



गृह मंत्रालय
MINISTRY OF
HOME AFFAIRS



Project Report

On

Effectiveness of CCTV Surveillance Systems for Police – “Comparative Study “

(Project No.11/MM:03)

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Project Leader	Shri Shri T.Vikram, IPS IG, CRPF
Project Members	❖ Prof. Mayank Vats, IIT Jodhpur ❖ Dr.Dhananjay Ghanwat, IPS,AIG, Assam ❖ Sh. N Prakash Reddy, IPS,DCP, Traffic, Hyderabad ❖ Sh. Amandeep Singh Kapoor, IPS, Principal CDTI, Jaipur ❖ Sh. Kranti Kr. Gadidesi IPS, Principal, CDTI, Hyderabad ❖ Sh Santosh Babu, IPS Dy. Director. State Intelligence, Bengaluru, Karnataka ❖ NPM, BPR&D
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PROJECT TITLE

EFFECTIVENESS OF CCTV SURVEILLANCE SYSTEMS FOR POLICE - COMPARATIVE STUDY

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MEMBERS OF THE GROUP

- 1) Shri Vikram Tummala, IPS (Group Leader)
ADG, Cyber Safety, Kerala (KL: 98)
- 2) Shri Kranthi Kumar Gadidesi, IPS (JH:2006)
DIG/Director, CDTI, Hyderabad
- 3) Shri Amandeep Singh Kapoor, IPS (RJ:2007)
DIG/Director, CDTI, Jaipur.
- 4) Shri Prakash Reddy, IPS (TELAN:2010)
DCP (Traffic), Hyderabad.
- 5) Dr. Dhananjay P Ghanawat, IPS (AM:2010)
AIGP (Admn.), Assam
- 6) Shri Santosh Babu, IPS (KN:2011)
S.P., Ramanagara, Karnataka
- 7) Shri Mayank Vats, Professor,
Jodhpur.

1. INTRODUCTION

Closed-circuit television (CCTV) is a system of video cameras, display devices, and data networks that are used to detect and deter criminal activity. Closed Circuit Television (CCTV) surveillance has become a common technology that can find use in a wide range of applications, such as public, private, social, or work environments. Today, CCTV surveillance has come to mean more broadly the observation or monitoring of anyone or anything, usually by a range of electronic means, and may include CCTV, satellite tracking, and dataveillance.

In the past decade, the capabilities of surveillance cameras have been transformed by fundamental shifts in how digital data is gathered, analyzed, shared, and stored. Security cameras are already playing a key role in the drive to smarter cities and the burgeoning industrial Internet of Things. Deep learning and AI are becoming more prevalent, as cameras can more accurately gather data and make predictions based on integrated analytical software manufacturers have developed. Similarly, the shift to a 'smart home' environment is also playing its role, as consumers have easier access than ever to easy-to-install wireless devices and doorbell cameras. The presence of close-circuit television (CCTV) cameras in public and private locations has long been a fact of life for citizens in many countries. For public safety, these devices present a useful way to collect, monitor and analyze information that can help to keep the public safe and prevent & detect crime. Today, rapid technological advances – both in cameras themselves and wider digital capabilities – are opening up new ways for CCTV and digital surveillance to benefit public safety.

Today CCTV is one of the most popular and cost-effective ways of protecting the public, assets, and systems and assisting the police in the deterrence and investigation of crime. It serves mainly as a security force

multiplier, often used to support comprehensive security systems by incorporating video coverage and security alarms for face recognition, vehicle number recognition, barriers, intrusion detection, and access control.

However, the full potential of CCTV systems is yet to be harnessed in India. While cameras have evolved rapidly in recent years – with higher resolution, better connectivity, and night vision – the underlying infrastructure and monitoring processes behind most CCTV systems in India have largely remained unchanged, focusing on manual monitoring and post-incident analysis.

Several States in the country have implemented CCTV systems, though to varying extents and capabilities. This project does a comparative study of the CCTV surveillance systems installed by the Police of different states of India to give an idea of how this matter is being approached in the concerned states.

2. OBJECTIVE:

This project aims to study the implementation of CCTV systems in the various states of the country and **to develop a National CCTV protocol to assist police functioning.**

Toward this end, the team has done a comparative analysis of the CCTV surveillance systems installed in 5 cities spread across the country – Hyderabad, Bangalore, Indore, Jaipur, and Surat. The team has also found that two States - Telangana and Gujarat - have taken comprehensive steps to implement CCTV networks in their states. Therefore detailed reports on the work done by the Telangana and Gujarat states in implementing the CCTV networks are also presented here as a reference for other states.

3. USES OF CCTV

- Safety of Streets & public areas
- Post-Incident Investigation & Video Forensics
- Proactive Traffic Management & Control
- Road Safety & Improved Urban Mobility
- Protection of Assets.
- Creating a feeling of safety and security in the minds of the common people.
- Collection of evidence in crime investigation
- Reduce the fear of crime anti-social behavior and disorder
- Prevent, deter, and detect crime, criminal damage, and public disorder, including vandalism, incidents of public nuisance, and anti-social behavior
- Identify, apprehend, and prosecute offenders concerning crime, criminal damage, public order, road traffic accidents involving serious injury, and all forms of harassment.
- Assist the emergency services in all aspects as appropriate, including major exercises relating to criminal activities and public safety
- Provide the Police, the Judiciary, and other organizations as authorized with evidence upon which to take criminal and civil actions in the Courts
- Protect areas and premises of critical government and sensitive installations and assets
- Reduce violent or aggressive behavior towards staff or citizens
- Assisting in staff disciplinary, grievance, formal complaints, and Health and Safety Investigations

- The enforcement of Road Traffic Regulations and Acts
- Assist third-party investigating authorities (outside of the police) in the investigation of road traffic incidents, etc.
- Assist in civil emergencies such as Dial-100.
- Investigation of kidnapping & missing cases.
- Monitoring of VVIP movements.
- Investigation of theft, robbery, and chain-snatching cases.
- Other Departments like Municipalities/ Cantonments/ Fire/ Electricity/ Sewerage/Water Supply can use CCTV to deter public garbage disposals, collect lighting blank spots at night for repair, monitor leakages in the water supply, etc. from CCTV Control Room.

4. CHALLENGES

Common CHALLENGES faced in the implementation of CCTV systems are:

- Disparate platforms and solution overlaps (No support for Business Process driven solution)
- Non-tech savvy police force.
- No Awareness of the technology and its benefits for the police force.
- Initial low acceptance of CCTV System operations.
- No Orientation of the police force for CCTV system operations.
- Initial low community participation.
- Power challenges at the field locations such as camera locations, traffic junctions, etc.
- Funding for CCTV System implementation

5. COMPARATIVE STUDY OF THE CCTV SYSTEMS IN 5 CITIES OF THE COUNTRY:

The table below shows a comparison of the CCTV systems in the 5 cities of Hyderabad, Bangalore, Indore, Jaipur, and Surat under various parameters:

COMPARISON AND REFERENCES

CCTV Analysis Chart																			
Name of the location	No. of Camera		The density of Population per camera	Transmission of Data Cable Internet based		Mega-pixel	Color	Video-based analytics (Yes/No)/Manuals	Functionality by ITMS or Crime		Data Coverage					Mechanism to check the functionality of CCTV Cameras installed	Maintenance of Mechanism	Financial Implementation	Legal Provisions
Hyderabad Police Commissionerate	Types of camera			Cable	Internet				ITMS	Crime	No. of screens in the Control Room	Manpower deployed in Control Room	Retention Period of Data	Storage capacity	Cyber Security				
	IP Based	21687		Yes		2MP	Yes		No	Yes	30	50	30 Days	14 PB	Yes	Through PWC	Through AMC	Budgetary allocation for Safe & Smart City and other Projects	Under the Provisions of TS Public Safety Measures Act 2013 & Rules-2014
	Static Camera	2856		Yes		2MP	Yes		No	Yes									
	Rotating	365		Yes		2MP	Yes		No	Yes									
Hyderabad Traffic Surveillance Camera Monitoring Center (SCMC)	Types of camera																		
	IP Based	140	1 Lakh	Yes	No	2MP	Yes	No	Yes	No	10	25	30 Days	24TB	Yes	Manually/ Through Field Team	Through a dedicated field team	State Budget Allocation for ITMS Project	Under the Provisions of TS Public Safety Measures Act 2013 & Rules-2014

