Palestine Polytechnic University

College of Engineering

Electrical Engineering Department

Communications & Electronics Engineering

Intelligent Fire Detection and Alarm System

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شهادة تقييم مشروع التخرج

جامعة بوليتكنك فلسطين

كلية الهندسة

دائرة الهندسة الكهربائية

Intelligent Fire Detection and Alarm System

فريق المشروع

حليمة فنون **حليمة نجاجرة**

أصالة سمامره

بناءً على نظام كلية الهندسة وإشراف ومتابعة المشرف المباشر على المشروع وموافقة أعضاء اللجنة المناقشة , تم تقديم هذا العمل الى دائرة الهندسة الكهربائية وذلك للوفاء بمتطلبات درجة البكالوريوس في هندسة الإتصالات والإلكترونيات.

توقيع المشرف

توقيع رئيس الدائرة

الإهـــــــداء

بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

"يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ"

صدق الله العظيم

الحمد لله أقصى مبلغ الحمد.. والشكر لله من قبل ومن بعد الحمد لله عن سمع وعن بصر.. الحمد لله عن عقل وعن جسد الحمد لله عن ساق وعن قدم.. الحمد لله عن كتفي وعن يدي الحمد لله عن قلبي وعن رئتي.. الحمد لله عن كلتي وعن كبدي الحمد لله عن أمي وعن أبتي.. والحمد لله عن أخوات ذا العبد....

اهداء وامتنان.. إلى أصحاب القلوب الطيّبة.. إلى أصحاب النفوس الأبيّة.. إلى أصحاب الابتسامة الفريدة.. إلى من حاربوا وساهموا في الكثير مِن أجلنا.. الى ابائنا الأعزاء....

ضحت من أجلنا بالكثير وعانت من أجلنا الكثير، علمتنا معنى الحب علمتنا معني العطف، نجدها دائماً وهي توجهنا في حياتنا أصبحنا قويات بها ، ولا نستطيع أن نوفي ولو بالبسيط من تضحياتها، ونخاف أن نفقدها ولو أرادوا أن يأخذوا عمرنا لأجلها لأعطيناهم إيّاها، لأجل ذلك نهديها كل الحب الذي في الأرض، نهديها هذا المشروع ، وكل نسمة هواءً في السماء نهديها كل ما في قلبنا نهديها كلمة شكر.الى امهاتنا الغاليات....

إلى من لهم الفضل بإرشادنا إلى طريق العلم والمعرفة إلى أساتذتنا الأفاضل، كم نحن فخورين بكم.الصداقة المبنية على العرفان بالجميل فحسب كالصورة الفوتوغرافية التي تضمحل مع الزمن... من القلب شكرا لكن صديقاتنا....

سألوني أتعشقها؟ قلت بجنون.. قالوا أجميلة هي؟ قلت أكثر مما تتصوّرون.. قالوا أين هي؟ قلت في القلب وبين الجفون.. قالوا ما اسمها؟ قلت: أمي فلسطين.. ومن سواها تستحق أن تكون....

شـــكـــر وتـــقـــديـــر

إن قلت شكراً فشكري لن يوفيكم، حقاً سعيتم فكان السعي مشكوراً، إن جفّ حبري عن التعبير يكتبكم قلب به صفاء الحب تعبيراً.

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أشكر لمن أنعم عليك، وأنعم على من شكرك، فإنّه لا بقاء للنعمة إذا كفرت، ولا زوال لها إذا شكرت.

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ونشكر طاقم دائرة الهندسة الكهربائية كلٌ بمكانه، فقد كرّسوا وقتهم وجهدهم لمساعدتنا ومساعدة زملائنا طوال فترة الدراسة.

ونشكر زملائنا وزميلاتنا الأعزاء الذين لولا وجودهم لما تذوقنا حلاوة العلم، ولا شعرنا بمتعة المنافسة الإيجابية.

أهلنا الأعزاء ... لو كتبنا كل صفحات الدنيا رسالة لكم كي نعبرّ لكم عن حبنا وتقديرنا واحترامنا لن تكفي صفحات الدنيا في أن توصل مشاعرنا إليكم ... شكرا لكم

الملخص

أنظمة التيار المنخفض هي كافة أنظمة الهندسة الكهربائية التي تستخدم تقنية اشارة التيار الكهربائي المنخفض .

في فلسطين بدأت التطبيقات الخاصة بهذه الأنظمة بالتزايد نظراً لتطور التكنولوجيا في حياتنا المعاصرة . بعض أنظمة التيار المنخفض تختص بالسلامة مثل **نظام الكشف والانذار عن الحريق** و**نظام هاتف الحريق** و**نظام الاخلاء العام**.

وبعضها تختص بالحماية مثل **نظام كاميرات المراقبة** و**نظام التحكم في بوابات الدخول والخروج** . وبعض

الأنظمة مختصة بإرسال الاشارة الصوتية مثل **نظام النداء العام** و**نظام الاجتماع الصوتي** . والبعض الاخر مختص بتوظيف التكنولوجيا في توفير الرفاهية للمستخدمين مثل **نظام جودة الصوت وكفاءته** و**نظام العرض الصوتي والمرئي** و**نظام الساعات المركزية** و**نظام التلفزيون المركزي .**

في مشروعنا سنقدم كتابا نظريا يحتوي على كافة أنظمة التيار الخفيف وأيضا يحتوي على تطبيق عملي لأحد هذه الأنظمة وهو نظام انذار الحريق لكي يعتمد كمساق نظري وعملي لطلاب الهندسة الكهربائية والحاسوب في جامعة بوليتكنك فلسطين .

