ROLE OF SURVEILLANCE IN SECURING CITIES

Smart Cities Council India

Supported by
Western Digital Technologies, Inc.

Contents

Executive Summary

Perception of safety is a state-of–the-mind concept; yet, the magnitude of demands and the rising costs of surveillance systems against the complexities of threats that the cities face today has demanded for **new improved capabilities and innovative approaches**.

A safe and secure city is an attractive and prosperous place, where residents and visitors feel safe to live, work, travel and thrive. Though the concept is still broad and evolving, the futuristic vision of the safe and secure city is to strongly promote an **integrated, holistic, analytical approach to city security**. The real-time, dynamic and pro-active video surveillance system forms an important key to achieve this vision.

Even in an industry accustomed to waves of change, video surveillance is set to go through a metamorphic change phase, an unprecedented period of disruption and innovation. While the global video surveillance industry is expected to grow at a CAGR of 11.87 per cent over 2015-2021 to reach a total market size of US$48.69 billion by 2021[1], the current India's video surveillance market of $952.94 million is projected to grow at a CAGR of over 13 per cent from 2016 to 2022[2]. The shift towards IP Surveillance, gradual move towards non-fragmentation and lack of standardisation broadly characterise the Indian video surveillance market.

With rising public security awareness, increasing government security spending through initiatives such as smart cities and surging digitisation, the government sector has become the major player in the surveillance market, both in India and globally. Moreover, escalating video surveillance adaptation rate and increasing demand for high-tech technologies in the private sector has also become an important driver of the outstanding growth of the surveillance market. However, each sector, especially public and private segments has very varied needs and requirements.

The governments should focus context specific needs and should invest into the latest video surveillance technology with highest-resolution cameras, best quality analytical tools and highest capacity storage. Some private sectors such as finance and banking, research labs, corporate headquarter, hospitals, sports facilities, auditoriums need cutting-edge technology with maximum security features. While the broader residential and commercial sector need reliable, efficient and cost effective solutions, which offers specialised needs such as low-light cameras and zoom-specific cameras.

A **collaborative approach** is required among various stakeholders, including the public and the private users as well as the vendors/installers and the policy makers, to efficiently run the multi-layered structure of city security as a **shared responsibility** for asset protection and public safety, in order to ensure secure living and prosperity.

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[1] *Video Surveillance Intelligence Service Report 2016 by IHS Technology*

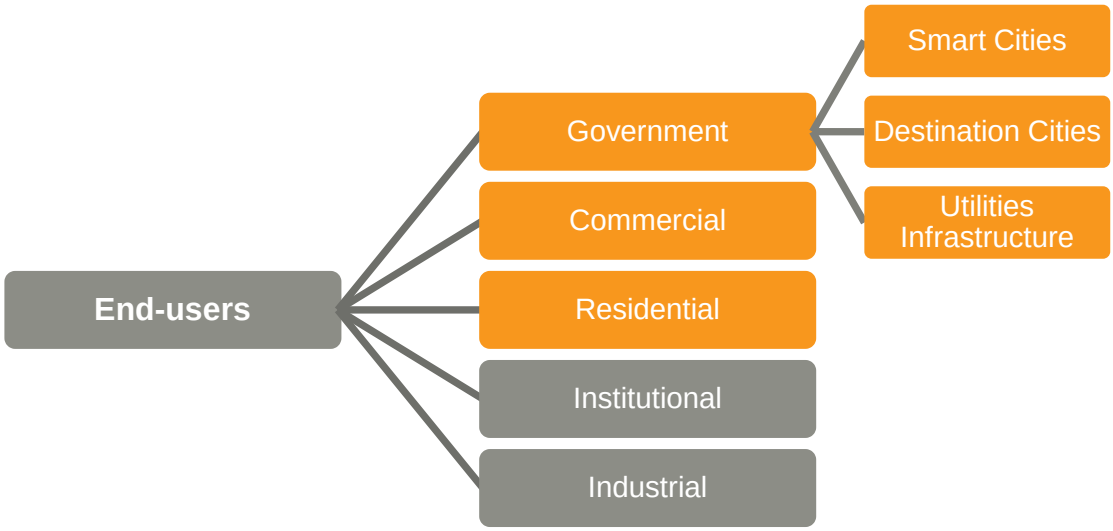
[2] *6Wresearch India*

Key Market Highlights

Key customer segments	Key market trends
• Government • Commercial • Residential	• Rise in violence • Shift from analog to IP • Emergence of IP

Key market challenges	Key market opportunities
• Rising security demand with multiple objectives • Disruptive technology trend • Growing storage concern • Lack of professional expertise • Lack of regulation certainty	• High growth in surveillance market • Huge expansion of IP surveillance market • Evolving industry eco-system • Multitude of features

Key customer segments



Key Impact Survey Highlights

Purpose of current security systems

50% Community Watch

50% Crime Detection

45% Crime Prevention

41% Woman Safety

41% Traffic Management

45% Customer Confidence

32% Employee Protection

27% Crime Solving

IP Surveillance and HD Surveillance Systems

68% IP Already Installed

11% HD Already Installed

Features to be upgraded to improve effectiveness of current system

68% Increasing Storage Capacity

50% Expanding Number of Cameras

41% Higher Resolution Cameras

9% Adding another System

Chapter 1

SAFE AND SECURE CITY: Video Surveillance Global Scenario

Safe and Secure City

Safe is not just a fact, it is a feeling. A safe and secure city is a nicer and attractive place where people – residents and visitors – feel safe to live, work, travel and thrive. Today, the metropolitan environment is dynamic and complex, and the cities face threats from rising crime rates, civil unrest, terrorist attacks to natural calamities. With more than half the global population today living in urban areas, in order to mitigate the impacts of these urban threats the governments around the world are investing in new and emerging technologies for safe and secure cities. With multi-layered structure of city security and numerous players involved, both public and private, the safe and secure cities concept is broad and still largely unformulated. However, the emergence of smart technologies is shaping its vision.

The futuristic vision of safe and secure cities goes beyond proactively reducing antisocial behaviours, urban crime and terrorism – to strongly promote an integrated, holistic, analytical approach to city security. Securing cities' properties – through protecting people, assets and reputation – is a major challenge, both at the organisation level and the city level. To successfully achieve the futuristic vision of secure cities, there is a need for real-time visibility, quick response and crime deterrent actions to ensure secure living and prosperity.

Digital technology has radically changed the surveillance and security scenario. Technology and data are continuously disrupting the city operations and business models and products-services. Technology innovation is rapidly changing the competitive landscape in every industry, and the security market is increasingly driven by significant advancement in technologies, such as network-based, high quality equipment, which produce enormous amount of data. From now until 2020, the digital universe will double every two years, expected to be 40,000 exabytes or 40 trillion gigabytes[3]. As safe and secure city collects big data from varied sources– transport systems, transit hubs, public events such as sports or concerts, hospitals, educational institutions, and private and public sector security systems – and through data mining techniques, trend analysis and 3D visualisation strive to achieve crime prevention and improves asset protection and public safety.

This holistic and proactive approach to city security is based on interconnectedness and an underlying connection between various stakeholders. The effective communication and collaboration between the public and private sector is imperative, as the city safety is the **shared responsibility** between multiple agencies. Emergence of smart technologies such as united communication and IP networks is a key driver in the formulation of safe and secure cities. These cities implement various technology-enabled safe city initiatives utilising the big data – with the intention of crime prevention (through better intelligence sharing) and risk mitigation (through better incident management) – in a comprehensive, integrated framework of technology deployment, crime management and policing.

[3] *According to DCI report 'the digital universe in 2020'*

Benefits of Safe and Secure City

Government

- Any time preparedness by Govt. to disasters & distress enhances Govt. reputation, even at country level
- Improves industries reliance on Govt.
- Transparent process improves citizen satisfaction
- Advanced security for Govt. & VIP buildings

Law Enforcement Departments

- Higher rate of incident detection and quicker response
- Remote surveillance ensures real-time information
- Increased situational awareness (effective decision making)
- Real-time decisions allows quick follow up actions
- Improved planing, resource allocation & optimised budget

Public

- Safer streets and neighborhoods
- Ability to identify safety incidents in advance & report
- Improved, timely communications about incidents / events
- Free flow of traffic & enhanced security improve public & industries satisfaction

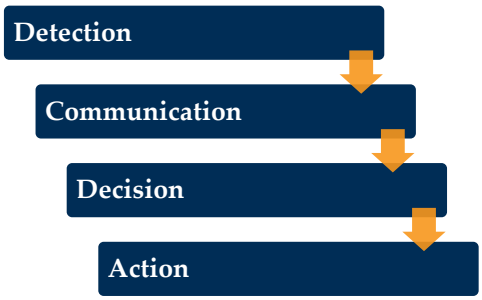
Investors

- Positive feel of safety due to people, asset and intelligent property security
- Advance intelligence infrastructures attract more investments
- Proactive surveillance solutions avoids unauthorised access & damage to infrastructure and goods

Components of a Safe and Secure City

The comprehensive security framework for a safe and secure city comprise of integrated public security system and incorporating a wide array of technology-driven subsystems.

At the core of this safe city are four integrated elements – Detection, Communication, Decision and Action.



These four entities are collectively part of a smart public safety and security architecture, and form the basis of the safe and secure city security framework:

1. **DETECTION –** Monitoring and detection systems

- **Video Surveillance** – This is the most common type of surveillance system, which is used as a crime deterrent as well as for crime detection. CCTV analog cameras are most widely used surveillance devices, however, there is a growing shift towards IP surveillance systems. There are multiple special video surveillance, which are used for specific situations.

  - **Vehicle Mounted Camera** – The Mobile Video Vehicle is equipped with a standard CCTV camera device with video display systems, and is capable of capturing and streaming real-time video feeds of an incident from any location which is not covered by fixed cameras.

  - **Body Worn Video (BWV)** – A video recording system that is typically utilised by law enforcement officials to record their interactions with the public or gather video evidence at crime scenes. BWVs are notable because their placement provides for first-person perspective and a more complete chain of evidence.

  - **Drone** – Surveillance drones carry out highly advanced surveillance, and are already in use by law enforcement with various types of equipment such as live-feed video cameras, infrared cameras, heat sensors, and radar.

- **Facial Recognition System (FRS)** – This surveillance system is a software-based solution which automatically identifies or verifies a person from a digital image or a video frame, using eye zone extraction and facial recognition.

- **Automatic Number Plate Recognition (ANPR)** – This solution uses character recognition on images to read the license plates on vehicles. This is used at toll booths, traffic signals and borders to identify vehicles with expired certifications or fake credentials to prevent accidents or assist in thefts.

- **Vehicle Tracking Systems on GIS Maps** – GPS-based Vehicle Tracking Systems (VTS) such as police, fire, ambulance, etc., enable command centre operators to accurately and easily locate as well as communicate with these vehicles.

- **Detection Sensors** – Various equipments such as motion detectors, door and window contacts as well as other safety aspects such as smoke detectors, glass break detectors, heat sensors, temperature sensors, carbon monoxide detectors, flood detectors, etc., can be deployed to detect intruders.

2. **COMMUNICATION** – Communication systems and analytics tools

- **Surveillance Storage** – The data generated by video surveillance and other surveillance systems gets stored on the surveillance storage, either direct attached storage (DAS), storage area network (SAN) or network-attached storage (NAS). One third to one half of total surveillance cost is typically driven by the storage employed, yet is a typically low priority area in the minds of security practitioners.

- **Network Connectivity** – The convergence of communication from various systems, such as cameras, data centre, Command and Control Centres (CCC), traffic centres, police stations, etc. needs reliable and scalable networks. In addition, satellite connectivity is required, to connect data centres, CCCs and mobile video vehicles.

- **Data Centres** – These centres record the video content for viewing at CCCs as well as forensic investigations. These data centre house Network Video Recorders (NVRs), servers and storage are required for recording and processing video feeds.

- **Analytics Tools** – Tools such as video analytics offers agencies the capability to automatically analyse and retrieve crucial information from the captured data for pattern analysis, event search, and video retrievals. These tools offer deep insights into surveillance video to improve incidence response.

