Surveillance Security System

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Technology: Computer

Presented By:

Md. Shakil Al Masum

Chief Instructor(Computer)

Barishal Polytechnic Institute

Chapter :01

Understand the Surveillance Security System

Sl no.	Topics Name
1.1	Understand the surveillance system
1.2	Describe the knowledge of pro's & con's of surveillance
1.3	Explain the facts of video surveillance
1.4	Explain & construct various nodes of CCTV surveillance system

Learning Objectives

After completed this session student will be able to-

- Define surveillance system
- Use surveillance system in government purpose
- Use surveillance system in personal purpose
- Merit's & Demerit's of Surveillance
- Video surveillance facts
- Know about different nodes of surveillance system

1.1 Understand the Surveillance System

- Surveillance cameras have been around since 1942 when the first one, invented by Walter Burch, was installed at a rocket launch site in Peenemunde, Germany. It wasn't long after that that banks installed them to help prevent and solve crime.

Definition

- The word "**Surveillance**" comes from a French phrase for "watching over" (sur means "from above" & veiller means "to watch").

- Surveillance is the monitoring of behavior, activities, or other changing information for the purpose of influencing ,managing, directing or protecting people.

Government Purpose

- Surveillance is used by governments for intelligence gathering, prevention of crime, the protection of a process, person, group or object, or the investigation of crime.

Equipments for Surveillance System

Types of Surveillance

1. Computer surveillance
2. Phone surveillance & Law interception
3. Closed circuit television
4. Social network analysis
5. Biometrics
6. Aerial Surveillance
7. Data mining & profiling

8. Data mining & profiling
9. Corporate
10. Business Intelligence
11. Intra Corporate Surveillance
12. Human operatives
13. Satellite imagery
14. Identification & credentials

1.2 Pro's & Con's of Surveillance

Pros:

1. Improve public safety
2. Reduce crime rate
3. Help catch criminal
4. Provide evidence & gather clues
5. Bring convenience for everyday life

- **Cons:**

1. They are easily abused.
2. Their effectiveness is doubted.
3. Public Camera surveillance is expensive.

1.3 Facts of Video Surveillance

- A digital video surveillance system is a surveillance system capable of capturing images and videos that can be compressed, stored or sent over communication networks. Digital video surveillance systems can be used for nearly any environment.

1.4 Explain & Construct various nodes of CCTV surveillance system

- **Nodes:**

1. CC camera
2. DVR/NVR
3. Monitor

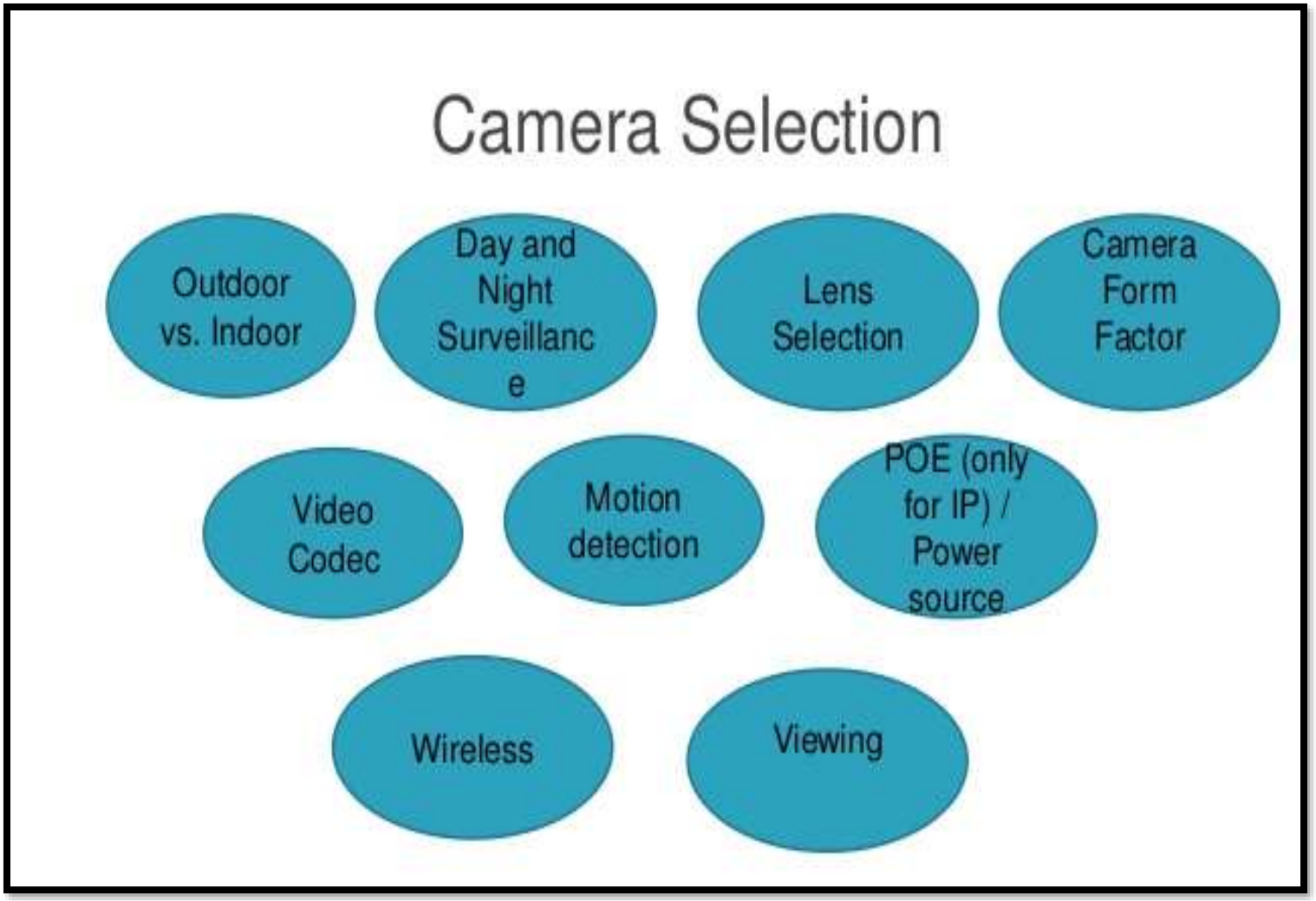

Camera Selection
Outdoor vs. Indoor
Day and Night Surveillance
Lens Selection
Camera Form Factor
Video Codec
Motion detection
POE (only for IP) / Power source
Wireless
Viewing

