Designing a Digital CCTV System

Firstly, what is a digital CCTV system?

CCTV stands for Closed Circuit Television.

A CCTV surveillance system is a collection of CCTV cameras that monitor a site and send video streams to a server for viewing and recording purposes.

Previously, the only way to do this was to use analogue cameras which transmitted signals over coaxial cable direct to a video recorder.

Nowadays the analogue system has been superseded by digital cameras that transmit the video streams over an ethernet network back to a Network Video Recorder. Each camera is connected to a network switch which also provides the power for the camera.

Advantages of a Digital CCTV System:

- Anywhere that you can join a network together you can put a CCTV camera. This means that for very large sites you can join networks and monitor all the cameras from one location even if parts of the network are in geographically remote areas.
- The quality of digital camera images is far higher than they were under analogue systems.
- Analytics (discussed later)
- Smart searches of recorded images

Things to consider when designing a surveillance system

1. Why do you need a CCTV camera system?
2. Locations that need to be covered.
3. Type of camera to be used.
4. Quality of Camera to be used including Analytics.
5. Sizing the Network Video Recorder.
6. Number of viewing stations.
7. Do I need a USP (Unified Security Platform)?
8. Maintenance.

1. Why do I need a CCTV camera system?

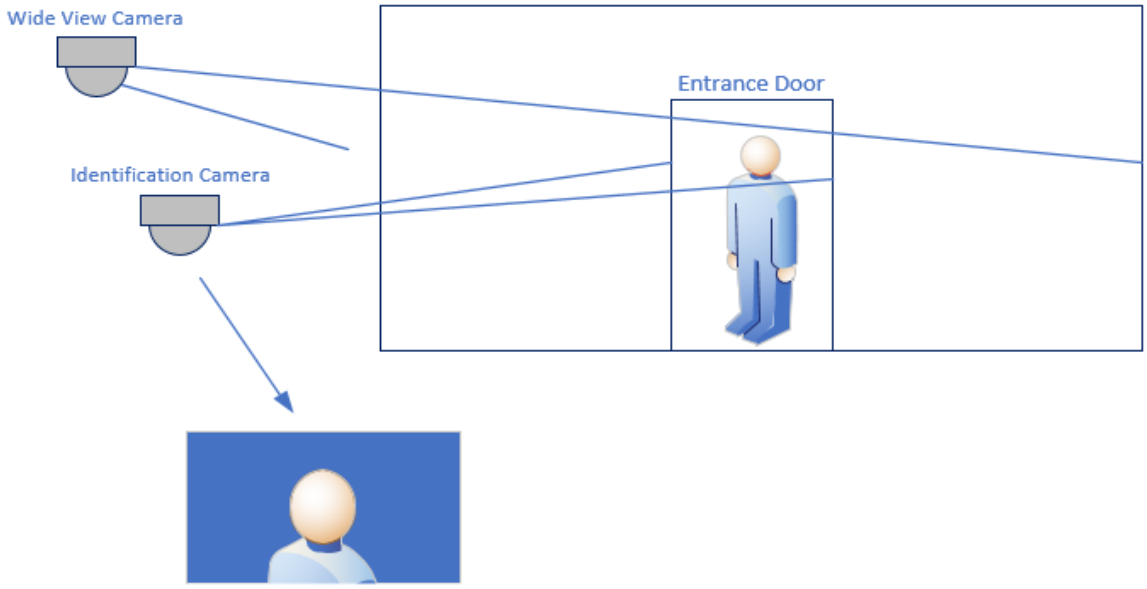
Generally, it helps to set out your needs for the surveillance system before proceeding to design it.
CCTV TV cameras will act as a deterrent to intrusion but will not prevent it. It can also give alarm signals of intrusion in areas that are not manually covered. Here are some common reasons for wanting a system:

A. You have a home that has two entrances, a garage and a garden shed and want all the exits covered and recorded.
B. You have a commercial premise where you need to see who is at the main entrance and also who is in the warehouse plus sensitive areas such as comms room.
C. You need a system for a multi-dwelling tower block with 24-hour concierge attendance where all entrances and lift lobbies are covered.
D. You have a high security, high value commercial enterprise and the CCTV coverage needs to be complete and link to alarm stations.

2. What locations need to be covered?

It is obvious to say that external entrances need to be covered but this also needs some careful thought. Entrances that can be approached from two directions may need two cameras. External cameras need to be sited high enough to be out of reach (even from someone with a baseball bat!). If you have a lobby area, then you may need cameras inside the lobby looking at the external entrance. If identification needs to be made from the image produced, then the camera needs to capture the head and top of body in full frame. Also, the available lighting needs to be considered when placing the camera.

Typical Lobby CCTV Design

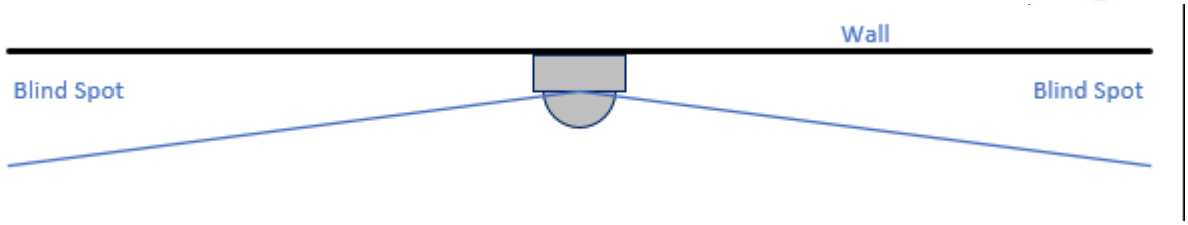


Lift lobbies are another area where there is a lot of people traffic which needs to be recorded.
It is also possible to place cameras in the lift cars.
Vehicle entrances and garages are another area where CCTV coverage is necessary, especially where damage to other vehicles might be a risk.
If the CCTV camera is going to be used to allow access to a garage, then an ANPR camera can be deployed. (ANPR stands for Automatic Number Plate Recognition). These cameras will read a number plate and check against a database to see if it is allowed in or not and send a signal to the access control system to open the gate.