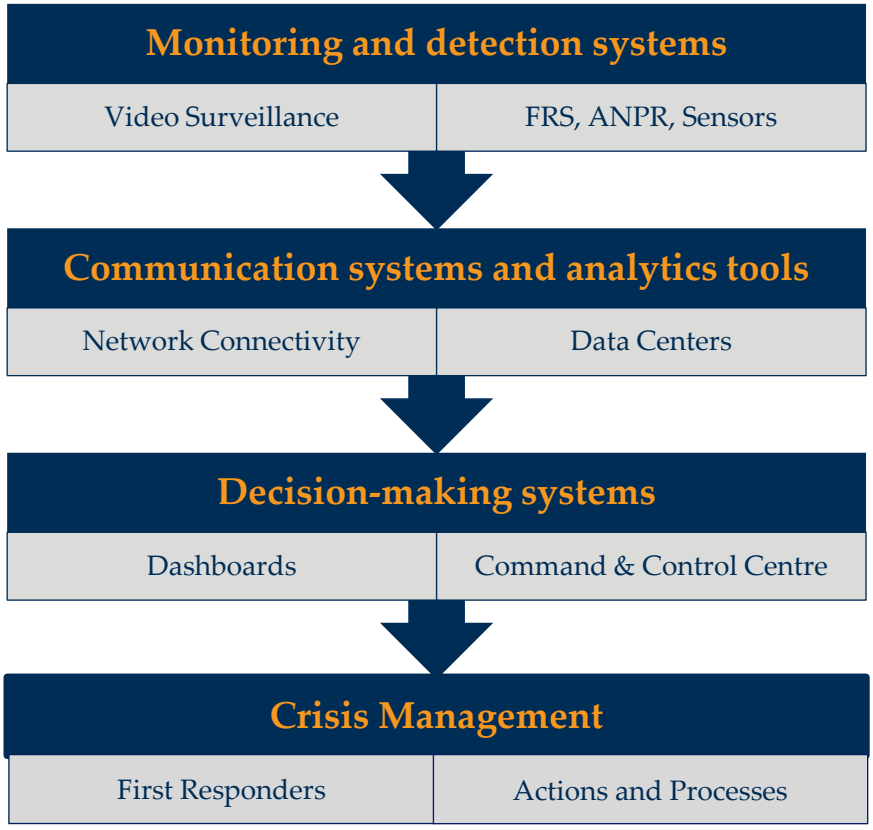
3. **DECISION** – Decision-making systems

- **Dashboards** – The dashboard reporting allows agencies to use the available information better, thus improving strategic and tactical decision-making.

Command and Control Centre (CCC) – Monitoring detection and communication systems are all linked together by the integrated CCC solution to mitigate risk across the city environment by providing actionable intelligence and enabling speedy security incident resolution. CCC provides greater visibility to all security activities in a real-time single platform.

4. **ACTION** – Crisis Management

This involves a team of 'first responders' to manage disaster emergencies with ready access to the integrated information base. The team will be equipped to respond to varied types of ground actions.



Video Surveillance – CCTV and IP Surveillance

Visual surveillance means the observation of an activity or changes in the environment from a distance with the help of electronic equipment such as various types of cameras for security of property and people.

Video Surveillance: An Enabler for Safe and Secure Cities

Public safety has emerged as an important function for governments across the world. Furthermore, there is greater focus on the high economic and social costs because of the lack of a robust public security architecture. Urban security is critical for development, investment and access to services. As cities continue to grow, attract businesses and become economic power houses, they breed crime, violence and terrorism. Rates of crime and violence can increase dramatically in cities and are usually most extreme in larger urban centres. Insecurity discourages local investment and prevents the participation of people in an active life, while restricting their access to services. Lack of safety prevents women from fully participating in the life of the city. City safety is a large umbrella of safety and security, which includes both personal safety as well as public safety such as public health safety, infrastructure safety and cybersecurity.

Video surveillance is a safe and secure city's primary tool to monitor population movement and to fight crime, as complex interactions between varied factors trigger and drive urban crisis. One of the key intentions of using the video surveillance system is '**crime deterrence**' – to monitor, prevent and detect theft and violent crimes – which is the main objective of using the visual surveillance in public transportation, retail, schools, public areas, etc. Another, key intension is '**crime detection**', which allows investigators and concerned parties to revisit the crime scenario and to identify the criminals – an exceedingly important function in urban cities to prevent violent and highly-complex, techno-driven crimes. There are multiple examples worldwide that shows the effectiveness of this systems – one such example is the Boston Marathon bombing, where the bombers were apprehended quickly due to surveillance cameras. Additionally, the scope of CCTV surveillance systems in efficient traffic management and urban traffic activity analysis has increased in recent years. Advancement of analytical techniques video-audio content processing with increased computing power allows to efficiently manage urban traffic.

The real-time 24x7 visibility offered by video surveillance not only acts as crime deterrent and assists in crime detection, but the visible presence of the system also spreads the feeling of safety among residents and visitors. Applications of video surveillance are not restricted to homeland security and include the domains of retail, banking, transportation, education, and healthcare as well. By combining information from video surveillance cameras, social media, citizen reports and other sensors, a comprehensive solution can be provided for a richer view of urban safety. When people feel safe, the city instantly becomes a nicer place to live, the infrastructure improves, talent and businesses move there. The city becomes more interesting, more diverse, more investment-friendly, and the city grows sustainably and becomes a futuristic place.

Technological Advancements in CCTV Surveillance Systems

Video surveillance solutions driven by cutting-age technology has evolved tremendously since its exclusive inception for prison security in mid-20th century, and its role in public, privacy and protection is radically increasing every day, transforming the public security and lives of people.

CCTV Surveillance System – On-premise

Closed Circuit Television (CCTV), a visible analog video system, nowadays offer cameras with Pan-Tilt-Zoom (PTZ) technology, high-resolution recording and variety of lenses including night vision.

CCTV camera captures analog video signal and transfer that signal to Digital Video Recorder (DVR). It also offers functionality, where the operator can synchronise the motion based video events with audio analysis. High-definition (HD) CCTV cameras have been replacing standard-definition (SD) in the last few years, and 2016 is another boom year for HD CCTV[4]

IP Surveillance System – Network-based

Internet Protocol (IP) Surveillance, a digitalised and networked version of CCTV system, is rapidly becoming the most flexible and future-proof option for security and surveillance systems.The IP Surveillance system is made up of two components –IP-based camera that records video content using a Network Video Recorder (NVR) and video surveillance platform that captures and distributes the video content through the network. IP cameras are preferred for large installation sites that already have a high bandwidth network installed.

[4] *Video Surveillance Trends for 2016 - IHS Technology*

Numerous benefits, offered by digitisation and network capabilities over CCTV, are driving the shift from analog to IP-based solutions, such as:

- Real-time surveillance
- Remote accessibility and administration from any location
- Digital zooming capability – high-resolution and better-quality images
- Lower operational as well as infrastructure cost incurred during installation
- Great integration potential with other systems including access control and building management systems
- Greater ease of distribution, immediate distribution and faster data transfer through email and other communications systems with automatic alerts
- Simultaneously record and play with advance search capabilities
- Video analytics goes beyond motion detection, to detect humidity, temperature, colour, noise, etc.
- Easy to install and move to another place and takes advantage of existing cables while attaching directly to the network
- Adjustable frame rates and resolution to meet specific needs
- Ability to compress content for improved storage

IP-based camera video surveillance systems are increasingly moving video storage onto network-attached disk storage. To address this shift, new video surveillance storage systems with high-availability, bandwidth and scalability characteristics are emerging; these new systems use SATA disk drives, iSCSI connectivity and clustering software to meet the particular storage requirements of video surveillance.

IP Surveillance System – Cloud

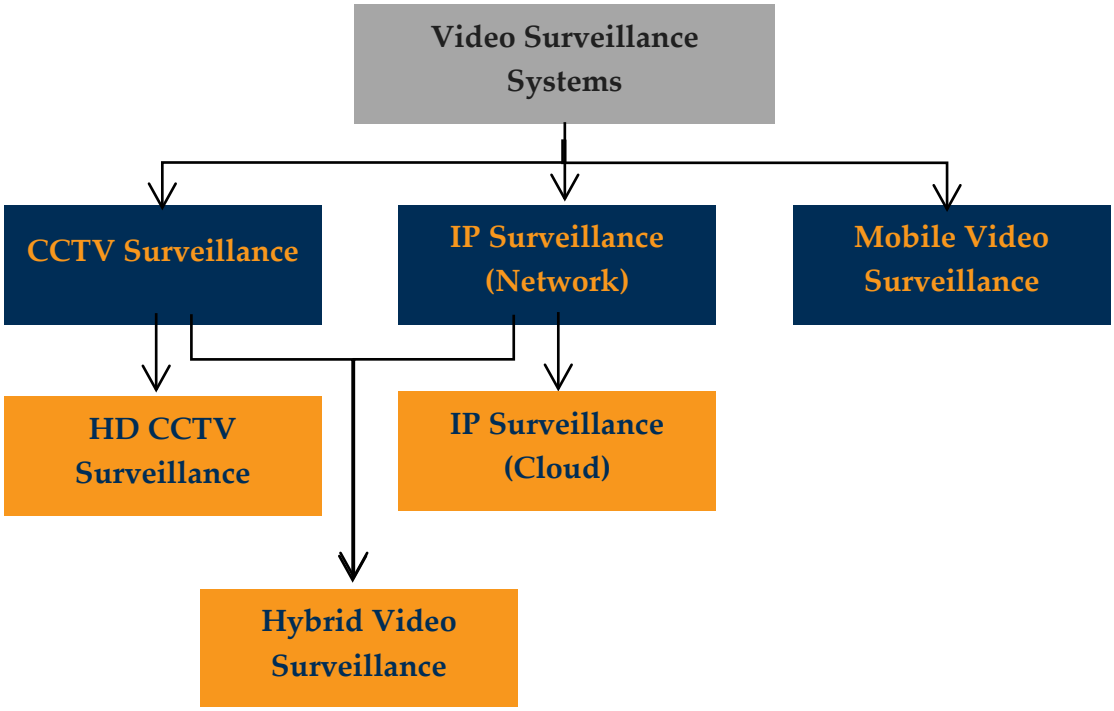
The IP wireless security camera system design is similar to the standard IP camera system design, except for the addition of wireless access points inserted between the network and cameras. This allows to place cameras up to 1.5 miles (plus up to 328 ft of Ethernet cable) away from local area network (LAN).

Hybrid Surveillance System

There is a hybrid alternative – to turn analog CCTV cameras to IP cameras using a video server – which is effective for upgrading existing huge CCTV infrastructure as well as the most cost-effective option. All types of cameras can be merged into an IP Surveillance system, with a small standalone video server, which can convert analog signals to a digital format and provide the analog cameras with IP addresses.

Mobile Video Surveillance System

Mobile video surveillance is another fast growing segment of the video surveillance market. The mobile video surveillance system can be both analog and IP. This market comprises surveillance equipment being installed in vehicles and trains. The mobile video surveillance market is being driven by the increasing cases of crimes in school buses, trains, and public buses, which amount to a loss of millions of dollars.



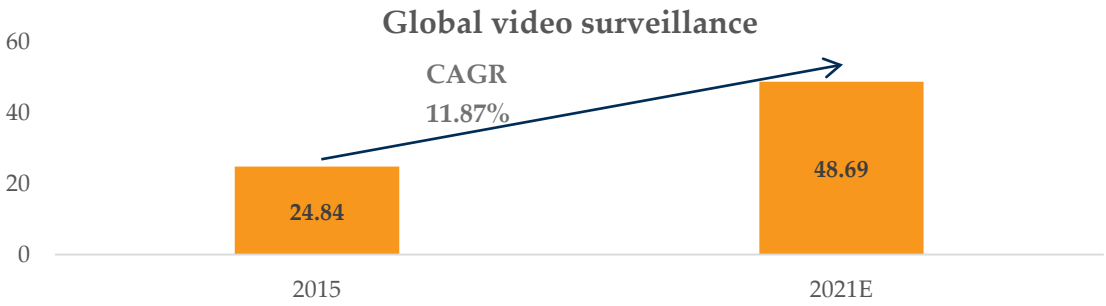
Scalable Surveillance storage

Surveillance storage is an issue that is faced by almost all organisations as well as city governments. With unrelenting data growth, government regulations, and technological advancements, the amount of data needed to be stored is increasing enormously and so does the storage capacity requirement. Surveillance users are nowadays looking for storage systems which can scale to larger storage capacities, record higher frame rates without dropping frames, suffice longer retention periods, handle high resolution videos from megapixel and multi-megapixel cameras, and prove cost effective as business grows in future. However, a scalable data storage solution involves much more than just capacity; performance, reliability, security and usability, as it must also keep up with sheer data volume.