Fig : Various nodes

Fig: Camera & Converter

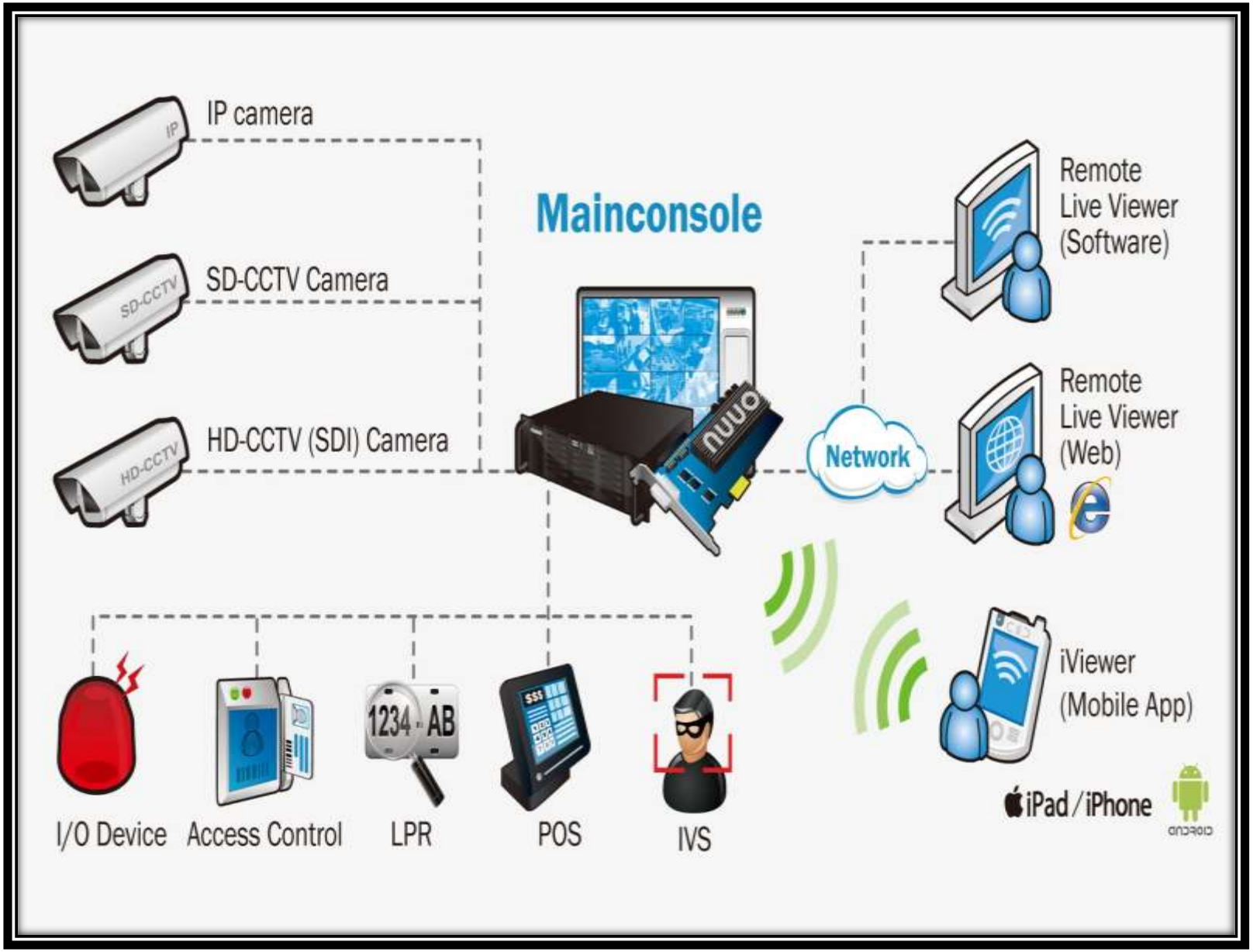


Fig: Internet Based Surveillance

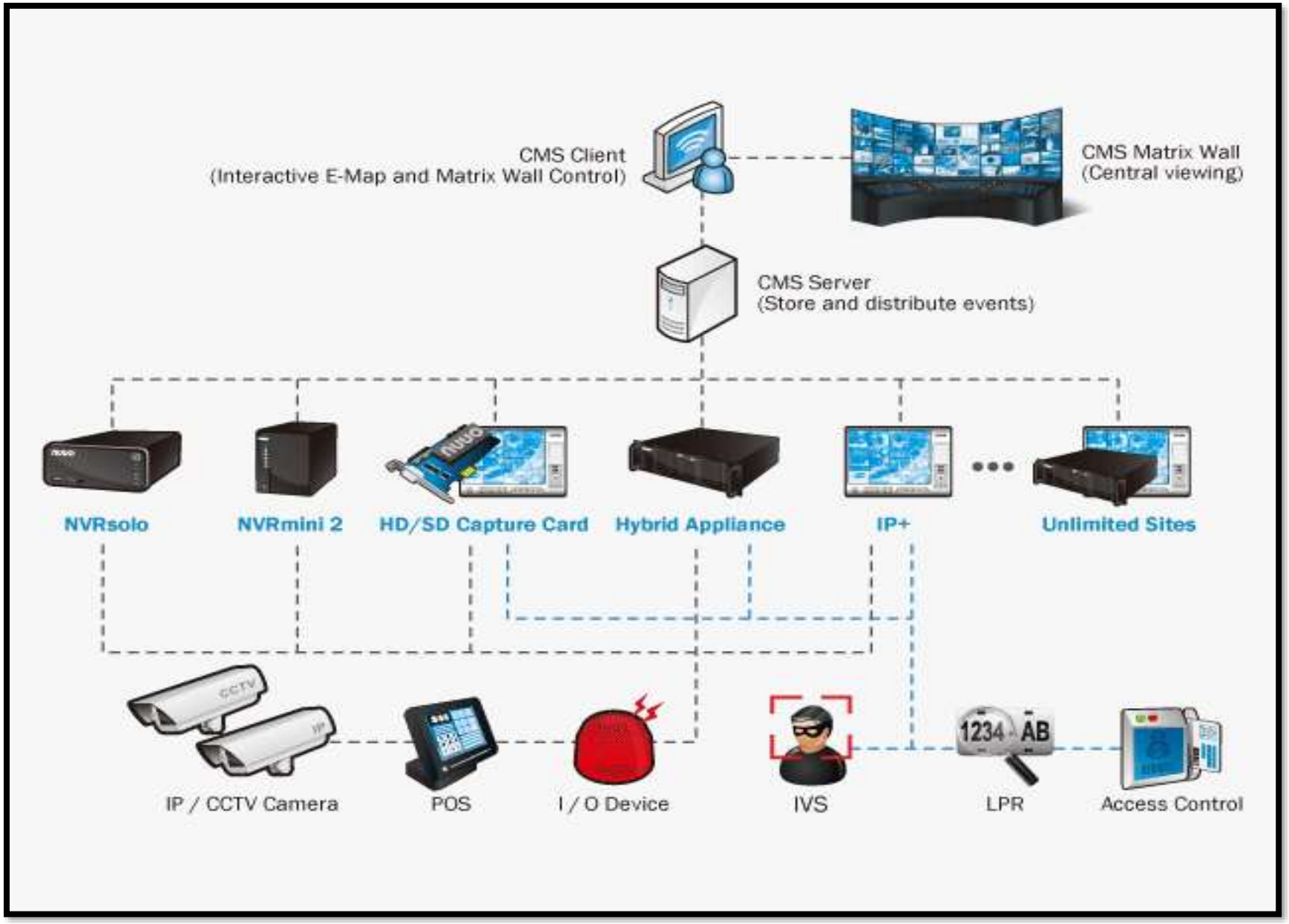


Fig: Internet Based Surveillance

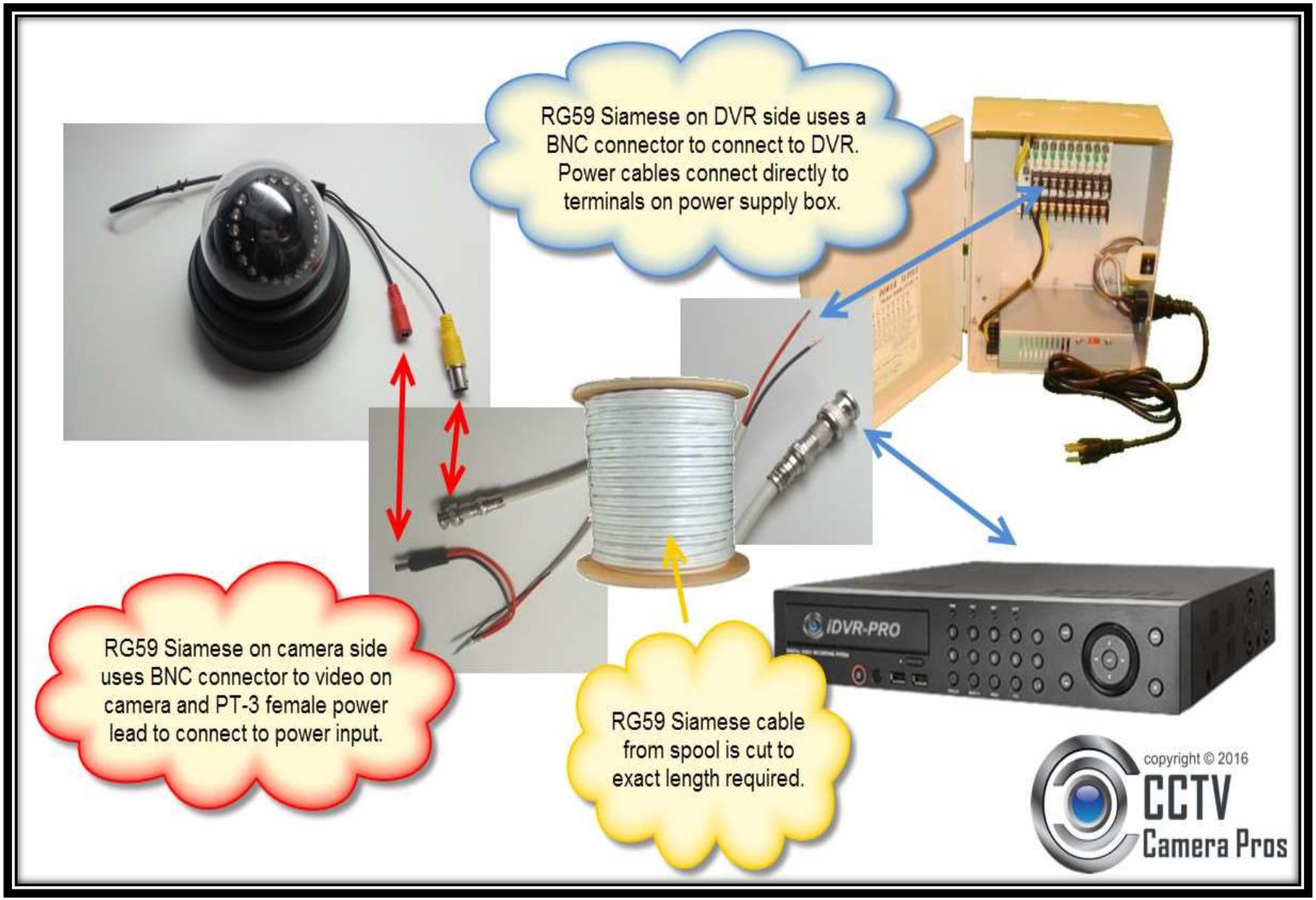


Fig: Surveillance Equipments

Chapter:02
Understand the functions of video surveillance

Sl no.	Topic
2.1	Construct a video surveillance system
2.2	Explain function of blocks & equipment required to implement a video surveillance system.
2.3	Understand the facts about CCTV & its interfacing device

Learning Objectives

After completed this session student will be able to-

- Define video surveillance
- How to construct a video surveillance
- Describe the function of blocks & equipment required to implement a video surveillance
- Description the facts about CCTV & its interfacing devices

Definition

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

2.1 Construct a video Surveillance System

1. DVR with HDD
2. Monitor
3. BNC connector
4. Cable (Coaxial/UTP Cat 5/6 or Ready Cable)
5. CCTV
6. Internet
7. Hik Connect Apps

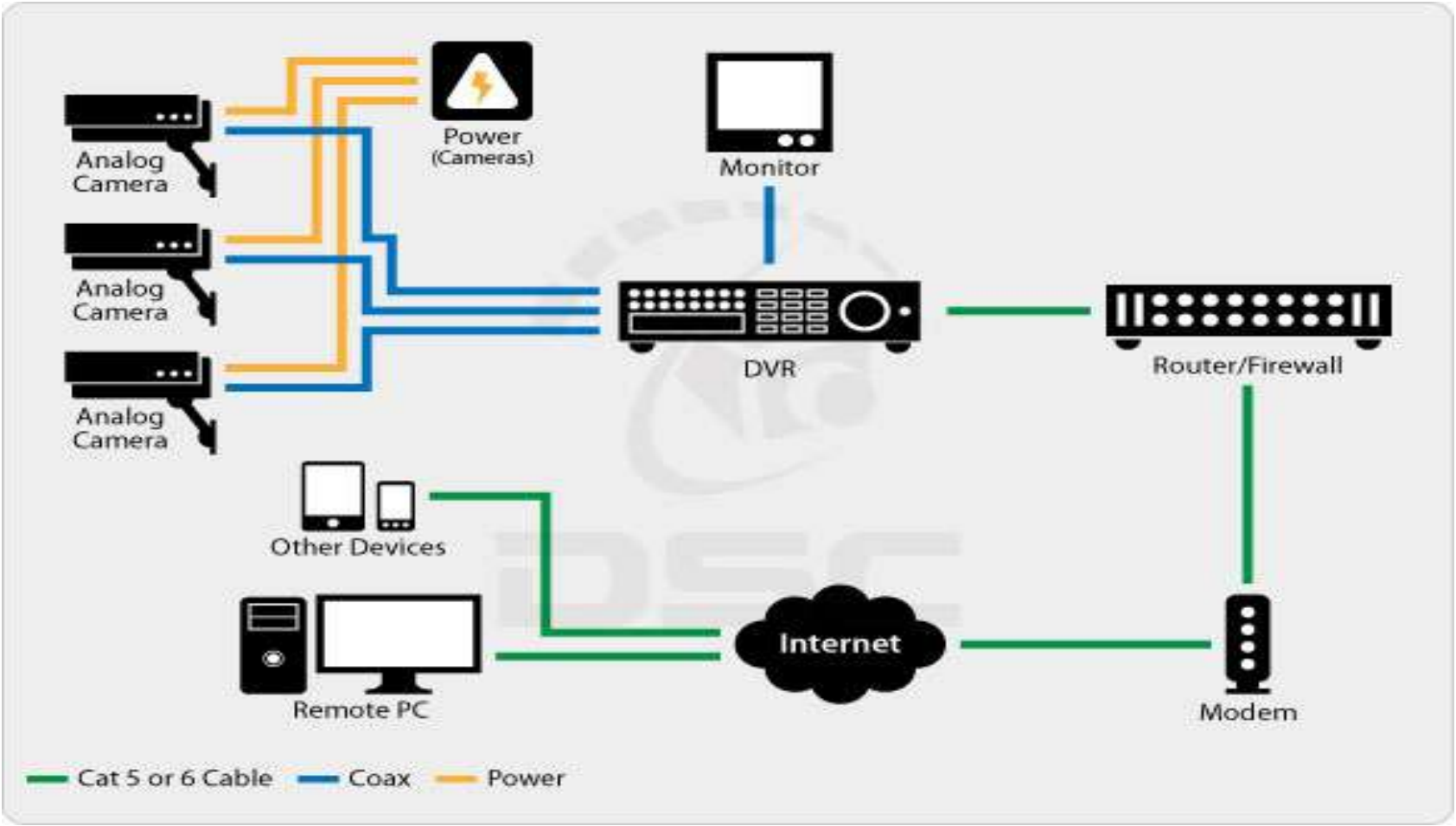
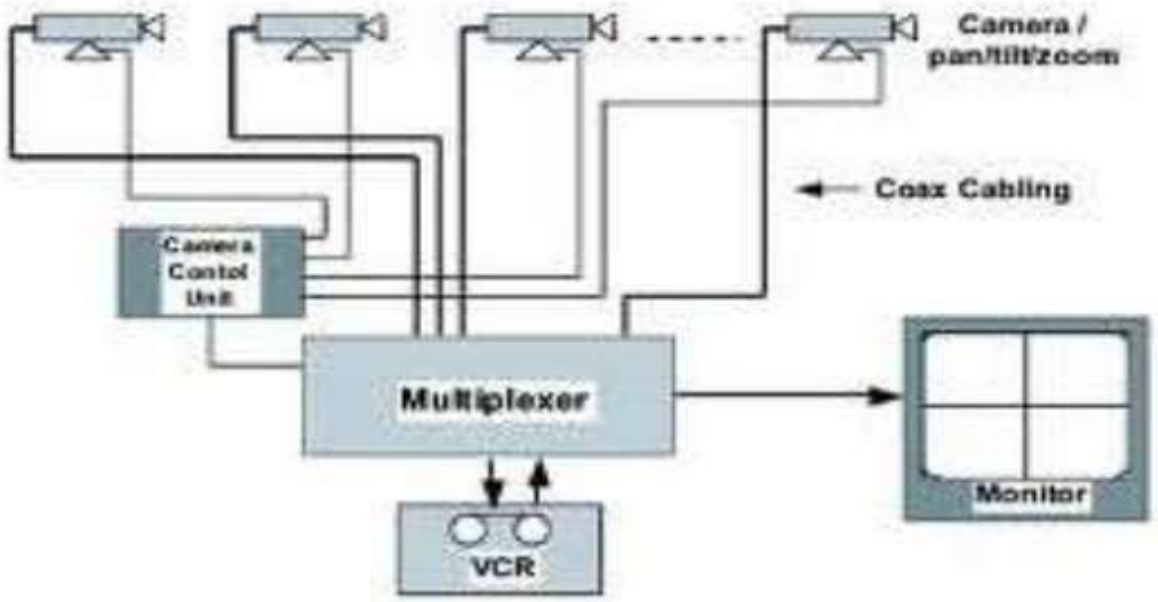