	Body Worn	250	56 Thousand		Yes	2MP	Yes	No	Yes	No	2	2	30 Days	2TB	Yes	Through Technical Team	-	State Police Budgeting	-
Telangana ITMS (e-Challan)	IP Based	447	30,837	No	Yes	2 MP	Yes	Yes	ITMS	Yes	6		30 days	240 TB	Yes	Through dedicated Professionals	Through AMC	Budgetary allocation for Safe City Project	Under the provisions of the TS Public Safety (Measure s) Act, 2013 & Rules-2014
	APR	20										20							
	ATCC	326	44,871	No	Yes	Sensor	No	Yes	ITMS	No			30 days						
Telangana CCTV Camera	Types of camera	734	10250	Yes	4 MB PS	2MP	Yes - All	No/Manual	Yes	Yes	Video Wall 67" Cube 9X2 (282 Sq Ft)	24	30 Days	1.5 PB	Firewall	VMS Application and NMS	Daily Health Checks, Preventive and Corrective	eChallan Enforcement	
	RFD	Nil																	
	IP Based	All																	
	Body Worn																		
	Static Camera	706 Fixed																	
	Rotating	28 PTZ																	
	Traffic Camera																		

Remarks: Apart from the above, around 8 lakh CCTV Cameras installed by Private Shops/Establishments/Homes are enumerated and geotagged which are called "Nenu Saitham (Me too) Project Cameras"

Name of the location	No. of Camera		Density of Population per camera	Transmission of Data Cable Internet based		Mega-pixel	Colour	Video-based analytics (Yes/No)/Manuals	Functionality by ITMS or Crime	Data Coverage				Mechanism to check the functionality of CCTV Cameras installed	Maintenance of Mechanism	Financial Implementation	Legal Provisions	
Bangalore	Types of camera																	
	RFD																	
	RFD																	
	IP Based (B + C)	7500	0.06%		MP LS		Yes		Yes	Video Wall screen of 8X3 Matrix (55” screen)	40-seater Comm and & Control Centre	a) 30 days storage of continuous background and video recording at the	15 Petabyte SAN/ NAS/Scale-out Storage in Data Centre	Yes. Threat Intelligence Management	Service Level Agreement.	Payments linked to Service Level Agreement.	Payments linked to Service Level Agreement.	Yes. The agreement signed with Master System Integrator
												Data Centre.						
												b) 60 days storage for flagged/ case evidence data.	6 Petabyte SAN/ NAS/Scale-out Storage in Data Centre					
	Body Worn	560	0.00%		SIM - based	8 MP	Yes		Yes			c) 60 days storage for ANPR and FRS Images.						
Static Camera (B)	6700	0.05%		MP LS	2 MP for 6300 Camera	Yes	Yes	Yes	Yes									

						ras and 8 MP for 400 cameras													
	Rotating (C)	800	0.01%		MP LS	2 MP	Yes	Yes	Yes (ANPR)	Yes				Body-worn camera with 64 GB internal storage					
	Traffic Camera																		
Traffic Management Center Indore	Types of camera	RLV D, ANPR, PTZ	8205 person/camera	OF C		2MP	Yes	Yes	ITMS				30 days	400 TB		functionality check-in client software	Annual Maintenance contract	MP Police	Yes (Gazette notification)
	RFD																		
	IP Based	Yes		OF C		2MP	YES	YES	YES										
	Body Worn	55	58181 person/camera			2MP	Yes	No		Yes	No	No	32 GB	32GB		2 years warranty	2 years warranty	MP Police	
	Static Camera	362	8839 person/camera	OF C		2MP	Yes	Yes	ITMS				30 days	400 TB		functionality check-in client software	Annual Maintenance contract	MP Police	Yes (Gazette notification)
	Rotating	28(PTZ)		OF C		2MP	Yes	Yes	ITMS				30 days	400 TB		functionality check-in client software	Annual Maintenance contract	MP Police	Yes (Gazette notification)

	Traffic Camera	390 (RLV D, ANPR)		OF C		2MP	Yes	Yes	ITMS				30 days	400 TB		functionality check-in client software	Annual Maintenance contract	MP Police	Yes (Gazette notification)
Name of the location	No. of Camera		Density of Population per camera	Transmission of Data Cable Internet based		Mega-pixel	Colour	Video-based analytics (Yes/No)/Manuals	Functionality by ITMS or Crime	Data Coverage						Mechanism to check the functionality of CCTV Cameras installed	Maintenance of Mechanism	Financial Implementation	Legal Provisions
Nagar Nigam	Type of camera																		
	RFD																		
	IP Based																		
	Body Worn																		
	Static Camera	184	0.06 %	Fiber cable		5 MP	Colour			184	30	16	15 Days	200 TB All Cameras		Daily regular basis	Daily regular basis		
	Rotating																		
	Traffic Camera																		
Indore District	Type of camera																		
	RFD	NA																	
	IP Based	608	500/1000	608		2	Yes	No		Yes	8	15	30 Days	1638 TB	Yes			BY RHQ	As per SOP

	Body Wor n	NA																	
	Stati c Camera	457	500/1000	457		2	Yes	No		Yes	8	15	30 Days	1638 TB	Yes			BY RHQ	As per SOP
	Rotat ing	125	500/1000	125		2	Yes	No		Yes	8	15	30 Days	1638 TB	Yes			BY RHQ	As per SOP
	Traffic Camera	NA																	
Name of the location	No. of Camera		Densi ty of Popul ation per came ra	Transmissio n of Data Cable Internet based		Mega -pixel	Col our	Video-based analytics (Yes/No)/ Manual s	Functionali ty by ITMS or Crime		Data Coverage					Mechanis m to check the functional ity of CCTV Cameras installed	Maintenance of Mechanism	Financial Implement ation	Legal Provisi ons
Jaipur (Aurion Pro)	Type s of came ra	Box, Bullet & PTZ		Fiber cable		3 & 2 MP	Col our	RLVD -27, SLVD -14 ANPR -8	504	30	16	30 days	Primary 5.2 PB Secondary 2.4 PB		Daily regular basis	Daily regular basis	e- challan enforcement		
	RFD	46																	
	IP Base d	All camera s																	
	Body Wor n	436																	
	Stati c Camera	62		Fiber cable		3	Col our												
	Rotat ing	16		Fiber cable		2	Col our												
	Traffic Camera	6		12-RFD & 4 Fiber cable				Col our											

Name of the location	No. of Camera		Density of Population per camera	Transmission of Data Cable Internet based		Mega-pixel	Colour	Video-based analytics (Yes/No)/Manuals	Functionality by ITMS or Crime		Data Coverage					
	Type of camera	Box, Bullet & PTZ		Fiber cable	Internet				ITMS	Crime	No. of the screen in the Control Room	Manpower deployed in Control Room	Retention Period of Data	Storage capacity	Cyber Security	
Surat	RFD	NIL														
	IP Based	All cameras	10250	OFC Cable	4 MB PS	2MP	Colour	No/Manual	Yes	Yes	Video Wall 67" Cube 9x2 (282 Sq Ft)	24	30 days	1.5 PB	Firewall	
	Body Worn															
	Static Camera	706 Fixed					Colour									
	Rotating	28 PTZ					Colour									
	Traffic Camera															

As part of the study, we have conducted a comparative study of the 5 best CCTV Projects in India comprising (a) Hyderabad (b) Bangalore (c) Indore (d) Jaipur, and (e) Surat.

1. **No. of Cameras:**

- Hyderabad uses 21,687 IP-based cameras, 2856 Static Cameras, and 365 Rotating Cameras installed for L&O purposes. Hyderabad also has 140 IP-based cameras and 250 Body Worn Cameras for the "Traffic Surveillance Camera Monitoring Centre (SCMC)". Hyderabad uses another 447 IP-based Cameras and 326 ATCC Cameras for ITMS (e-Challan) purposes. Apart from these Cameras, Hyderabad also uses 706 Fixed and 28 PTC CCTV Cameras.

- Bangalore uses 7,500 IP Based Cameras (6700 Static and 800 Rotating). Unlike Hyderabad, there is no mention of the purpose (i.e. L&O, Traffic, ITMS, etc.). 560 Body Worn Cameras are used by Bangalore Police.
- Surat uses 706 Static Cameras and 28 PTZ Cameras.
- Indore uses 362 Static Cameras, 55 Body Worn Cameras, 28 PTZ Cameras, and 390 (RLVD, ANPR) Cameras for Traffic Management Centre.
- Nagar Nigam, Indore uses 184 Static Cameras. Indore District uses 608 IP Based Cameras, 457 Static Cameras, and 125 Rotating Cameras.
- Jaipur uses 62 Static Cameras, 16 Rotating cameras, 6 Traffic Cameras, and 436 body-worn cameras.

From the above, it is clear that Hyderabad has a robust system in place with different cameras being used for different purposes. Bangalore has a good number of body-worn cameras.

2. Density of population per camera:

- In respect of Hyderabad, the density of 1 lakh population is covered per IP-based camera in SCMC and 56,000 people are covered by Body Worn cameras. Similarly, 10,250 persons are covered per camera through CCTV Camera. The above is if only network cameras connected to Control Room are considered. If all cameras available (geotagged/enumerated in the police database) are considered including those installed by private individuals, there are more than 10 lakh cameras for 1 crore population in Hyderabad implying 1 camera for every 10 persons.
- In Bangalore, 0.06% of the population is covered by IP-based cameras.
- In respect of Surat, 10,250 population per camera are covered.
- In respect of Indore Traffic Management Centre, 8,205 persons are covered per RLVD, ANPR, and PTZ Camera; 58,181 persons are covered per Body Camera; 8,839 persons are covered per Static

Camera.