Advanced surveillance drives reduce video frame loss while providing consistent performance over extended period of time. Cloud disk-less NAS systems offer not only advanced data protection and custom security setting but also scalable performance and enormous storage capacity.

Global Video Surveillance Market

The global video surveillance industry is expected to grow at a CAGR of 11.87 per cent over 2015-2021 to reach a total market size of USD 48.69 billion by 2021, from USD 24.84 billion in 2015[5]. Various factors are driving revenue growth in video surveillance market. Developed networking services and the increasing need of public safety is expected to drive the market. In addition to traditional security device business, new applications of video surveillance products for smart cities, Internet of Things (IoT), industrial automation as well as the use of embedded analytics, are also driving demand in the video surveillance market. The robust upgrade demand for the hardware devices along with the increasing sales of operation service and solutions is also expected to boost the market. Moreover, the Smart City projects are one of the biggest prospects for the implementation of video surveillance in the coming years.



Source: Video Surveillance Intelligence Service Report 2016 by IHS Technology

Market Segmentation

The Global Surveillance and Security Equipment market is segmented on the basis of two types: Geography and End-users

Geography

There are five major segments by Region: **North America, Europe, Asia-Pacific (APAC), Middle East & Africa (MEA), and Latin America region**

The Asia-Pacific region is one of the key growing regions that has been dominating the global video surveillance market since 2014 and is forecasted to continue to grow in the same manner until 2021. Reduction in IP camera prices and the rapid development in emerging technologies are the key enablers for the highest growth in APAC region, especially China's and India's consumption share globally during 2016-2021. Growing adoption of IP based surveillance systems and increasing IT spending in government projects, reinforced by supportive government policies, and rapidly growing commercial and residential consumers, are expected to drive the increase in revenue generation from ROW at a double CAGR during 2016-2021[6]. With the US being one of the fastest adopters of technologies, North America continue to dominate the global market, and constitutes the biggest market share followed by Europe.

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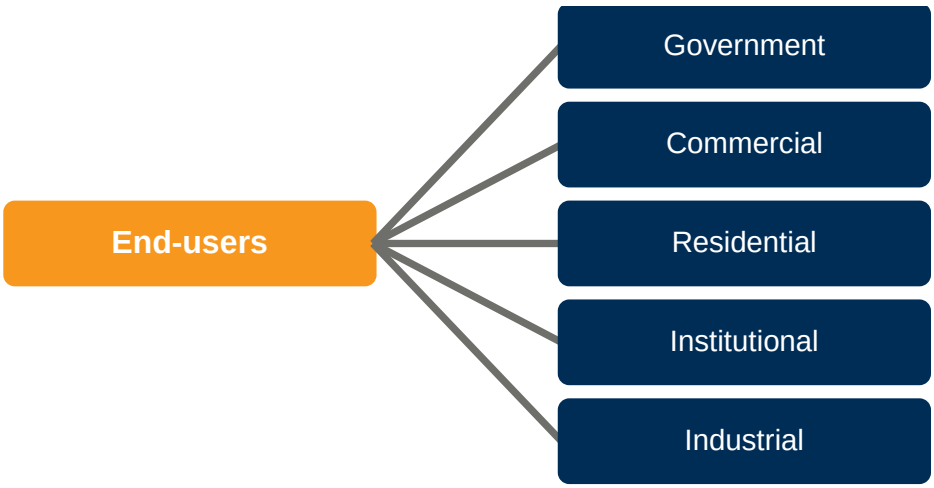
[5] *Video Surveillance Intelligence Service Report 2016 by IHS Technology*

[6] *Global Video Surveillance Market Forecast to 2021 by Market Research Future*

The global market for video surveillance equipment and storage grew by 1.9 per cent in 2015, much lower rate of growth than in 2014 (14.2 per cent) and 2013 (6.8 per cent). The slowdown of the market in China in 2015 was largely because of price erosion. As even though the number of surveillance equipment increased, the average prices of cameras and recorders fell sharply. However, the market is forecasted to grow at rate of 6.4 per cent in 2016 [7], regaining the earlier pace, and will be worth USD 15.8 billion. Heavy investment in R&D and technological development has resulted in high quality products with increased efficiency.

End-Users

There are six major segments by end-user sectors: **Government** (including infrastructure, public transportation), **Commercial** (including retail), **Banking, Financial Services and Insurance** (BFSI), **Institutional** (including education and healthcare), **Residential**, and **Industrial** sectors.



The Commercial sector is expected to grow at the highest CAGR between 2016 and 2022. The demand for security systems in large and small retail businesses is rapidly increasing to reduce theft and inventory loss. In the commercial sector, financial institutions and banks highly recommend video surveillance systems to provide security to the buildings, maintain cash management, and monitor customers and staff activities. This enhances security parameters and drives the surveillance system market for the commercial sector.

Network cameras accounted for 53 per cent of all security cameras shipped in 2015. IP Surveillance systems accounted for 32.3 per cent of the global market share in 2011 and are expected to grow with a CAGR of 41.78 per cent from 2011-2016.

There has been a rapid transition from standard-definition analog cameras to HD CCTV cameras (most notably HD-CVI, TVI and AHD). In 2016, for the first time, there will be more HD CCTV cameras shipped globally than standard analog cameras. Asia-Pacific

[7] *Global Video Surveillance Market Forecast to 2021 by Market Research Future*

region though slowly but surely shifting to HD CCTV, evident from the data that 24 per cent of the HD CCTV cameras sold in 2015 were sold in China.

Competitive Landscape

The Global Surveillance and Security Equipment landscape is highly fragmented (the top 10 players account for only ~30 per cent of market share). Bosch Security Systems, Cisco Systems, Honeywell Security, NICE Systems, and Tyco International dominated this market till early 2010s[8]. However, newer trends are emerging now.

Consolidation is a growing trend, which has started to increase since 2014. The market share of the top 15 security equipment and services companies grew to 23.1 percent in 2015 from 21.4 percent in 2014, and will further increase their market share in 2016[9]. This escalating market share will be an aggregate effect of large-scale mergers and acquisitions as well as the supplying of good products at lower prices by competitor Chinese firms such as Hikvision and Dahua Technology. Additionally, a number of Chinese vendors continued to rapidly gain market share in regions outside China in 2015, by offering low prices.

Tyco International was the largest supplier to the equipment and services market in 2015, comprising 3.8 percent of the market, followed by ADT at 2.9 percent, and the biggest mover, Hikvision at 2.5 percent. Hikvision, Dahua Technology and Axis Communication (Sweden) are the global market leaders. Hikvision has maintained its position as the world's largest supplier of CCTV and in almost every category of video surveillance equipment, for the fifth year running, and occupies 19.5 per cent market share for the global CCTV and video surveillance equipment market in 2015, up from their already dominant 16.3 per cent in 2014[10].

However, comparing video surveillance players' revenues in global markets excluding China, Axis Communication is the largest video surveillance player and was ranked the highest in 2015, followed by Hikvision, Honeywell, Panasonic, Samsung Techwin, Bosch Security Systems (Germany), and Tyco.

Other prominent vendors in the market include ADT, Avigilon, Axxon Soft, DvTel, FLIR Systems, Genetec, Hikvision Digital, Intergraph, Limited, MOBOTIX, Moonblink, Motorola, S2 Security, Salient Systems, Sony (Japan), Schneider Electric, Security Station, Siemens, Swann, and Toshiba. Some of the major players in the mobile video surveillance market include March Networks (Canada), Safety Vision LLC (U.S.), and Iveda Solutions, (U.S.).

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[8] *Global Surveillance and Security Equipment Market 2015-2019, Market Research Reports*
[9] *IHS Markit Physical Security Equipment and Services Report 2016*
[10] *IHS Markit Report 2016*

Market Trends

Asia-Pacific to lead the global market – IHS forecasts that China alone will account for over 40 percent of the world market in 2016. Moreover, the world's largest two vendors, Hikvision and Dahua are China-based vendors that are aggressively expanding overseas. With vast deployment of video surveillance equipment and smart projects as well as supporting policies, China is set to lead the overall market with India to follow closely next.

Major shift from CCTV to IP Surveillance – There is a growing industry trend towards replacing analog CCTV with IP Surveillance systems. The on-premise segment dominated the video surveillance market, accounting for over 36 per cent share during 2015[11]. However, this segment is expected to witness decline due to high implementation cost. High-resolution and better-quality images, especially for moving targets, and no degradation of content over time and ability to view the video from any camera connected to the network potentially by anyone on the network are few of the key driver behind the shift.

Software component and service segment growing in market share – The market for the service segment is expected to grow at the highest CAGR between 2016 and 2022. With growing IoT, the cloud services and video surveillance as a service (VSaaS) play an important role in the video surveillance system. The video analytics and video management software are the key drivers of the software components segment. Also, the use of neural networks and algorithms in the biometric surveillance system is a part of software component. The advancement in software technologies and networking services would lead the video surveillance market.

User-friendly solutions with incremental technology advancement – Though the IP-Surveillance system offers tremendous benefits, nevertheless, there are two major types of disadvantages – greater complexity and higher bandwidth demands as well as video loss due to network failure. Hence, there is a hybrid solution which can be very effective, as it can offer the advantages of simplicity of CCTV along with capability of network connectivity.

Clear trend in price decline – Last couple of years saw a clear trend of equipment prices declining, especially of smaller systems. This is also resulting in rapid surge in the number of cameras, a trend which is going to continue for next few years. The increased number of cameras also poses bigger requirements for storage as well as the video management software to manage and find all the videos.

Industry Consolidation – There is a growing trend of industry consolidation, which not only promotes standardisation and improved product quality but also result in better integration for superior customer experience. This trend will no doubt continue into 2016 and beyond, not only for video hardware manufacturers, but ultimately for the entire security industry as a whole.

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[11] *Global Video Surveillance Market 2016-2020 by Global Information Inc*

Global Success Stories

Public Transportation System, Taiwan

With the growing number of passengers in both modes of transport, there was an increasing demand of security and safety for the public transportation system in Taipei.

The Metro along with the Civil Aviation system are the two most important modes of transport in Taiwan. Taoyuan International Airport is the largest international airport in Taiwan, and by far the busiest air hub for intercontinental air travel between the eastern and western countries. Terminal 2 is capable of handling 17 million passengers per year, and the current expansion is expected to increase passenger handling capacity by an additional five million per year. Taipei Metro, commonly known as MRT, is the first metro system in Taiwan since 1996, servicing up to 1.8 million people daily.

To increase security and safety in the public transportation system of Taiwan, CCTV surveillance systems were installed to enable real-time monitoring in the stations and airport. WD Purple drives were opted for storage solutions along with Shany Electronic Co. for the cameras, to be deployed for Metro Line 1 and in Airport Terminal 2.

Given the WD Purple drive's compatibility with industry-leading chassis and chip set manufacturers, and its ability to withstand high temperature fluctuation and equipment vibration, it was an ideal storage solution for the specific scenario.

School Transit System in Dubai

In order to make the School Transit System more robust and secure, there was a need to install a CCTV surveillance system for real time and continuous monitoring of data from surveillance systems like public buses and bus stands, metros, railway stations and airports.

With global presence of international school facilities across Europe, APAC, EMEA and the US, Global Education Management Systems (GEMS) Limited has collaborated with School Transit System (STS) in Dubai to initiate a TOTAL Safety approach for its students - aiming to achieve 'Zero Injury and Zero Casualty' while commuting over 60,000 passengers in 2,000 trips, over 1,500 routes of 110 areas, covering more than 140,000 km every day.

To increase security and safety in the STS in Dubai, CCTV surveillance systems were installed with WD Purple storage solutions and the cameras/NVR were provided by Everfocus Electronics Corp. Given 'the WD Purple drive's compatibility with various chipset manufacturers and its ability to withstand high temperature, it posed an exceptional solution.

Taiwan Skyscraper

With 4,100 parking spaces in the car park covering from level B2-B4, the complexity to govern traffic flow and tracking of vehicles, while maintaining green power efficiency has been a challenge in surveillance.

The skyscraper in Taiwan was awarded the LEED platinum certification, which is the highest award according to Leadership in Energy and Environmental Design (LEED) rating system; it became the tallest and largest green building in the world.

WD Purple drives were implemented for their ability to stream 32 HD surveillance cameras in 24x7 surveillance storage facilities. LiLIN cameras were implemented as one of the components of the surveillance system.

