduced Congestion

Vehicle flow improves with visible signage

Violation Detection

50+ daily violations previously unmonitored



Improved Efficiency

Automated e-challans streamline violation resolution

Safer Environment

Pedestrian safety increases at chokepoints

Manpower Reduction

Enforcement manpower reduced by 40–50%





SenPIC

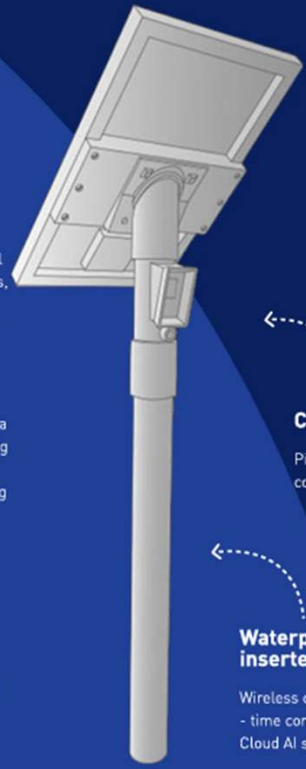
Pole Insertable Camera

SenPIC leverages AI technology to turn ordinary street poles into a remote parking compliance monitoring network allowing local authorities to monitor regulated parking areas, ensuring motorists are adhering to parking regulations to reduce congestion, and provide equitable access to parking spaces for the community.

The system works by inserting a smart camera and solar panel into street poles in any parking area such as on-street, off-street, carparks, capturing images of parked vehicles, recording the GPS coordinates, time, duration of stay, licence plate.

Our pole insertable cameras can be easily relocated with minimal efforts simplifying portable deployment at an affordable price.