The coverage per person per camera appears to be better in Hyderabad followed by Bangalore and Indore. Note: This observation does not take into account the uneven distribution of the population over the area.

3. Transmission of Data – Cable/Internet based:

- All the cities use Cable Connectivity for the transmission of Data. Hyderabad uses Internet Connectivity for “Automatic Number Plate Recognition” (ANPR) and “Automatic Traffic Counter and Classifier” (ATCC).

4. Mega-pixel:

- All the cities mostly use Cameras of 2 Mega Pixel.
- Hyderabad uses Sensors for ATCC.
- Bangalore uses 2 MP for 6300 Cameras and 8 MP for 400 cameras and their Body Worn Cameras are SIM-based.
- Surat uses 2 MP for its Cameras
- Indore Nagar Nigam uses 5 MP Static Cameras.
- Jaipur uses 3 & 2 MP Cameras.
- As far as Mega Pixel are concerned, all the cities are using similar megapixel cameras.

5. Colour:

- All the cities use color cameras except the ATCC Cameras in Hyderabad.

6. Video-based analytics (Yes/No)/Manual:

- Hyderabad uses Video based analytics in ITMS and in all other cameras Manual analysis is used.
- Bangalore uses Video based analytics.

- Traffic Management Centre, Indore uses Video based analytics and manual analysis in body-worn cameras.
- There is no mention of this in other cities

7. **Functionality by ITMS or Crime:**

- The CCTV Surveillance System is being utilized for Crime, SCMC, and ITMS by Hyderabad.
- Bangalore uses it for Crime purposes.
- Surat uses it for both ITMS and CCTV.
- Traffic Management Centre, Indore uses it for ITMS.
- Indore District uses it for Crime.

All the cities are using the systems according to their needs.

8. **Data Coverage:**

(a) **No. of screens in the control room:**

- Hyderabad has 30 Screens installed in the Hyderabad Police Commissionerate; 6 Screens in the SCMC for IP-based cameras and 2 Screens for body-worn cameras; 10 Screens in the ITMS and Video Wall 67" Cube 9x2 (282 Sq Ft) in CCTV Camera.
- Bangalore has a Video Wall Screen of 8x3 Matrix (55" Screen).
- Surat has a Video Wall of a 67" Cube 9x2 (282 Sq Ft).
- TMC, Indore has no screens but Nagar Nigam has 30 screens.
- Indore District has 24 Screens and
- Jaipur has 30 screens.

Hyderabad has more screens installed for monitoring every activity.

(b) **Manpower deployed in the control room:**

- Hyderabad has deployed 50 personnel in Hyderabad Police Commissionerate; 25 personnel in SCMC; 20 personnel in ITMS and 24 personnel in CCTV Camera.

- Bangalore has a 40-seater Command and Control Centre but the exact number of personnel was not mentioned.
- Surat deployed 24 persons in Control Room.
- TMC Indore has no personnel deployed. Indore Nagar Nigam has deployed 16 personnel.
- Indore District has deployed 45 personnel and
- Jaipur has deployed 16 personnel to monitor the CCTVs.

(c) Retention period of Data:

- On average, all the cities have a Data Retention Period of 30 days.

(d) Storage capacity:

- Hyderabad uses 14 PB storage capacity in Hyderabad Police Commissionerate; 24 TB in SCMC; 2 TB in Body Worn Cameras; 240 TB in ITMS and 1.5 PB in CCTV Camera.
- Bangalore uses 15 Petabyte SAN/NAS/Scale-out Storage in Data Centre; 6 Petabyte SAN/NAS/Scale-out Storage in Data Centre and Body Worn camera with 64 GB internal storage.
- Surat uses 1.5 PB of storage capacity TMC Indore uses 400 TB storage capacity and 32 GB in Body Worn cameras.
- Indore District uses 1638 TB.
- Jaipur uses Primary 5.2 PB and Secondary 2.4 PB.

Here too, Hyderabad uses good storage capacity followed by Bangalore and Indore

(e) Cyber Security:

- All the cities have installed robust cyber security systems to protect the data.

9. Mechanism to check the functionality of CCTV Cameras installed:

- Hyderabad checks the functionality of the CCTV Cameras through PWC (Price Water Cooper) in respect of the Hyderabad Police

Commissionerate, Manually/Through Field Team in respect of SCMC, Through Technical Team in case of Body Worn Cameras, through dedicated professionals in respect of ITMS and VMS application and NMS in case of CCTV Camera.

- Bangalore checks the functionality through the “Service Level Agreement”.
- Surat uses VMS Application and NMS for maintenance.
- TMC, Indore checks the functionality through client software.
- Indore Nagar Nigam checks the functionality through daily checks.
- Jaipur also checks the functionality through daily checks.

All the cities have a good system in place to check the functionality of the CCTV Cameras.

10. Maintenance of Mechanism:

- Hyderabad maintains its systems through AMC in respect of Hyderabad Police Commissionerate, through a dedicated field team in respect of SCMC, in respect of ITMS, and through Daily Health Check, Preventive and Corrective in respect of CCTV Camera
- Bangalore maintains its systems through Payments linked to Service Level Agreement.
- Surat conducts daily health checks, preventive and corrective, to ensure the proper functioning of the Cameras.
- TMC, Indore maintains its systems through AMC.
- Indore Nagar Nigam maintains its systems through daily regular checks and
- Jaipur also maintains its systems through daily regular checks.

All the cities have taken appropriate measures to ensure the proper maintenance of their equipment.

11. Financial Implementation:

- Hyderabad Police Commissionerate is allotted funds from Safe & Smart

City and other Projects. For their ITMS, the budget is allotted from Safe City Project, and for the CCTV Camera, revenue is generated from Challan enforcement (Facilitation Charges).

- Bangalore gets its funds from Payments linked to Service Level Agreement.
- Surat uses eChallan Enforcement.
- TMC, Indore is funded by Madhya Pradesh Police.
- Indore District is funded by its Regional Headquarters.
- All the cities have good sources of funding.

12. **Legal Provisions:**

- In respect of the Hyderabad Police Commissionerate, legal provisions have been laid under the TS Public Safety Measures Act 2013 and Rules-2014. For SCMC, legal provisions have been laid down under TS Public Safety Measures Act 2013 and Rules-2014. For ITMS, legal provisions have been laid down under TS Public Safety (Measures)Act, 2013 & Rules-2014.
- Bangalore has an agreement with Master System Integrator.
- TMC, Indore is covered by Gazette Notification and
- Indore District has SOP in place.

However, Hyderabad has a comprehensive legal provision to back the system.

6. IMPLEMENTATION OF THE CCTV SURVEILLANCE SYSTEMS IN TELANGANA STATE

As part of the effort to enhance public safety and quality of life, Telangana State Police initiated a three-pronged IP based Video Surveillance program viz.,

1. Nenusaitam
2. Community CCTV Surveillance System, and
3. Safe and Smart City

The basic premise of the Telangana State Police CCTV Project is –

- a. 1 CCTV is equal to work done by 100 policemen
- b. CCTV ensures 100% detection and conviction of offenders thereby facilitating Preventive deterrence.
- c. CCTV also ensures that no innocent person is fixed in a crime and no offender is spared.