Abstract

Low current systems are Electrical Engineering systems that operate and function using low current signal.

The applications of low current systems are increasing in Palestine due to development in technology. Some of these systems specialize in a human safety such as **Fire Alarm System**, **Fire Telephone System** and **Voice Evacuation System**. Some of these systems specialize in security such as **CCTV System** and **Access Door Control System**. Some of these systems specialize in voice transferring such as **Public Address System** and **Audio Conference System**. Some of these systems specialize to employ the technology in the human luxury such as **Professional Audio System**, **AV System**, **MATV/IPTV System** and **Master Clock System.**

In this project, will provide a theoretical book containing all low current systems. We will present a practical DEMO for Fire Alarm Systems to be as one of the elective courses for Electrical and Computer Engineering students.

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List of Abbreviations

PPU	**Palestine Polytechnic University**
CPU	**Central Processing Unit**
MCP	**Manual Call Point**
DEMO	**Demonstration**
MIC	**Microphone**
IR	**Infrared**
FIFO	**First In First Out**
LIFO	**Last In Last Out**
MHZ	**Mega Hertz**
VHF	**Very High Frequency**
LED	**Light Emitting Diode**
CCTV	**Close Circuit Television**
PTZ	**Pan Tilt Zoom**
CCD	**Charge Coupled Device**
CIMOS	**Complementary metal oxide semiconductor**
IP	**Internet Protocol**
WAN	**Wide Area Network**
LAN	**Local Area Network**
PC	**Personal Computer**
COAX	**Coaxial Cable**
PAL	**Phase Alternating Line**
NTSC	**National Television Standards Committee**

SECAM	**Séquentiel couleur àmémoire**
NVR	**Network Video Recorder**
DVR	**Digital Video Recorder**
HVR	**Hybrid Video Recorder**
WDR	**Wide Dynamic Range**
HDD	**Hard Disk Drive**
CAT6	**Category 6**
PAS	**Public Address System**
PA	**Public Address**
DVD	**Digital Video Disc**
CD	**Compact Disc**
USB	**Universal Serial Bus**
AM	**Amplitude Modulation**
FM	**Frequency Modulation**
VA	**Voice Alarm**
S/W	**Software**
PSU	**Power Supply Unit**
VAS	**Voice Alarm System**
MCS	**Master Clock System**
DST	**Daylight Saving Time**
NTP	**Network Time Protocol**
GPS	**Global Positioning System**
NENA	**National Emergency Number Association**
PTP	**Precision Time Protocol**
SNTP	**Simple Network Time Protocol**

PoE	**Power over Ethernet**
VAC	**Volt Ac**
CAT5	**Category 5**
CAT6	**Category6**
AV	**Audio Visual**
LCD	**Liquid Crystal Display**
DLP	**Digital Light Processing**
XGA	**Extended Graphics Array**
MATV	**Master Antenna Television**
IPTV	**Internet Protocol Television**
IF	**Intermediate Frequency**
RF	**Radio Frequency**
LNB	**Low Noise Block**
TV	**Television**
VOD	**Video On Demand**
QPSK	**Quadrature Phase Shift Keying**

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CHAPTER ONE:

INTRODUCTION

In this chapter, we describe the objectives of the project, including a discussion of the related work, challenges and requirements:

1.1- Main Idea:

- To author a low current handbook, to be as one of the elective specialization courses for Electrical and Computer Engineering students.

1.2- Objectives:

- To explain low current systems to students in University and its applications in Palestinian market.

1.3- Outline:

This report is structured as follows:

Chapter one includes the introduction, provides a general overview about the project, its main idea, objectives, plan. In chapter two, we discuss the audio conference system. In chapter three, we discuss the CCTV system. In chapter four, we discuss the axis door control system. In chapter five, we discuss the audio system. In chapter six, we discuss the master clock system. In chapter seven, we discuss the AV system. In chapter eight, we discuss the TV system.

CHAPTER TWO:

AUDIO CONFERENCE SYSTEM

2.1- Audio Conference System:

- Is the live exchange and mass articulation of information among several persons and machines remote from one another, but linked by a telecommunications system.
- Is used to facilitate meetings between several parties by using telephone / MIC Instead of in person.
- The parties joining the call are known as the participants.

2.2- Uses:

Audio conference systems are used for small- and medium-sized businesses. The use of teleconferencing is growing by leaps and bounds. It is one of the best communication alternatives employed by company directors, managers and other business executives. This communication system saves the business organizations travel and meeting costs. In order to introduce a project to the executives, the managers or directors of an organization may communicate through phone conferencing right from their desks. Further, such systems offer several different applications, including:

- Discussing customized projects one-on-one with clients and team members.
- Coordinating marketing, advertising or other company activities and efforts with remote employees.
- Sharing company numbers or plans with key stakeholders or investors.
- Facilitate the communication and exchange of information between traveling company members about new developments.
- Allows improvement of productivity and business a competitive edge.

2.3- Pros and Cons of Audio-Conferencing Systems:

Establishing an audio conference system provides your business with advantages, which include:

- **Quality:** the quality of exchanged audio data is high.
- **Scalability:** there is flexibility in the design that allows different ranges of site (small, medium & large).

- **Usability:** ease of usability**.** Any person can operate the system without troubles and difficulties.
- **Saving of money and time:** Audio conferencing can be a practical alternative to business trips. People don't have to travel around the country or the world to attend a meeting or seminar. Hence, Audio conference systems save a lot of time spent money.

However, **with Audio conference systems, the communication is only verbal:** The communication means doesn't support visual images &non-verbal data.