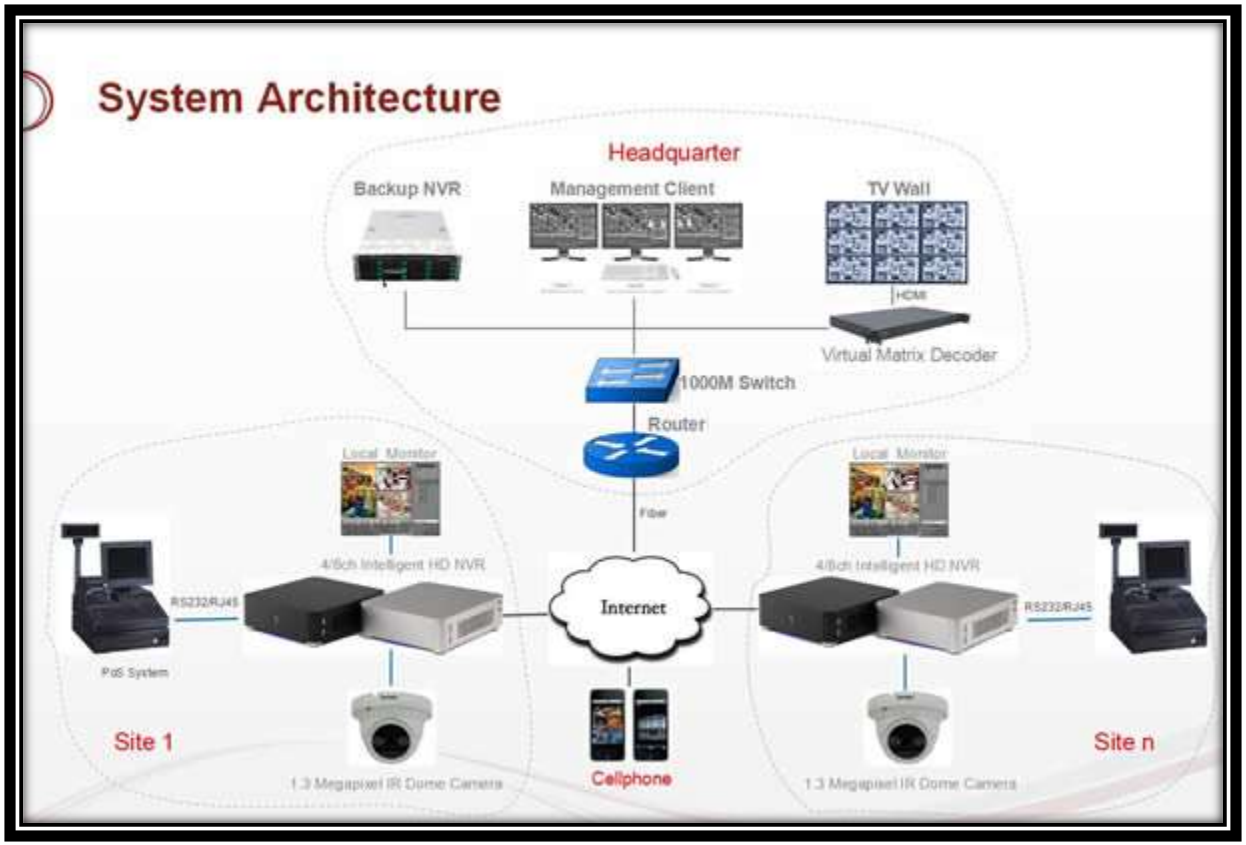
Fig: A video surveillance system

Analog CCTV Camera Architecture



2.2 Explain function of blocks & equipment required to implement a video surveillance system

Block & Equipment of a video surveillance system:



