Ojo Technology
Experts in IP Video Surveillance

Ojo Technology Whitepaper

The differences between CCTV and IPVS technology

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Abstract:

The purpose of this white paper is to provide an accurate and practical comparison between CCTV (closed-circuit TV) or IPVS (Internet Protocol Video Surveillance) systems including function, cost, and value. A technology and feature comparison table is provided. Practical observations about drivers of system cost are included as bullet lists. A few features unique to IPVS are discussed.

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Overview

The fundamental elements of any video surveillance or monitoring system include one or more ***cameras***, which connect to ***central server*** location where video may be viewed on a monitor in ***real-time,*** and/or ***recorded*** electronically, for playback and review at a later time. Some systems have real-time monitoring only, without recording. Other systems have recording only, with no real-time monitoring. Systems may implement a dynamic mix of both of real-time monitoring and recording, depending on time of day, camera location, staff availability, and other factors.

The purposes of such video surveillance systems are to:

1. Deter criminal activity, such as theft, robbery, assault, or vandalism;
2. Provide a faster or more appropriate response to an incident
3. Provide a record usable in a court-of-law to identify and prosecute an individual who committed a criminal act
4. Provide an improved shopping, working, or visiting experience for customers, employees, and visitors.

How surveillance systems provide an improved experience is discussed below.

Both analog CCTV systems and digital IPVS systems are capable of providing all four of the above system benefits. However, the effectiveness with which a system meets these goals often varies widely. In addition, both one-time costs and support costs for the two types of systems are often substantially different.

Overview of CCTV Systems

A traditional Closed-Circuit TV (CCTV) system consists of:

- One or more analog cameras
- Per-camera coaxial cables to a central monitor
- Central monitoring station
- Optional video tape recorder

Each camera includes a sensor, a lens, and analog video-output circuitry. The sensor will be either a traditional scanned tube or a solid-state CCD integrated circuit. The camera may be placed on a pan-tilt-zoom mechanical platform. The camera does not include any storage, processing, or programming capability. The video output will be in one of a small number of standard formats, typically NTSC or its equivalent "raw" analog video (identified as EIA- or RS-170), with a fixed scan rate and resolution compatible with traditional analog television monitors.

The central monitoring station will include a multi-camera switch, and electronics to display multiple video signals on a single monitor. The switch may have a built-in timer, to cycle through the supported number of cameras. The cameras could be either color, or more commonly, monochrome (black/white).

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Overview of IPVS Systems

An IP Video Surveillance (IPVS) system consists of

- One or more digital "network" cameras
- A standard computer network, either shared or dedicated
- A central server
- One or more client viewing stations
- A digital storage unit

IP cameras always contain a digital CCD or CMOS sensor, and a small, embedded microcomputer to do image processing and interface to the network. Both the digital video output from the camera and camera control information flow through a standard Ethernet connector.

The computer network is standard, in the sense that it does not "know" that cameras are connected to it. The network cabling and switches support the digital video flow and the camera control information identically to the data from office computers and data to printers. Network cable, switches and hubs are standard hardware products, widely available and inexpensive. The network for the IPVS cameras is often shared with an existing, installed data network. This is appropriate if the current network is 100base-TX or 1000base. Some businesses may desire to run a dedicated network, or a partially dedicated network for the IPVS system. Sometimes businesses choose to upgrade an older network, providing improved office computer functionality as well as supporting networked cameras.

The central server is often a standard Windows-based desktop computer, typically running the camera server software as a dedicated application. The server may physically connect to the network at any point. A standard mouse, keyboard and computer monitor connected to the server may function as a real-time monitoring station. However, the server is fully functional with no keyboard or monitor connected.

The client viewing stations are standard office PCs or laptop computers. A simple Windows application, standard web browser permits client viewing. Multiple client viewing stations are easily supported anywhere on the network or anywhere in the world, connected to the server via the Internet. PDAs may also be used to view video, as well as to control cameras. The PDA capability of IPVS systems may substantially improve emergency response, crowd and event control, and facility maintenance, by placing key information directly into the hands of personnel in the field.

The digital storage unit is a standard disk subsystem, consisting of one or more disk drives. Often, multiple disks are used to provide fault tolerant video storage and to store many days of video. The disk subsystem is normally connected to the server, however it may be placed anywhere on the network, or even remotely via the Internet.