2.4- International Brands of Audio Conference Systems:

The well-known international suppliers of audio conference systems are:

- TOA (JAPAN)
- BOSCH (GERMANY)
- TELEVIC (SPAIN, BELGIUM)
- AVAYA (USA)
- POLYCOM (USA)

2.5- Types of Audio Conference Systems:

Based on the means of communication between the audio conference system devices, there are three types of Audio conference systems:

a- Wired.

b- Wireless Infrared (IR).

c- Wireless Infrared (IR) with voting function.

In the following sections, we will explain and provide details about each type:

2.5.1- Wired Audio Conference System:

2.5.1.1- Definition:

A wired Audio Conference system is a system that allows a meeting between several parties over the wired MIC instead of in person.

In this section, we will discuss the system components and provide an example from TOA JAPANESE brand.

2.5.1.2- System Components:

1-CHAIRMAN UNIT: is a MIC. Unit for the manager of meeting. It has buttons (Talk, priority, etc.).

Figure 2.1 Wired Chairman Units

Example of TOA chairman unit: As shown in the figure, the unit has two buttons:

a. TALK: when pressed, the managers' voice will be heard by persons through built in speaker inside this unit or outside speakers.

b. PRIORITY: when pressed, the manager silent all other MICs, which may be on air.

Figure 2.2 TOA Wired Chairman Unit

2- DELEGATE UNIT: is MIC. Unit for the users of meeting, it has one button:

a. TALK: when a user press of it, then his voice will hear by persons through built in speaker inside this unit or outside speakers.

TOA BOSCH

Figure 2.3 Wired Delegate Units

Example of TOA delegate unit: As shown in the figure, the unit has one button, TALK, when pressed, then the users' voice will be heard by all persons through built in speaker inside this unit or outside speakers.

Figure 2.4 TOA Wired Delegate Unit

3- PORTABLE MIC: is a MIC connected to chairman and delegates units. It is of two types: a - LONG MIC. b - SHORT MIC.

Figure 2.5 Conference Long &Short Mics.

4- CENTRAL UNIT: is the unit that controls and manages all components of the audio conference system.

Figure 2.6 Wired Central Unit

5- EXTENSION CORD: is a cable with all its accessories that connects the audio conferences components. There are two types of it: a- 2m extension cord. b -10m

Figure 2.7 Extension Cord

Application:

YAMAMAH CEMENT PROJECT –RIYADH/SAUDI ARABIA:

2.5.2 - Wireless Audio Conference System:

2.5.2.1- Definition:

A wireless Audio conference system allows a meeting between several parties over the wireless MIC Instead of in person.

In this part we will discuss the system components and provide an example from TOA JAPANESE brand.

2.5.2.2- Advantages of the Wireless IR Conference System:

- Easy and quick set-up (no troublesome wiring).
- Visually attractive in a tidy manner.
- Flexible number of participants.
- Easy storage.
- Elegant design.
- Secured system (no crosstalk / no eavesdropping).

Figure 2.8 Radio Waves Radiation

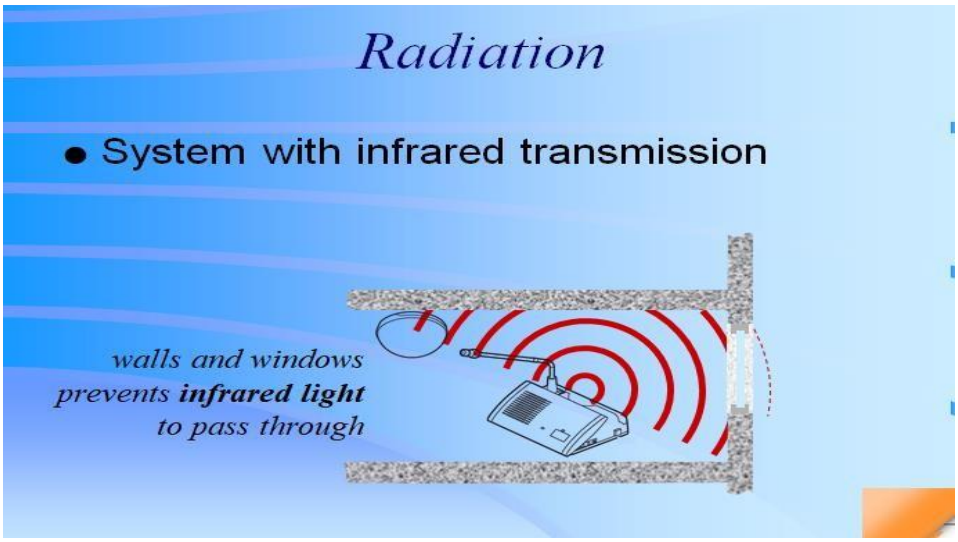

Figure 2.9 Infrared Transmission Radiation

2.5.2.3- System components:

1-CHAIRMAN UNIT: is a MIC unit designed for the manager of a meeting. It has buttons (Talk, priority, etc.).

Figure 2.10 Wireless Chairman Unit

Example of TOA chairman unit: It has two buttons:

a. TALK: when pressed, the voice will be heard by persons through built in speaker inside this unit or outside speakers.
b. PRIORITY: when pressed, the manager can silent all other MICs which may be on air.

2- DELEGATE UNIT: is a MIC unit designed for the meeting participants. It has one button, TALK, when pressed, the users' voice will be heard by persons through built in speaker inside this unit or outside speakers.

Figure 2.11 Wireless Delegate Unit

3- PORTABLE MIC: is a MIC connected to chairman and delegates units.

4- CENTRAL UNIT: is a unit that controls and manages all audio conference components.