Comparative descriptions of the three projects are as under:

Parameter	Nenusaitam (Me too)	Community CCTV System	Safe & Smart City
Purpose of CCTV system	Intended for protection and safeguard of individual residential, commercial, or religious premises	Intended for the protection and safeguarding of residential areas, the business community, or a neighborhood geographical area	Intended for State-level protection and safeguarding of all citizens, and enhance quality of life
Source of Funds and Ownership	Premises owners / occupants	Group of individuals / Community groups/ Interest groups/ Corporates (CSR)/ MPLAD or MLA funds	Sponsored by Government
Place of Equipment	At each of the Premises including storage	At respective police stations including storage	At the data center centrally including storage

Command Center	Not integrated into Data Center	Integrated the Community system into the data center as the external system	Part of the System integrated into the data center
Access	On-demand, access to video footage is extracted from the local premises	Can be accessed from any police station or any other place subject to connectivity including mobile devices	Access from anywhere including mobile devices
Major Challenges	No control over the systems at each premise	Good control of the system. Power and Video network	Network connectivity

Details of the above programs are as under:

Nenusaitham Program (Me too)

Parameters	Program Description
Program	Nenusaitham (Me too)
Objectives	Stimulate the premise owners taking the responsibility and ownership to safeguard their premises and build cohesiveness amongst the occupants of the premises for their safety, security, and improved quality of life.
Solution	1. Installation of CCTV cameras covering the premises perimeter, lobbies, corridors, parking lots, common areas, parks, playing grounds, and entry & exit gates covering a 50-meter outside area surrounding the premises for better insight into the movement of habitats, intruders, unauthorized persons and protection of assets. 2. Standardization of Technical and Functional System specifications has been defined and published through pamphlets, dossiers, etc., 3. Regular Awareness and training sessions have been organized to state-level CCTV Vendors to provide an open platform to be part of this mega initiative.
Funds	The CCTV system is completely funded by the premise owners or occupants and continuous maintenance of the system for an unlimited period
Process	1. Premises owners/occupants will engage local vendors to implement the CCTV system in their premises as per the

	guidelines provided by the local police station representative 2. Local PS representative facilitates the Premises owners based on their request or wherever necessary for the successful implementation of the system 3. CCTV equipment including IP network and storage unit is installed and maintained at designated locations within their premises under the ownership and guidance of the occupants 4. Monitor CCTV cameras Live for any movement of unauthorized persons or intruders. 5. Full access to Live & Record video stream to the occupants through a mutually agreed internal process by the occupants. 6. Recorded video footage is stored and retained locally for 30 days on First-In-First-Out (FIFO) basis as part of the CCTV System. 7. Full access to Live & Recorded video streams to law enforcement agencies on-demand in case of any police interventions or post-incident situations. 8. Extraction of on-demand recorded video footage from the system from law enforcement agencies for any incidents or situations
Benefits	1. Evidence-based video footage on the movement of people, assets, or any objects from the premises round-the-clock in case of any incidents. 2. Acts as deterrence thereby reducing/eliminating crime. 3. It helps in the prevention of crime, thefts, and vandalism of property 4. It sends alerts/alarms for any abnormal behaviors. 5. It encourages good behavior, and tidiness of the premises and improves the confidence of the occupants, authorized visitors, etc.,

Community CCTV System Program

This project is an initiative led by communities in which they actively participate and become key stakeholders in the system. They are responsible for installing CCTV cameras in their neighbourhoods, including lanes, by-lanes, colony intersections, and crime hotspots, with the aim of enhancing the safety and security of their community.

To date, more than 35,000 cameras have been installed across these

neighbourhoods. Community groups take the initiative to procure and install the CCTV systems, working with vendors who have been approved and meet the standard technology stack requirements. The respective police station staff plays a facilitating role, collaborating closely with the community groups to ensure the successful installation of the CCTV systems within the police station's jurisdiction.

Once installed, these CCTV systems are seamlessly integrated into the respective police station's mini Command & Control rooms. The police station operators then gain access to both community and safe city cameras through a unified platform.

Parameters	Program Description
Program	Community CCTV System (under Public Safety (Measures) Enforcement Act, 2013)
Objectives	Encourage the group of individuals, homogenous/heterogenous residential & business community groups, and corporates under CSR to own, install and maintain the CCTV cameras covering the community or neighbourhood to safeguard their complete area. The system helps in • Deterrence of crime, reduction in crime • Suspect / Criminal Surveillance and their Movements • Protect the entries and exits of criminal/suspect movements within the community/neighbourhoods • Evidence-based video footage for any post-incident scenario or situations • Traffic movement and congestion in the lanes & by-lanes.
Solution	1. Install and maintain of CCTV Surveillance cameras covering sensitive and crime locations, entry & entry roads, in-roads, lanes, by-lanes, intersections, critical infrastructures, religious places, playgrounds, parks, etc., of community/neighborhood. 2. Standardization of technical and functional system specifications and SOPs have been defined and published to maintain the uniformity of the technology for ease of integration and interoperable

	with other systems. 3. CCTV vendors have been empaneled and rate-contract the equipment prices through an open competitive bid. 4. TSP through the local police station staff acts as a facilitator with the community/corporate groups to help in owning and implementing the program. 5. A central “Sys-Admin” team has been created to oversee the health and upkeep of the CCTV system and coordinate with multiple stakeholders to ensure the high availability of the system.
Funds	1. Pooling of funds by groups of individuals, residential or business community groups to own, implement and maintain the CCTV system. 2. Public and Private corporates invest through their NGO agencies under Corporate Social Responsibility (CSR) scheme on their own, implement and maintain the CCTV System 3. Investment sponsors from Hon’ble MPs & MLAs to implement in their constituencies routed through District Collector Office. 4. The complete system is under the ownership of the Sponsor for its implementation and maintenance.
Process	1. Community group / Corporate entity (“Sponsor”) in coordination with Sys- Admin and local police station representative will survey the area within the community where planned to implement the CCTV system 2. Sponsor engages the empanelment vendor based on their competitive price subject to not exceeding the rate-contract price for the implementation of the system terminating the video network camera feeds at the local police station control room for monitoring & tracking of Live viewing and recording of video footage. 3. Recorded video footage is stored and retained in local PS for 30 days on First-In-First-Out (FIFO) basis as part of the CCTV System. 4. Extraction of on-demand recorded video footage from the system from law enforcement agencies for any incidents or situations 5. The CCTV system is still owned by the Sponsor but under the use of police personnel daily for full access to the system. 6. Geo-mapping of camera locations on the GIS

	platform helps greatly in the investigation or surveillance process
Benefits	1. Evidence-based video footage on the movement of people; assets or any objects within the community round-the-clock in case of any incidents or situations and assists in the prosecution of suspects. 2. Facilitate the detection and investigation of offenses 3. Enhance existing policing provisions within the community and increase community involvement in the provision of legitimate video footage as evidence 4. Acts as deterrence thereby reducing/eliminating crime and reducing the fear of crime. 5. It helps in the prevention of crime, thefts, and vandalism of property 6. It sends alerts/alarms for any abnormal behaviors. It helps the First Responder with the live view or recorded footage in an emergency situation for quick response. 7. It helps the patrolling officers & first responders to strengthen the communities through tracking & monitoring of live feeds to safeguard the communities.

Safe and Smart City Program

The city-wide CCTV system (part of the Safe & smart city project) was initiated by the state government with significant investment to improve public safety and security. The key features are:

- **Government-Initiated City-Wide CCTV System:** As part of the comprehensive Safe & Smart City project, the state government has taken a significant step to enhance public safety and security within the city. The project encompasses the following key components:
- **10,000 IP HD Cameras:** A total of 10,000 high-definition IP cameras will be strategically installed across the city. These cameras will cover main junctions, crime-sensitive hotspots, traffic junctions, and procession routes, providing a wide-reaching surveillance network.

- **Automated Number Plate Recognition (ANPR) Solution:** The project includes the deployment of an Automated Number Plate Recognition (ANPR) solution with sensors at critical locations. This technology will facilitate the identification of vehicles of interest, contributing to improved law enforcement capabilities.
- **Video Management and Central Command Center:** To ensure effective management and monitoring of the city-wide surveillance network, video management and command center applications have been set up at the Central Command and Control Center (CCC). This center enables remote access for relevant stakeholders, enhancing their ability to respond to incidents swiftly.
- **Geospatial Crime Mapping:** A geospatial mapping system is employed to track crimes, criminals, incidents, and camera locations on a digital map. This geospatial approach aids in analyzing the city's security landscape.
- **Integration of Street Equipment:** Street equipment such as cameras, sensors, Video Management Boards (VMB), Public Announcement Systems (PAS), etc., is seamlessly integrated at the CCC through a city-wide telecom network. This integration ensures that data & information flow efficiently for real-time decision-making.
- **Edge Video Analytics:** Critical camera locations are equipped with edge video analytics capabilities. This technology automatically detects abnormalities, allowing for rapid response to potential security threats.
- **Project Implementation:** The project has successfully gone live, marking a significant milestone in enhancing public safety & security throughout the city.

In summary, the state government's initiative within the Safe & Smart City project involves the installation of a sophisticated city-wide CCTV system with advanced technologies & robust infrastructure to ensure the safety & well-being of its citizens.

Parameters	Program Description
Program	Safe & Smart City
Objectives	The project is sponsored by the Government of Telangana with the following objectives: 1. Hyderabad City is a lifeline for the State of Telangana, to achieve the Government's vision of transforming Hyderabad City into a Global City, TSP also needs to be upgraded to deliver policing services at global standards. 2. To enhance the safety and security of every habitant and quality of life in building a safer State of Telangana. 3. It should enable to attract investments from global communities for economic growth.
Solution	1. Deployment of a citywide CCTV System helps in enhancing safety and security; improves responsiveness and effectiveness in policing services, and induces confidence amongst the citizens of a feel-safe factor. 2. CCTV System to cover the main/major roads, major traffic junctions, traffic congestion routes, religious procession routes, VIP movements, criminal/suspect movements, major infrastructures, government assets, sensitive locations, and areas, entry & exit roads of district and state boundaries, etc., 3. Provision of video analytics such as Facial Recognition, Number plate recognition, and other basic analytics with alerts/alarms at critical and sensitive locations to detect abnormal behavior of persons / critical assets status/blacklist persons & vehicles; 4. Tracking and monitoring of whitelist persons (VIP etc.,) & priority vehicles (Ambulances, Fire, VIP, First responders, etc.,) for a smooth flow to reach their destination.

