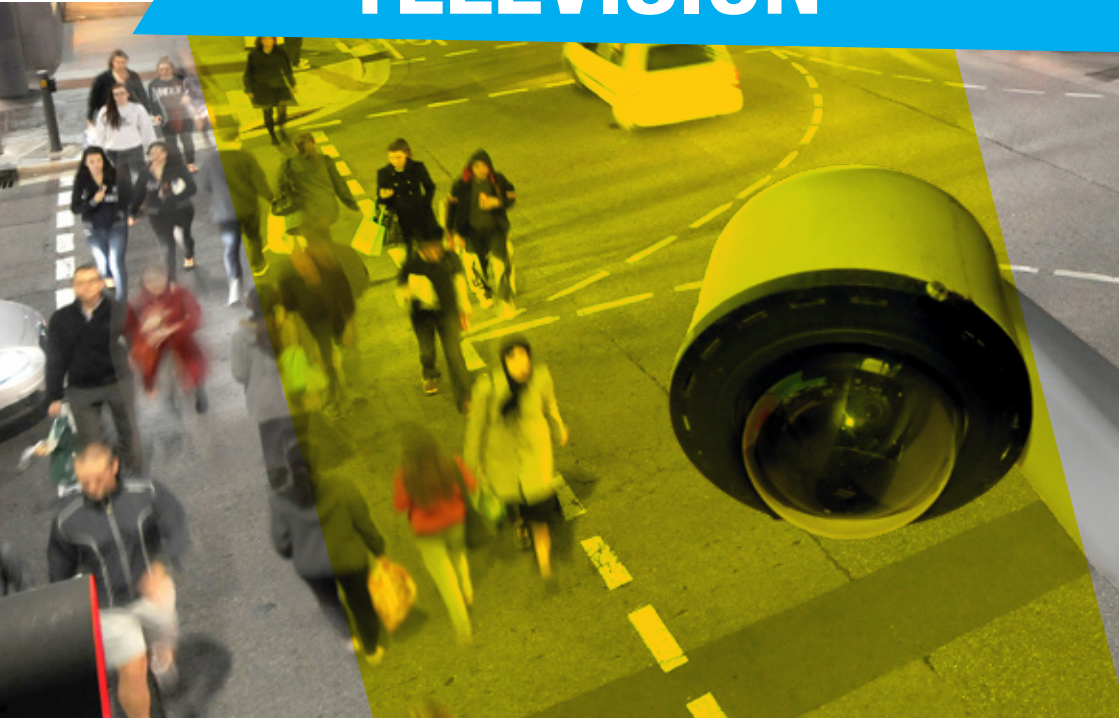




SOUTH AUSTRALIA POLICE
KEEPING SA SAFE

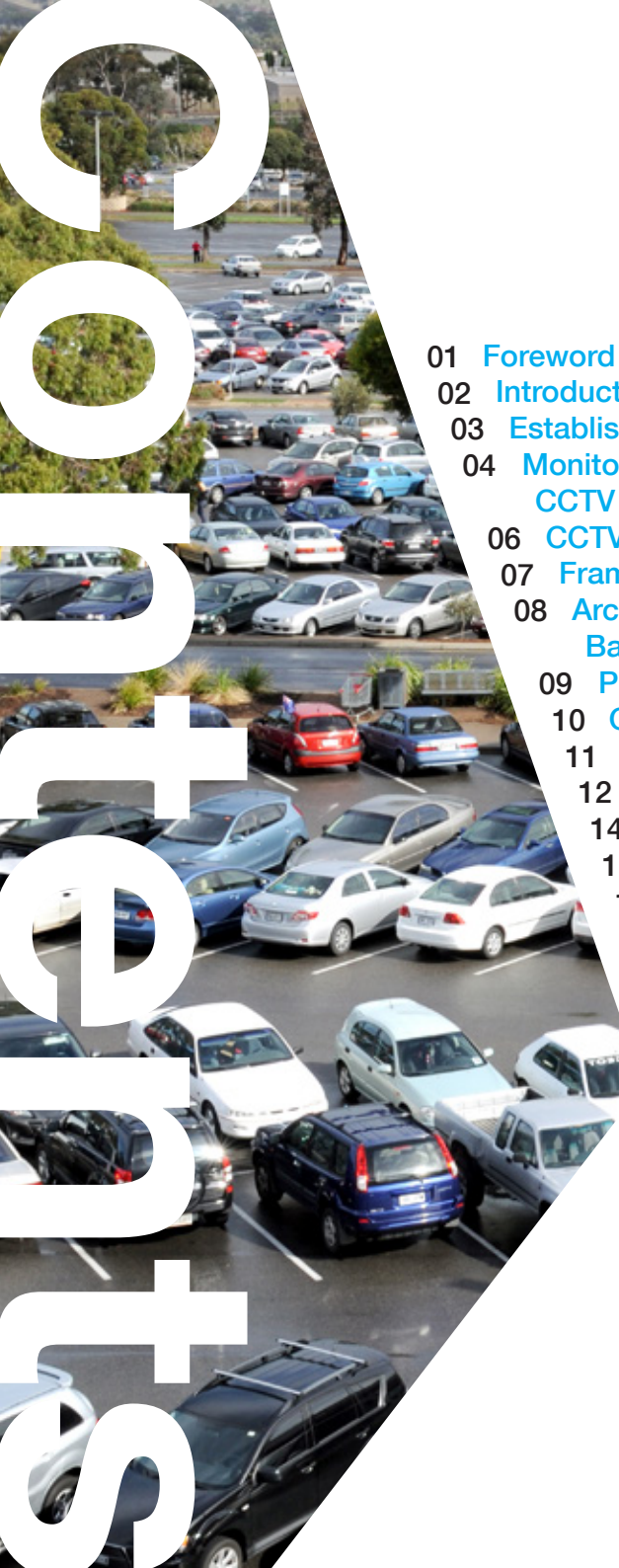
CLOSED CIRCUIT TELEVISION



South Australia Police
A GUIDE FOR BUSINESS



Government
of South Australia



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South Australia Police's (SAPOL) 2020 vision is to deliver a visible, responsive police service for all South Australians. To help achieve this, SAPOL works collaboratively with businesses and the community to prevent crime and the fear of crime.

Closed Circuit Television (CCTV) plays an important part in this through the detection and deterrence of offences, evidentiary benefits and the reassurance it provides businesses, their staff and customers, as well as the broader community.

As CCTV security systems evolve it is important that this new technology complements, or indeed enhances, any security needs and achieves maximum effectiveness. The location of equipment, monitoring, archiving and implications for facial recognition opportunities are all important considerations.

This Guide has been developed to assist the community and businesses when considering the installation or upgrade of existing systems. It provides useful information on how to get the best coverage and quality and make the most of any CCTV security system.

FOREWORD

INTRODUCTION

There have been significant advances in CCTV from the days of black and white cameras, time lapse video recorders and VHS video tapes.

Today's CCTV systems incorporate digital and network recording technology, advanced camera and software applications providing greater image clarity, faster frame rates and the ability to store recorded vision for longer periods through operational formats, improved video compression and reduced costs of hard drives. Advanced video analytics software packages including face and movement detection, people counting and licence plate recognition are rapidly improving, enhancing CCTV capabilities and its effectiveness in a variety of operational environments.