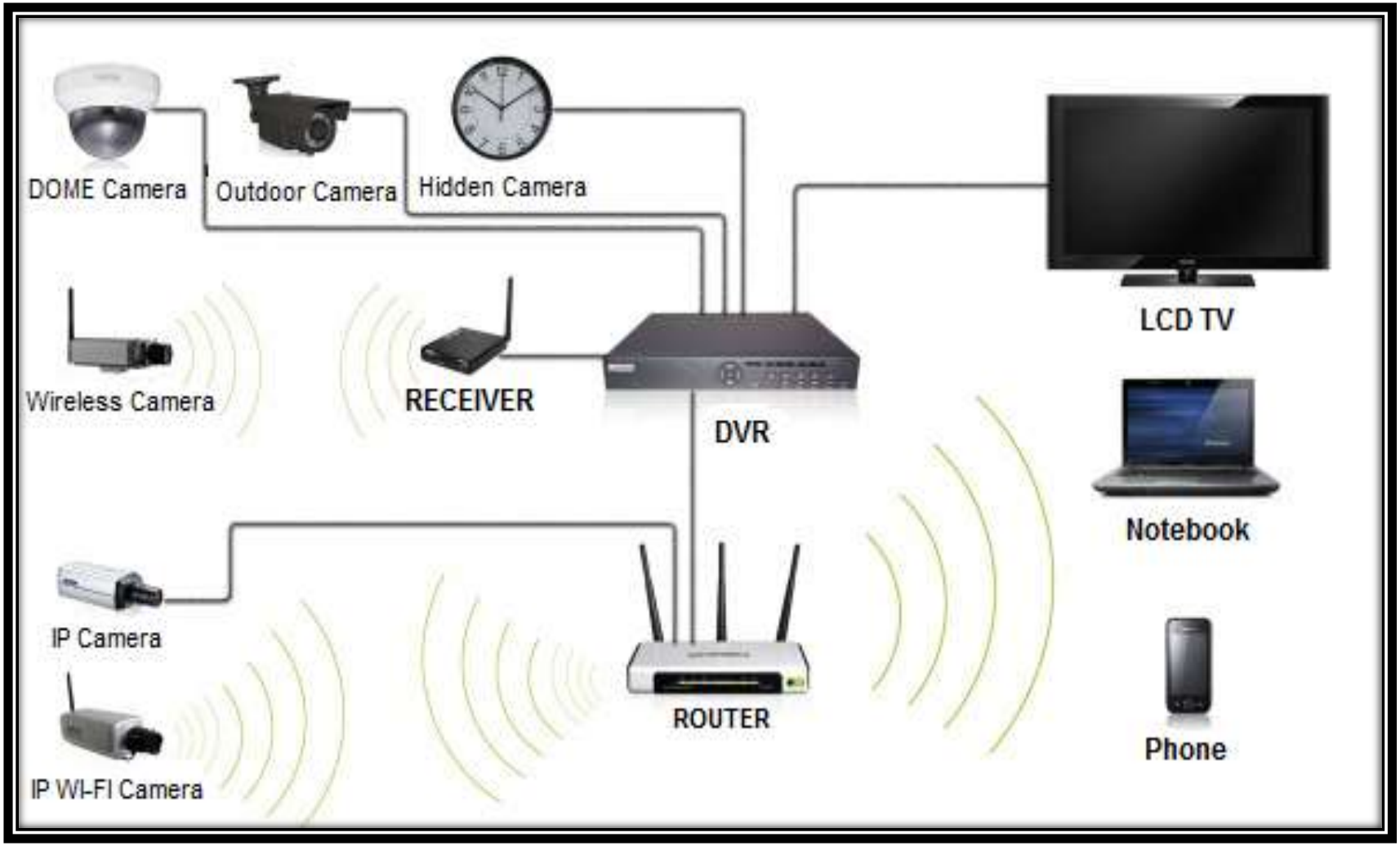


Fig: Block diagram of Surveillance security system

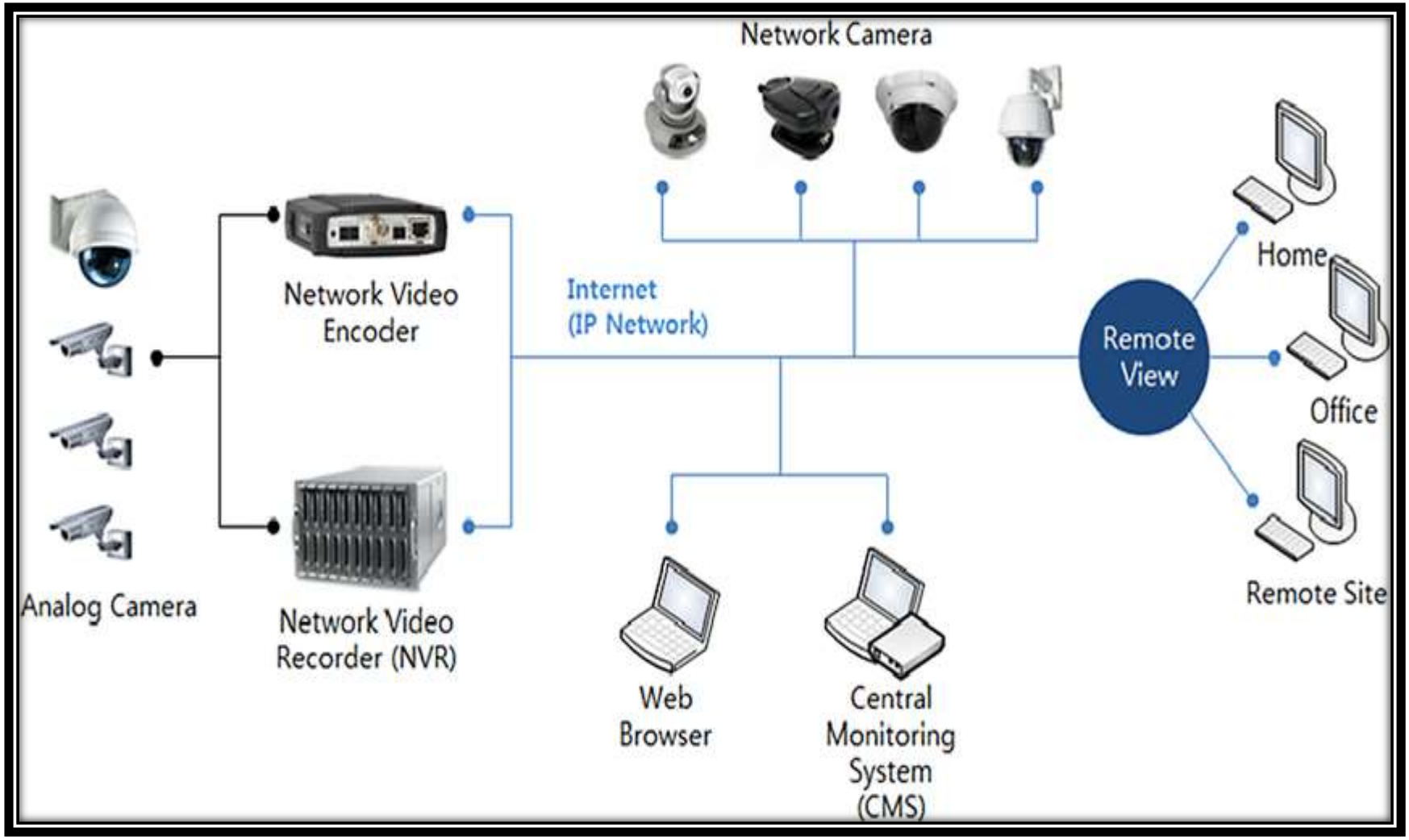


Fig: Internet based Surveillance

2.3 Understand the facts about CCTV & its interfacing device

- The first CCTV camera was installed in Germany in 1942 for observing the launch of V2 rocket at Test Stand VII by German engineer, Walter Bruch. They only started being used publicly in 1962.
- There are 25 million CCTV cameras in operation worldwide, with 4 million in the UK. The UK has more CCTV cameras per head of population than any other country.
- The average citizen is caught around 300 times per day on CCTV.
- Experts believe that as many as 67% of burglaries could be prevented if people had CCTV camera systems at home.
- Approximately 9% of homeowners have CCTV, compared to 40% who have a burglar alarm.
- We can access most CCTV systems remotely via the internet so we can keep an eye on our property even when away from home/our business.
- We should always display a warning that CCTV is in operation at our property so people are aware that they're being filmed.

- IP CCTV cameras are increasingly being used over the analogue cameras that have been commonly used until very recent times. These offer high definition images of a superior quality and are now much more affordable due to advances in technology
- Some public CCTV uses automatic number plate recognition (ANPR) technology, allowing them to recognise vehicle number plates. This can be used to identify vehicles used in crimes or number plates can be 'tagged' so that the authorities can be alerted when they are picked up on camera
- As well as being used to prevent or detect crime, CCTV is commonly used to monitor areas where it is not safe for humans to operate such as nuclear power plants, areas of extreme temperature or in bomb disposal With 40 years in the business we know quite a lot about CCTV and can supply camera systems that offer a range of features, including many of those outlined above.

Chapter :03

Understand the types of Camera ,Lens ,Sensors & their Functions

Sl. No	Topics Name
3.1	Understand the various types of Camera & their functionality
3.2	Reassembling the Camera & Exam the parts of Camera to understand their mechanism.
3.3	Selecting suitable camera after understanding
3.4	Describe different types of Lens & their Utility
3.5	Differentiate & select the best camera from the same group depending on the image quality being measured by TVL chart
3.6	Selecting a camera for higher security application

Learning Objectives

After completed this session student will be able to-

- Describe types camera & their function
- Describe different parts of camera & their working mechanism
- Describe the benefit of different types camera to select them
- Describe different types of lens
- Differentiate different types of camera which is best
- Select a camera for higher security application

3.1 Understand the various types of Camera & their functionality

Types of CC Camera

1. Dome Camera
2. Bullet Camera
3. C-Mount Camera
4. Day/Night CCTV Camera
5. Pan Tilt Zoom (PTZ) Camera
6. High Definition CCTV Camera
7. Infrared/Night Vision CCTV Camera
8. Network/IP CCTV Camera

Functions

1. **Dome Camera** : The dome camera is one most commonly used for indoor & outdoor security & surveillance.

1. **Bullet Camera:** A bullet camera is a small video camera typically installed as part of a video surveillance system. These camera are typically only 2 to 2.5 inches long, which makes them easy to hide. These camera are developed in residential & commercial surveilla

3. **C-Mount Camera**: C mount is a type of lens mount commonly found on 16 mm movie cameras, closed-circuit television cameras, machine vision cameras & microscope phototubes.

4. **Day/Night CCTV Camera**: A day & night camera is a security camera that can see the picture during the day hours, when there is enough sunlight, and during the night in total darkness or minimum illumination. As a result, the end user can see picture in total darkness at the distance of infrared emission produces by LEDs.

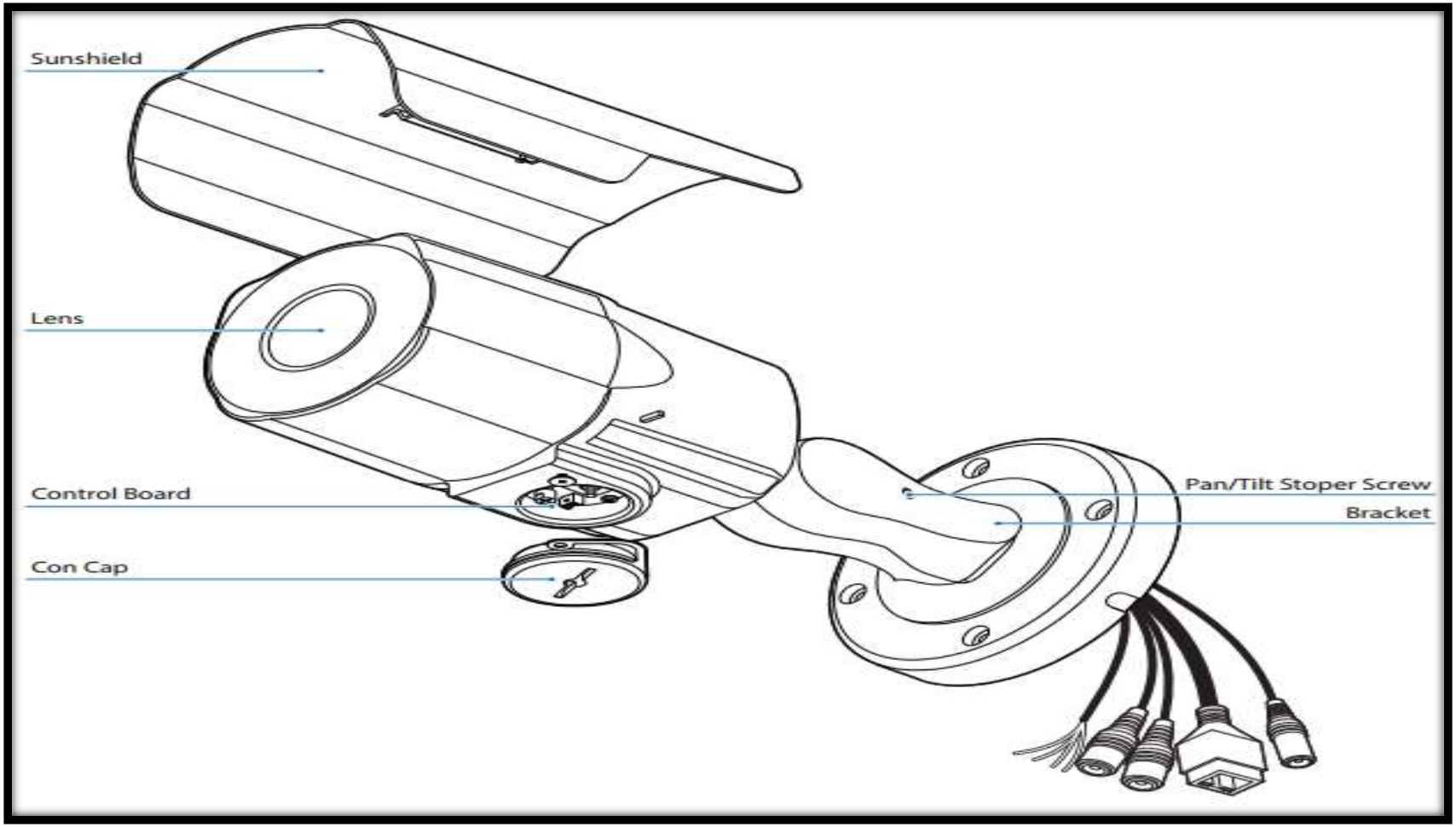
5. **Pan Tilt Zoom (PTZ) Camera**: Pan Tilt Zoom (PTZ) Camera is a name given to a type of IP camera where the user can control the movement & position of lens from a remote location using controls on an internet browser or software application.

6. **High Definition CCTV Camera**: HD security cameras, also known as HD CCTV cameras & HD over coax cameras, are capable of capturing high definition video surveillance footage up to 1080p resolution (1920x1080 pixels).

7. **Infrared/Night Vision CCTV Camera**: The most common type that's used on most security cameras is infrared (IR) night vision, which relies on infrared light. This automatically detects daylight & applies the filter to block out the IR light during the day in order to keep colors looking accurate.