	5. Installation of Digital message boards and Public Address Systems to disseminate information to the public.
Funds	1. Sponsored by the State of Telangana under the stewardship of the High-Powered Committee headed by the Chief Secretary. 2. The system is completely owned by the State of Telangana with TSP as a leading member of the program
Process	1. L&T is the System Integrator who is implementing and maintaining the Safe & Smart City project through an Open Bid Competition for 5 years. 2. All the video feeds are recorded and retained for 30 days on a FIFO basis at the central Data Center and accessed by the various users remotely. 3. Extraction of on-demand recorded video footage from the system from law enforcement agencies for any incidents or situations 4. The video live feeds and recorded videos can be accessed from anywhere such as police stations, offices, mobile devices, etc., 5. Geo-mapping of camera locations on the GIS platform helps greatly in the investigation or surveillance process
Benefits	1. Evidence-based video footage on the movement of people; assets or any objects within the community round-the-clock in case of any incidents or situations and assists in the prosecution of suspects. 2. Facilitate the detection and investigation of offenses and provide action intelligence 3. Enhance existing policing provisions within the community and increase community involvement in the provision of legitimate video footage as evidence 4. Acts as deterrence thereby reducing/eliminating crime and reducing the fear of crime. 5. It helps in the prevention of crime, thefts, and vandalism of property 6. It sends alerts/alarms for any abnormal behaviors. 7. It helps the First Responder with the Live view or recorded footages in emergencies for quick response. 8. It helps the patrolling officers & first responders

	to strengthen the communities through tracking & monitoring of Live feeds to safeguard the communities. 9. Integrated display and advanced control and management software serve the surveillance cameras, intruder alarm data, process monitoring, and other facility network applications – with powerful control capabilities for a seamless 24/7 fully equipped command center. 10. When a security event occurs, information from the field gets to the center from various types of sources including CCTV cameras, alarm & fire sensors, access control, ANPR systems, and site electronic map indicators. All sensor indicators are then viewed & recorded and evaluated at the command center for fast decisions. The data offers the command center operators and decision makers a complete overview of a security ongoing event and helps them to understand each situation and manage it according to government or city regulations.
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7 IMPLEMENTATION OF CCTV SURVEILLANCE SYSTEMS BY GUJARAT POLICE

Similarly, the Gujarat Police has implemented a CCTV system for traffic management and road safety with the installation of 16000+ CCTV cameras in various cities vide their projects Safe City, VISWAS, CSTMS, SCDP, and Smart City with objective as follows:

- Safety of Streets & public areas.
- Post Incident Investigation & Video Forensics.
- Proactive Traffic Management & Control.
- Road Safety & Improved Urban Mobility.

And following key performance indicators:

- 4D Effect: Deterrence, Detect, Delay & Denial of Crime.
- Force Multiplier Effect.
- Intruder-free Traffic Enforcement.

Introduction:

Gujarat is the 5th biggest and 3rd highest urbanized state in the country. The rise in vehicular population and lack of voluntary compliance with traffic rules was posing a major challenge to traffic management and road safety. There was a felt need for a CCTV Camera based safety & integrated traffic management system to keep a tab on interstate movement of vehicles, and prevention of theft of vehicles.

There are 16,000+ CCTV Cameras installed under different projects across the state of Gujarat as shown below:

Projects	No. of Cities	No. of Cameras
Safe City Surat & 2-other projects in PPP mode	3	930
VISWAS	41	6800

CSITMS	3	312
SCDP	1	36
Smart City	6	8,573
Total		16,651

VISWAS Project:

Back in 2013-14, under the leadership of the Hon. Prime Minister, Shri Narendra Modi, who was then the Chief Minister of Gujarat, an ambitious vision was set in motion. The goal was to establish a state-wide CCTV camera-based system dedicated to traffic regulation and public safety.

Pioneering Pilot Project: This visionary idea led to the launch of a pilot project from 2013 to 2015, which was initially implemented in the cities of Ahmedabad, Vadodara, and Gandhinagar in August 2015. This marked the beginning of a transformative journey.

VISWAS Project: The "Video Integration and State-Wide Advance Security" (VISWAS) Project became the flagship program of the Home Department, Government of Gujarat. Its aim was to create a state-of-the-art CCTV camera-based Surveillance and Integrated Traffic Management System (ITMS) across 41 cities throughout the state, including 34 District Headquarters and seven tourist destinations.

Extensive CCTV Deployment: To achieve this, a total of 6,500+ CCTV cameras, encompassing ANPR Cameras, Fixed Cameras, RLVD Cameras, and PTZ Cameras, have been strategically positioned at critical locations such as traffic junctions, entry-exit points, and other strategic sites.

Command & Control Centers: The backbone of this extensive network includes Command & Control Centers (CCCs) equipped with state-of-the-art technology. These centers, established at District Headquarters, are complemented by a State Level Command & Control Center (SLCCC) in Gandhinagar. The SLCCC coordinates the collective efforts of all district-level CCCs.

Advanced Video Analytics: The system features advanced video analytical tools like ANPR (Automatic Number Plate Recognition), RLVD (Red Light Violation Detection), VTS (Vehicle Tracking System), and Speed Violation Detection. These tools are deployed at NETRAM, enabling real-time monitoring of key traffic junctions and strategic locations.

This initiative is a testament to the innovative spirit and commitment to public safety, and it has transformed Gujarat's approach to traffic management and security with cutting-edge technology

Strategic Objectives:

- Safety of Streets & public areas
- Post-Incident Investigation & Video Forensics
- Proactive Traffic Management & Control
- Road Safety & Improved Urban Mobility

Key Performance Indicators (KPIs):

- 4D Effect: Deterrence, Detect, Delay & Denial of crime
- Force Multiplier Effect
- Intruder-free Traffic Enforcement

The following were the benefits-related complexities or gaps which had been

overcome under VISWAS Project:

1. The VISWAS Project was strategically divided into two phases. Phase-I involved establishing the essential central and district infrastructure, including TRINETRA and NETRAMs, alongside endpoint hardware such as cameras at 41 major cities in Gujarat. Phase-II focused on procuring endpoint hardware for around 51 additional cities, which were seamlessly integrated with the Phase-I infrastructure.
2. Massive Scaling Effort: To accommodate the ambitious scale of this project, hardware sizing for the central and district infrastructure had to account for approximately 20,000 cameras (combining both Phase I & II), out of which about 6,500 cameras were successfully installed during Phase-I.
3. Advanced Incident Investigation Tools: VISWAS Project elevated post-incident investigation capabilities by introducing advanced analytical tools and Incident & Alarm Management systems. This upgrade significantly enhanced law enforcement's effectiveness.
4. Capacity Building through Training: A comprehensive training program under the VISWAS Project has equipped over 1500 police officials with the necessary skills to maximize the state-of-the-art infrastructure and effectively manage security challenges.
5. Citizen-Friendly Payment Portal: A unified payment portal was developed, offering citizens a range of voluntary payment options. This user-friendly approach enhances convenience and compliance.
6. Streamlined Procedures: Different Standard Operating Procedures were meticulously implemented across various aspects of the VISWAS Project, including E-challan, operations, and video analytics, ensuring smooth and

efficient operations.

7. Integration for Synergy: Under the VISWAS Project, various city-specific projects, previously operating in silos, have been seamlessly integrated under the guidance of the State Level Command & Control Centre. This coordination brings harmony and synergy across the state of Gujarat, enhancing overall efficiency.

In essence, the VISWAS Project is a ground breaking e-governance initiative undertaken by the Home Department of the Government of Gujarat. It stands as a pioneering project, covering Tier-II and Tier-III cities with advanced video analytics and forensics. The system serves as a force multiplier, offering round-the-clock surveillance capabilities and contributing to improved police efficiency, crime prevention, quality of investigation, and urban mobility.

Furthermore, this non-intrusive traffic management system has significantly reduced police intervention, allegations of corruption, and abusive behavior. It has led to greater citizen satisfaction, creating safer streets for women, children, and senior citizens, while also enhancing road safety in urban centers. The VISWAS Project has truly set a remarkable standard in the realm of public safety and governance. The multiple CCTV Camera based infrastructure created under the Smart City Project, 'Suraksha Setu' Community Policing Program, National Highway Authority of India (NHAI), and other agencies are being integrated.