Regardless of what system is selected, it is important to identify your desired application of CCTV, its benefits, aims and objectives, as well as the purchase cost, maintenance and life expectancy.



ESTABLISHING CCTV OBJECTIVES

When considering installing CCTV the risk management process plays an important role. Risk management assists to identify threats to your organisation's assets including people, property and information, and determine vulnerabilities or weaknesses in your organisation's security program which may reveal CCTV to be a cost effective treatment to support your security functions.

Before introducing CCTV into any organisation it is essential to establish aims and objectives, or specifically, what is it that you expect to achieve from the installation of CCTV. CCTV may deter and/or detect crime, provide evidence to the police in the event of a crime as well as promote the perception of safety and reduce the fear of crime among your clients, staff and the general public.

Cost benefit analysis should also be a consideration, weighing up the purchase cost of the system and ongoing operating and maintenance expenses against the potential costs associated with crime such as theft by staff or opportunistic criminals, and property damage including graffiti crime, vandalism or arson.

Crime Prevention Through Environmental Design (CPTED) is a crime prevention approach that may offer an alternative or supporting strategy for CCTV. CPTED uses the built environment to influence behaviour, deter crime and encourage use of space by legitimate users of a space. The principles of CPTED focus on Natural Surveillance, Natural Access Control and Territorial Reinforcement. For more information about CPTED contact SAPOL's State Community Engagement Section or visit www.police.sa.gov.au.