8. **Network/IP CCTV Camera**: An internet protocol camera, or IP camera, is a type of digital video camera that receives control data & send image data via the Internet. They are commonly used for surveillance.

3.2 Reassembling the camera & Exam the parts of camera to understand their mechanism



All CCTV cameras include three basic elements:

1. Image sensor

- –Converts light (photons) into electronic signals;

2. Lens

- –Gathers light reflected from a subject and focuses the light on the image sensor;

3. Image processing circuitry

- –Organizes, optimizes, and transmits video signals. The type of camera best suited for a CCTV system depends on the operational environment and how it will integrate into the system.

3.3 Selecting suitable camera after understanding

1. Internal and External Dome Camera

Benefit:

- Ease of installation
- Vandal-resistant features
- IR night vision

2. Bullet Camera

Benefit:

IR night vision

- Compact size aids installation
- High-quality image resolution

3. C-mount Camera:

Benefit:

- Can support changes in technology
- Effective for indoor use
- Bulky size makes them noticeable (which acts as a deterrent)

4. Day/Night Camera

Benefit:

- Record in both colour and black & white.
- Wide variety of sizes available
- Infrared capability

5. PTZ Pan Tilt & Zoom Camera

Benefit:

- 200m IR night vision
- X36 optical zoom
- High-quality image resolution

6. Discreet CCTV

Benefit:

- Can be propped up or mounted
- Can be disguised in various objects
- Effective for indoor use

7. Thermal Image Cameras/Infrared Cameras

Benefit:

- Detect intruders up 250-300 metres away
- Good in low-light
- Thermal radiation passes through visual barriers

8. Varifocal Cameras

Benefit:

- Can capture those ‘dead zones’ that other cameras can’t Offer exceptional focus
- Work well up close and at long distances

9. Network Cameras

Benefit:

- Data can be easily accessed
- Ideal for homes and companies
- Less cabling and less maintenance

10. High Definition Cameras

Benefit:

- Clear, detailed pictures
- Offer maximum safety for high risk establishments
- Can zoom in without losing focus

What Type of CCTV Camera Should we Buy?

- It's extremely important to ensure that we have chosen the right CCTV camera, because depending on where they're positioned and their primary use, we will need to find one that best accommodates your needs.

- Whether we're looking to install a CCTV camera outside a property to catch criminal activity, or have placed one inside to monitor the home or a company's goods, there's something for everyone.

3 factors you need to consider:

If you've been asking yourself, *'what type of cctv camera should I buy?'* then we have come to the right place, because the experts here at Caught on Camera will be covering things to consider and the best types of CCTV cameras for the home. But first, there are 3 factors to consider:

- **1. The correct lens**

This will ensure that we receive a quality image. Choosing the right lens will allow our camera to focus and will bring enough light to the sensor on the camera, helping us to read registration plates and recognize faces etc.

2. The correct sensor

There are two things to take note of when finding the right sensor: the type and size.

These are:

- **CMOS** (complementary metal oxide semiconductor)
- **CCD** (charged coupled device) cameras

CCD are more expensive than **CMOS** and they produce a clearer image, ideal for identifying faces and registration plates.

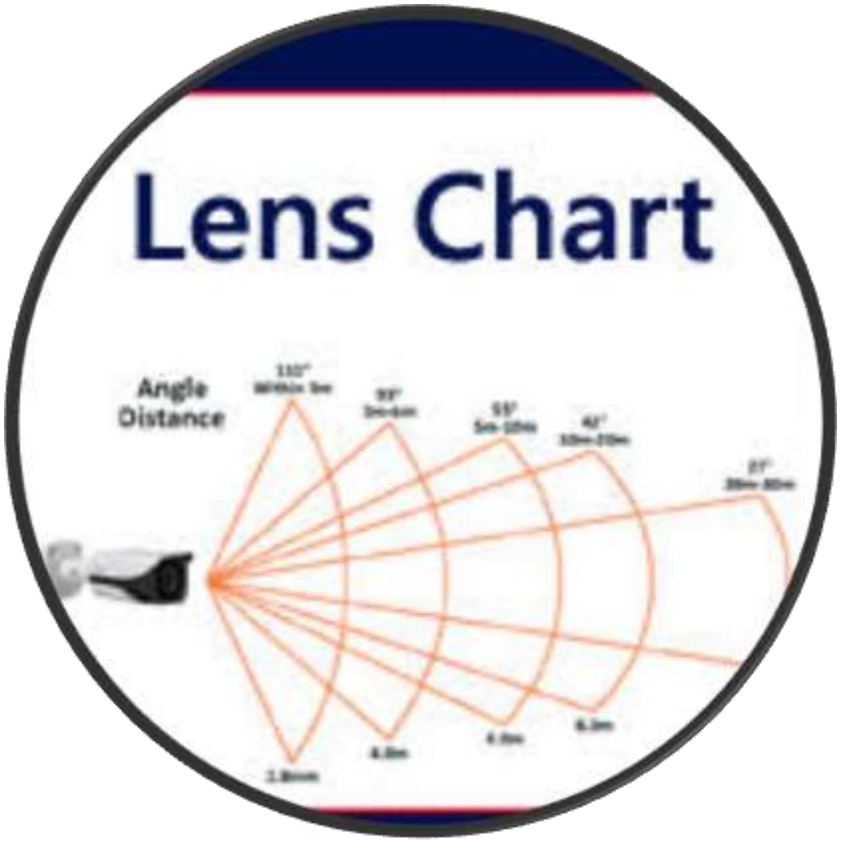
3. The correct output resolution

- The more pixels, the better the picture. The highest resolution you can get is **700TVL** but many mainstream cameras range between **300-550TVL**. It's important to match a resolution that your camera can produce, anything more is completely unnecessary.

- **What to Look for When Buying a CCTV System:**

- Should my CCTV cameras be discreet or a visual deterrent?
- How do I know what to use indoors and outdoors?
- What are the light conditions like?
- Is image clarity important?
- Is audio required?

3.4 Describe different types of lens & their utility



Types of Lenses

Lenses are available in three basic types:

- **fixed focal length**, **varifocal (vari able focal length), and zoom.**

a. Fixed Focal Length Lenses

Fixed focal length lenses are built with one set, unchangeable, focal length. Such lenses are useful in situations where the camera remains in a fixe position and the requirements to observe an area do not change.

b. Varifocal Lenses:

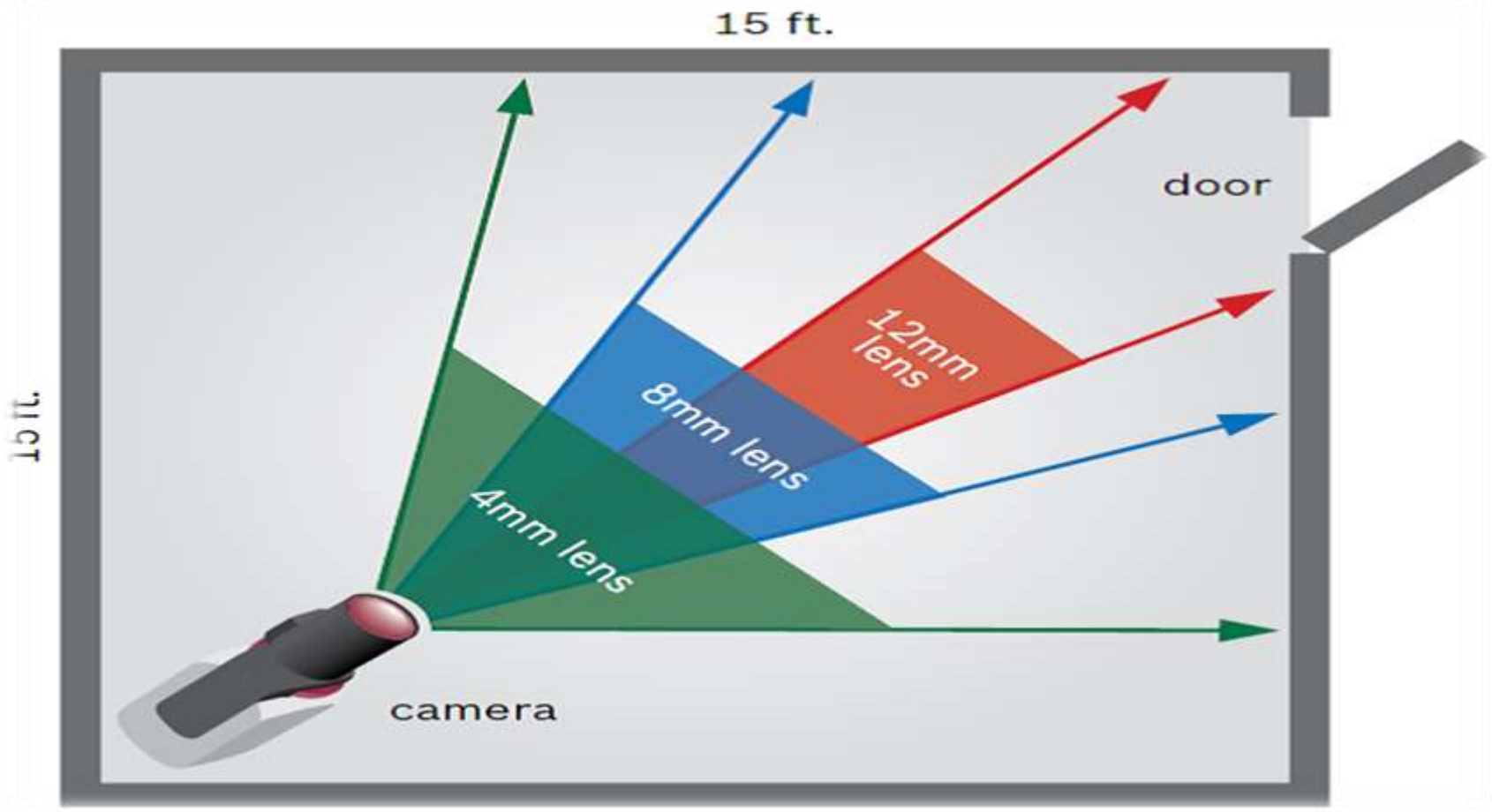
The focal length of varifocal lenses can be changed within a specific range; however, each change must be accomplished by hand at the camera.

C. Zoom Lenses:

Unlike the varifocal lens, the zoom lens is designed to maintain the focus setting throughout the focal length range. Zoom lenses in the CCTV industry are often built with integral motors to enable changing the focal length from a remote location.