E-Challan System Summary of VISWAS Project:

VISWAS Project-based E-Challan system has been implemented in a total of 34 districts out of which in 7 districts from 01/07/2019 and in the remaining 27 districts from 15/02/2020 which helped in traffic regulation and citizen behavior. The e-challan system data are mentioned below as of 02.05.2022:

E-Challan System Details			
Sr. No.	Description	Count & Amount	Recovery %
1	Total Generated e-Challan Count	14,31,028	-
2	Total Generated e-Challan Amount	₹ 51,67,21,500	-
3	Total Paid e-Challan Count	6,80,501	47.55%

4	Total Paid e-Challan Amount	₹ 22,83,11,805	-
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Usage of CCTV Cameras of VISWAS Project:

Under the VISWAS Project, the video feeds of the CCTV cameras have been used for various crime investigations, VVIP arrangements, religious occasions, fairs, etc. in a total of 6080 events as of 02.05.2022.

Sr. No.	Type	No Of Events
1	Accident/Hit & Run Cases	837
2	Traffic Management in Fairs/Festivals/Special Occasions/ Processions	508
3	General Traffic Management	1069
4	Kidnapping/Missing Cases	504
5	Monitoring of VVIP Movement	1075
6	Others	367
7	Post Incident Investigation	448
8	Theft/ Robbery/Chain Snatching Cases	1272
Total of Events		6080

It should be noted that Rs. 13.63 Cr worth of Stolen Properties are recovered under this project.

Through such effective project management practices, Project performance became better, faster, and more efficient because of the same, The VISWAS project received many recognitions/awards in past years as mentioned below:

- (i) VISWAS Project has been awarded **SKOCH GOLD Award 2019** for governance in the category of Public Safety & Security.
- (ii) VISWAS Project has been awarded **Governance Now Award 2020** in the state category of Digital Transformation.
- (iii) VISWAS Project has been awarded **Smart Cities India Awards 2021** in the category of Safe City.
- (iv) VISWAS Project has been awarded **the Runner-up Award Project of the Year 2021** in the category of Contributing to the Community.
- (v) Uzbekistan Delegation visited Gandhinagar NETRAM

The coordinated and combined efforts resulted in an increase in the crime detection rate in Gujarat as shown below:

Year	2018			2019			2020		
Heads	Total	Detected	Detection %	Total	Detected	Detection %	Total	Detected	Detection %
Murder	1127	1037	92.0%	1069	1009	94.4%	1075	1028	95.6%
Attempt to murder	1280	1255	98.0%	905	900	99.4%	934	925	99.0%
Dacoit robbery	342	310	90.6%	221	211	95.5%	146	138	94.5%
House Theft	1488	1069	71.8%	1038	833	80.3%	512	449	87.7%
House Theft	4101	1418	34.6%	3541	1519	42.9%	2709	1264	46.7%
All Theft	14168	5484	38.7%	14274	6420	45.0%	9659	4822	49.9%
Riots	1955	1921	98.3%	1378	1374	99.7%	1211	1205	99.5%
Injuries	8204	8095	98.7%	7469	7385	98.9%	7880	7841	99.5%
Kidnapping	3111	2860	91.9%	2843	2717	95.6%	2134	1971	92.4%
Others	31179	27561	88.4%	29474	26521	90.0%	25780	23424	90.9%
Total	66955	51010	76.2%	62212	48889	78.6%	52040	43067	82.8%

1. BASIC REQUIREMENTS OF CCTV SYSTEMS:

Infrastructure & Equipment:-

- Well-equipped command centers, including a Dial-112 center with live LBS system, well-connected crime and vehicle databases with easy access to field officers, real-time traffic management systems, and all of this connected to video seamlessly feeds with analytics.
- Complete CCTV solutions with standardized accessories like external IR, and LPU wherever applicable, a minimum height of 8ft and a maximum of 14 feet depending on resolution and field requirements, etc.

Manpower & Training:-

- Well-trained and tech-savvy Police forces
- Training centers all over India to train police officers.

2. STAKEHOLDERS

- Ministry of Home Affairs
- Bureau of Police Research & Development
- State / UT Police
- Police Training Centers
- Various Govt. / Corporate offices and residents involved / willing

3. IMPLEMENTATION PROCESS

- Community and stakeholders' Inclusiveness
- Legislative Compliance (TS Public Safety Enforcement Act, 2013)
- Amendment to guidelines on CSR programs to promote Women's Safety
- Governance Structure (Steering groups & committees)
- Overall citywide CCTV System Architecture and Design Guidelines eg: In place of the criterion for minimum footfall, the criteria for crime sensitivity or

a secured area can be considered.

- Evolution of CCTV Technology Standards and Protocols
- Multiple Procurement Channels
- Vendor Empanelment, Tender, etc.
- Uniform Service Delivery

**TECHNICAL
SPECIFICATIONS FOR
EFFECTIVE
SURVEILLANCE SYSTEM**

MAJOR COMPONENTS OF A CCTV SURVEILLANCE SYSTEM

Sr. No.	Major components used in CCTV Surveillance
1	CCTV Cameras
2	Video Management Software (VMS)
3	Local Processing Units (LPUs)
4	VMS Servers
5	POE Switch
6	Ethernet Connection/4G/5G Connection
7	Centralized Command Center
8	AI-based Video Analytics Software (VA)
9	AI Training Server

A. CCTV CAMERA SPECIFICATIONS

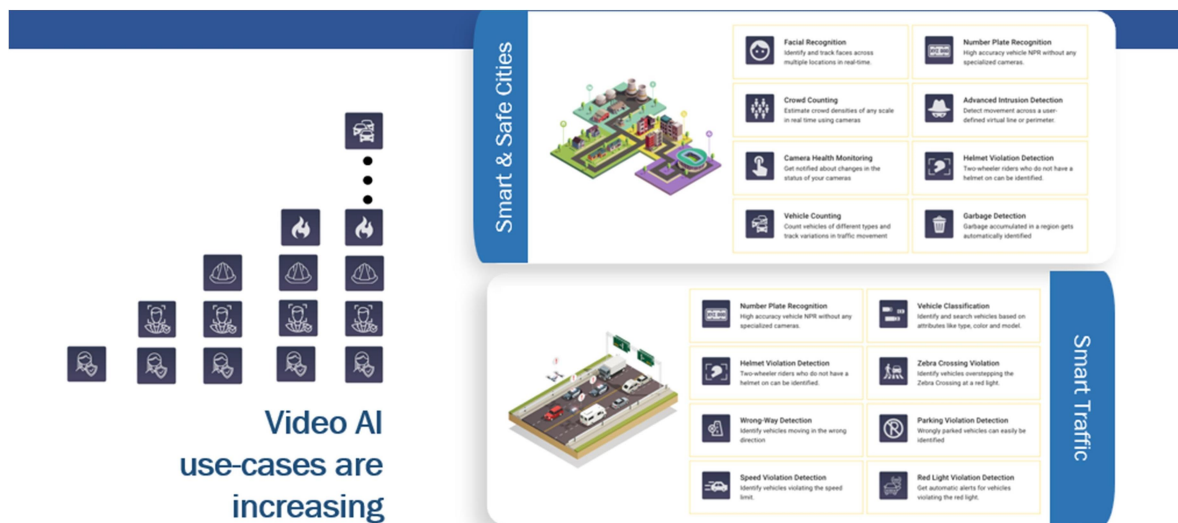
	PTZ	General Purpose	Lane Monitoring	High-Resolution
Resolution (MP)	2 MP	2-4MP	2MP	16MP+
Focal Length (mm)	Varifocal – 30x	2.8-12mm (4x)	5-50mm (10x)	2.8-12mm (4x)
Zoom	Motorized	Motorized	Manual	Motorized
On-Board Storage (SD Card)	Expandable upto 128GB	Expandable upto 128GB	Expandable upto 128GB	Expandable upto 128GB
Connectivity & Power	Power over Ethernet PoE+	Power over Ethernet PoE+	Power over Ethernet PoE+	Power over Ethernet PoE+
IP Rating	IP66/67	IP66/67	IP66/67	IP66/67
Encoding	H.264/H.265/HEVC	H.264/H.265/HEVC	H.264/H.265/HEVC	H.264/H.265/HEVC
WDR	True WDR at 120DB or better	120DB or better	120DB or better	120DB or better
Video Streaming	Multicast & Unicast (2MP Stream)	2 Streams or better	2 Streams or better	2 Streams or better
Protocols	All protocols are required for the efficient working of the system	All protocols are required for the efficient working of the system	All protocols are required for the efficient working of the system	All protocols are required for the efficient working of the system
Interpretability/Application Programming Interface	ONVIF Profile S/G/T/2.x	ONVIF Profile S/G/T/2.x	ONVIF Profile S/G/T/2.x	ONVIF Profile S/G/T/2.x
Operating Temperature (In degree Celsius)	0 to 50	0 to 50	0 to 50	0 to 50
InfraRed Illumination	External	External	External	External

B. VIDEO ANALYTICS SPECIFICATIONS

1. VIDEO AI USE CASES (EASY TO INTEGRATE)

The platform should provide developers with SDKs and tools for the development of newer applications. This can also include training and benchmarking tools that may help developers in training their existing AI models as well as comparing the performance of their models with other standard models. It should also allow developers to test the implementation of their applications in real-life scenarios.