Deploying Surveillance Systems for a top American Retailer

The company wanted to take measurements to secure and prevent theft of merchandise, and to enhance safety of general public and staff. This, calls upon implementing security and surveillance from exterior to interior of the complex, covering the outdoor parking, cash register, goods distribution area, hallway, etc.

A top retailer in America – with $16 billion in annual sales and goods in value, wanted to create a system to enhance safety in their retails stores.

Given the varied nature of monitoring data being generated from various surveillance streams, WD Purple drives with their design for 24x7 surveillance storage system in

ability of 32 HD surveillance cameras and ideal storage solution along with ACTi Corporation's surveillance cameras.

Sydney Opera House

Source: Vivid Sydney Festival of light, music and ideas – 2013 from Sydney.com
(Image Credit Sonia M Photography)

With seven million people visiting the site and 300,000 people participating in guided tours of the facility each year, to ensure the integrity and preservation of artefacts and the heritage structure, SMART surveillance with motion positioning is incorporated to prevent tourists from entering non-public areas or coming in contact with restricted artefacts.

The Sydney Opera House has served as a multi-venue performing arts centre since 1973. Vivid Sydney, the World's largest light festival attracts record number of visitors. In 2015, alone more than 25,000 international visitors came to Sydney just a span of 23 days.

For storage solutions in the surveillance system WD Purple drives were chosen for their large capacity storage, reaching up to 6TB with long hours of video capturing before re-write facilities. With its 24x7 surveillance storage capability, along with its ability to withstand high temperature fluctuation and equipment vibration it is the functional fit.

Surveillance Systems at home

With world population ageing and growth in fast pace living within cities, surveillance at home has become a necessity to help white collars oversee elders and children while keeping both sides in touch at any given time.

In addition, it provides security in preventing vandalism of house property and with options to connect directly to local authorities (such as Secom Co., Ltd) that provide assistance of 24-hour monitoring and emergency response.

WD Purple drives integrated with Vivotek Cameras/NVR offer a surveillance solution for houses. The WD Purple drive's 24x7, always-on-design for surveillance storage with All Frame technology duplex with ATA streaming capability – as defined in ATA specification reduces video frame loss with surveillance class storage, is a great fit. Its IntelliSeek™ feature provides for low power consumption. Its three years limited warranty (worldwide) is an additional benefit that places it well above other products in the segment.

Storing for Social Media

With world population ageing and growth in fast pace living within cities, surveillance at home has become a necessity to help white collars oversee elders and children while keeping both sides in touch at any given time.

In addition, it provides security in preventing vandalism of house property and with options to connect directly to local authorities (such as Secom Co., Ltd.) that provide assistance of 24-hour monitoring and emergency response.

An ideal storage solution for social media includes WD Gold™ for its 24x7, always on design for durability and reliability for mission critical application. It is also equipped with StableTrac™, Dual Stage Actuator and Tied Shaft Motor technology for vibration protection for data centre and rack solution.

WD Ae™ can also be opted for given its ideal specifications. It is incorporated with IntelliSeek™ feature delivering a balance of performance and power perfect for cold data archive storage architectures. Its progressive capacity technology allows increment of capacity with production maturity taking advantage of a HDD full capacity when possible, hence providing ideal TCO.

Smart City Copenhagen

BUILD A SAFE AND SECURE CITY:

A global leader in smart city services and recognised as the world's most sustainable city, Copenhagen aims to become a carbon neutral capital by 2025.

In addition, it provides security in preventing vandalism of house property and with options to connect directly to local authorities (such as Secom Co., Ltd.) that provide assistance of 24-hour monitoring and emergency response.

- 20,000 Networked LED Street Lights – targeting 50 per cent reduction in energy use, cutting CO_2 emissions and lowering costs.
- Environmental Sensors – improving efficiencies and public safety for pedestrians and bicyclists with automated controls for adaptive lighting.
- Standards-based IPv6 Network – increasing RoI with multiple applications (e.g., smart street lights and traffic control) on the same network.

Traffic management – Smart Mobility Amsterdam

Improving traffic flow and, and improving viability using smart traffic management, automated / innovative / cooperation.

The Amsterdam region is one of the busiest regions of the Netherlands and there are three road managers active; the municipality of Amsterdam, the province of North Holland and the national government. Amsterdam makes a dashboard available displaying real-time traffic information, public transport performance, air quality and so on. It also has a website detailing all of the smart city projects underway, how they affect the city and so on.

The city of Amsterdam uses TrafficLink's SCM system that is connected to the traffic system of the national government. Both centres can see live feed, on just one screen. This is how the centres can jointly and automatically manage traffic within the region (in and around Amsterdam)[12].

Since the initiative is for regional cooperation and implementation of intelligent traffic management, the percentage of vehicle loss hours in the Amsterdam area has dropped by 10 per cent.

[12] *Amsterdam Smart City – http://oud.amsterdamsmartcity.com/projects/detail/id/58/slug/smart-traffic-management*

Global Best Practices in Video Surveillance

With rapid revolutionising and global knowledge sharing in video surveillance, various best practice treads have been emerged in choosing, deploying and managing the video surveillance systems.

Planning and implementation

Identify objectives and goals

While adding the new surveillance systems or upgrading the existing systems, it is crucial to understand the current and future needs, identify objectives and set milestones. For example, is the goal is to cover a larger area or capture specific details like currency or faces? First, it is essential to perform threat/risk analysis to get clarity about what needs to be protected, then determine the location of cameras.

Choose right security systems and equipment

Accurately selected cameras that are suitable for the location can address lighting and coverage issues. Fixed and mechanical PTZs are the two traditional options. Panoramic cameras are an emerging category and are almost always megapixel IP. Choose a communication network with proven processes and technology, effectively deployed in large-scale production environment. Make certain that the network includes built-in security and a proven track record of resilience against threats.

Devise a strategic plan

Elaborate planning of the security system is important to determine the camera and right number of recording devices, views, and connectivity to provide an efficient and cost-effective system. Camera placement can be characterised by either overview or detail view. The camera placement influences the resolution, frame rate and codec.

Integration with other security systems

Furthermore, the existing legacy systems must be integrated into the new video surveillance solutions and other systems. With all of this integration and the addition of high-resolution cameras, bandwidth issues can be a challenge, particularly for retrofit environments. Access control techniques to limit the users that are allowed to configure and view an IP camera directly should be implemented.

Physical access to equipment and storage

The financial rewards for stealing organisation or even citizen data are sufficiently high enough that intruders will also seek to access the network by directly hacking into onsite physical equipment. Provision of secure access to video storage servers and equipment rooms as well as securing equipment cabinets, not only protects the network, but prevents ‘smash and dash’ thefts.

Regulatory and Stakeholder Scenario

Openness and transparency

One of the important aspect to consider is openness and transparency. Being open about the purpose of the cameras from the outset will make it easier to address any concerns of the public. Should these concerns arise, adjusting the surveillance will be less of a strain on the organisation. Many of these concerns can be addressed by consulting with the public before installing the cameras. In addition, it will be important to continuously inform the public about any changes that are made to the surveillance system, especially in the public domain. As with the installation of any video surveillance, mounting cameras in troubled areas should not be a covert operation. Posting signs in the areas under surveillance to keep individuals informed will proactively answer many of the public's queries.

Ensure fast community results and benefits

Start with a low-risk and high return project, such as integrated CCTV on networked LED street lighting, to quickly demonstrate public safety and operational benefits. Educate your community on benefits. Integrated CCTV on networked street lighting built on a scalable platform has been proven to reduce crime up to 10 per cent and make roadways safer through improved visibility. Your community will instantly see the difference with better and more reliable street lighting, and you get immediate ROI with lower energy usage due to automation and networked control drastically reduced maintenance costs.

Surveillance data protection

As with any collection of personal information, the proper safeguards must be in place to protect the information. These information practices and security arrangements must be made clear to individuals as failure to protect the information can lead to privacy breaches. A method of reducing the possibility that a privacy breach occurs while using video surveillance is to ensure that all video feeds are encrypted. By encrypting video feeds, there is less of a risk that unauthorised users could access the information. When a video feed is not encrypted, it is possible to purposefully (or even accidentally) intercept the signal with a wireless device.

Communication about cost savings and privacy policies

Probably the biggest challenge for integrated security solution, however, isn't technical. It is cooperation and communication. In addition, the growing number of cloud-based surveillance systems, and even the most traditional security camera system are now connected to the internet for remote access, support, and maintenance. With cyber-attacks accelerating, physical security integrators and internal support staff must to keep up-to-date on cyber security threats and precautions.

Chapter 2

VIDEO SURVEILLANCE IN INDIA: Challenges and Opportunities

Understanding Safe and Secure City scenario in India

Public safety and security is not a novel phenomenon, however, the safe and secure city concept is being slowly adopted in India in recent years. The ambitious and inspiring Smart Cities Mission launched by the Government of India in 2015, with the 'Smart City Challenge' of building 100 smart cities over the next five years, is certainly going to boost the formation of safe and secure cities going forward.

Security has remained one of the major issues in India. Even though public security and asset protection has been one of the top priorities for governments and organisations, the changing dynamics and complexities of the metropolis and cities need a closer and critical relook at the security. Against the multiple terrorist attacks and violent crimes, the advancing criminal intelligence system, and increasing dwelling of infrastructure across different cities, the demand for smart and intelligent security systems such as video surveillance systems in India has seen an increasing trend over the last few years, especially after the 2008 terrorist attacks in Mumbai.

Challenges of Safe and Secure City Formulation

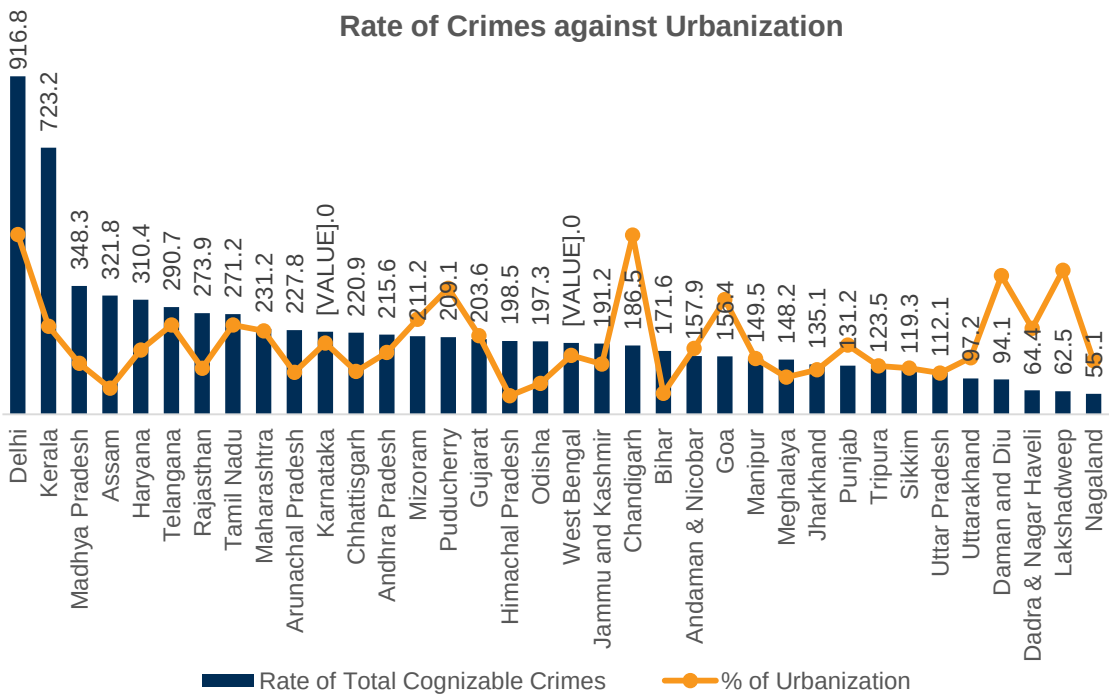
India's vibrant democracy and healthy amalgamation of the socio-economic and cultural diversity is reflected in its cities. This also gives rise to complex and interrelated challenges that impend the adoption of the safe and secure cities vision. Various interconnected factors such as the urbanisation, crime rate, socio-economic landscape, crime against women and children, traffic congestion, tourism, cybercrime, etc. drive the need for a robust security system.