"Plug-and-play" – takes less than 10 minutes to install



Solar panel

Charging the battery during the day to run the system at night

Camera

Pinhole 2 Megapixel full colour smart sensor

Waterproof pole inserted battery

Wireless connectivity for real - time communication with Cloud AI system

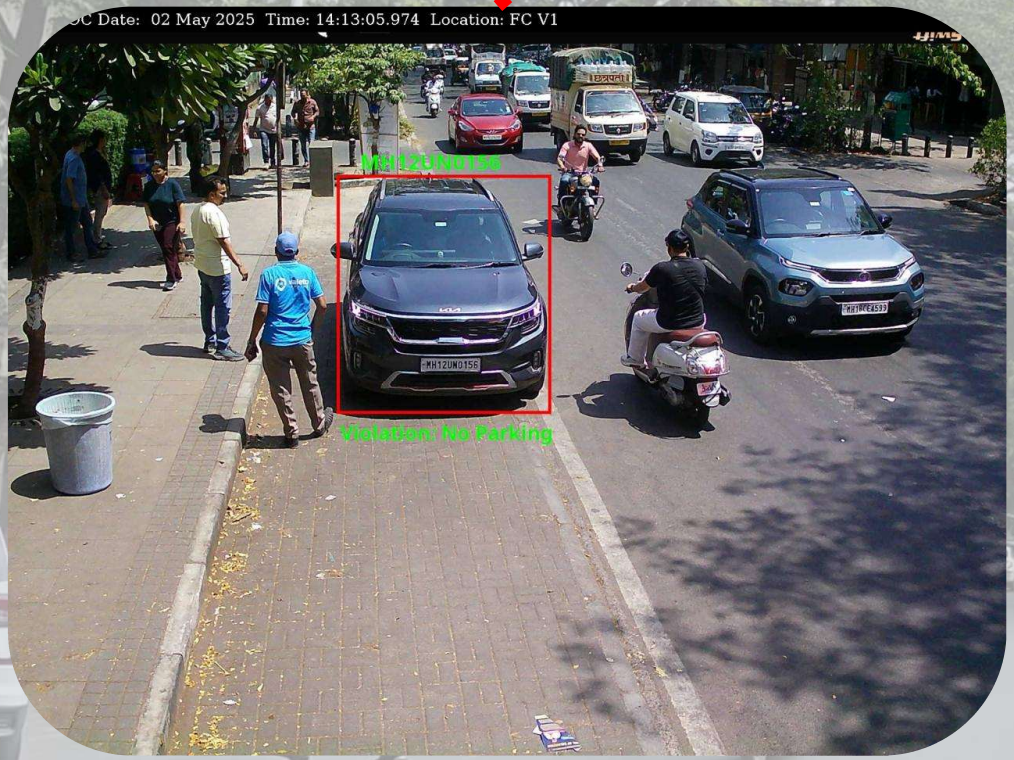
Rapidly deployable design

Scalable and cost effective

Integrate with existing infrastructure

Operational in all weather conditions

Process



Violation alert review

The one-stop event centre provides centralised display of identified violation events, reducing the added pressures of resource management, enabling an officer to quickly review alerts from the previous day at the start of their shift, before continuing with their allocated patrol while providing the option to accept the right data for infringement ticket issuance.



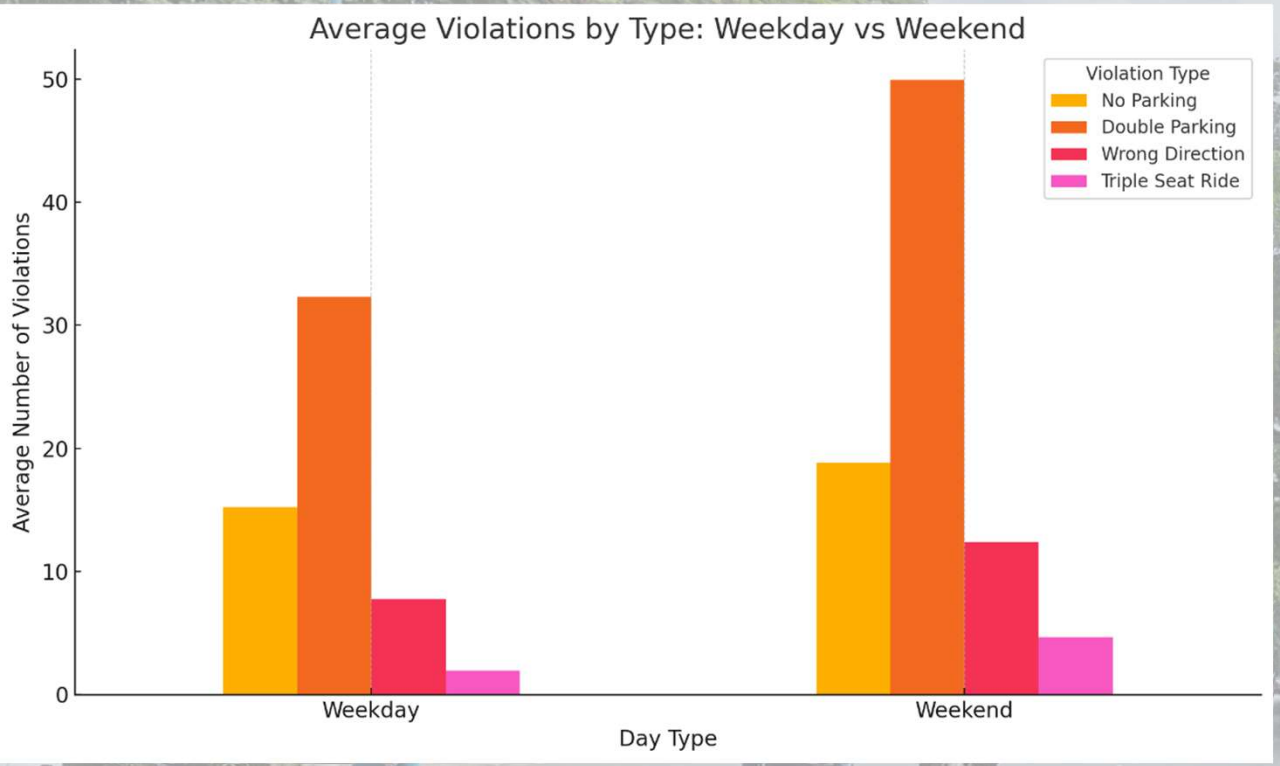
Evidence Package

Automate collection of high-resolution images leveraging a unique combination of cloud IoT and Ai, tagged with the precise date and time, GPS location with contextual information such as the type of violation ensuring accurate and reliable documentation.