Standard Lenses for Image Sensor Size

Sensor Size	Standard Lens Size
⅔ inch	16 millimeter
½ inch	12 millimeter
⅓ inch	8 millimeter


15 ft.
15 ft.
door
12mm lens
8mm lens
4mm lens
camera

3.5 Differentiate & select the best camera from the same group depending on the image quality being measured by TVL chart

Cameras	Cable types	Lens	Advantages	Uses
PTZ camera	Cat5/6 or power cable	Fixed/zoom	Pan, tilt & zoom	Outdoor open areas & higher locations
Wireless cameras	Power cable	Fixed/zoom	Only one cable, easy to install	Indoor & outdoors
Bullet camera	Cat5/6 or power cable	Fixed/zoom	Smaller, easy to hide	Indoors & Outdoors
Dome camera	Cat5/6 or power cable	Fixed/zoom	Deceptive viewing angle	Indoors & Outdoors
Battery camera	No cable	Fixed	Portable, easy to install	Indoors & Outdoors
4G camera	No cable	Fixed	Portable, No WiFi	Remote shed, wild, dock, boat, RV, etc

3.6 Selecting a Camera for higher Security Application

The Top 10 Security Cameras

- Nest Cam Outdoor- **Best Overall Security Camera**
- Lorex Security Camera- **Best Night Vision Range**
- Ring Spotlight- **Best Smart Home Camera**
- Arlo Pro 2- **Best Weatherproof Design**
- Swann Bullet Camera- **Best Motion Detection**
- Zmodo Security Camera- **Best Wireless System**
- ADT Outdoor Camera- **Best for Monitored Security**
- Netatmo Outdoor Camera- **Best Outdoor Security Camera**
- Reolink Argus Eco- **Best Affordable Security Camera**
- Blink XT2 Camera- **Best HD Surveillance Camera**

Chapter:04
Understand the DVR,NVR interface

4.1	Define DVR/NVR
4.2	Describe the function to view & record image transmitted by a camera using DVR/NVR
4.3	DVR/NVR as interface to view & record the image transmitted by a camera
4.4	Explain the function of various blocks of DVR,NVR
4.5	Understanding the recording format of a DVR,NVR
4.6	State enabling & disabling the features of a DVR,NVR depending on the level of surveillance & requirement
4.7	Define attendance device & its features
4.8	Describe different type of attendance device & their functionalities

Learning Objectives

- After completed this session student will be able to-

- Define DVR/NVR
- Describe the function to view & record image transmitted by a camera using DVR/NVR
- DVR/NVR as interface to view & record the image transmitted by a camera
- Explain the function of various blocks of DVR,NVR
- Describe format of a DVR,NVR
- Describe enabling/disabling features of a DVR,NVR
- Define attendance device & its features
- Describe different type of attendance device & their functionalities

4.1 Define DVR/NVR

DVR : Stands for "Digital Video Recorder." A DVR is basically a VCR that uses a hard drive instead of video tapes. It can be used to record, save, and play back television programs. Unlike a VCR, however, a DVR can also pause live TV by recording the current show in real time. The user can choose to fast forward (often during commercials) to return to live television.

- **NVR**: A network video recorder (**NVR**) is a specialized computer system that includes a software program that records video in a digital format to a disk drive, USB flash drive, SD memory card or other mass storage device. An **NVR** contains no dedicated video capture hardware.

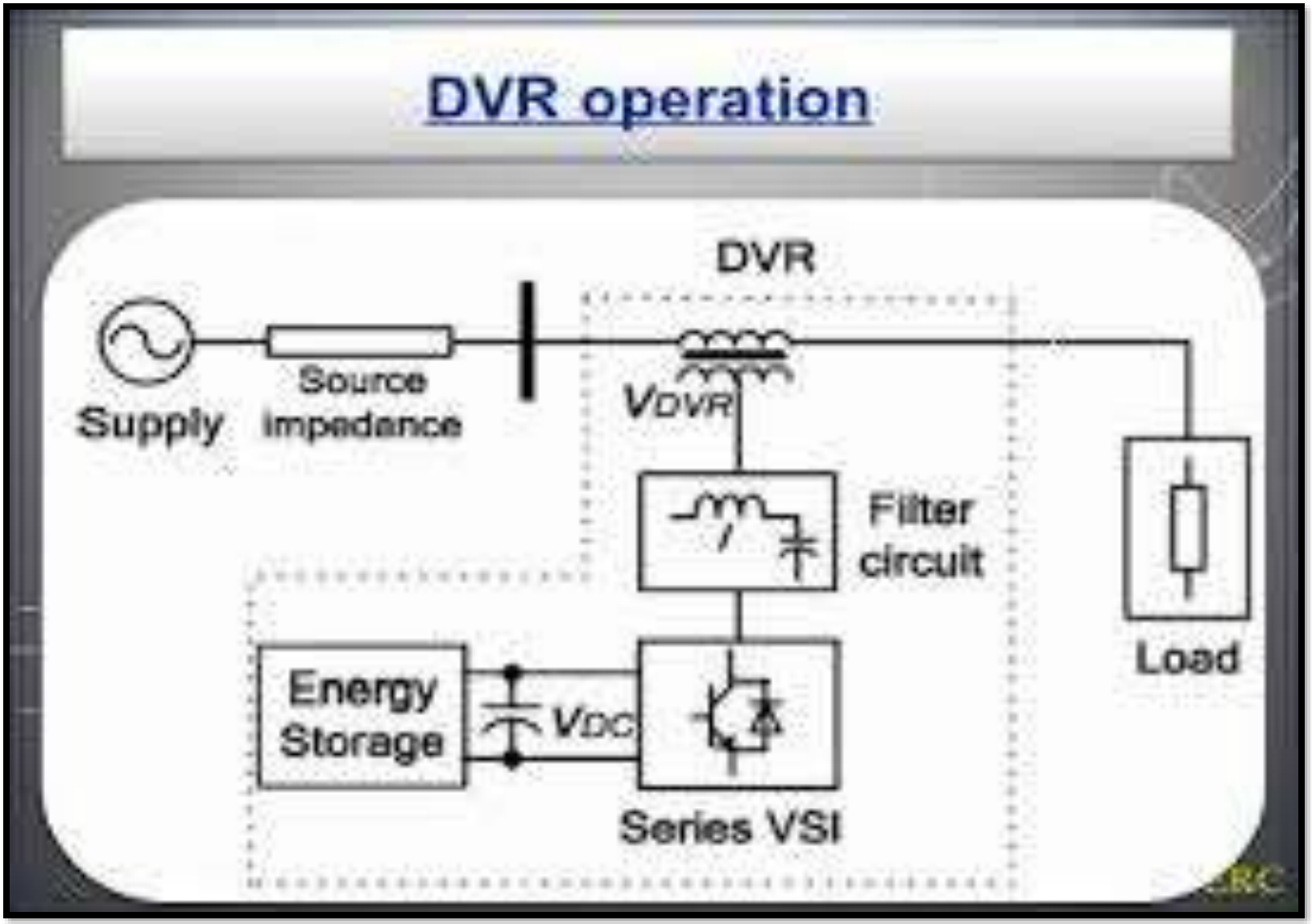
4.2 Describe the function to view & record image transmitted by a camera using DVR/NVR

- **How NVRs and DVRs Work:**

  NVRs and DVRs have the same job of saving and storing surveillance videos, but they are designed to work with different types of cameras. Both NVRs and DVRs come in form factors—stand alone appliance, a tower server, or a rackmount server.

- DVRs are used in CCTV, or analog, surveillance systems. Older systems would record video directly to tapes using a VCR; modern systems use DVRs to convert video files into digital formats, allowing you to store more videos. DVRs also give you the convenience of remote access, common on newer IP cameras and NVRs.

DVR operation



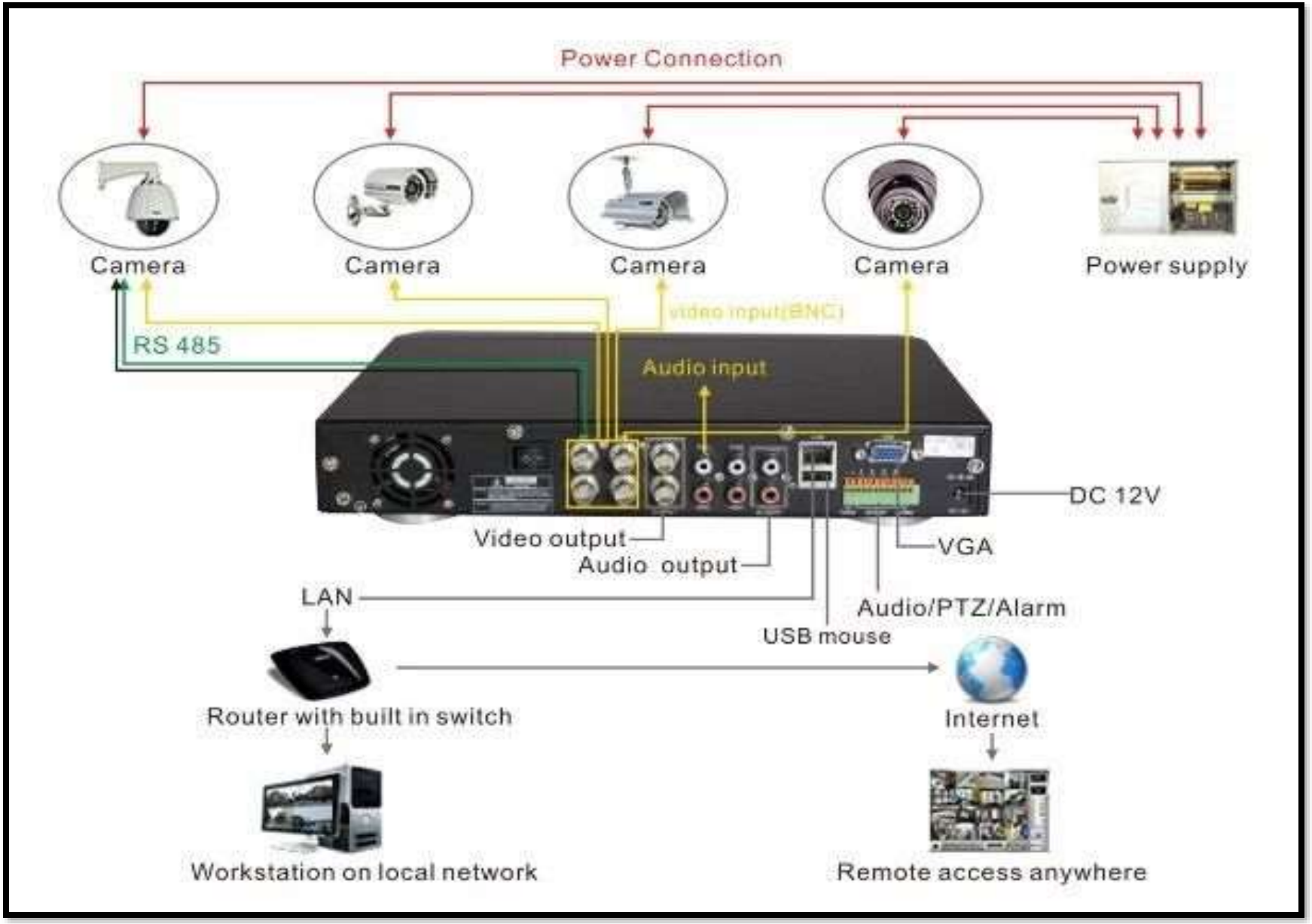


Fig: Image/video transmitted by a camera using VDR

- If we have IP cameras, we'll want a NVR instead. These recording devices use the local network to send and receive data, and are ideal for remotely monitoring your surveillance system from your computer, smart phone, or tablet. Because IP cameras are the cutting edge of surveillance technology, including a NVR in your system allows you to include new cameras with more advanced features. While most IP cameras and NVRs are compatible, you should always check with your surveillance system integrator to ensure all your products will work together properly.
- If we surveillance system has a mixture of CCTV and IP cameras, we can use specialized video encoders that allow our CCTV cameras to be connected to an NVR.