Urbanization and crime rate

Though urbanisation in India may look undersized in comparison to the world – 31 per cent compared to 54 per cent worldwide – there is, however, there is considerably hidden urbanisation. According to the Agglomeration Index, an alternative measure of urban concentration, the share of India's population living in areas with urban features in 2011 was over 55 per cent. This predominantly unorganised urbanisation (sometimes in the form of *ghettos*) is pressurising the existing civic infrastructure creating a severe competition over scarce resources in the cities, thus spurring violence and crime.

Prevailing crime rate across various states and UTs in India is an important factor while analysing the challenges towards safe and secure cities formulation in India. The NCRB data in 2015 shows the high crime throughout the country as well as its comparison with urban density.

The States such as such as Delhi and Kerala, where high-density of urban population is correlating to high-crime rates, need immediate actions for transformation. Rapidly growing areas such as Daman and Diu, and Sikkim also offer opportunity for planned development.



Source: Crime in India 2015 – National Crime Records Bureau, and Census of India, 2011

Video surveillance systems acts as crime deterrent – criminals are less likely to commit crime in the area in the presence of advanced, well-covered video monitoring system. Across India, police officials reel off cases where CCTVs have made all the difference in identifying offenders and speeding up investigations. Public surveillance cameras can be cost effective way to deter, monitor and reduce crimes.

Socio-economic landscape

The social, economic as well as political environment of a city and a state has significant impact on the safety and security of the region. Financial and economic hubs such as Mumbai, Bangalore, Gurgaon and Hyderabad and political centres such as Delhi attract more number of crimes and are more susceptible to terrorist attacks. These cities need immediate measures to create robust security framework. While historical and social centres such as Gujarat, Rajasthan, Goa, etc. also offer vast opportunities to develop security architecture to protect the history and culture of the nation.

Crime against women and children

The crime rate in Indian cities is increasing, especially that of child trafficking, kidnapping and abduction of women[13]. Women and girls are frequently subject to violence and abuse – from physical and verbal harassment to assault – on city streets, public transportation or in their own neighbourhoods. Such daily occurrences limit the rights and freedoms of women as equal citizens to enjoy their cities.

Some cities are perceived to be safer for women than others. This is based on the crime rates in those cities and the measures taken to curb them as well as steps taken against

[13] *According to National Crime Records Bureau (NCRB) data, 2015*

anti-social elements. Safe cities adopt advance technologies in public spaces to ensure timely interventions, and introduction of women friendly public transport systems, with 24/7 CCTV surveillance in transit hubs and mobile tracking on the rail and metro cars.

Traffic Congestion

The increasing traffic density on city roads has led India to widen its existing roads, build new roads and construct flyovers. Yet, congestion on the roads and accidents are still a major problem. Ineffective new planning, deteriorating road quality and lax traffic management are causing traffic congestions. This brings an array of negative impacts including economic loss through delays, vehicle emissions, and increased fuel consumption. However, with technological innovations and traffic management systems, the issues can be resolved by reducing traffic congestion.

Traffic Surveillance and Intelligent Traffic Management Systems (ITMS) along with the Command and Control Centres will provide tools to monitor, analyse and manage the growing traffic issues. CCTV systems also have capability to help generate E-challans for cities.

Tourism

Along with the perception of safety of citizens, tourists' perceived vision of the safety of the city is important, as tourism is a key sector, which has been increasing its contribution to India's growing economy. Choosing a tourist destination is partly based on the city's ability to provide a secure environment for its visitors. Hence, in order to develop and sustain quality tourism, cities must ensure their visitors are safe and favour peaceful coexistence with locals. With varied linguistic and cultural backgrounds of visitors, tourism further adds to security challenges.

Tourism driven cities like Jaipur and Allahabad have taken the lead in providing innovative use of ICT for enabling better delivery of infrastructure and services including ITS for traffic signalling, smart signage, intelligent parking system, etc., and surveillance systems including CCTV, panic buttons and mobile apps. Jaipur is aiming to cut the crime rate by half in the next five years to provide tourism a boost.

Cyber Risks

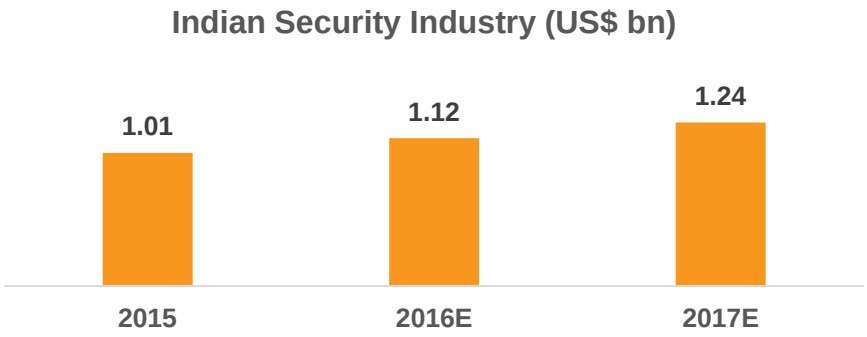
One of the downsides of cutting-edge technology is the newly emerging, more complex and significantly threatening cyber risks - Cybersecurity attacks have increased exponentially in the last few years. India has already started experiencing cyber-attacks, and it's going to escalate more and more in the future. Surveillance systems play a key role in identifying and preventing these threats to urban cities.

Video Surveillance landscape in India

The Indian market for surveillance and security is rapidly growing and is fast changing with new technologies. India is one of the leading countries in terms of volume demand of Smart City Technologies in the rapidly expanding Asia Pacific market, which is such as to become the largest Smart Cities market in the world over the next decade. The global investment in smart technologies is expected to exceed $174 billion from 2014-2023, and out of the $23 billion annual market, Asia Pacific market is estimated to be $11.3 billion annually until 2023[14].

Indian Video Surveillance Market

The security industry (hardware, software and services) in India will continue to grow in 2017 and projected to reach $1.24 billion, from expected revenue of $1.12 billion in 2016[15], up 10.6 per cent from $1.01 billion last year.



The security systems sector in India can broadly be divided into four main categories: Alarm systems, access control, detector and scanners, and CCTV. In terms of volume demand, the CCTV segment is the biggest segment, accounting for more than 50 per cent of the entire electronic security equipment market in India. As the most-widely implemented surveillance device globally, the adoption rate of CCTV in India is very high, reflecting an annual expected growth rate of more than 20 per cent for 2016.

The video surveillance market in India has increased tremendously over the recent years, especially in CCTV, which is expected to reach $952.94 million by 2016, with a CAGR of 32.49 per cent from 2011-2016. Furthermore, India's video surveillance market is projected to grow at a CAGR of over 13 per cent from 2016 to 2022[16].

The security conscious organisations in private sector, enterprises as well as small and midsize business (SMB), shows potential, however, the government sector by far is the biggest segment in terms of volume demand. The government initiatives and funding to secure all major government institutions and public infrastructure has accelerated the video surveillance market significantly.

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[14] *Navigant Research report in Q4 2014*
[15] *According to Gartner research firm*
[16] *According to 6Wresearch*

Competitive Landscape

Bosch, Honeywell, Samsung Techwin, Pelco, DVTel, EMC, HP, Genetec, Milestone, etc. are some of the major vendors catering to the Indian market especially to the government and public infrastructure verticals. On the other hand, few vendors mainly from China, Taiwan and Korea, such as HikVision, Avtech, CNB Technology, etc. focus majorly on the private sector in the country.

Market Trends

Growing awareness – The growth in the market has been driven by the growing awareness among different end user segments, such as transportation, human services (hospitals, educational institutes), banking and financial, hospitality, retail, BPO and in manufacturing. Supportive government schemes such as the '100 Smart Cities' and Make in India, and escalating manufacturing investment as well as the rapidly growing need from commercial clients are expected to drive a significant increase in India's surveillance market during 2016-2021.

Shift towards IP Surveillance – In India, traditionally the analog based CCTV surveillance systems are preferred, however, recent trends indicate a shift towards digitalised, network-based IP Surveillance systems. Sophisticated capabilities of digitisation, remote surveillance, open sourcing, video analytics, and full-integration ability as well as declining costs are making the IP Surveillance system more and more affordable, desirable and a future-proof solutions.

Gradual move towards non-fragmentation – Today, the security segment is a largely fragmented industry. Until now, the organised sector that accounts for almost 50 per cent of the total market has been flourishing within the security domain, due to their low-priced security products. Furthermore, 'lifecycle cost' is an emerging trend, where the consumers are becoming conscious of aspects such as quality and features of the products and take into consider the entire lifecycle cost while making the purchase, even though the initial cost is higher.

Lack of standardisation – The segment is also characterised by lack of standardisation and an absence of a regulatory framework to oversee the quality of products being offered in the market. Lack of a common standard and the presence of varied products as well as technologies, are proving to be barriers in the integration, collaboration as well as the communication of various solutions.

Customers' preference – Rapidly growing customers' preference for integrated solutions not only include setting up security infrastructure, but also involve back-end analytics and maintenance of infrastructure. Furthermore, it is leading to novel emerging business models, where provision of service rather than equipment sale is offered – where customers pay a monthly rent to the vendor for the maintenance of their entire security framework rather than incurring capital investment or Operations and Maintenance (O&M) costs.

Indian Video Surveillance Scenario

Many states such as Gujarat, Maharashtra, and Delhi are forefront of video surveillance. However, many Tier-II and Tier-III cities as well have implemented high-tech safety solutions and are becoming lighthouse examples to inspire other cities.

Cutting-edge tech is transforming India´s temple towns

The Rath Yatra conducted at Puri, fetches a footfall of more than 4.5 million annually, against the city's population of 0.4 million. Puri city authorities have to take care of issues such as central monitoring of the temple to control crowd influx, verifying abandoned objects, monitoring the 2.5 km procession, crowd and vehicle management at entry points and checking crowd movements to avoid stampedes.

The Schneider Electric team completed this task within two months. The company installed 220 cameras (Fixed and PTZ cameras), a central monitoring centre with video walls at the town police station (with 15 operator capacity), a command centre application for video analytics, Police Control Room (PCR) vans equipped with CCTV and GPS for the coverage of the city's vital points and an automatic number plate recognition (ANPR) system to track vehicle thefts. With the wireless surveillance, traffic vehicle counting helped in managing the flow. Similarly, crowd counting helped in understanding the gathering points for action.

Influx of foreign tourist and increasing curiosity from domestic tourists, many temple towns are witnessing huge crowds, which have led these towns to map blueprints spearheaded by the latest technologies. The cumulative business from the last three back-to-back Kumbh Melas, Allahabad (2013), Nashik (2015) and Ujjain (2016), was around Rs 33,000 crore and these cities received around 220 million visitors in total.

In Ujjain and Nashik, civic authorities have extensively used CCTV and centralised public announcement systems connected to loudspeakers. In addition, biometric attendance systems scrutinised access to staff members and uninterrupted video conferencing kept them connected with intra- and inter-city management teams.

In Ujjain four drone cameras, 256 watchtowers and 481 CCTV cameras at 125 different locations transmitted the real-time feed to the central control room through a high-speed optical fibre network. CCTVs at 11 entrance gates tracked visitor counts on normal and special days. Headcount cameras were used to manage crowd flow and divert people to other locations in case of congestion.

In Nashik, the authorities relied heavily on CCTV and experimented with analysing crowd density by using mobile phone signals reported by mobile towers in the city. Video walls at various places helped visitors gauge crowded areas and plan their routes accordingly. Other tech intervention, such as official apps, including panic button and wearable SOS device-based solutions helped visitors to map their route to alert police about the emergencies in real-time.