WHAT DO I WANT MY CCTV SYSTEM TO ACHIEVE?

03

MONITORING

It is important to determine how a CCTV system is to be monitored. There are three monitoring modes:

- 1 Active monitoring where surveillance is conducted by personnel using CCTV cameras.
 - 2 Passive monitoring where surveillance is conducted by personnel who undertake other activities or duties.
 - 3 Recording whereby images are recorded and accessed for historical, intelligence, investigative and/or evidentiary purposes.
- Monitoring modes will play an important part in establishing camera placement, selection and capability of the CCTV system.

WHAT DOES MY CCTV SYSTEM NEED TO DO?

CCTV IMAGES

When developing the objectives of a CCTV system, consideration should be given to whether the system is designed to identify, recognise, detect or observe.

When using standard definition cameras (D1):

- **Identify**

The picture quality and detail should be sufficient to enable the identity of a subject to be established beyond reasonable doubt or a vehicle licence plate to be read without enhancement. The subject target occupies 120 per cent of the height of the screen image when using standard definition cameras (D1).

- **Recognise**

The subject target should occupy 50 per cent of the screen image height with sufficient detail to identify a known person or establish colour, make and model of a vehicle.



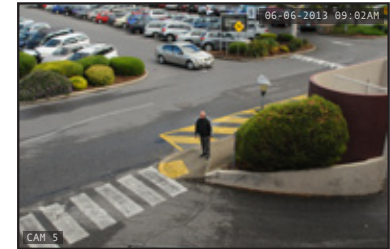
- **Detect**

Subject target occupies 10 per cent of the screen image height with sufficient detail to detect activity within the camera's field of view and establish the activities or circumstances of an event such as the movements and activities of persons or vehicles.



- **Observe**

Target subject occupies five per cent of the screen image height and enables movements to be observed and tracked, or the number of persons involved in an incident and other useful information.



The percentage of screen image height can be reduced when using high resolution/megapixel cameras.

CCTV systems may be used to investigate crime and prosecute offenders. Police specifically require the ability to identify offenders and/or vehicles, therefore a great deal of thought should be undertaken prior to investing in CCTV. Inexpensive systems, while abundant and easy to install, may prove to be unsuccessful when a crime has occurred and police proceed to investigate only to find that the images have been overwritten or are of poor quality.

A good CCTV system is one that achieves its operational objectives and may represent a substantial capital investment. Consequently, consideration should be paid to its design, capability and the quality of the images it delivers. Images from CCTV systems should be good enough to achieve its objectives without enhancement, e.g. digital zoom in. When installing CCTV systems the quality of images should be based on its playback performance not its live image quality. Playback images can present poor quality although live images seen on a monitor may be clear.

CCTV RECORDING SYSTEMS

There are a number of systems used to record CCTV images. Digital technology has paved the way for CCTV video images to be recorded to large capacity hard drives. There are Digital Video Recorders (DVRs) and Network Video Recorders (NVRs) both which record images from cameras directly connected to the recorders. However, IP (Internet Protocol) cameras or centralised IP cameras used with an NVR do not need supporting infrastructure such as power at the site of the camera. Instead, IP cameras use power over Ethernet (PoE) whereby power and data can be passed over the same cable usually Cat 5 or Cat 6. Decentralized IP cameras do not require a central NVR, as the cameras have recording functionality built-in and can record directly to digital storage media, such as flash drives, hard disk drives or network attached storage.

Should the user wish to incorporate their existing analog cameras with new IP cameras, hybrid recording systems are available that are capable of recording both and new technology allowing Ethernet over coax via special converters. This allows cameras and recording equipment to be upgraded with IP and NVR based systems without expensive re-cabling of the existing coax.

Regardless of the systems selected, a CCTV system should be tailored to meet the requirements of a specific business including petrol stations, retail outlets, office accommodation, factories or commercial properties.

CCTV systems are not all alike and operate on different architectures such as Windows or Linux operating systems. Systems may differ in the video compression formats such as Motion-MPEG, MPEG-4, H264 and latest H265 supporting 4K Ultra High Definition (UHD) and 8K UHD video equipment. There are pros and cons for each format, however newer systems tend to use H264 and H265 compression due to their high resolution and faster frame rates whilst using less archive space.