Beyond "face blurring" to protect privacy of parents, the community and students, the system is upgraded to include "boby blurring", blurring the entire body of any citizen captured alongside an illegally parked vehicle.

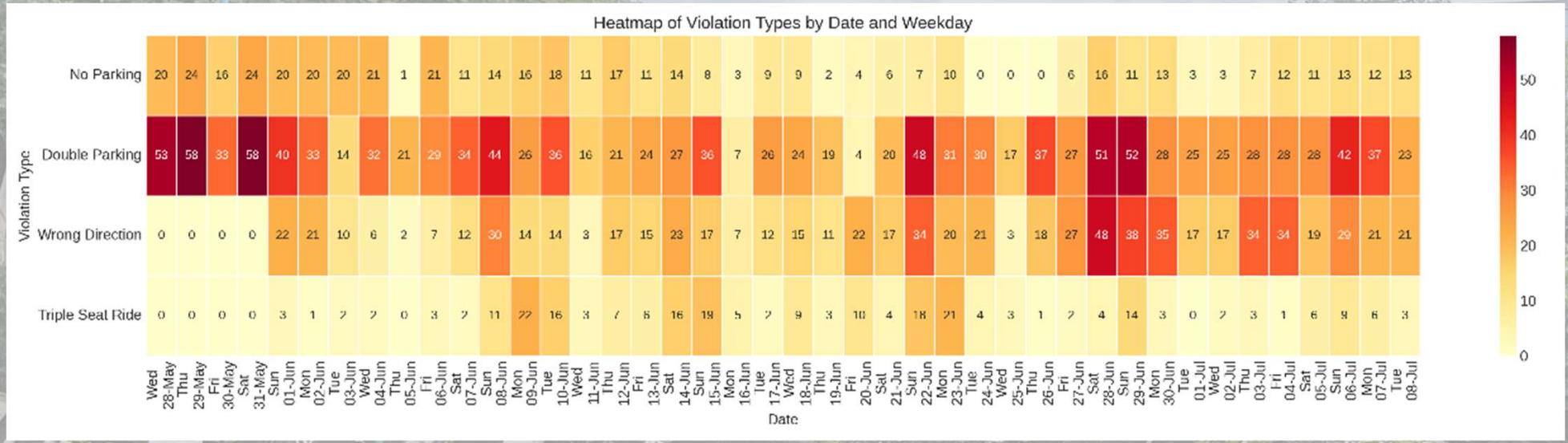


Average Violations by Type: Weekday vs Weekend



- **Double Parking** has a clear weekend spike.
- **No Parking** remains steady or slightly increases.
- **Wrong Direction** and **Triple Seat Ride** show modest increases on weekends.