Figure 2.12 Wireless Central Unit

 Priorities:

- FIFO (first-in-first-out)

- LIFO (last-in-first-out)

- Priority fixed for the first unit, and last-in-first-out priority for all other subsequent units

  Example of fixed priority for the first unit, and last-in-first-out priority for all other subsequent units (number of open microphones=2)

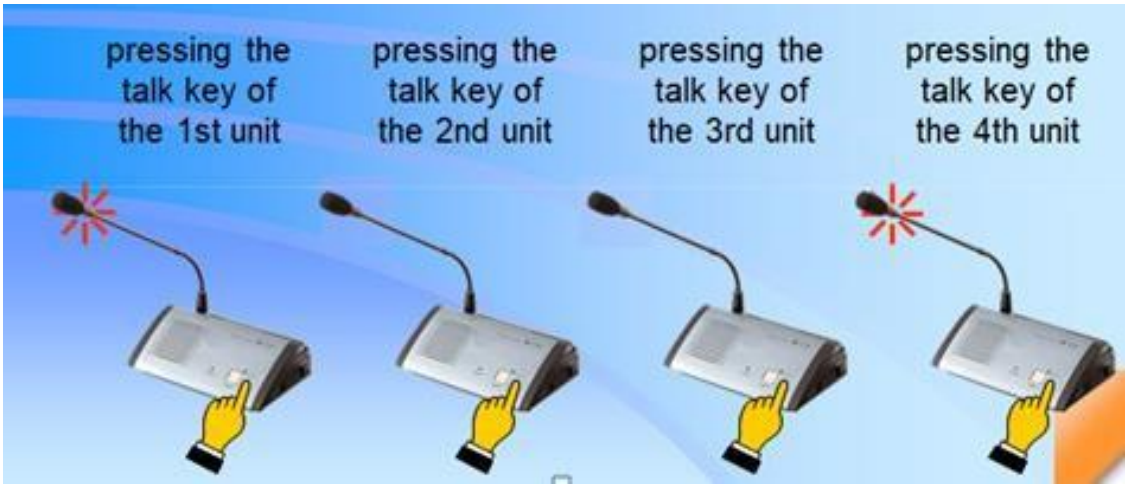

Figure 2.13 Priority Fixed For the First Unit, And Last-In-First-Out Priority

5- INFRARED TRANSCEIVER UNIT: is an Infrared Transmitter/Receiver of the Infrared Conference system. Since the system is cordless, it can be easily installed and removed.

- Unobtrusive Design.
- Characteristics:
  - Transceiving radius :7 m
  - Transceiving angle:150 degree
  - Coverage area=150m^2 □ Placing (spacing) of:
  - Safe coverage in the room of 900 m^2(30m by 30 m) with 16 TS-905

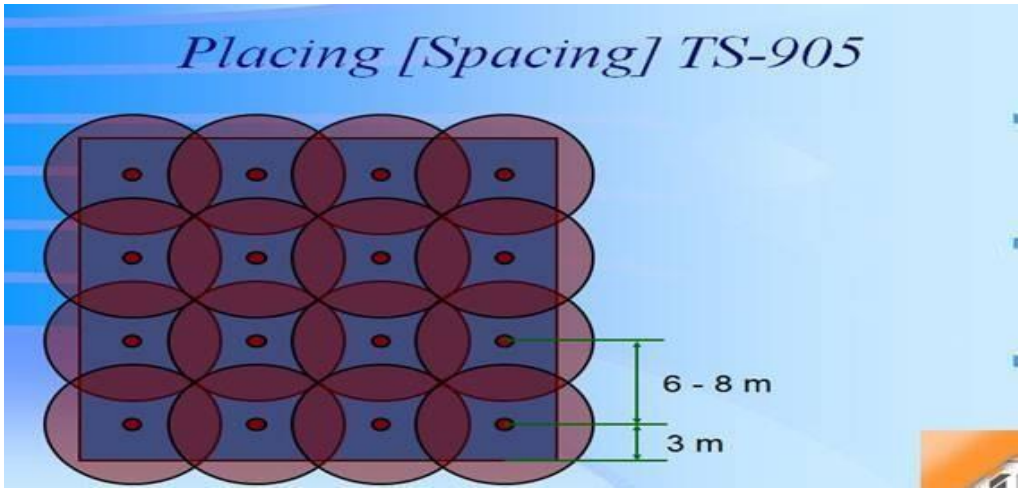

Figure 2.14 Placing (Spacing) IR Transceiver

- Receiving radius at desk height:

Figure 2.15 Effect of Distance and High in Coverage Area

6- CABLE SPLITTERUNIT: is a distributor that can work in the frequency range of 1.6 to 1000 MHz {except 50 to 70 MHz; because this range is an amateur radio frequency band in the lower very high frequency (VHF) spectrum, this spectrum has a unique character and because very few countries have an allocation there, very little dedicated commercial amateur equipment is available}. Power passing type permits easy power supply.

Figure 2.16 Cable Splitters

7- ACCESSIORIES: are components for the system, examples are:

- 19” mounting brackets MB-TS900.
- AC-mains adapter AD-910.

- Battery charger BC-900.
- Battery BP-900.



Figure 2.17 Accessories BP-900BC-900MB-TS-900

- Battery BP-900:
  - Lithium-ion battery.
  - Providing 10 hours operation.
  - No memory effect.
- Battery Charge BC-900
  - Charging 8 batteries within 5 hours.

2.5.2.4- Communication Test Function:

- The IR conference system provides a function to test the communication between the central unit and the chairman and delegate units.

- This supports the installation of the system.