Comparison of Technologies

It is difficult to make a direct comparison of analog CCTV systems with digital IPVS systems. The two types of systems have the same purpose, and superficially include

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comparable hardware and similar features. In practice, however, delivered features, capabilities and value differ significantly depending upon the application.

CCTV Strengths

If only real-time monitoring is required, with no video storage, then CCTV is simpler. The systems are not programmable and no training is required. However, IPVS may be lower cost, particularly if there is an existing data network or if there are long cable runs required.

IPVS Strengths

There are two applications where IPVS has clear superiority. The first is on large sites, such as on campuses, public facilities, and many government buildings. Cabling costs for IPVS on large sites are always less than for CCTV. If there is an existing data network, then cabling costs are usually dramatically less. For large installations, the cost of running cable is normally higher than all other system costs combined. IPVS connects via any network topology, versus CCTV's requirement for point-to-point wiring back to the server. Thus, for large, new installations, IPVS will generally result in a lower total system cost.

The second application best suited for IPVS is one where the quality and usability of recorded video is critical. Such applications often include schools, where identifying an individual who causes vandalism or starts a fight is critical to the school's commitment to a safe campus. Similarly, if a license plate must be read, or a person must be identified to a degree of certainty required by a court-of-law, then the resolution and consistency of a digital system is normally required.

Although analog CCTV systems may include a tape recorder, or a more modern "digital video recorder" (DVR), image retrieval in such systems is difficult and the review process is tedious. After an event, management rarely has the time or patience to review many hours or even days of recorded video. More often, the cost of the crime is not worth the cost of retrieving the critical few seconds of video out of the long river of recorded inactivity.

An IPVS system dramatically improves the ability to retrieve recorded events. First, the system only records each camera's video when there is activity within the field of view of that camera. The standard "pre-recording" of a few seconds video prior to detected activity assures that the entire event is digitally preserved. Secondly, by displaying a time-line of activity on the user's console any recorded time for viewing can be instantaneously selected. Any number of selected camera's video may be viewed side-by-side on the monitor. Locating the exact recorded moment of the crime is accomplished with a minimum of viewing time.

The key recorded event is easily copied and saved, and it is easily forwarded via the Internet to others who need to see it. Hardcopies of images showing a face or a license plate can be easily printed or emailed for distribution.

IPVS cameras come in a wide range of resolutions, from very-low-cost "webcams" to ultra high-resolution cameras designed to monitor large construction sites or giant public venues.

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The following table compares features of CCTV and IPVS systems.

Feature	CCTV	IPVS
Camera Type	Analog	Digital
Wiring topology	Point-to-point, each camera to server	Network (arbitrary) topology
Wire type	Coax	Ethernet
Server	Dedicated proprietary	Dedicated PC
Recording technology	None, video tape or "digital video recorder," usually proprietary format	PC disk drives
Remote clients	Difficult – dedicated wiring required	Standard
Wireless support	Difficult and proprietary	Standard
Resolution	Low to moderate	Low to very-high
Video standards	NTSC, RS-170	JPEG, MPEG
Monochrome v color	Fixed by camera and monitor	Cameras auto-convert from color to monochrome at night
Automatic motion detection	No	Yes
Camera can enable lights	No	Yes
Expansion – more cameras	Up to limit of server, typically 4, 8 or 16.	Unlimited, although software license upgrade may be required.
Remote clients	No	Standard
Internet accessible	Very difficult	Standard
Fast review of events	No	Standard
Motion-based recording	No	Standard
Automatic motion-follow cameras	Not available	Available
Selectable partial-frame motion detection	Not available	Available
Export video	Difficult – video tape duplication	Standard
Print video	Difficult	Standard
Uninterruptible Power	Optional	Standard

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What do digital consumer cameras have in common with IPVS?

Most people understand the differences between traditional film cameras and the newer digital cameras.

The transition from film cameras to digital cameras is similar to the industry transition from CCTV to IPVS.

Both types of cameras take excellent pictures. Both categories of cameras offer a range of prices and capabilities. For the same quality lens, a digital camera will cost more. However, as millions of people are discovering, the ease of use, and instant review of images, provided by digital cameras offers huge benefits for the amateur photographer. Saving, sharing, and printing images becomes "mouse-click easy."

Similarly, the simplicity and ease with which a manager can call in an employee to look at video clip and ask, "what do you think about this?" convinces everyone who has ever worked with an IPVS system that they would never go back to CCTV.