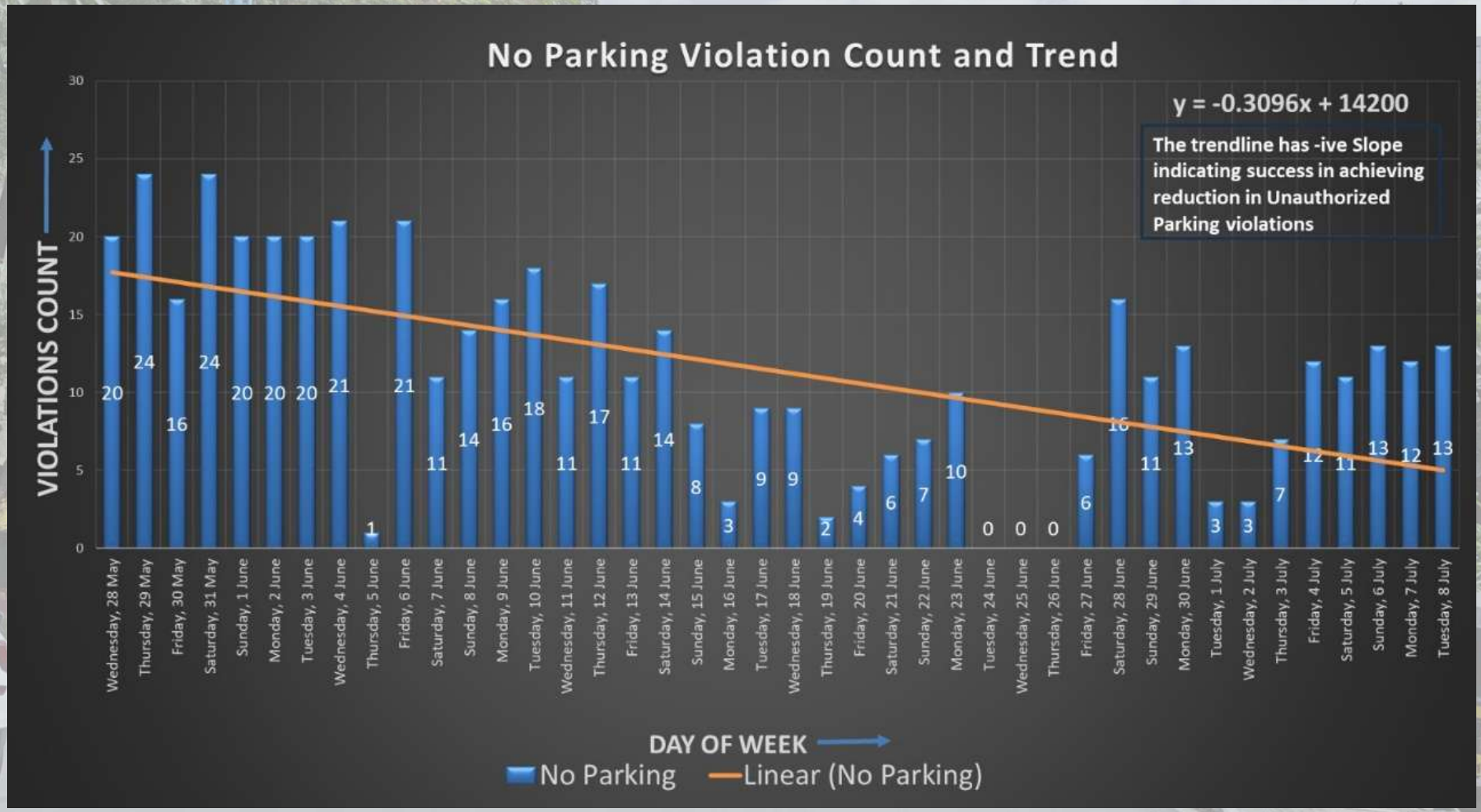
Heatmap of Violation Types by Date and Weekday



- **Double Parking shows the highest and most frequent.**
- **This suggests weekends; especially Saturdays and Sundays, are more prone to illegal double parking, likely due to market days, events.**


Before
Embrace the warmth of indoors!
After

No Parking Violation Trend



REFRAME

From policing traffic to operating the network

YESTERDAY

Traffic policing

Observe · Intervene · Stop · Issue challan · Manage incidents

TODAY

Traffic operations

Sense · Analyse · Predict · Coordinate · Enforce · Optimise

TOMORROW

AI-driven operations

Sense → Understand → Decide → Act → Learn

Enforcement stays essential, but it must be:

Uniform: the same rule detected the same way across the city

Consistent: the same evidence standard and penalty logic

Fair: explainable, appeal-ready, human-supervised

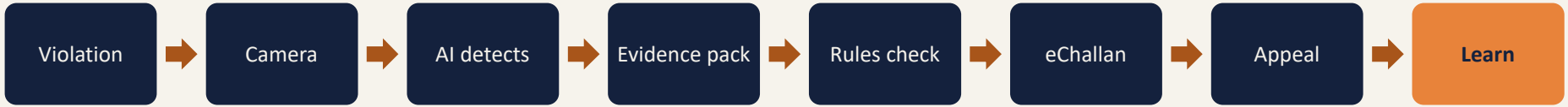
THE FUNDAMENTAL CHANGE

Enforcement becomes a digital workflow

Traditional: an act performed by a person



Digital: a process governed by rules, evidence and audit



Human review stays, **at the exceptions, not at every event**. Every step leaves a record a court, an auditor or a citizen can inspect.