Figure 2.18 Communication Test Function

- Keep the check button pushed when switching on the unit, the battery LED indicates that the check function is active.
- Flashing of the chairman and delegate unit's microphone LED's confirms that the signal was received.
- Continuous illumination of the LED confirms bi-directional communication.

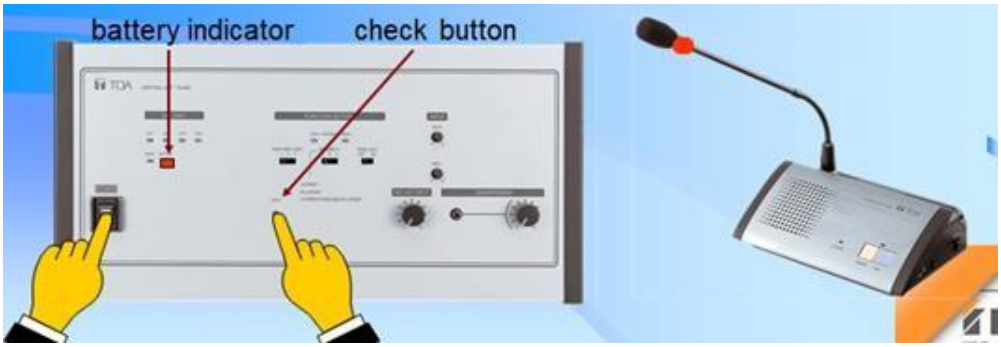

Figure 2.19 IR Communication Between Central Unit & Conference Mic.

2.5.3- Wireless audio conference system with voting function:

2.5.3.1- Definition:

Wireless Audio conference systems with voting function are used to allow a meeting between several parties over a wireless MIC instead of in person with extra voting choice function.

In this part we will discuss the system components and provide an example from TOA JAPANESE brand.

2.5.3.2- System Components:

1-CHAIRMAN UNIT: is a MIC unit designed for the manager of a meeting. It has buttons (Talk, priority, voting, etc.).

Figure 2.20 Wireless Chairman Unit with Voting Function

Example of TOA chairman unit**:** It has the following buttons:

a . TALK: when pressed, the managers' voice will be heard by all persons through built in speaker inside this unit or outside speakers.

b . PRIORITY: when pressed, the manager silent all other MICs which may be on air.

c . VOTING:

Figure 2.21 Wireless Chairman Unit with Voting Buttons

2- DELEGATE UNIT: is a MIC unit designed for the meeting participants. It has (talk, voting) buttons:

a. TALK: when pressed, the voice will have heard by all other participants through built in speaker inside this unit or outside speakers.

b. VOTING:

Figure 2.22 Wireless Delegate Unit with Voting Function

3- PORTABLE MIC: is a MIC connected to chairman and delegates units in some brands.

4- CENTRAL UNIT: is a unit that controls and manages all the audio conference components.

 For the checking process, the display indicates:

Figure 2.23 Wireless Central Unit with Voting Function

 Providing 2 channels e. g

- Main channel for the original language.

- Sub channel for a foreign language with interpreter.

5- **INFRARED TRANSCEIVER UNIT:** is an Infrared Transmitter/Receiver of the Infrared Conference system. Since the system is cordless, it can be easily installed and removed.

6- **CABLE SPLITTERUNIT:** is a distributor that can work in the frequency range of 1.6 to 1000 MHz {except 50 to 70 MHz; because this range is an amateur radio frequency band in the lower very high frequency (VHF) spectrum, this spectrum has a unique character and because very few countries have an allocation there, very little dedicated commercial amateur equipment is available}. Power passing type permits easy power supply.

7- **ACCESSIORIES:** are some components in the system as the following:

- 19” mounting brackets MB-TS900.
- AC-mains adapter AD-910.
- Battery charger BC-900. □ Battery BP-900.

2.5.3.3- Main channel & Sub Channel In Central Unit And Conferences Mic.:

- Channel individually selectable at each chairman and delegate unit.

Figure 2.24 Main & Sub Channel

CHAPTER THREE:

CLOSE CIRCUIT TELEVISION

3.1 Definition:

CCTV system is a system that uses video cameras to transmit a signal to a specific place, on a limited set of monitors.

3.2 System components:

The system is comprised of the following components.

A- Camera:

Camera System Classifications:

1- Installation location:

Indoor Camera:

- Is the camera that is often installed inside the closed area.

Outdoor Camera:

- Is the camera that is often installed outside the closed area, in order to hold out volatility in temperature, humidity, dust & rain.

-

Figure 3.1 Indoor & Outdoor Camera

2- Camera shape:

Dome Camera:

Is the camera that looks like a dome; it is commonly installed in the ceiling inside building. Some of its features are:

- Cheap.
- Light Weight. o Small Size. o Elegant Shape.

Figure 3.2 Dome Camera

Box Camera:

Is the camera that looks like a box. It is mounted in the ceiling or wall inside and outside building. Some of its features are:

- It can be Weatherproof.
- User for Indoor & Outdoor Applications. o Made of Strong Material. o Made of Plastic or Metal.

Figure 3.3 Box Camera

- Bullet Camera:

Is a type of cameras that is typically small and shaped like a rifle bullet shell or lipstick case.

Figure 3.4 Bullet Camera

3- Lighting:

- **Day & Night camera:**

  Is a camera that is ideal in high or low light conditions. It needs IR illuminator in the darkness case.