How NVRs and DVRs Can Help Us?

- NVRs and DVRs are ideal for managing multiple cameras from one central location. They can improve our surveillance system by:
- Storing larger amounts of video files than a camera can store on a local Micro SD card, allowing you to keep videos for longer periods of time or record larger HD videos
- Setting up alerts and motion detection windows, if those features aren't available through our cameras
- Reviewing and analyzing all your surveillance videos from a single interface, instead of accessing each camera's videos individually
- NVRs and DVRs are available from many major surveillance brands including Milestone, Smartvue, and QNAP.

4.3 DVR/NVR as interface to view & record the image transmitted by a camera

- A CCTV system may send digital or analog video to the recording system. A DVR receiving analog video takes two fields of the analog signal and builds one image, which is then digitized and compressed. If the video going to the DVR is digital, it is normally compressed to save storage space. Various data compression methods can be used that offer varying degrees of performance, quality, and storage economy.

DVRs can include a variety of features and capabilities such as:

- On-board software, such as video analytics;
- Image protection/authentication techniques;
- Ports for additional recording capabilities;
- Internal hard drive for video storage;
- Ability to easily search for and locate events;
- Ability to record one or more camera inputs while performing video analytics;
- Removable hard drive for archiving purposes; and
- Ability to transfer data to expandable storage systems called Redundant Array of Independent Disks (RAID) to free up recording space

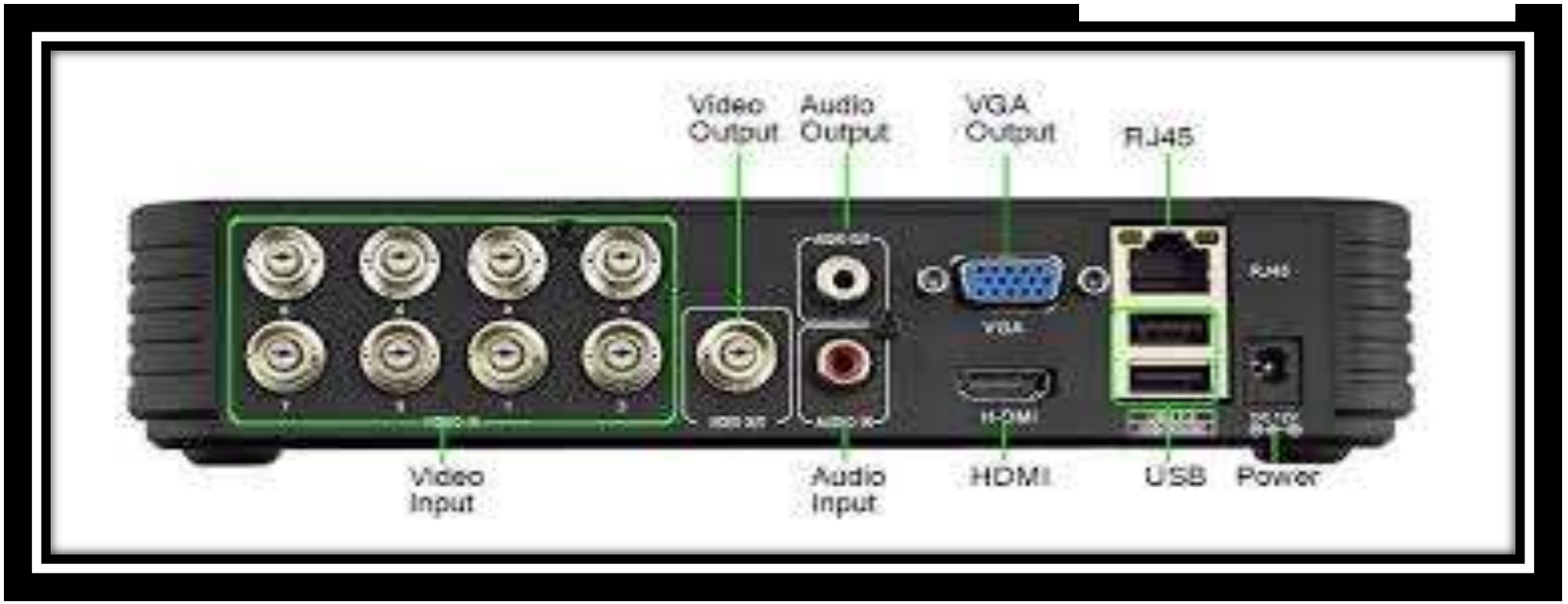
- DVRs may be classified as simplex, duplex, or triplex. Simplex DVRs cannot record while searching and viewing recorded images. Duplex systems can record while searching. Triplex DVR systems allow the operator to view recorded and live video while recording continues.
- **Recording Capacity–**Many components of a CCTV system need to be integrated and configured according to other device settings. For example, the method in which the system's cameras capture images will influence the amount of data the DVR needs to record and retain. Two important determinations include the frame/image size and the frames/images per second.

- **Frame/Image Size–**This value is the average size of each image as recorded. The actual figure will be a function of the image resolution (in pixels or TV lines) and the amount and type of compression applied to the image or video sequence.
- **Frames/Images Per Second (fps and ips**)–The number of frames/images recorded each second by a camera has a significant impact on the amount of data being generated.The preferred frame rate should be determined in the design phase. The fps or ips value can be dynamic if a camera is triggered by external alarms or motion detection. Some systems may be configured to record only when activity is detected. Other systems may provide continuous recording at a low image rate (e.g., 1 ips) until activity is detected. The system then records at a higher image rate (e.g., 12 ips) for a specified period of time.

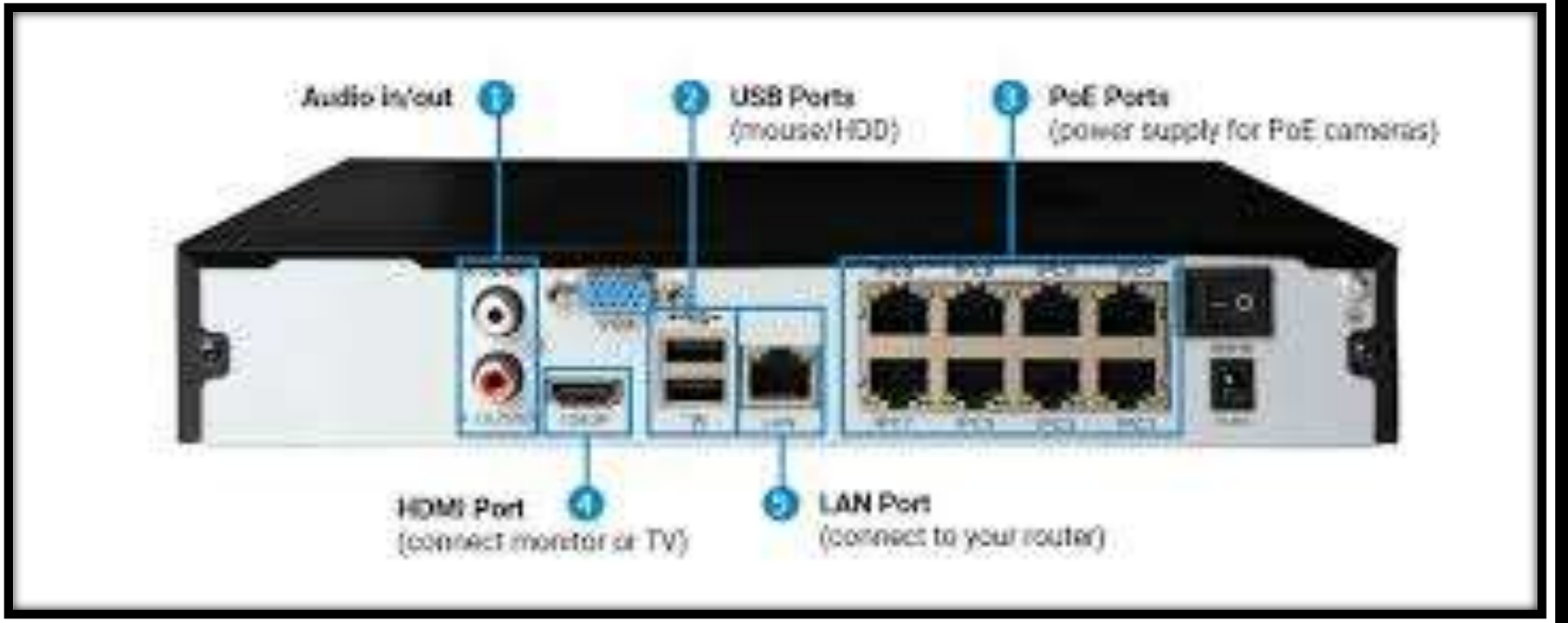
- **Recording Strategies** –Organizations may find it beneficial to customize the recording settings for various cameras. For example, the recording rates set for primary cameras (i.e., those that are viewed most frequently) may be set at a higher rate to allow quality viewing of movement. In contrast, the default setting for secondary cameras (i.e., those that are focused on less critical areas) could be set at a lower rate.

4.4 Explain the function of various blocks of DVR,NVR

DVR:



NVR:


Audio in/out
1
2
USB Ports
(mouse/HDD)
3
PoE Ports
(power supply for PoE cameras)
HDMI Port
4
(connect monitor or TV)
5
LAN Port
(connect to your router)

4.5 Understanding the recording format of a DVR,NVR

- DVRs can usually record and play H.264, MPEG-4 Part 2, MPEG-2 .mpg, MPEG-2 .TS, VOB and ISO images video, with MP3 and AC3 audio tracks. They can also display images (JPEG and PNG) and play music files (MP3 and Ogg).

- Some devices can be updated to play and record in new formats. DVRs usually record in proprietary file systems for copy protection, although some can use FAT file systems. Recordings from standard-definition television usually have 480p/i/576p/i while HDTV is usually in 720p/1080i.

There are 4 common file formats DVR / NVR systems use in video backups.

- **.dav**
  Certain models of DVR / NVR create .dav or proprietary video files by default.
- **.asf files**
  These files can be played on most computers using readily available free software from the Internet. To play an .asf file, use a third party media player such as VLC Media Player.
- **H.264 / H.265 / MPEG-4 Part 10, Advanced Video Coding (MPEG-4 AVC)**
  Advanced Video Coding formats are currently one of the most commonly used formats for recorded video.
- **.avi**
  Audio Video Interleave (.avi) is a multimedia container format by Microsoft, and can contain both audio and video data in a file that allows audio-with-video playback simultaneously. You can view .avi files in most media players.

