Video Surveillance Systems: Current Systems and Future Trends

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Video Surveillance Systems

Definition:
“A video surveillance system monitors the behaviour, activities, or other changing information, usually, of people from a distance by means of electronic equipment.”

Scope:
• Prevention
• Reaction
• Detection
• Intervention
CCTV – Closed Circuit TV

CCTV is a system where signals are not publicly distributed but monitored for security purposes.
Surveillance in Numbers

- Global Surveillance Market (2013, $) 55B in 2020
- Surveillance Equipment Market (2013, $) 45B in 2020
- Video Analytics Market (2013, $) 1,2B in 2017
- Surveillance Cameras (2013, No)

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Existing Systems - Analogue

An analogue camera transmits video via coaxial cable to a single central location for monitoring, recording, and video analysis.

**Characteristics:**
- Low initial investment
- Wide-spread compatibility
- Robust camera performance under difficult scenarios

Hybrid Systems
**Existing Systems – Network (IP)**

A digital camera transmits video via network to a single central location for monitoring, recording, and video analysis.

**Characteristics:**
- Superior image quality
- Easy, future-proof integration
- Scalability and flexibility
- Cost-effectiveness
- Distributed intelligence
- Remote accessibility
- Easy, reliable installation
Video Analytics

Object Detection
- Person
- Vehicle
- Static objects

Event Detection
- Moving in an area
- Crossing a line
- Tailgating
- Loitering

Search Parameters
- Target type
- Event type
- Colour
- Similar targets

Results Visualization
- Video Summary
- Thumbnails
- Target Path
- Site Map

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Technology Limitations

Analogue Systems
- Low resolution
- Expensive cabling
- Bounded scalability
- Lack of analytics
- Remote access

Network Systems
- Low performance in low-light environments.
- Inconsistent frame-rates
- High cost of cameras
- Lack of interoperability
- Network congestion
Installation Inefficiencies

• Surveillance Cameras
  ✗ Poor camera positioning
  ✗ Poor quality video recordings
  ✗ Inadequate maintenance

• Control room
  ✗ High camera to operator ratio
  ✗ Difficulty in following events across cameras
  ✗ Ineffective operator’s workspace setup
  ✗ Communication difficulties
Pitfalls and Fallacies (Technology)

- Network systems are better than Analogue ones
- More pixels means higher image quality
- 80% Analytics is “Good Enough”
- Analytic systems are in any way a match for an (attentive) operator
Surveillance video quality can be enhanced in a lab using software

Facial recognition software can pick someone out of a crowd

Most surveillance content is monitored in real time

Surveillance videos are stored indefinitely

Human behaviour can be predicted
Pitfalls and Fallacies (Societal)

- Video surveillance cameras are an effective standalone crime prevention measure
  - Video surveillance cameras deter crime
  - Dummy cameras may scare away some criminals
- Surveillance system installations are well targeted
- The best reaction to crime and security incidents is to put up cameras
- Video surveillance cameras justify their cost
Future Trends in Hardware

- System-wise
  - Crowd Sourcing Video Surveillance (i.e. mobile devices)
  - Distributed (in edge devices) analytics
  - Migrating physical security onto the network

- Cameras
  - Wide Dynamic Range (multi-exposure)
  - Super low-light performance
  - Multi-Megapixel cameras
  - Panoramic cameras
Future Trends in Software

- System-wise
  - Video Surveillance as a Service (VSaaS)
  - Integrate applications beyond security (e.g. retail)
  - Social Media Analytics

- Analytics
  - Face recognition
  - Behavioural analytics
  - Illicit action prediction
Emerging Issues

• Technology
  – Video storage
  – Network utilization
  – Computational needs
  – Video verification

• Privacy and Security
  – Security in VSaaS systems
  – Privacy issues arising from new analytics
  – Privacy in crowdsourcing solutions
Thank you for your attention

Questions?
Sources

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