- **Infrared IR Camera:**

  Is a camera that is ideal in all light conditions. It uses built in LED infrared lights. The infrared light spectrum is not visible by the human eye, but can be seen by the camera

Figure 3.5 Infrared IR Camera

4- Camera Movement:

□ Fixed Camera:

After installation, fixed CCTV cameras remain affixed in one direction at all times. These cameras provide constant coverage of a specific area. Fixed cameras are often visible, enabling them to help deter illicit activity.

Additionally, many fixed cameras can be used with interchangeable lenses and housings to suit a particular surveillance scenario. For example, fixed dome cameras are popular for their durability.

Figure 3.6 Fixed Camera

□ Pan Tilt & Zoom (PTZ) Camera:

Pan, tilt and zoom (PTZ) cameras cover more ground than fixed cameras and are quite flexible in their coverage. Pan and tilt functions enable the camera to cover a larger area than fixed cameras. Zoom capabilities allow the viewing of fine details, while preserving the ability to zoom out to a wide field of view. Often housed in glass domes, PTZ cameras are often smaller, more discreet and aesthetic than their fixed counterparts. PTZ cameras can be wall or ceiling mounted, and also come in pendant models.

Figure 3.7 PTZ Camera

5- Wiring:

Analog Camera:

Is a camera that has analogue security system begins with a CCD image sensor and then converts the images into a digital form for processing. But before it can transmit the videos, it needs to convert back in an analogue form. Thus, Analogue devices such as video recorder and monitor, can receive the videos.

Further, the camera uses coaxial cable.

Figure 3.8 Analog Camera

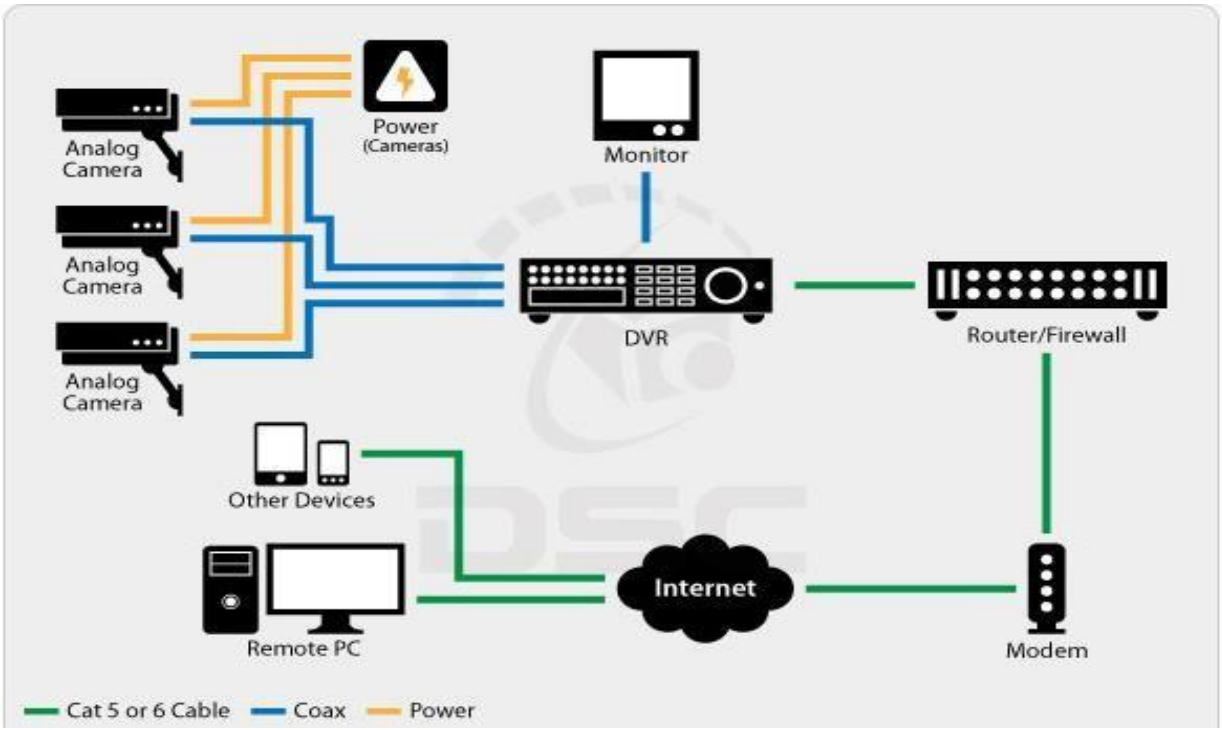

Figure 3.9 Analog Camera System

IP Camera:

Is a camera that has an IP security system that broadcasts video as a digital stream over an IP network such as a WAN, LAN, Internet or Intranet. IP cameras combine the capabilities of cameras and some PC functionalities so that they don't require a direct connection to a PC to operate. This means that an IP Camera can be placed anywhere within a network.

Further, the camera uses the Ethernet data cable.