3. What Type of Camera should I Use?

Cameras can either be for internal or external use. External cameras need to be vandal proof and resistant to water ingress and temperature.
The three most common type of camera are Dome, Bullet or PTZ (Pan, Tilt, Zoom) all of which come in internal or external varieties depending on manufacturer. A less common type of camera is a discrete camera.

Dome Camera: This is the most common type of camera and can be used in almost all situations, so it is best to talk about the exceptions. The camera cannot view at 90 degrees from the base, so if you mount it on a wall and need to see further along the same wall there will be a blind spot of about 5 degrees (depending upon manufacturer).



It can be mounted on a wall or ceiling, and can also be flush mounted in a ceiling where only the dome shows through and not the base of the camera.

Bullet Camera: This camera is generally mounted outside as it is not suitable for corridors/lobbies etc. It can view along a wall as it is mounted on a bracket. It is vulnerable to tamper if it can be reached. (People have used sticks to knock these types of camera away from the viewing area)

PTZ Camera: This camera is used where there is a manned monitoring station that can use this camera to turn to any direction and follow someone, or zoom in to view detail without loosing quality of picture. This camera can also be used in conjunction with other cameras to be automatically directed to areas that have movement. Some PTZ cameras need extra power so a local mains power outlet will be needed.

Discrete Camera: This camera cannot be seen by the public. It presents itself as just a small hole of about 2mm diameter through which it videos a scene. It is used in retail applications or any other where you do not want the people who are in the view knowing they are being viewed. It cam be fitted into a pole or doorframe or even behind a wall.

4. What Quality of Picture do I need?

Digital cameras are defined in two ways which is a bit confusing. They can be 720P/108oP which refers to the horizontal line or they can be 2MP (Megapixel)/3MP/4MP/8MP which is a multiplication of the horizontal and vertical definition. To the untechnical all of this means nothing.

In general, the minimum that should be considered is 2MP which will give you a 1080P HD picture in 16:9 aspect ratio (Widescreen)

Higher megapixel cameras give higher resolution pictures, but the cost goes up accordingly so choosing what you need should be done with care. Certainly, in areas where Identification is necessary then 4MP and above should be used. If you have a fixed camera where you might need to digitally zoom into smaller areas of recordings, then you should go for a higher resolution camera as you will lose definition as you zoom into an area.

Other considerations you may need for a camera include:

- WDR (Wide Dynamic Range) this may be needed when looking at an area where there is both high lighting and deeper shadow and you want detail in both areas.
- Day/Night or Infrared. Where there is little light then consideration needs to be made about what feature the camera needs. If you cannot add a light to give a better-quality image, then either a day/night or infrared camera need to be used.

5. Sizing the Network Video Recorder?

Network Video Recorders have many channels (1 channel = 1 CCTV camera) normally up to 64. If you have a larger site, then you will have to add more video recorders.

The sizing of the disk space need for the storage of recorded video is a more difficult process, and involves answering the following questions:

- How many days do you need to keep the recorded images for before they are overwritten?
- How many cameras are recording?
- How many Megapixels are the cameras?
- What Frame Rate will the cameras run on recording? Cameras can record up to 30fps (frames per second) General 12fps is adequate to capture everything seen within a view. The exceptions to this are scenes that have fast moving parts such as cars, hands in a casino or on a checkout till etc.
- What compression rate will they be using (This refers to the way images are transmitted, not all the image is transmitted all the time especially in areas that do not change much, so the bandwidth of the stream will be less)
- For how much of the day will the camera record? When using analytics such a motion detection to monitor when something is moving within a view, then the only time you need to record is when there is activity. So instead of recording 24 hours the total recording hours may go down to 2 hours in a low activity area.

There are tools available on the web that will calculate the size of disk you need from these figures.

6. Number of Viewing Stations?

This is an easy question to answer for each situation. For a small establishment then one viewing station might be adequate. If you have more than one manned entrance, then you may need one viewing station for each and then one for a security room.

If managers need access for overview, then these also need to be counted.

7. Do I Need a Unified Security Platform (USP)?

For each Network Video Recorder, you need a VMS (Video Management Software) of which each viewing station will have a client of this software. It enables you to set up your own views/screens showing different areas.

The move to a Unified Security Platform offers further advantages by combining inputs from access control/door entry and allowing ease of access to recordings of any event. This is a big subject and usually more important for bigger sites with a lot going on.

8. Maintenance

Lastly (or maybe it should be firstly!), the design of your system should be such that access to the cameras is easy to get to for maintenance purposes. The cable route should be hidden from the public.

As far as maintenance is concerned it is worth building into your design the need for continued support from a reputable company. They will manage any day to day problems, training, disk replacements, software and firmware updates etc.

At Able we offer a full service including design, specification, installation and maintenance. Please let us know how we can help.