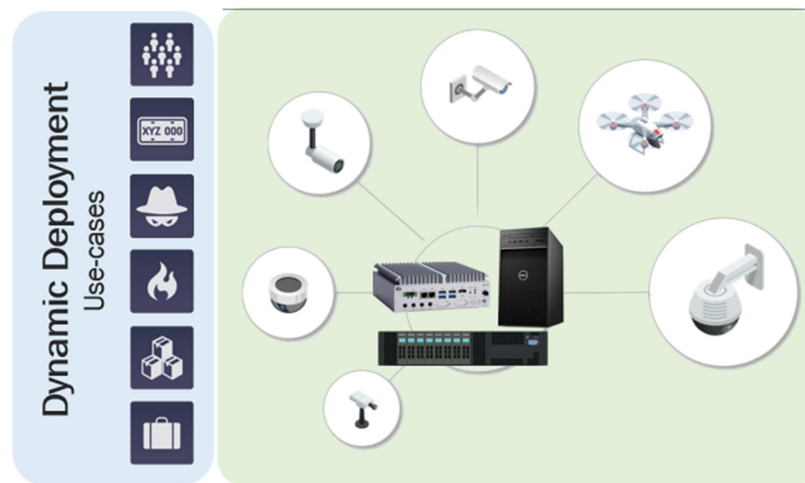
- Video Analytics can easily be integrated with any surveillance infrastructure
- It is readily compatible with all of the major VMSs, As well as all of the major Command & Control Software



2. CAMERA & HARDWARE AGNOSTIC

The platform should be capable of running on any standard hardware infrastructure, and should not be restricted to a limited number of makes and models. Hardware herein includes all kinds of hardware components related to a Video Analytics system, such as cameras, servers, data storage devices, etc. This would not only widen the scope of hardware options available to the city but would also allow the utilization of the city's existing hardware infrastructure.

- Video AI on any CCTV camera without any hard-coding
- Flexible Compute Options
 - Rack Server
 - WorkStation
 - Edge (LPU)
- Ease of Deployment with “Click to Deploy”



3. SCALABILITY & FUTURE READINESS

The platform should be flexible with respect to the deployment of applications on video sources, which is to say that authorities should be able to run any of the applications available to them on any of their cameras as and when needed. It should also allow for the addition as well as reconfiguration of cameras and computing resources whenever required. This implies that the platform should theoretically be able to:

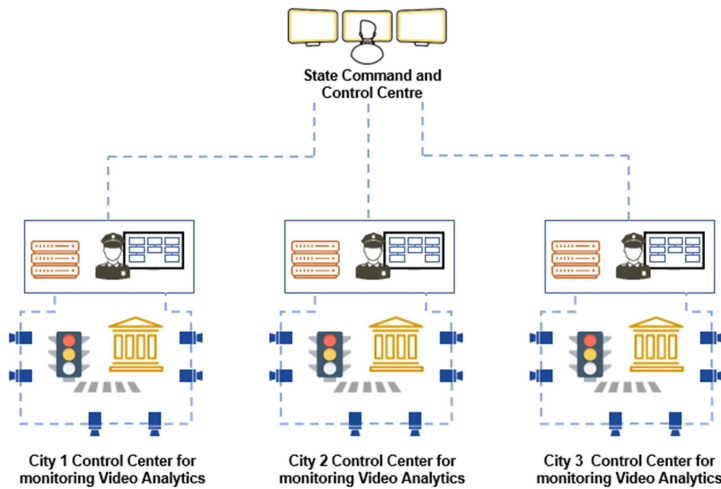
- Run any number of applications on a single video source/camera.
- Add new cameras/ video sources.
- Add new hardware resources (viz. servers, storage devices, etc.)
- Run any single application on any number of video sources/ cameras.

.. from small deployments to state-level distributed deployments



4. CENTRALIZED MONITORING OF VIDEO ANALYTICS DATA

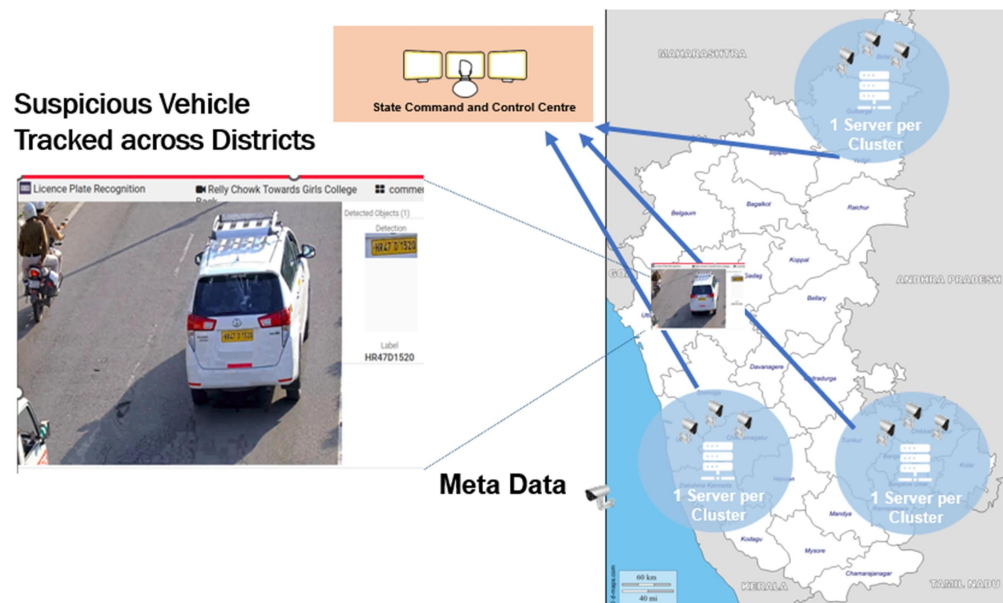
All live video feeds will be processed in the city command center, and the resulting metadata will be sent to the state Command and Control Centre. With this architecture, the police will be able to conduct surveillance of the entire state from the state command and control center. If a violator enters City 2 after being flagged in City 1, the system will alert authorities in real time.



“A violator in
CITY 1
would be flagged
when he enters
CITY 2”

5. INTERCITY ARCHITECTURE

An LPU (Local Processing Unit) will be installed at each junction to enable local processing. Video analytics alerts will only be sent to the city surveillance center via the Internet. This is an economically viable option for implementing the system in tier II cities and major highways.



6. VIDEO ANALYTICS HARDWARE COMPUTE

The specifications for a video analytics server will depend on the requirements of the business or organization using it. However, some common specifications to consider when selecting a video analytics server may include:

Processing Power: The server should have a high-performance CPU and GPU to handle the intensive computational requirements of real-time video analytics.

Memory: Sufficient RAM is necessary to enable the server to handle multiple video streams simultaneously.

Storage: Adequate storage capacity is required to store the video data for analysis.

Network Connectivity: High-speed network connectivity is critical for transferring large amounts of video data in real time.

Software: The server should have video analytics software installed that supports the specific features required by the business or organization, such as facial recognition or object tracking.

Reliability: The server should be designed with redundancy and failover capabilities to ensure maximum uptime and data integrity.

Security: The server should have robust security features to protect the video data and prevent unauthorized access.

	High Compute	Medium Compute	Edge Compute
Representative Image			
Form Factor	Rack Server	Tower WorkStation	Fanless Edge Device
Min Processing Cores	>32	> 12 Core	8
RAM DDR4	128 GB	32 GB	16 GB
Hard Disk	4TB	1TB	500GB
Placement	Data Center	Field Site/Booth	Junction Box
GPU for Video AI acceleration	Up to 4 GPUs	1 GPU	NA
Support for Video AI Analytics	Up to 100 Cameras	Up to 20 Cameras	Up to 6 Cameras

4. CONCLUSION & RECOMMENDATIONS:

Based on the experience of several states in the country it can be concluded that the installation of widespread CCTV networks has helped policing both in prevention and faster detection of crime. However, Police face several challenges in installing CCTV cameras on a large scale, one of them being financial.

Recommendations for new CCTV surveillance systems

Police is a major user of CCTV hence, CCTV can assist the police in manifolds, viz. Law enforcement, Crime prevention, Investigation, Traffic management, Crowd control, Protection of vulnerable sections, Counterterrorism, Maintaining law and order during elections, Community policing, etc. Ideally, States should have an integrated approach to installing CCTV surveillance systems in their limits. The objectives should be multi-fold — public safety, traffic monitoring, crime deterrence, and prevention among other things. Accordingly, the connectivity and the specifications for the cameras, networks, control, and monitoring rooms, video analytics, etc. can be decided. The technical specifications/parameters enclosed can be standardised to enable the seamless sharing of data pan-India to enable real-time interventions in crime and incidents.