Figure 3.10 IP Camera

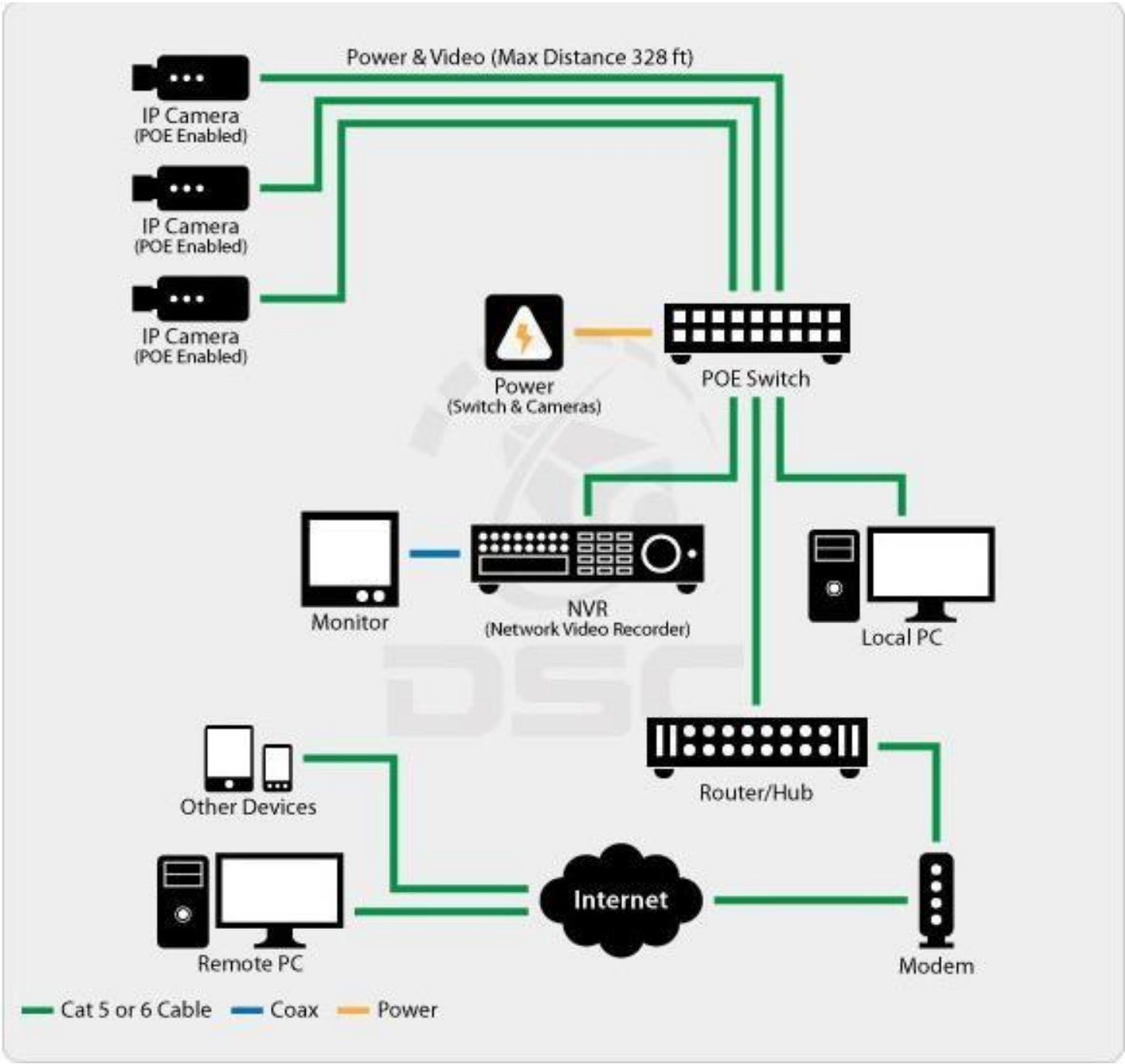

Figure 3.11 IP Camera System

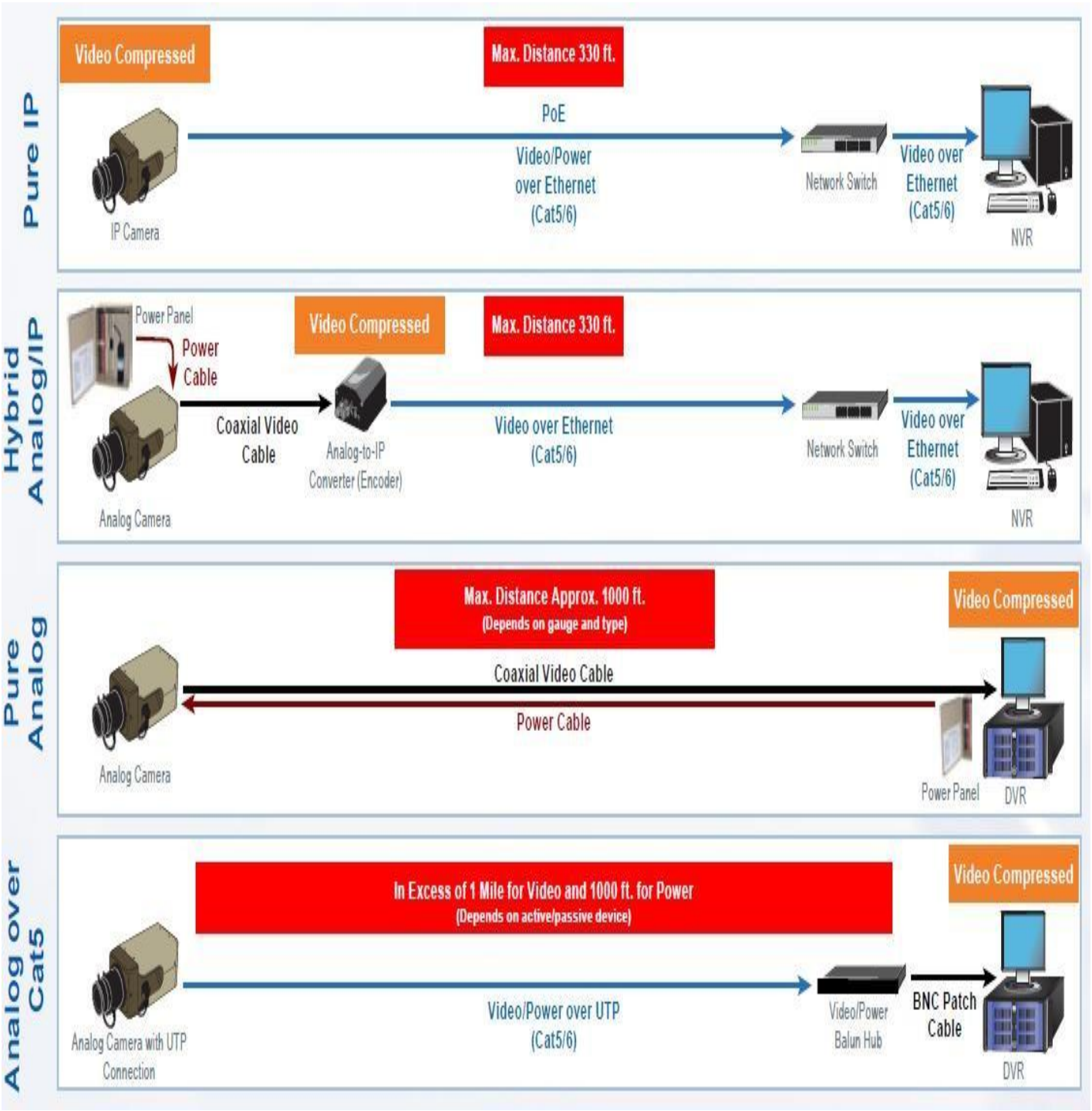

Figure 3.12 Camera System Wiring

Table 3.1 IP Camera vs Analog Camera

Technical Comparison between IP and Analog cameras

	IP Camera	Analog Camera
Video Quality	Higher than analog/Megapixel	Lower than IP/TVL lines
Cable Infrastructure	Can Use existing networking cable cat#6	RG#59U
Cable Distance	We use cat#6 if the distance less than 90 for longer OFC is recommended	80 meter of standard coaxial 150 meter on RG 6 till 3000 meter using video balun
Fault tolerance	in case of network failure the whole system can go down	Limited to failure of individual component
Security	Data Encrypted at camera so threat minimum	Data Encryption done at DVR so less secure system
Maintenance	Required Skilled IT Staff	Any body can Manage
No# of camera	Less compared to Analog as Megapixel camera have more FOV	more compared to IP
Wireless	Very easily compatible but bandwidth is a issue	Have to use convertor
Installation	Required some skilled manpower	Little to do network so anybody can do
Compatibility	Compatibility of camera and NVR will require some research	Any camera is compatible with DVR
Scalability	Very easy only plug and play will require	May require additional hardware
Cost	about 5 times Analog	about 1/5 cost of IP

6- Industrial Environment:

Industrial Camera:

Is a camera which has been designed to high standards with repeatable performance and robust to withstand the demands of harsh industrial environments.

Figure 3.13 Industrial System

Non-Industrial Camera:

Is a camera which has been designed to operate in normal environments.