Success Stories

Sri Kashi Vishwanath Mandir, Varanasi, Uttar Pradesh

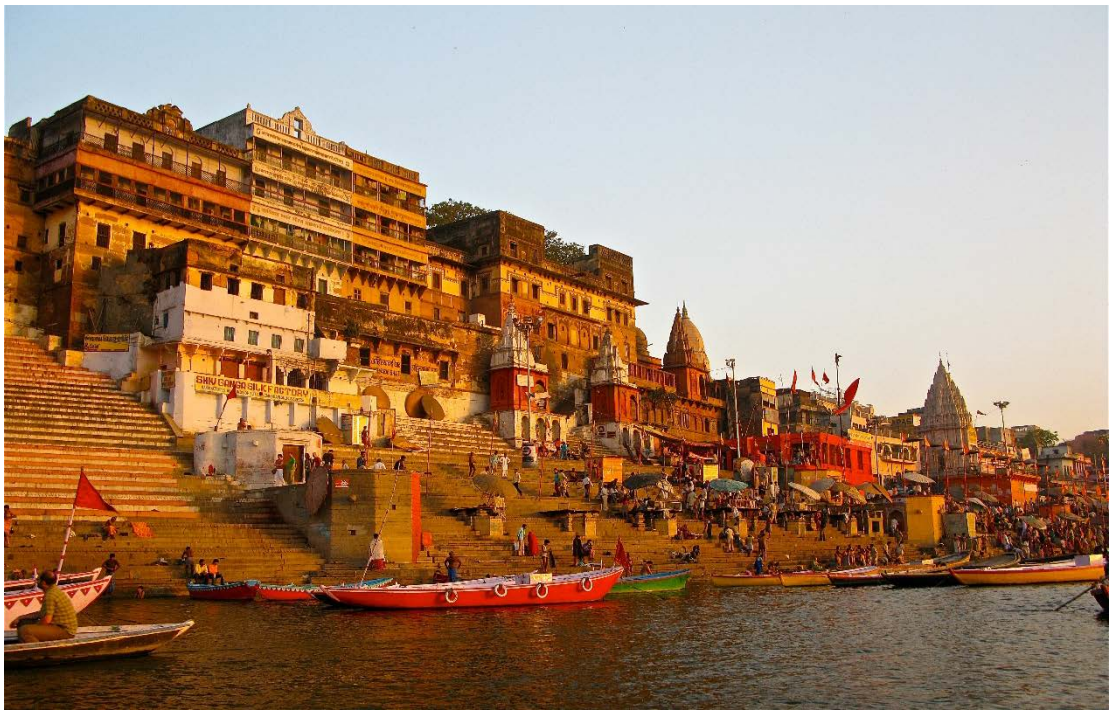


Photo Credit: http://www.indiatravelblog.net/wp-content/uploads/2010/04/Shri-Kashi-Vishwanath-Mandir.jpg

The Mandir has also been a constant target for terrorist attacks; hence the data availability for post event analysis was paramount. CCTV was required for crowd management, pilferage, and to prevent nuisance and damage done by the visiting crowd.

Sri Kashi Vishwanaath Mandir, is one of the most visited temples in Varanasi with millions coming for '*darshan*' every year. Initially AMC was proposed, however, over time there were multiple issues. Therefore, the system was upgraded to a hybrid one containing both IP and HD analog system, with redundant recordings kept at two different locations. A major concern during the installation was the physical inability of wiring anywhere in the temple premises as it is heavily crowded.

As the area was quite vast, the following systems were used:

- Hikvision Analog HD DVR, with WD Purple drives 2TB, used existing video wires where new wiring was not possible. These were established at multiple points.
- Analog PTZ were replaced in IP Speed domes.
- Interconnection of the devices we done by single mode optical fibre using Gpon adapter and layer 3 switching.
- Hikvision NVRs with 4TB WD Purple drives and video controllers were established at the control room, which maintain set of recordings and display the same.

After the installations, there have been hardly one service call in a month – which is a huge reduction, as prior to this, the temple had one person stationed continuously.

Gandhinagar Police curb criminal activities by 30%

The police department always faced with the challenge to get to know about the crime scene and respond in timely manner, as the control room operations had a manual interface, which was time-consuming.

The Gandhinagar Police department implemented a four-layered system — call jump software, computerised messaging, GPS, and CCTV surveillance. This allows the police to not only monitor the activities in in real-time but also respond in timely manner. Because of the monitoring through CCTV, other criminal activities are also in check.

As a part of the Smart City initiatives, around 240 CCTV cameras have been installed to watch over the city. Of 240 cameras, around three are equipped with face recognition. The CCTV cameras have been integrated with four-layered structure where a map data system displays where officers are located at any given time of their shift, on a computerised map. These CCTV cameras also monitor the movements of PCR vehicles such as location and halting points. GPS helps decrease response times to emergency calls by locating the officer closest to the calls.

The deployment of CCTV cameras has helped in managing the traffic, crowd management and nabbing criminals quickly. The four-layered system has helped in cutting response time from 22-26 minutes to 4-6 minutes over the past three months and reduce the criminal activities by 30 per cent.

Nanded keeps its city safe and criminals in check

The city wanted to address the following concerns: early warnings for preventing disasters, efficient monitoring for better governance, better traffic management and crime prevention and control.

Known for the second largest Gurudwara in India, and a pilgrimage centre that attracts hundreds of pilgrims and tourists every day, Nanded has faced growing security concerns over the years. Nanded Waghala City Municipal Corporation (NWCMC) and Nanded Police implemented an intelligent video surveillance solution to address its concerns.

A total of 104 high-resolution, night-vision, fixed and PTZ Axis cameras were installed at all strategic locations spread across the city. The solution included advanced features such as fully integrated C4i software in C-Cube (Command, Control and Communication) centre, GPS-based Vehicle Tracking System (VTS) on emergency vehicles. The installed cameras included AXIS P1354, a fixed day and night camera with superb image and excellent video quality, and AXIS Q6035-E, a robust outdoor camera with HDTV 1080p, 20x optical zoom and high-speed pan/tilt performance for coverage of wide areas and great detail when zooming in.

The solution has not only had an impact in helping the local authorities solve traffic cases, it has also helped to combat and resolve cases of violence in the city. Overall, NWCMC and Nanded Police have not only succeeded in securing the residents, they have also improved the city's civic situation and administration.

Airports Authority of India prevents possible threats

AAI is faced with daunting to manage security, cyber threats and surveillance together. AAI needs to focus on strengthening the security of vital installations and airports.

Airports Authority of India manages 125 airports, which include 18 international airports, seven customs airports, 78 domestic airports and 26 civil enclaves at defence airfields. Airports have to constantly live with the possibility of a terror attack. A single terror threat —hoax or serious — can cost the affected airline a whopping Rs 1-2 crore and cause major inconvenience to passengers.

AAI has deployed NetApp's storage platform that provides cutting-edge video analytics at its 12 airports. Aligned with its existing roadmap, the NetApp Video Surveillance Storage platform (VSS) is designed to support video monitoring and connect the 12 airports in real-time to Committee of Secretaries on Aircraft Hijack, an apex government body situated at the Rashtrapati Bhawan.

Concerns over security and terrorism have driven the creation of massive video surveillance infrastructure — increasing the demand for video storage. With the deployment of VSS, NetApp provides highly efficient systems to manage world-class density and scalability of big data at AAI airports. NetApp's central storage will help AAI retain data in the long term, which can be used as evidence and also for analysis.

Surveillance drones prove worthy

These days in India, drones are making life easier for police departments and city civic authorities, especially during festive seasons.

With examples set by Ujjain, where the city used four drones to monitor the entire Kumbh Mela, the Mumbai Police deployed drones to monitor security at immersion points during the Ganapati festival in the city, and used last year's feed for traffic security protocol to support the drones.

Furthermore, the Mumbai Police has constructed watchtowers on all the routes that will lead to immersion spots within the city limits. Interestingly, the police department already has cameras installed in South Mumbai and Central Mumbai, connected with the central control room. In addition, to ensure enhanced security arrangement of pandals/mandals, their individual security feeds have also been looped with the police control room.

The National Highways Authority of India (NHAI) started monitoring highway stretches with the help of drones. The Mumbai State Road Development Corporation (MSRDC), along with the state highway police of Thane and IRB Infrastructure Developers Ltd, had conducted a pilot-monitoring project using five drones over a 16-km stretch, which is proven successful in catching the law-breakers from day one, on this busy Mumbai-Pune stretch. The drones are armed with night vision cameras and are capable of sending live feed of traffic on a 1-km stretch to the base station.

Regulatory Scenario

With increasing external threats, both in terms of nature and scale, there is a growing conflict between the 'need' of the government and organisations to protect the national security, assets and people, and the 'concern' of protection of individual privacy.

Video Surveillance and Privacy

Surveillance technologies have both enabled improvements in law enforcement and security, but at the same time created unresolved implications for privacy and civil rights. Today, in India crime and terrorism have shown a rising graph, be it the financial city, the capital city, tourist place or a holy place, video surveillance has become imperative. However, surveillance should be done in a well thought-out and discerning manner.

CCTV surveillance though started expanding in the metro cities, such as a Delhi, Mumbai, Chennai, and Bangalore, they are now installed everywhere, penetrating the Tier-II and even Tier-III city market. Still the technology is more concentrated in urbanised areas, and has yet to become rampant in small towns and villages.

Laws and Regulatory Authorities

Currently, in India there are no specific laws and regulation relating to video surveillance planning, implementation and management. There are few acts that are indirectly related such as Information Technology Act, Section 69, has provisions on public emergency or interest of public safety and surveillance of internet data.

Furthermore, there is no specific laws and rules about use and implementation of CCTV surveillance as well as no particular regulatory authority or government department that is designated to look into any abuse or misuse of CCTV. A simple notice of "This premises is under CCTV surveillance" is required in the public areas.

In many states such as Karnataka, it is mandatory to install CCTV cameras in many commercial establishments, such as banks, ATMs, pubs, restaurants and cyber cafes. Besides promoting video surveillance (and making it mandatory in certain cases), the government has not done much to create controls and determine how personal video data will be gathered, how it will be stored and used, and most importantly how to prevent its abuse and misuse.

Increased online criminal activity has forced many countries globally to impose strict regulations to secure their city assets and critical infrastructures as well as the citizens. There is need for the similar stringent regulations in India against the ever increasing external threats.

Challenges and Opportunities

Public safety faces a series of burgeoning challenges, for both 'consumers' and 'vendors/installers', in various forms such as new waves of disruptive innovation, newly evolving external threats, shifting regulatory demands, and so on. Despite this, the industry growth is projected to be skyrocketing, as the operators widen their solution sets and take aim at a new wave of growth opportunities driven by the IoT and initiatives like smart and secure cities.

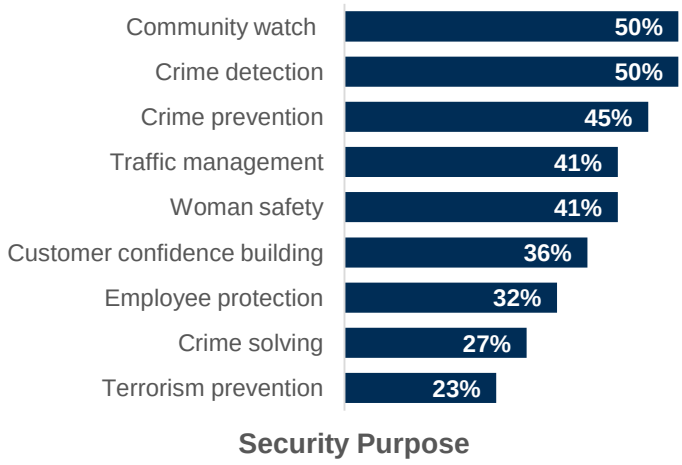
Based on the Impact Survey analysis and the market research we identified various challenges that the industry is facing as well as the opportunities presented. All the data is based on the Impact Survey results.

Challenges:

Rising security demands with multiple objectives

Deep security concerns are driving rising security demands for public safety and the commercial sector for business intelligence.

About 70 per cent of the respondents stated the reason to upgrade the security system is the **changing needs of the business**. Respondents were asked about what they needed to achieve with their video surveillance systems and one thing becomes quickly apparent that most organisations needed to meet multiple objectives.



For example, about 50 per cent of the responders need cameras that can assist in 'Crime detection' and 'Community watch'; while crime prevention, traffic management and women safety are other objectives that are deemed important by responders, accentuating focus on **crime reduction** and **improving safety**.

Escalating external threats

Despite continuous security upgrades, both at organisational level as well as city level, the nature, frequency and severity of external threats has become multi-dimensional. Significant increase in the local crime and terror groups' activities beckons the need for increased security of common individuals.