Recorded images should have the time, date and camera location superimposed on the CCTV vision. This provides invaluable information for legal proceedings and should be reviewed regularly against a valid time source to ensure accuracy. A Network Time Protocol (NTP) can be used for clock synchronisation. The NTP is an Internet Standard Recommended Protocol for communicating the Coordinated Universal Time (UTC) from special servers called time servers and synchronising computer clocks on an IP network.

When selecting a CCTV system, watermarking of CCTV vision should be a feature of the system. Watermarking is a digital signal or pattern inserted into a digital image and is downloaded when copies are made to CD/DVD or other suitable media. Digital watermarks provide an element of authenticity as digital images can be altered with various software applications.

WHAT TYPE OF SYSTEM DO I NEED?



FRAME RATE

One important factor to keep in mind is the frame rate, or the number of images that are able to be recorded from CCTV cameras. Frame rates are measured in frames per second (fps). Video is just a collection of still pictures or frames taken at a given rate. If the pictures are taken in rapid succession, they give us the impression of fluid motion. The higher the frame rate the more realistic the vision. However, with higher frame rates there is a requirement for the CCTV system to integrate superior performing cameras, digital processors and greater storage capacity of the DVR or NVR.

It is recommended that CCTV systems achieve frame rates of 25 (fps) or greater, regardless of the number of cameras connected to the system.

HOW WILL FRAME RATE AFFECT MY CCTV SYSTEM?

07

ARCHIVE CAPACITY

Most systems will record images for a specific period of time depending on the frame rate, image resolution and number of cameras on the system. When the hard drive is full the images will be overwritten unless they have been downloaded to suitable storage media. This is known as the 'overwrite period'.

It is recommended that archive capacity is calculated to achieve 31 days or more of available images before overwrite occurs as per Australian Standard AS 4806.1. Archive capacity should be increased as an alternative to reducing frame rates or image resolution quality. A feature of modern CCTV systems is a function known as movement detection where the recording system only records when movement is detected within the camera's field of view. This not only saves archive space but assists when reviewing vision because there is less vision to search.

HOW LONG DO I NEED TO KEEP CCTV FOOTAGE?

CCTV recorders should be secured from unauthorised access. Recording units must have protection from interference with its recording, archiving and system operation. Access to live images should also be restricted to those persons who need to view live camera images. Most systems are equipped with password protection or key locks to prevent unauthorised access.

As CCTV systems are mostly electronic components they should be free from exposure to dust, extreme temperatures, humidity and other airborne and environmental conditions.

DO I NEED TO RESTRICT ACCESS TO MY CCTV SYSTEM?

PHYSICAL LOCATION

BACK-UP POWER

WHAT HAPPENS WHEN THE POWER FAILS?

In order that the security function of a location continues during localised or widespread power interruptions, cameras and recording devices should be connected to the essential services power supply of a building or a designated UPS (uninterrupted power supply).

This minimises the risk of overriding the security protection of your establishment by interfering with the power supply.



CAMERAS

CAMERA PLACEMENT

The market place has an abundance of different makes and models of CCTV cameras, recorders and associated equipment. Cameras have varying degrees of quality, resolution and capability some which have the ability to view scenes in low light conditions using IR (Infrared Illumination) A camera's clarity can be measured in TV lines or pixels. Analog cameras are measured in TV lines and IP network cameras are measured in pixels. The higher number of TV lines or pixels the more superior the detail achieved. Images from analog cameras are digitised by a DVR or a video encoder when recording to a NVR. It should be remembered that the maximum resolution a conventional analog camera can provide after the video signal has been digitised is D1, which represents 720x576 pixels (PAL Video format). IP cameras typically provide a megapixel resolution of 1280x1024 pixels or even greater with new emerging technology providing greater detail and superior vision.

There are two types of camera configurations. These are known as 'fixed' cameras whereby the camera is mounted in a stationary position and views that same scene until physically relocated and 'PTZ' (pan, tilt, zoom) cameras which are motor-driven with remote control over the observation direction, focus and zoom capabilities of a camera.

Most PTZ cameras are programmed through the CCTV software to change their view at certain times (pre-set function), patrol specific areas and be integrated into alarms system inputs to focus on a particular area when alarms are activated. Although PTZ cameras have greater flexibility they are significantly more expensive than fixed cameras.

Advancement in CCTV cameras now allows 360° views that can be split into, and number, individual scenes pre and post recording.