ELECTRONIC EVIDENCE CHANGES THE ARCHITECTURE

Every event must produce an evidence package

- Image and video clip
- Synchronised timestamp
- Location
- Device identity
- Vehicle details
- Violation type and rule
- Detection metadata
- System and model version
- Integrity hash and signature
- Audit trail and human review

THE OBJECTIVE

Evidence must be reproducible, traceable and auditable, not merely visible on a screen.

Built so that certification under the Bharatiya Sakshya Adhiniyam can be issued with confidence.

A NEW PRINCIPLE

ITMS is critical digital infrastructure

~~CCTV · Signal · Controller · ANPR · Radar · VMS · Network gear~~ → **City digital assets with an owner and a lifecycle**

01 Plan

Corridor requirements and architecture

02 Procure

Open, interoperable specifications

03 Deploy

Calibrate, commission, accept

04 Operate

24×7 monitoring against SLAs

05 Maintain

Preventive and corrective

06 Upgrade

AI, firmware, cybersecurity, optics

07 Reconfigure

New traffic patterns and road geometry

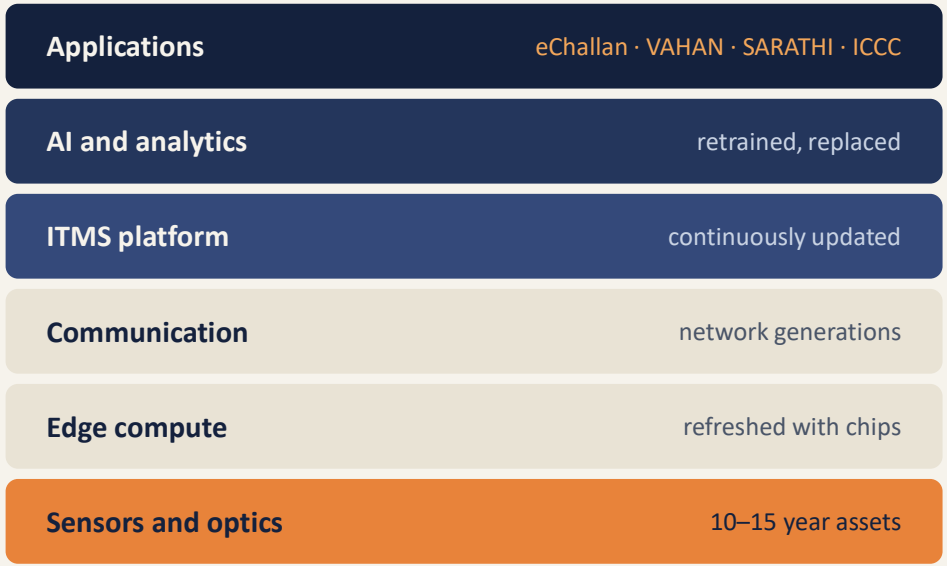
08 Retire

Secure decommissioning and data handling

The cost of an ITMS is not its purchase price. **The real asset is its operational life.**

OPEN ARCHITECTURE AS POLICY

Decouple the layers; let each one evolve



Standard video streams, event metadata and APIs between every layer. Edge, cloud or hybrid by latency, bandwidth and cost.

The camera should become a platform

TODAY

ANPR, red light, speed, helmet, seatbelt

TOMORROW

Wrong-side, parking, incidents, congestion, pedestrians, road condition

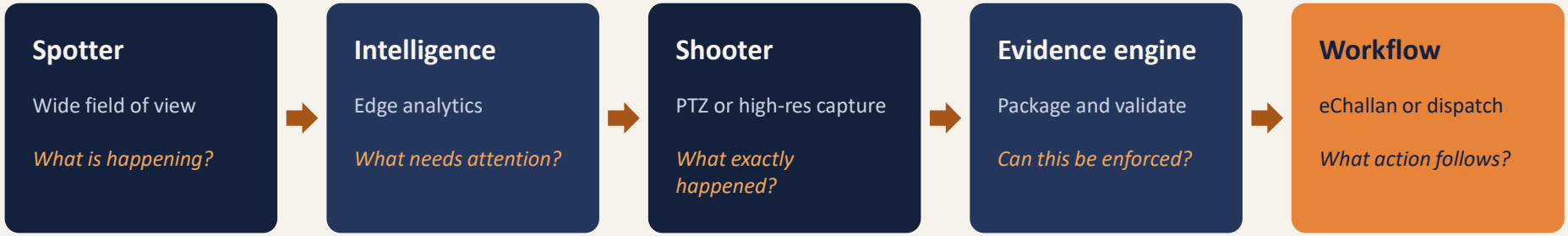
LATER

Vision foundation models, multimodal reasoning, new rules

Right optics first, AI second. Hardware, software and models each have their own lifecycle.