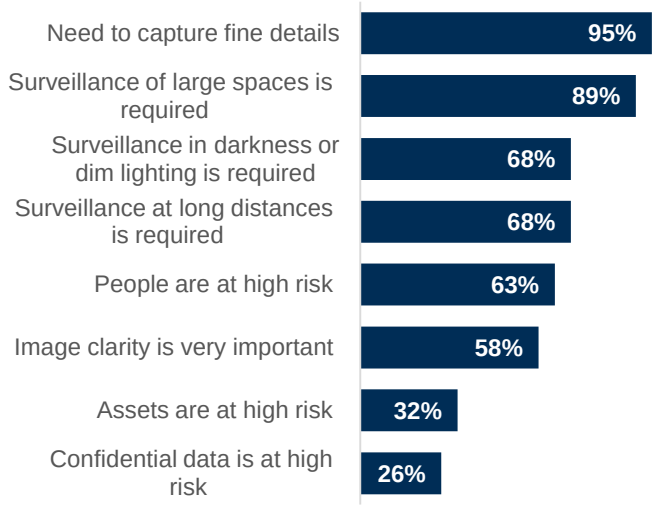
Overwhelming trend of disruptive technology

The era of cloud computing and smart initiatives have brought a period of disruption, with changes occurring faster, more continuously and from more directions than ever.

The cloud has emerged as a transformational force requiring strategic changes. Though this transformational force is global, it is affecting business models and changing the business landscape. Clearly, these multiple waves of disruption and their magnitude are defining the industry transformation.

Increasing requirements driven by challenging environment

Today, proactive surveillance has become a requirement, and the security needs are shaped by challenging physical environment, including challenges like low-light conditions or large spaces.



Requirements driven by environment

A staggering 95 per cent responders chose '**Need to capture fine details**' as the important priority, closely followed by 'Surveillance of large spaces' (89 per cent). 'Surveillance in darkness', 'Surveillance at long distance' and 'People risk' are ranked considerably above the clarity, asset or confidential data risks. This indicates that responders' more focus on **crime detection** and **crime solving**.

Technology induced complexities

Advanced high-resolution video surveillance systems are becoming more multi-functional and data-intensive, and create new integration issues. The video surveillance systems are continuously generating enormous amounts of data, which need to be analysed using more advanced analytical tools, to make inferences and use it as a predictive tool rather than just a reactive tool.

Storage: A Growing Concern

With rapidly increasing video surveillance demand and technology advancements such as high-resolution, the amount of data needed to be stored is increasing enormously, creating major surveillance storage challenge for city officials and commercial organisations alike.

About 41 per cent of the respondents rated the current storage capacity as fair or poor; while the overall surveillance system was rated higher on effectiveness and adaptability. Furthermore, about 55 per cent of the respondents disapproved the quality of the audio.

Asked to prioritise the most important advance features / functions for operational needs of the business, the '**large storage capacity**' came up as the number one priority on the list of whopping 90 per cent of the respondents. It is evident that as the focus on Indian consumer is shifting towards higher quality IP cameras with other advance features,

providing innovative storage solutions to meet the exponentially growing the storage capacity plays an important role in building the safe and secure cities.

Lack of professional expertise and high TCO

To maintain the high rate of adoption of new technology requires professionals to continuously update themselves with changing technology. However, there is a shortage of skilled manpower to maintain smart security devices. This huge gap in the availability of qualified professionals to maintain security infrastructure is prompting organizations to shift to cloud computing and virtualization. Also, the initial investment for smart security devices is high, leading to a high TCO.

Lack of regulatory certainty

The regulatory and compliance burden facing operators is changing rapidly. Regulatory attitudes toward consolidation remain a key factor as operators consider more rational market structures that can support long-term network investment. At the same time, regulatory frameworks themselves are shifting as convergence and disruption undermine traditional market and service provider definitions.

Cybersecurity risks

Even though organisations are increasingly and widely using specialised software to automate processes with information technology security, cyberattacks are becoming more stealthy and sophisticated, creating a complex and dynamic risk environment for IT-based operations. These cybersecurity concerns will escalate in the future.

Opportunities:

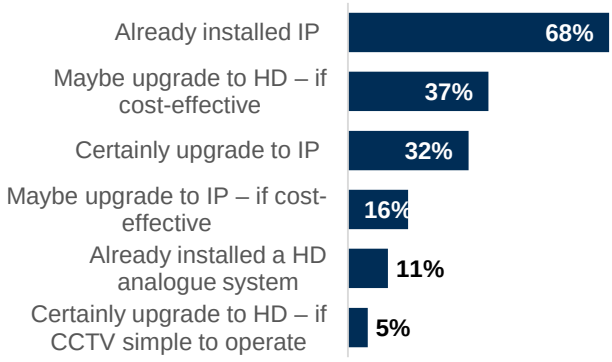
Indian cities have increasing started relying on video surveillance to solve crime. Across India, police officials reel off cases where CCTVs have made all the difference in identifying offenders and speeding up investigations. Public surveillance cameras can be a cost effective way to deter, monitor and reduce crimes. Traffic Surveillance and Intelligent Traffic Management Systems (ITMS) along with the CCC provide invaluable tools to monitor, analyse and manage the growing traffic issues. CCTV systems further offer the capability to help the city governments generate E-challans for cities.

High growth in video surveillance market

High level of security concerns and increasing rate of adoption of security systems are creating exponential growth in surveillance market. It has also created enormous market opportunities for the vendors and installers. Additional measures taken by institutions and increasingly by individuals, to reduce theft and vandalism are inducing further demand in this market. Additionally, this increasing adoption rate has also opened up opportunities in the government and commercial sectors for business intelligence.

Huge expansion of IP surveillance market

The ability to allow integration with wireless technologies, remote access, video analytics and the rapidly declining costs of IP Surveillance systems are driving the shift from analog to IP-based solutions. Though IP network cameras currently cost twice as much as analog CCTV cameras and installing analog cameras coupled with DVRs is still most cost-effective, the unique combination of the numerous benefits of remote monitoring and significantly declining cost of IP cameras and components is spurring the growth of IP Surveillance systems. This trend of shifting to IP surveillance is already started spreading, which is evident from the impact survey. 68 per cent of the respondents stated that their organisation **already installed IP**. Furthermore, 16 per cent respondents voiced that the organisations **certainly upgrade to IP**, while about 32 per cent stated the organisation **may be upgrade to IP Surveillance if the solution in cost-effective**.



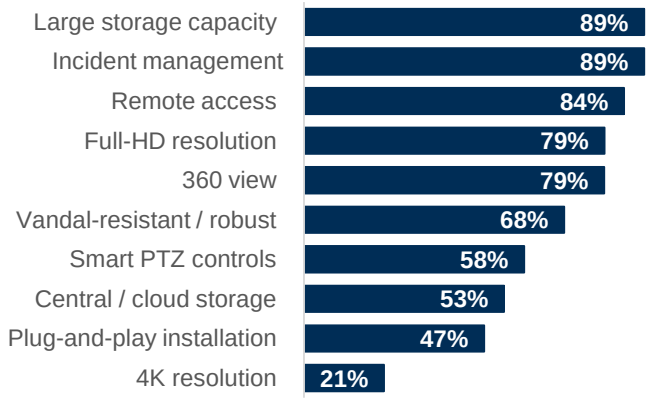
HD and IP Surveillance

Evolving industry ecosystem

The increasing shift towards network cameras creates new opportunities to work with new applications. IP solutions can stretch far beyond security applications. Retailers, for example, are utilising the technology to manage their inventory and optimise store layout, while cities are using it to manage the flow of traffic, reduce vandalism, and much more. The limits can be pushed in terms of features like image quality, to optimise the surveillance task for low ambient or no light conditions. Furthermore, new prospects for integration are forming new opportunities for partnerships and expansion – such as the physical access control market.

Multitude of features for the city, organisations and end-users

Even with increasing potential threats, new technologies have opened up tremendous opportunities for organisations and end-users in terms of options for their increasingly specific needs such as cameras that can work in challenging physical environment like low-light conditions or large spaces. The cutting-edge features – mobile access, PTZ smart controls or 4K resolution – are most important to security end-users, which is clearly evident from the responses.



Advanced Features

Gap Analysis

The survey was conducted by Smart Cities Council India, which was commissioned by Western Digital Technologies, Inc., surveyed 42 technology professionals in various verticals, both government and public in November and December 2016. Our survey findings and discussions with experts suggest that there is a gap between the status quo of video surveillance security and goals of organisations and this gap will be widened with the development of new governmental regulations and ever-changing security threats.

Most of the responders indicated that the current systems are either IP-based or planning to upgrade to IP Surveillance in near future. While commenting on the current security system, about 70 per cent responded that the current system is highly effective, while scalability and adaptability were rated highly effective by 60 per cent. However, audio quality was rated good to fair.

Another interesting observation was that while, almost all responders experienced more than 10 per cent reduction in violence or crime, Gandhinagar Police Department experienced 30 per cent and Mumbai Traffic Police indicated that there was more than 50 percent reduction in violence or crime and traffic accidents. This indicates that video surveillance system is proving effective in the public domain in India.

Almost all of responders deemed the impact of insufficient or poor quality of data as serious while the work managed was ranged across all three levels of complexity – high, moderate and low – indicating that 'high-quality' was a preferred parameter across all sectors.

The responders when asked to indicate the level of difficulty in the current security infrastructure management, most indicated that the level of difficulty of management was 'easy', except for the public infrastructure and human services such as Western Railways and Lilavati Hospital, Mumbai.

If organisations and cities do not take immediate steps to establish a comprehensive security system, existing challenges and unknown potential risks will make the security environment even worse. To close such gaps would require a transformation in security functions.

Making such an adjustment does require a two-pronged approach. Firstly, it requires internal capacity building on the consumer side – leadership, commitment, and determination to act. The organisations need to take steps to link their security strategy to the business strategy, redesign the architecture, execute the transformation sustainably and only then dive into the opportunities and risks of new technology. Accordingly, organisations could make a fundamental shift in their operation and close the ever-widening risk gap.

Secondly, there is a need for innovation in the external environment and regulatory norms. However, with city governments promoting large-scale video surveillance

schemes for security, there are no legal sanctions or safeguards for protecting privacy. Wider policy initiatives in data protection and the digital society contain both opportunities and challenges for operators. Further, it is important for any network camera to follow JPEG and MPEG-4 standards in their entirety. Many vendors claim compliance with a standard, but do not adhere to that standard 100 per cent. Full adherence not only ensures the flexibility to use video for many different applications but also guarantees video quality that lasts for several years.

Another technological gap is to understand the limitations and invest in innovative solutions. For example, there are instances in which it is not sufficient to simply convert an analog camera video stream into digital, due to limitations in video quality. Hence, such limitation to integrate analog cameras into system needs to be addressed and innovative solutions need to be devised.

There is also urgent need to enhance software assurance to address the users' concerns about the integrity and reliability of commercial security software, and meet customer requirements. Vendors must undertake efforts to reduce vulnerabilities, improve resistance to attack and protect the integrity of the products. Software assurance is especially important for organisations critical to public safety and economic and national security.

Chapter 3

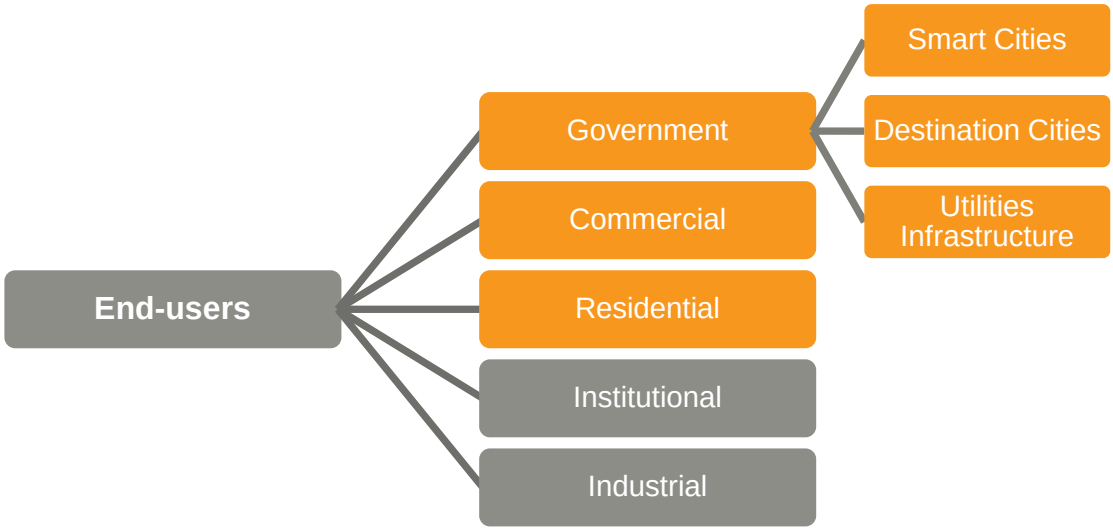
RECOMMENDATIONS: Conclusion

Recommendations

The video surveillance landscape analysis, both global and India specific, indicates that government is the major player in the surveillance market. Furthermore, increasing demand in the private sector is also an important driver of the remarkable growth of the surveillance market. However, each sector, public and private, has varied needs and requirements.