**DO I NEED
ANALOG
OR IP
CAMERAS?**

**WHERE DO
I PLACE MY
CAMERAS?**

**WHAT
TYPE OF
CAMERA
DO I NEED?**

By developing your objectives and using the risk management process it will become clear as to what assets are in need of protection and the best possible location of CCTV cameras. Each camera should fulfil its objectives to identify, recognise, detect or observe persons, vehicles or other activities regardless of the time of day and environmental conditions.

Cameras may need protection from vandalism or interference however this does not necessarily mean that cameras should be placed in an elevated position away from a vandal's reach. It is more important to maintain the camera's original objective therefore physical protection of the camera may be necessary by introducing protective enclosures.

The risk of camera theft can be minimised by the addition of tamper switches connected to an alarm system which will trigger sirens, strobe lights and communicate the interference to the alarm system's monitoring centre for appropriate action.

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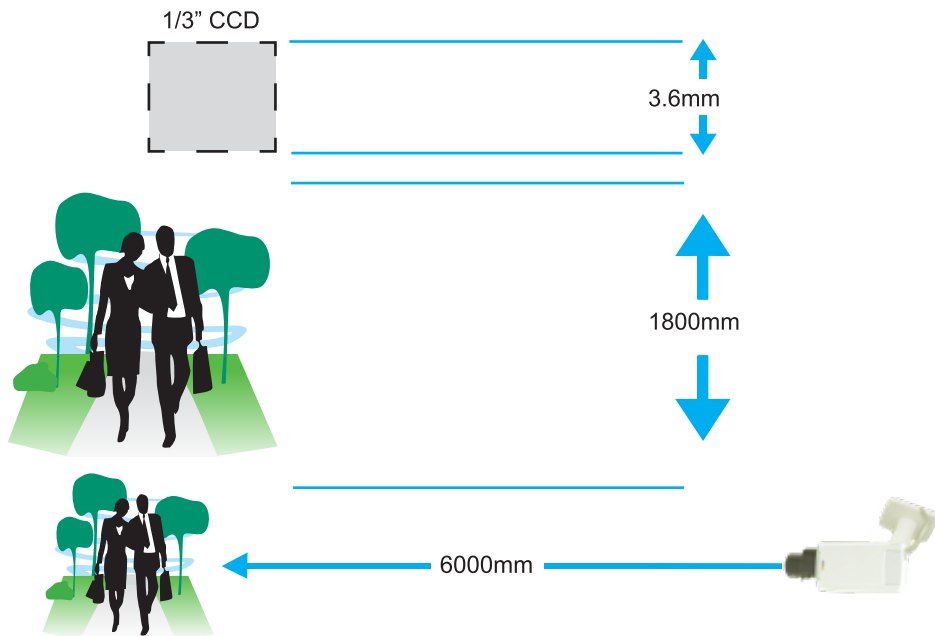


CAMERA LENSES

CCTV cameras require the correct lens to achieve their full potential. Lens size and type is as crucial to the effective use of CCTV as the camera or any other component of the system. Lens size requires calculations to achieve the desired image.

As a basic guide, lens size is calculated from the height of the image sensor used to convert light into digital images (CCD i.e. charge-coupled device or CMOS i.e. complimentary metal-oxide semiconductor). Image sensors range in size from 1/6" to 1". The larger the image sensor the more light it can capture and the better the images. The height of the sensor forms part of these calculations as detailed below.

WHY ARE CAMERA LENSES IMPORTANT?

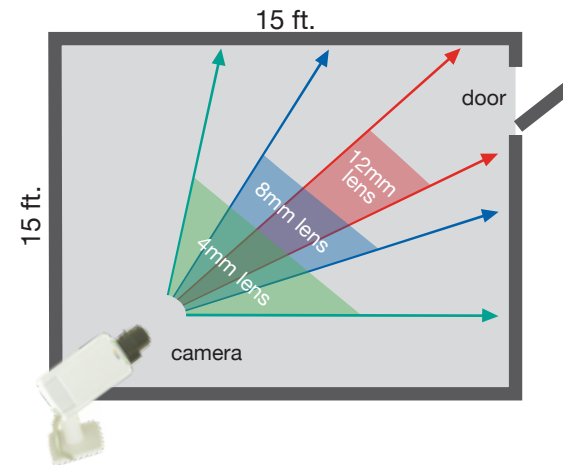


1/3" image sensor has a height of 3.6mm, divided by height of subject target of 1800mm and multiplied by distance from the camera at 6000mm.

$$\frac{3.6 \text{ mm}}{1800 \text{ mm}} \times 6000 \text{ mm} = 12 \text{ mm lens}$$



The Field of View (FOV) is based on the camera and the lens. By increasing the size of the lens or the focal length, a decrease in the FOV occurs. The perceived view of the object, or how far the object is seen on the screen is improved with higher numbered lenses but narrows the FOV.