SPOTTER–SHOOTER ARCHITECTURE

See wide, then capture precisely



Fewer blind spots

than PTZ-only designs at complex junctions

Stronger evidence

plate, context and multiple angles for contested cases

Scales to corridors

junctions and mid-block stretches alike

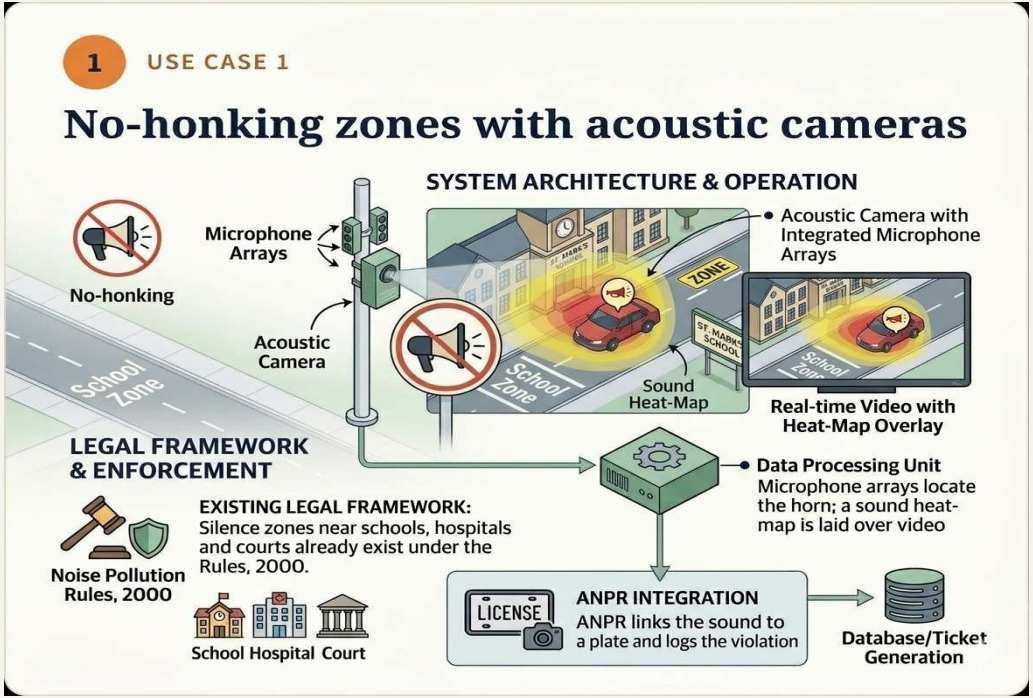
A working case for open architecture: spotters, shooters and analytics from different vendors can only cooperate through **open interfaces**.

Physical AI is deployable today

1 USE CASE 1

No-honking zones with acoustic cameras

- Silence zones near schools, hospitals and courts already exist under the Noise Pollution Rules, 2000
- Microphone arrays locate the horn; a sound heat-map is laid over video
- ANPR links the sound to a plate and logs the violation



Physical AI is deployable today



2 USE CASE 2

Every emergency vehicle as a mobile sensor

- Green corridors cover equipped junctions, not mid-block obstruction
- Low-cost AI dashcams on ambulances, pilot and patrol vehicles
- Detect failure to yield and emergency-lane blocking, with plate evidence (MV Act §194E)

POLICE TRANSFORMATION

Police do not disappear. The role changes.

From *being everywhere* to **managing the system that sees everywhere**.