Based on our analysis of 'Impact Survey' findings and the market research, we expect the government and commercial sector to move up as the top contributors of smart security. Another sector that is catching momentum is the residential sector, which is revealing consistent growth in past couple of years and has huge still significantly untapped potential.

We expect that the Smart cities, the Destination Cities and the Utilities Infrastructure are the three key subsectors that will be at the forefront of the safe and secure city initiative during 2016-2020. The banking, finance services, and investment (BFSI) sector still be remain a huge contributor of smart security solutions. Other subsectors that will significantly contribute to market growth include transportation, healthcare, education, retail and sports facilities.



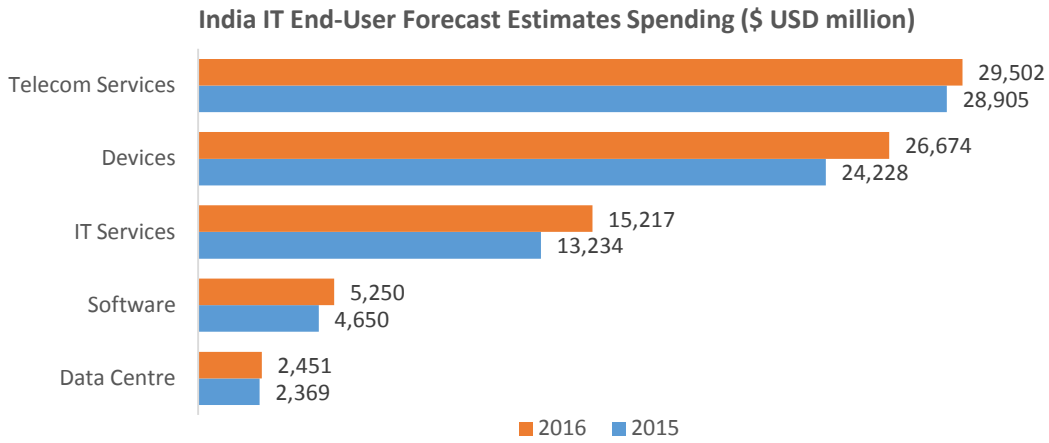
Government Sector

The government spending in India is expected to be INR 3140 billion at the end 2016, and estimated to increase INR 3887 billion in 2017[17]. In the long-term, the government spending is projected to trend around INR 3520 billion in 2020[18].

Worldwide IT spending is forecast to decline 0.5 per cent in 2016, the IT spending by GoI will increase by 6 per cent in 2016 over 2015, and the spending on IT products and

[17] *According to Trading Economics global macro models and analysts expectations*
[18] *India Government Spending Forecast 2016-2020, Ministry of statistics and programme implementation*

services to reach USD 7.1 billion[19]. This trend has been continued for past two years (increase of 5.2 per cent in 2015 and 9.4 per cent in 2014), and will sustain in coming years with the government's focus in the "Digital India' programme. The central and state agencies will spend on internal services, software, IT services, data centre, devices and telecom service. After the telecom services market, the surveillance devices market is the second largest, significantly outpacing the other three markets.



Source: Gartner, Inc report October 2014

As city governments and ULBs are increasingly implementing and sponsoring multitude of smart cities initiative and other safe city initiatives, from the government perspective the risks are very high. Due to the magnitude of the criminal activities as well as the population, accuracy, clarity and safety of the data becomes very critical. The public segment needs **high quality, high reliability** and **high data protection**.

The governments should focus on identifying the context-specific needs and use the best practices as a base, and determine the needs and define objectives. However, as the various city functions are becoming more interdependent, it is evident that the security within public segment perimeter needs investment in latest video surveillance technology with **highest-resolution cameras, best quality analytical tools** and **highest capacity storage**.

Smart Cities

India is building 100 smart cities in an ambitious plan, which offers enormous opportunity – INR 48,000 Crores proposed investments over 2016-2020 – for smart security initiatives in various verticals. Technology Infrastructure is a key subsector in developing Pan City (PC) and Area-based Development (ABD) solutions. Other subsectors such as intelligent traffic management, smart public transport, health and education, and power distribution, offer significant direct opportunities, while others such as waterfront development, smart lighting, and smart water meters provide indirect, integrated opportunities.

[19] *Forecast: Enterprise IT Spending for the Government and Education Markets, Worldwide, 2013-2019, 4Q16 Update. Gartner, Inc*

Destination Cities

Today in India, video surveillance is not just restricted to Tier-I cities, many Tier-II and Tier-III cities display exceptions examples, as seen in the success stories of Puri, Ujjain, Allahabad, Varanasi, and Nashik. Along with the finance, business and political centres, the other destination cities such as tourist destinations, holy destinations, cultural destinations and heritage destinations have immense potential for developing smart security markets. As these destinations attract huge number of tourists, including the increasing influx of foreign tourists, it has become paramount to develop quality, reliable and high-tech security framework to make these destinations safe and secure cities.

Utility infrastructure

Utility infrastructure constitutes a major part of critical infrastructure. The number of critical infrastructures, oil and gas manufacturing sites, water distribution and sanitation sites, nuclear facilities, and energy maintenance sites, is expected to see a marked increase in 2014-2019. These infrastructures are considered high-value construction projects and, therefore, security has gained paramount importance because of a considerable increase in cyber-attacks worldwide over the years, which are now increasingly seen in India.

Commercial Sector

One of the largest private segment, the commercial sector, encompasses the hospitality subsector including hotels, restaurants, etc., corporate offices, retail, warehouses, and large-scale public-private spaces like auditoriums, sports facilities, and shopping malls. With the nature of the mass public interactions, it is important to monitor the activities and behaviours of people in commercial buildings, enterprises, and hospitality establishments. The commercial sector is expected to grow at a very high CAGR during 2016 to 2020. The high demand for security systems in large and small retail businesses is increasing due to theft and inventory loss. Commercial sector is growing rapidly and needs cutting-edge technology where quality, clarity of data as well as flexibility and adaptability of the system cannot be compromised. In the commercial sector, financial institutions and banks highly recommend video surveillance systems to provide security to the buildings, maintain cash management, and monitor customers and staff activities. This enhances security parameters and drives the surveillance system market for the commercial sector.

Residential Sector

Residential security is among the major concerns in the present market scenario. Escalating in-home burglary rates, availability of attractive insurance policies for the installation of security solutions, and growing number of smartphone and tablet users are driving the demand for security solutions and electronic security equipment such as intruder alarms, surveillance, access control, electronic locks, etc. The affordable entry level security solutions are creating and developing a strong need for an advanced range of security solutions in the residential sector.

Product and Professional Expertise Perspective

Surveillance solutions should deliver scalable, well-proven network video solutions that offer outstanding video surveillance and monitoring capability, combined with exceptional flexibility that keeps costs down. CCTV-generated enforcement should focus on the reduction of overall crime, violence and terrorism prevention. Wireless networks are proven to be the best and have cost-effective solutions for security and surveillance installations and hence are driving the shift from analog to IP surveillance.

The shift from analog to **IP surveillance technology** is already in full swing. Although analog CCTVs still make up majority cameras installed, IP cameras are gaining traction within Indian market, on account of performance and cost-saving advantage due to scalability, installation flexibility, remote control, TOC, etc. IP network cameras provide up to 16 times the resolution of traditional analog cameras. This reduces cost of ownership, monitoring as well as maintenance. Video analytics exceptionally increase the functionalities of the cameras.

Today far more videos are being recorded than anyone could ever monitor or search. The variety of storage options available for IP surveillance systems makes it crucial to consider the different ways the information will be used and stored for the long term. As hard drive technology continues to advance, it is important to utilise **open standards** to ensure that storage is scalable and future proof. In addition, advances in IP-surveillance - such as intelligent video algorithms - will make it even more critical to select open storage devices that can handle combinations of data from different sources. Storage systems should be able to accommodate new and upcoming applications so that equipment investments are not lost as technology advances. There is a need to use server clustering method with the same storage device, such as a **RAID system**, and same IP address to make the "fail-over" completely transparent.

Meanwhile, data breaches continue to accelerate throughout the world. With increasing Internet connectivity, physical security systems are very vulnerable to cyber-attacks, both as direct attacks and as an entrance to the rest of the network. Security professionals must continually revisit their strategies and assets and assess whether they are fit for the purpose and can face the new challenges.

Conclusion

First and foremost, citizens and visitors should feel safe and comfortable while inside the city. Here, video surveillance has emerged as one of the key components of the safety and security framework – for both organisations and city governments, as it allows for real-time monitoring, evaluation of situations and provides capability for taking the appropriate action and preventive surveillance, rather than just passive recording of video.

The era of cloud computing has emerged as a transformational force, encompassing new business models, new entrants and markets. The public sector by far is the biggest segment in terms of volume demand in India. With smart cities initiatives and the rapidly accelerating surveillance demand in organisation, commercial and residential sectors, the video surveillance market in India is projected to reach $952.94 million in FY2016.

With the rapidly escalating video surveillance adaption rate, it is important to identify camera types and location based on the organisation-specific needs and objectives. The recent trends indicate a shift towards digitalised, network-based IP surveillance systems. The network cameras offer added capabilities, including better quality, more flexibility and full-integration ability as well as declining costs, which are the key to making the IP surveillance system more affordable, desirable and a future-proof solutions. Consumers are taking now into consideration the life-cost instead just low-cost options, and as such, changing customer preferences are driving the changes in the technology on one side, and cutting-edge advancements – high-quality, multi-functionalities and larger storage capacity – on the other side.

When successfully deployed, security camera systems enhance overall safety and security, deter crime, and otherwise support the protection of people and property. However, this requires an integrated, holistic approach among all stakeholders, collaboration between the public and private users as well as vendors/installers and policy makers. Steps taken against anti-social elements also help in strengthening the perception of security in the minds of customers. This perception is of utmost importance to boost confidence and moral strength and help create a safe and secure city.

About the Report

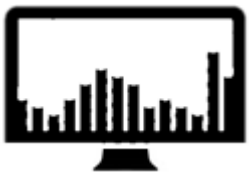
The 'Role of Surveillance in Secure Cities' report is a market report, based on primary and secondary research. Impact Survey is one of the important tool used in this analysis.

Research methodology

This report is based on the synthesis, analysis, and interpretation of information about the Indian surveillance market collected from specialized sources. The analyst have derived insights using a mix of primary and secondary research with an aim to provide a holistic picture of the market.

Primary Research

- Interviews with industry
- Telephone and online survey
- Vendor briefings



Secondary Research

- Company reports and publications
- Webinars and podcasts
- Industry journal and publication

Qualitative Analysis

- Drivers, challenges and trends
- Vendor analysis

Quantitative Analysis

- Market size and market share
- Statistical analysis

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The survey was completed by security professionals with various levels of authority, in organisations ranging in size and spanned across variety of verticals, such as Government, Commercial, Infrastructure, Residential, Institutional, Industrial as well as the technology providers across the value chain. The stakeholders are from around the India though Mumbai accounted for the largest proportion.

Our thanks are due to the following key people (listed alphabetically by surname) for their time and insights:

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- Girish Koppar, Sr Manager IT, Lilavati Hospital
- Gautam Kothare, Sr Manager-BMS, Raheja Corporation
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- Nitin Parab, Purchase Head, A D Associates Electricals Pvt
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- Nilesh Kumar Purey, VP-ICT, GIFT City Ltd
- Dr Aparajitha Ramadyani, Director- Manufacturing, Jakson Engineers Ltd
- Niranjan K Ramakrishnan, CIO, Sir Ganga Ram Hospital
- P Siva Sankar, Municipal Commissioner, Kolhapur Municipal Corporation
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- Col K Satyanarayan, System Administrator, IFIM Institutions
- Rahul Savdekar, Director Industry Solutions (Govt), Microsoft India
- Sagar Tawde, System Administrator, Hindustan Construction Company
- G S Tuteja, Chief Signal & Telecommunication Engineer, Western Railway
- Virendra Yadav, Superintendent of Police, Gandhinagar Police Station

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