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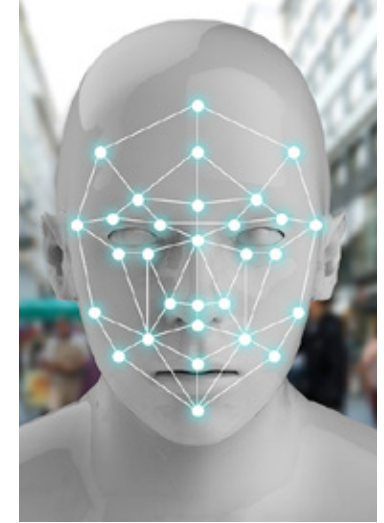
When installing CCTV cameras there are a number of other factors that need consideration including:

- Crime Prevention Through Environmental Design (CPTED).
- Correct lighting to illuminate the target area without causing glare. This includes glare from windows or reflected glare from floor surfaces, buildings or vehicle headlights in the field of view of the camera.
- The camera's performance at night under low light or artificial lighting conditions.
- Vegetation, including its potential growth and movement in windy conditions.
- The effects of the sun, taking into account its seasonal positions.
- Objects that are subject to movement including banners, posters or suspended objects that may trigger the activity detection function of the CCTV system causing valuable archive space to be consumed.
- Environmental conditions (wet/dry/dusty/coastal/hot/cold/day/night).

WHAT ELSE DO I NEED TO CONSIDER?

FACIAL RECOGNITION

A facial recognition system is a computer application capable of identifying a person from a digital image or video frame. Facial recognition provides SAPOL with the ability to analyse all images of a crime, from public and private CCTV systems, leading to rapid identification of potential suspects.

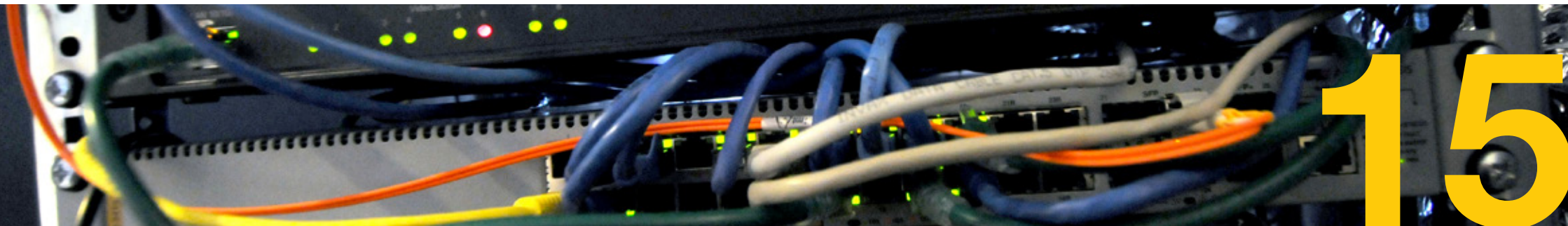


When installing or updating a CCTV system the following factors need to be considered in relation to facial recognition:

- Frontal angle – facial recognition systems work by analysing a person's face so the more of the face available the more chance there is of making a match. The ideal image is of a person looking straight at the camera.
- Tilt angle – as with the front angle the more of the face the better. Also with the weather here in Australia many people wear hats so if a camera is placed too high, looking down the face is more likely to be hidden by the brim of a hat.
- Camera height – In order to obtain the best image of a person's face a camera would ideally be placed at that height. Cameras placed at a height of between 1.6 metres and 1.8 metres would capture the face of most adults.
- Image quality – the higher the quality of the image the better. The more pixels in an image the more chances there are of a successful match.
- Lighting – images should be captured under good, even lighting conditions, not too bright and not too dark. The image should clearly show the contours of a person's face.

HOW DOES THIS WORK WITH MY CCTV SYSTEM?