Officers focus on

- High-risk interventions and serious violations
- Incident and emergency response
- Intelligence and investigation
- Citizen interaction, exceptions and appeals

Technology handles

- Continuous observation and detection
- Evidence creation and data correlation
- Routine enforcement workflow
- Network analytics

A **Traffic Safety & Operations Authority**, not a challan-generation department. Human judgement where it matters; automation where scale matters.

CITIZEN-CENTRIC ENFORCEMENT

Certainty for citizens, not surprise

Every citizen receives

- **Clear evidence**: what the system saw
- **Clear rule**: which provision applies
- **Clear reason**: why it is a violation
- **Clear path** to challenge it
- **Clear timeline** for resolution

Data governance, DPDP-aligned

1. Capture only what the rule needs
2. Purpose limitation
3. Role-based access control
4. Defined retention and deletion
5. Independent audit
6. Named accountability

More cameras must mean **more accountability**, not simply more surveillance.

What has changed, and what must follow

Dimension	Earlier model	Emerging model
Evidence	Human-generated	**Electronic and digital evidence**
Enforcement	Manual	**Electronic monitoring**
Procedure	Physical, paper-based	**Increasingly digital**
Data	Department silos	**Integrated, interoperable systems**
CCTV	Video equipment	**Secure, certified connected device**
Signals	Standalone equipment	**Networked digital infrastructure**
ITMS	Fixed project	**Lifecycle-managed platform**
AI	A single application	**Upgradeable intelligence layer**
Procurement	Hardware specification	**Architecture plus outcomes**
Operations	Police manpower	**Traffic operations centre**
Governance	Department-centric	**Federated and interoperable**

ADMINISTRATIVE POLICY MUST CATCH UP

Six things policy must do next

01 Open architecture

A national open ITMS reference architecture, building on IS 19413:2025. No proprietary end-to-end lock-in.

02 Lifecycle ownership

Every ITS asset gets a named owner, a lifecycle budget and an upgrade plan.

03 Interoperability

CCTV, signals, ANPR, radar, VMS, ITMS, eChallan, VAHAN and SARATHI on shared schemas and APIs.

04 Evidence governance

Creation, integrity, retention, access, audit and appeal, specified once, nationally.

05 Outcome-based RFPs

Pay for safety, travel time, uptime, detection quality and response time. Use modular lots and sandbox pilots.

06 AI governance

Model validation, human oversight, false-positive monitoring, drift checks and auditability.

WHO DOES WHAT

Procure a capability, not boxes

Don't procure

~~“10,000 cameras + 500 signals + 1 ICCC”~~

Procure

Traffic intelligence as an operating capability

MoRTH & NITI Aayog

- Publish the open reference architecture and model RFPs
- Set national outcome KPIs
- Add sandbox clauses to Smart Cities, AMRUT and other schemes

State Urban Departments

- Plan by corridor, aligned with mass transit
- Mandate open interfaces in state tenders
- Use ITMS data for bus, parking and school-access planning

City Traffic Police

- Own corridor performance and safety outcomes
- Co-design spotter–shooter layouts for pain points
- Lead human review, appeals and public communication

Commit to 2035; keep 2047 open

2026 – 2030 · COMMIT

Digitise enforcement

- Standard evidence packages
- Open ITMS on priority corridors
- Spotter–shooter, mid-block and acoustic sensing
- AI dashcams on patrol and emergency fleets
- eChallan, virtual courts, human review

2030 – 2035 · COMMIT

Integrate operations

- Adaptive control tuned to corridor KPIs
- Predictive analytics and corridor digital twins
- Transit priority and multimodal coordination
- Acoustic enforcement in all silence zones
- Lifecycle refresh of AI without replacing optics

2035 – 2047 · SCENARIOS

Intelligent mobility

- AI-driven network operations
- Mixed autonomy and dynamic right-of-way
- Federated mobility intelligence across states
- Revisit the plan every 3–5 years against reality

India does not need more isolated ITS projects. It needs an intelligent mobility operating model.

Enforcement → **Compliance**

Traffic policing → **Traffic operations**

Projects → **Lifecycle-managed infrastructure**

Closed systems → **Open, upgradeable ITMS**

Technology that makes mobility safer, fairer and more efficient, for every citizen.

Let's co-create the national playbook.
Vijay Khuspe
ITS India Congress 2026