Cost Comparison

It is difficult to directly compare system costs of CCTV v. IPVS in a white paper because cost differentials between the two technologies can vary substantially based on the presence of existing cameras on a site, an existing data network, days of recording required, and other site-specific factors.

When bids for CCTV are compared side-by-side with bids for IPVS, the capabilities of a proposed CCTV system are rarely comparable to a proposed IPVS system because of the following factors:

- Existing analog CCTV systems are often upgraded to IPVS—in fact, this is believed to be the most common type of IPVS currently installed.
- Existing CCTV cameras, if high quality, may easily be converted to work in an IPVS system for less than the cost of purchasing a new IPVS camera.
- IPVS cameras typically cost more than CCTV cameras, although they also have more capabilities.
- In a CCTV system, cabling will typically be the most expensive part of the system.
- In an IPVS system, disk storage will typically be the most expensive component of the system.
- If an existing data network is installed, it can often be used as the network for the IPVS system. Upgrading to 100base or 1000base may be recommended.
- Using an existing data network will generally cause an IPVS system to be lower cost than a CCTV system.
- Maintenance of a digital IPVS is typically lower cost and less frequently needed than an analog CCTV system.
- It is easier to upgrade (or replace) individual components within an IPVS system than a CCTV system, because typically a higher fraction of the IPVS system components use open standards (rather than proprietary), and use standard hardware, such as network switches and PCs.
- Expanding an IPVS, such as adding cameras or adding remote clients, is nearly always lower cost that expanding a CCTV system.

Additional IPVS Capability

IPVS systems support advanced features, such as linking to retail POS systems, and linking to alarm and access control systems. Connecting CCTV systems to computerized operations facilities systems such as these is rarely feasible.

In the unlikely, but serious scenario of a major event, such as a shooter, terrorism, or hostage taking, the increased accessibility of real-time and recently recorded video can be critical for emergency response. Emergency personnel both on-site and remotely can view video that clearly identifies the suspect.

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Personnel can rapidly identify both safe and unsafe areas of the site. This may provide faster aid to anyone who has been injured.

Features Beyond Security

An IPVS system can do more than just deter or capture criminal acts. Systems with multiple clients (viewing locations) are able to provide a better experience for customers, employees, and members of the public. For example, a video surveillance system may be used to identify traffic jams, long lines, broken signs, trash, burned out lights, abandoned shopping carts, lost visitors, potential confrontations, or any of a hundreds minor, but annoying situations. Often, IPVS systems are used to reduce overall site costs by reducing the number of maintenance or customer service staff required. They improve situational response times by providing the right person with the right tools to quickly restore an isle, path, hallway, escalator, parking lot, plaza, conference center, public park or lobby to a clean, comfortable state.

To effectively take advantage of the improved customer service aspect of video surveillance systems, it is often necessary to have multiple, distributed client viewing stations. Typical locations include the office of the customer service manager, facilities maintenance, head of security, food service, a parking office, as well as one or more guard stations or a lobby service desk. IPVS systems use standard networked PCs for client viewing. Normally, no additional hardware or network costs are required to add additional clients locations. Standard wireless laptop computers (using 802.11b or 802.11g, for example) may view video anywhere there is wireless network coverage. Passwords, encryption, and other methods are used to assure that only permitted individuals have access to networked video.

Mobile Viewing

A PDA video client is available, including remote pan-tilt-zoom camera control. This level of convenient and universal access dramatically improves the practical (time-saving) and customer experience improvements available within IPVS system installation.

Summary

Though a head-to-head comparisons of features and costs are challenging, due to the substantial architectural and ease-of-use differences between the two generations of technology, this paper provides some general comparison points and a high-level understanding of cost involved for installing these systems. For additional information, you may wish to have a qualified vendor provide a site survey and design of a system that is customized to your business and location.

About Ojo Technology, Inc.

Ojo Technology is a solution provider and systems integrator with expertise in both security and in data networking. Ojo has the ability to deliver complete customer

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specific solutions for local governments, educational institutions, retail establishments, as well as many other industries. Whether developing a completely new IPVS solution, or upgrading and enhancing an existing analog video surveillance platform, Ojo Technology delivers complete solutions including consultation, design, hardware, software, data cabling, electrical, installation, maintenance, and support services. Ojo Technology also provides complete user training. Learn more about Ojo Technology online at www.OjoTech.com.

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