The factors above do not need to be considered for all of the cameras in a CCTV network. As previously mentioned in the section Camera Placement each camera should fulfil its objectives. Consideration should be given to entrances to premises or 'pinch points' where people filter through an area. For facial recognition to be considered police only need one, really good image of a suspect's face. When preparing CCTV footage for police, check to see if you have a good image of the suspect's face and provide some still shots (if you are able) along with the actual footage.





EXPORT TO PORTABLE MEDIA

Recorded vision can be exported to portable media such as CD/DVD, USB or flash drives. Alternatively, some systems have built in archive hard drives where recorded vision can be exported to prevent overwriting. Vision exported in this manner may be recognised by the system's operational format so viewing simply requires launching the saved file, however, if exported to CD/DVD or other portable media device the file may require software to be exported onto the device along with the vision to enable the file to be viewed.

Police retrieving vision will usually request images to be burnt to a DVD or CD, however if USB is the only method of export, only a SAPOL USB device is to be used.

HOW DO I PROVIDE CCTV FOOTAGE TO POLICE?

VIDEO ANALYTICS

Video analytics, sometimes known as Video Content Analysis (VGA) are complex algorithms implemented as software on CCTV systems or cameras that analyse video to automatically detect events, behaviours or characters. A number of these software applications are used in CCTV systems including licence plate recognition, face detection, people counting, movement detection, tripwire and missing object.

Video analytics may be helpful, however, before incorporating video analytics into a CCTV system it is important to evaluate their application, reliability and subsequent value. Demonstrations and trials are recommended before introducing video analytics into CCTV systems.

MAINTENANCE

Regular maintenance of CCTV systems is possibly the area that is most neglected. CCTV systems require maintenance of camera lenses (focus and alignment), cleaning of enclosures and viewports, adjustment of recorders' time and date to allow for daylight saving, and correct operation of the recording units, air conditioning systems and uninterrupted power supplies.

DOES CCTV REQUIRE ONGOING COSTS?

Over time, some cameras may no longer serve to achieve specific objectives and should be repositioned where they can be effective. Annual risk assessments and audits of CCTV systems may determine that CCTV cameras could provide greater efficiencies if relocated.



HOW DO I
MANAGE
MY CCTV
SYSTEM?

POLICY AND PROCEDURES

It is part of good corporate governance to ensure that CCTV systems are operated ethically and do not breach privacy laws or a person's right to privacy. An organisation using CCTV needs to develop an effective policy to govern its use regardless of its application and ensure that its operation is appropriately supervised, documented, details responsibilities and reflects accountability.

Policy must be supported with suitable training of CCTV operators, whether personnel are engaged in the active or passive monitoring of large CCTV systems or required to undertake operating functions of recorders such as downloading, playback or set up tasks.

Operation manuals for all system components should be kept in a safe place for future reference.



SIGNAGE

Suitable signage indicating that CCTV is in operation in a particular area may deter would-be offenders from committing crime. However, it is important that legitimate users of an area or space are informed of the presence of CCTV. While CCTV signage may provide a level of confidence it should not provide a false assumption that the level of security is heightened.

Signage should not overstate the capability of CCTV. If the CCTV system is not actively monitored then signage should not indicate that it is. Careful selection of wording is important to deliver the right message. Consideration should also be given to the use of symbols to address multicultural barriers.

The location of CCTV signage should also be considered. *Australian Standard AS4806.1 – 2006 Closed Circuit Television – Management and Operation* states that (as a minimum) CCTV signage be posted at all CCTV system site entries.

Signage placed at face level may be more easily noticed, however signage mounted higher may assist in preventing vandalism, theft or graffiti. Signage should be provided adequate illumination, be visible and legible at all times and treated with anti-graffiti coatings to facilitate graffiti removal and UV stabilisation to prevent fading from sunlight.

DO I NEED
TO INFORM
PEOPLE I
HAVE CCTV?

FURTHER INFORMATION

Australian Standard AS4806.1 – 2006 Closed Circuit Television – Management and Operation

For more information about how to prevent crime in your business, contact your local Crime Prevention Section of South Australia Police. A number of crime prevention fact sheets and brochures are available from www.police.sa.gov.au to help improve your business security.

**DO YOU
HAVE EYES
ON YOUR
BUSINESS?**

Notes

What do I want my CCTV system to do?

What sort of system do I need?

Other notes:

My CCTV system maintenance:

Installer details:

System details:

Serial number:

Model number:

Asset number:

Maintenance contact details:

Initial system review date:



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