4.6 State enabling & disabling the features of a DVR,NVR depending on the level of surveillance & requirement

Two different methods for enabling DVR

Service: a global method and a package method.

- When enabled using a global method, all DVRs are enabled for DVR service.
- When using the package method, only the DVRs that have been authorized for DVR service with a DVR package are enabled for DVR service.

Disabling the feature of DVR/NVR

- 1. **Enter the shutdown menu.**
- Menu>shutdown
- Select the **shutdown** button
- Click the Yes button
- For some models, turn off the power switch on the rear panel when the note appears.

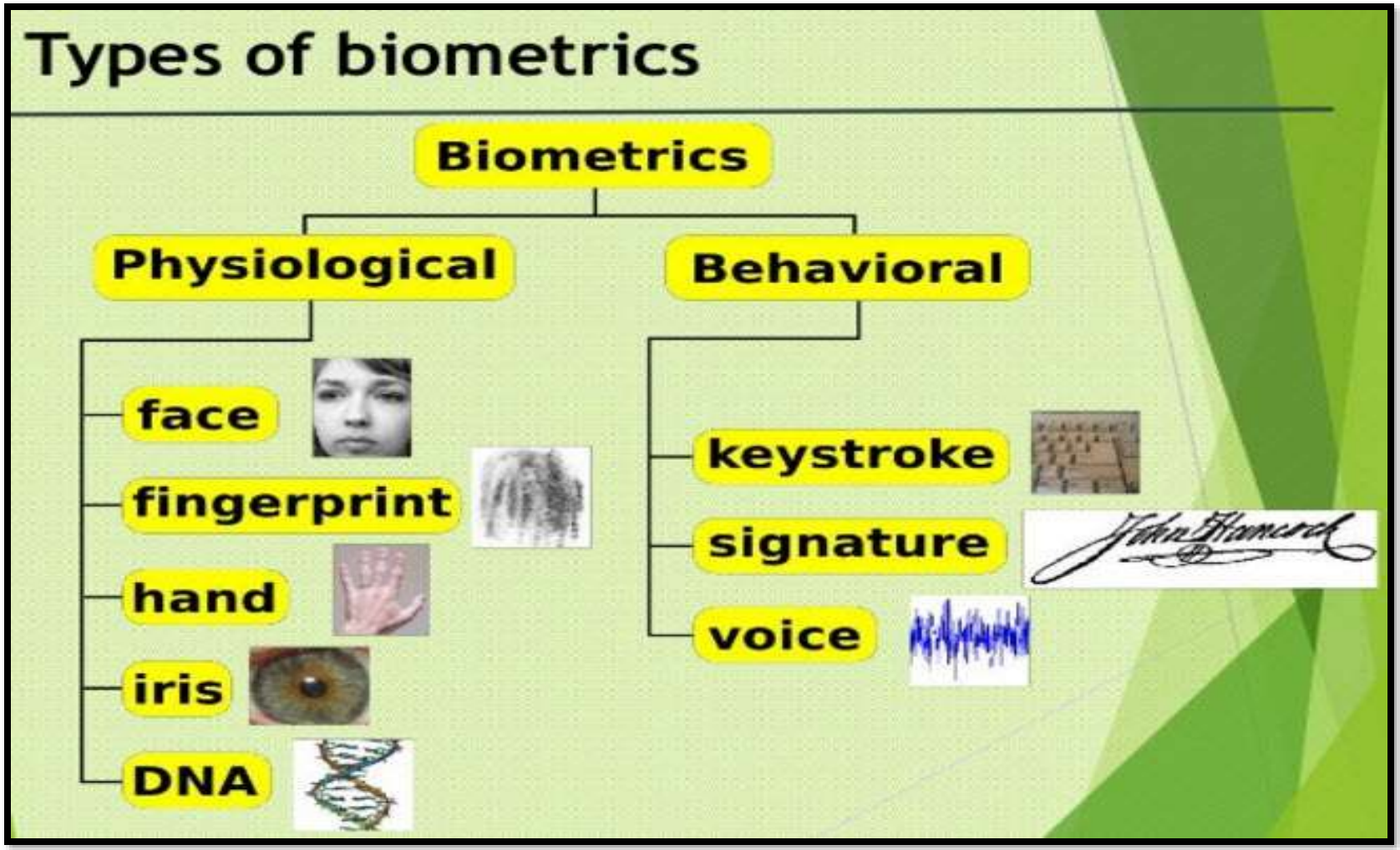
4.7 Define attendance device & its features

- The biometric attendance system will play an important role in employee attendance management, payroll generation, and monthly attendance reports. Human resources play a vital role in helping managers create effective, performance-based staff reports.

10 important features of any biometric attendance device

- Registration time
- Fingerprint template capacity
- Battery backup
- Application support
- Maintenance free
- Web portal support
- GPS for employee tracking
- Payroll management dashboard
- Wi-Fi connections
- SMS notification of check-in/check-out status

4.8 Describe different type of attendance device/biometrics & their functionalities



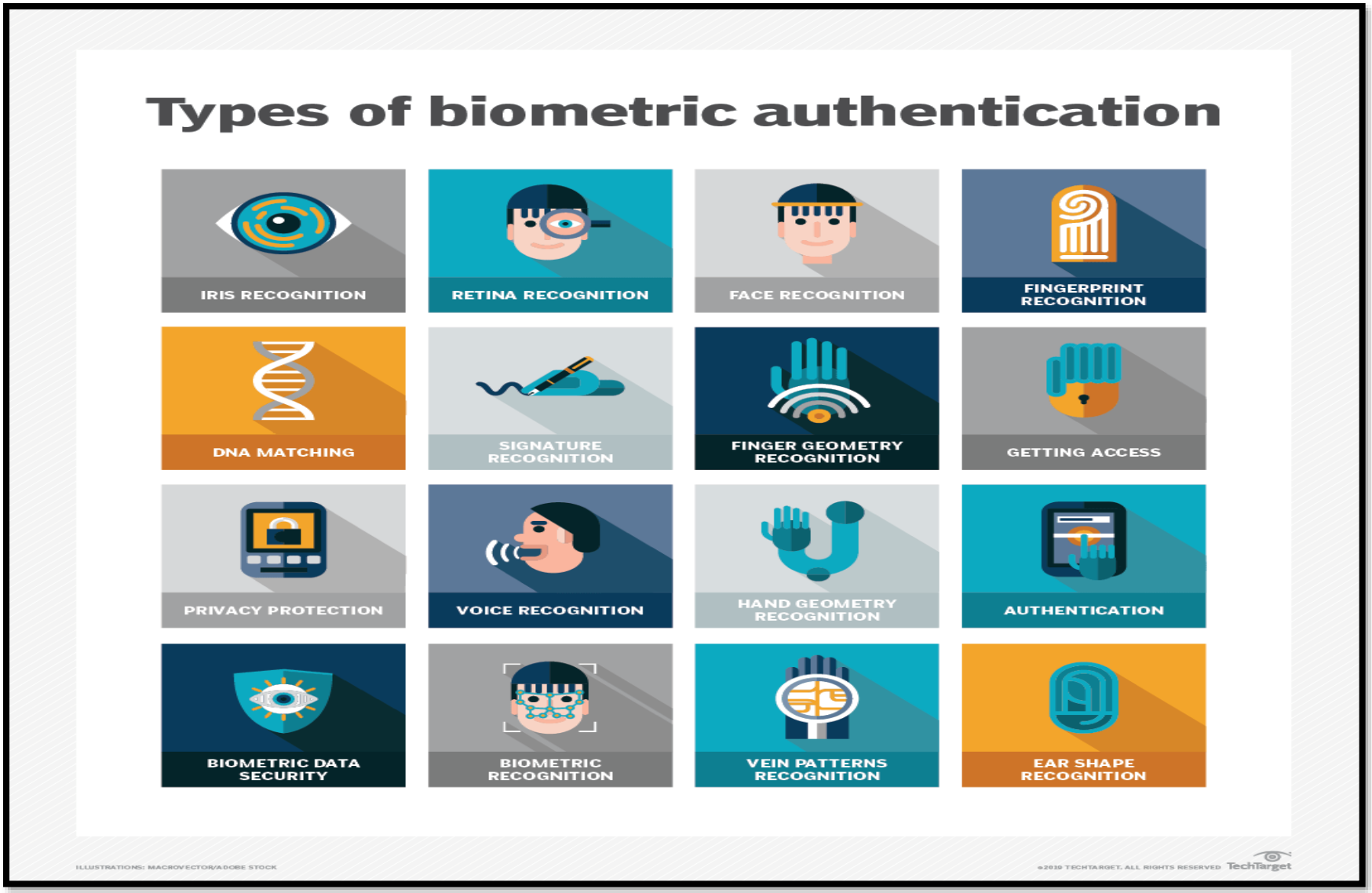

Types of biometric authentication
IRIS RECOGNITION
RETINA RECOGNITION
FACE RECOGNITION
FINGERPRINT RECOGNITION
DNA MATCHING
SIGNATURE RECOGNITION
FINGER GEOMETRY RECOGNITION
GETTING ACCESS
PRIVACY PROTECTION
VOICE RECOGNITION
HAND GEOMETRY RECOGNITION
AUTHENTICATION
BIOMETRIC DATA SECURITY
BIOMETRIC RECOGNITION
VEIN PATTERNS RECOGNITION
EAR SHAPE RECOGNITION
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Fig: Different types of Attendance machine

Functionalities

- Communication with attendance terminals (automatic, continuous or manual) – task planner, processing of data from terminals can be automatic or manual
- A graphic representation of attendance of individual employees for the whole month with the possibility to edit it
- Attendance monitoring for a selected time period – a month, a week, 2 weeks, 10 days, 28 days, etc.

- Register of breaks including the possibility to enter automatically according to set rules (after a certain interval was worked through, in set times, in relation to the worked hours)
- A three-level approval system for the edited attendance (processed, checked, approved), automatic attendance approval under set conditions
- Overtime monitoring system – decides how many hours will be transferred to the next month, paid, cancelled

- Monitoring and calculation of over fund – overtime monitoring for a longer period
- Scanner register (for attendance and access terminals) with a definition of permissible operations and implicit times of operations
- Possibility to define a group of employees authorized to use individual terminals
- Operation register (working hours interruption) – to be set by the user according to the needs of the company

- Definition of the time-bound part of wage into which the operation (working hours interruption) will be calculated
- A detailed set of the time-bound part for a time-period of a day, a month and a variable time-period
- Possibility to set an ignorance mode for timely arrivals of employees at work

- Working hours balance processing using the balance data for attendance terminals
- Time-bound part statistic processing (worked hours, absence and substitutions, etc.) for a given period
- Quick and easy access to monthly and daily attendance outputs

- Data import and export to the HR and wage system
- Automatic data synchronization with the superordinate systems (wages, HR, manufacturing, etc.)
- Data outputs, manager – a large number of predefined output sets with the possibility of user definition of outputs to be displayed
- Output set editor – creation of custom-made sets, export graphs