A good model to follow is the VISHWAS project in Gujarat.

However, funds constraint is a major issue in the setting up of CCTV systems. Therefore a multi-pronged approach is recommended as was done successfully in Telangana in the following ways:

- a) Making individual premises owners install cameras for their safety (Nenusaitam program)

- b) Promulgating a Law making it mandatory for commercial establishments with a certain minimum footfall to install CCTV cameras to cover their premises
- c) Approaching associations of residents, business and commercial establishments, etc. to install CCTVs in their areas of interest (Community CCTV program)
- d) Tapping Govt. funds under the Smart City program to install CCTVs
- e) In urban areas, provision through appropriate law can be considered in the "Registration Act" for houses and commercial property, that CCTV coverage to all entry points/exits & the entire premises is catered prior registration deed is executed.
- f) In addition to the installation of CCTVs, the maintenance and operational expenditure connected with the entire system can also be also considered through the Modernisation of Police Forces Grant/CSR/Community activities in urban as well as rural areas.
- g) Industries in urban areas be encouraged to fund CCTV Surveillance systems at public places/areas as is being done wherein certain green belts/parks are maintained by Industry partners/ MNCs in many cities/towns.

Thus all concerned stakeholders have to be taken on board in the effort to build up the networks. Multi-pronged strategies would have to be implemented to tap the funds in various schemes like smart city projects, plan funds of the states and center, MPLADS & MLALADS, funds with local self-governing institutions, funds with residential associations and associations of various professional groups.

The necessity of creating a mechanism to empanel the vendors at the National/State/District/Police Station level should be explored and only these empaneled vendors should be allowed to install CCTV at any of the places in

the country so that a uniform mechanism can be adopted and maintained.

An imperative step in the push to increase the CCTV network in a state is the promulgation of a law along the lines of the Telangana Public Safety (Measures) Enforcement Act or the Gujarat Public Safety (Measures) Enforcement Act.

It is further seen that surveillance systems in policing can be broadly divided into three types:

- 1) Major cities.
- 2) Tier two cities and rural areas.
- 3) Highways or major roads

Below are discussed the issues faced and the recommendations pertaining to each of the above types:

1) Major cities

Major cities generally have fund allocations from the government, CSR from private firms, funds or CCTV installations from local corporations, and installations by private commercial properties, and residential houses. The problems faced by major cities given these factors are enumerated below.

- Lack of uniformity and quality specifications among the CCTV installations by other agencies and the private sector.

- Convincing the government for funds every year to ensure optimum coverage of the city.
- Convincing private firms for spending huge amounts on surveillance systems as part of CSR.
- Not knowing the locations of all CCTV cameras in the city public or private.
- Other agencies are more bothered about the number of installations than the quality of specifications and more importantly maintenance of cameras over the years.

Solutions and recommendations to the above issues are given below:

- Most projects become vendor driven rather than requirement-driven projects. Specifications for each place should depend on the requirements of the police in that location. General purpose cameras with a wide field of view and analytics of all types (ANPR, FRS, etc.) on the same camera should always be preferred over specific cameras for each analytics to save cost and also to ensure that all analytics are done in all cameras. Police requirements must push industry innovations rather than the other way around.
- Uniform minimum specifications advisory must be given for all cameras, particularly regarding resolution, the format of recording, method of recording (NVR or DVR), connectivity options, etc, and should be given to all other stakeholders except the police. The reason for minimum specifications should be standardization and it should never be a limiting factor for innovation. In Karnataka, the public safety act 2017 mandates such minimum specifications.
- Governments should be sensitized by the central government and mandated to increase CCTV coverage year after year and also provide

for their maintenance to increase the number of CCTV cameras in all cities. Prevention of Human rights violations and scientific investigation and even quick detection of cases is possible only with CCTV cameras and this has to become part of the government's budget.

- CSR rules for corporates too can be modified to ensure that they contribute enough in this regard.
- Locations of all private CCTV cameras which faces public area or road can be mapped using an app for policemen. Such an exercise has been conducted in Karnataka using a custom app.
- Police play an active role in CCTV installations by corporations or other government agencies like smart city projects etc. A government order making the police the nodal agency of consultation for all CCTV installations by any government department would achieve this objective.
- Innovation must be key for police installations of CCTV. This applies to both hardware and analytics of any installation. Emphasis should be given to what has worked and difficulties faced in evidence retrieval or analytics in previous installations must be kept in mind to avoid the same mistakes in the new project.
- Due to good connectivity options available in cities, they should always go for wired Optical Fiber Cable connectivity from any telecom service provider and stream all video data live to their data centers for analytics. Storage of a minimum of 30 days is for all footage and 1 year for all marked important footage, an indefinite for evidence footage is advisable.

2) Tier two cities and rural areas

Major issues for smaller cities include,

- Lack of funds from the government
- Lesser importance is assigned from the state or central government perspective.
- Lack of availability of good bandwidth infrastructure both wired and wireless.
- Smaller municipalities, lesser corporates, and fewer private installations of CCTV cameras.

Solutions and recommendations for such cities and rural areas are:

- Start small but never go after numbers while ignoring quality. Analytics must form part of CCTV anywhere and even one CCTV camera with good external IR and a wide field of view with analytics is better than 10 cameras that lack any of these features when it comes to detecting crimes and ensuring safety.
- Governments should be sensitized by the central government and mandated to increase CCTV coverage year after year and also provide for their maintenance to increase the number of CCTV cameras in all cities. Prevention of Human rights violations and scientific investigation and even quick detection of cases is possible only with CCTV cameras and this has to become part of the government's budget.
- Emphasis on wireless options for data connectivity like MIMO antennas, 4G, etc. Local Processing units with only relevant data streaming, and ensuring uniformity of CCTV cameras over time will ensure large coverage areas with less funds.

- Determining the locations must be based on key escape routes rather than big junctions. This will ensure the optimum use of cameras.

3) Highways or major roads

The issues faced in such places are:

- Large areas of roads are used by all with little or no coverage of CCTV. criminals are well aware of this and use it to their advantage in trans-border crimes.
- Neither police nor corporations, municipalities, or any other agency claims to own problems of the entire stretch of road. Multiple agencies result in a lack of coordinated effort from anyone for the safety of road users.
- CCTV is the least thought of as a requirement compared to repairs, potholes, etc. Even roads with tolls don't have CCTVs other than at toll plazas.
- The crimes committed at either end or on the highway, accident prevention, and traffic violations on the highway are largely manual and left to the police to deal with.

Solutions and recommendations in this regard are:

- CCTVs must be made part of any new road construction, specifications for the same must be given by local state police and the entire requisite data must also be integrated with police control rooms.
- For already constructed highways, the installation of CCTVs can be taken up as part of maintenance year on year to cover the entire stretch in a time-bound manner.
- Government rules in this regard for national highways authority, state highways authority, Zilla Panchayat, etc. will have to be modified for the

same to ensure CCTV becomes part of the road construction and maintenance budget.

- The cameras so installed need not stream live data but process the video locally using LPUs and send only analytics data to the police control room. With local storage of 30 days, it would do lots of good for crime detection, accident prevention, traffic management, and road safety for all road users.

Based on the learnings of several states public safety agencies need to keep in mind three key issues with today's CCTV systems to harness the full potential of their CCTV systems.

1. Most public safety CCTV operations remain focused on reactive processes.

The first is that most public safety CCTV operations remain focused on reactive processes. CCTV cameras now boast many advanced features, and the video footage they capture is usually recorded and archived – but is only subjected to analysis if warranted by reports of an incident, after the event.

2. Manual interventions still tend to dominate CCTV operations.

The second – related – the issue is that manual intervention still tends to dominate CCTV operations. A lack of automation means that most real-time monitoring and supervision of CCTV content is still carried out by teams of humans sitting in control rooms, watching content and monitoring other sources such as sound sensors, and then reporting back on what they're seeing and hearing to determine what the public safety response should be. The use of video analytics-based alert systems to enable real-time interventions in crimes and incidents has to be developed and incorporated into the CCTV systems.

3. The ability to share data across functions or other organizations is very limited.

The third challenge for today's public safety CCTV systems is that their ability to share data across functions or other organizations is very limited. The ability to transfer video evidence seamlessly between different public safety agencies and other participants in the ecosystem delivers many benefits. A related issue is the standardization of the CCTV systems – both hardware and software – that would enable seamless sharing of data across the country. On the same lines as CCTNS, CCTV feeds of all cameras be interconnected to provide seamless and uninterrupted coverage to enable real-time tracking of criminals/miscreants as part of National CCTV protocol in urban and rural areas.