Television Standards:

1- PAL (Phase Alternating Line):

Was developed in 1967 by the United Kingdom & Germany. PAL standard utilizes a wider channel bandwidth than NTSC which allows for better picture quality. Its Parameters are:

- Frame rate: 25 Hz
- Lines: 525
- Picture resolution: 720 x 576; 704 x 576; 352 x 576; 352 x 288

2- NTSC (National Television Standards Committee)

Is the oldest existing standard, developed in the USA and first used in 1954. It's parameters are:

- Lines: 625
- Frame rate: 29.97 Hz
- Picture resolutions: 720 x 480; 704 x 480; 352 x 480; 352 x 240

3- SECAM (Sequential couleurmmoire):

Was developed in France in 1967. SECAM uses the same bandwidth and resolution (720x576) as PAL but transmits the color information sequentially. It is known that only a handful of products support SECAM.

Camera Lens:

Basic Lens Action:

- The lens work by refracting or bending light beams.
- Refraction occurs because light travels slower in the dense glass medium.
- Focal Length - A measurement expressed in millimeters. It is the distance from the optical center of the lens to the front of the imager sensor.
-

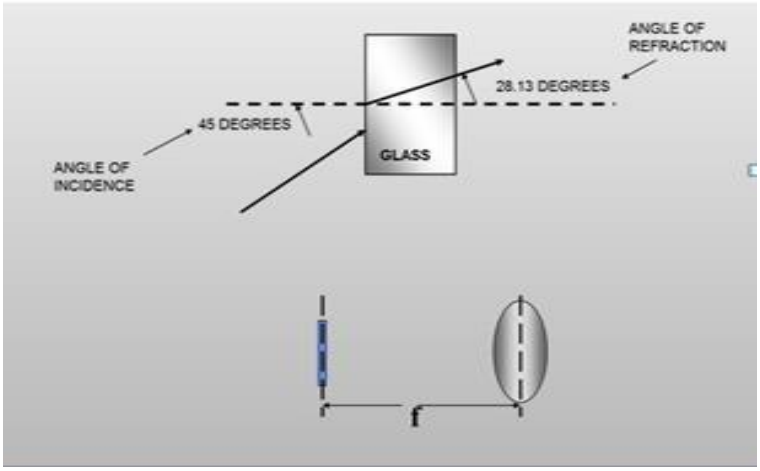

Figure 3.14 Basic Lens Action

 Spherical **& aspherical lenses:**

- Spherical lenses are designed such that light passing through the glass is refracted and it crosses an axis for prime focus.

- Spherical aberration occurs when light rays from outer edges are refracted more than those that pass near the center of the lens.

- Allow correct refraction from outer edge of the lens enabling a wider aperture and the camera to operate in lower light conditions.

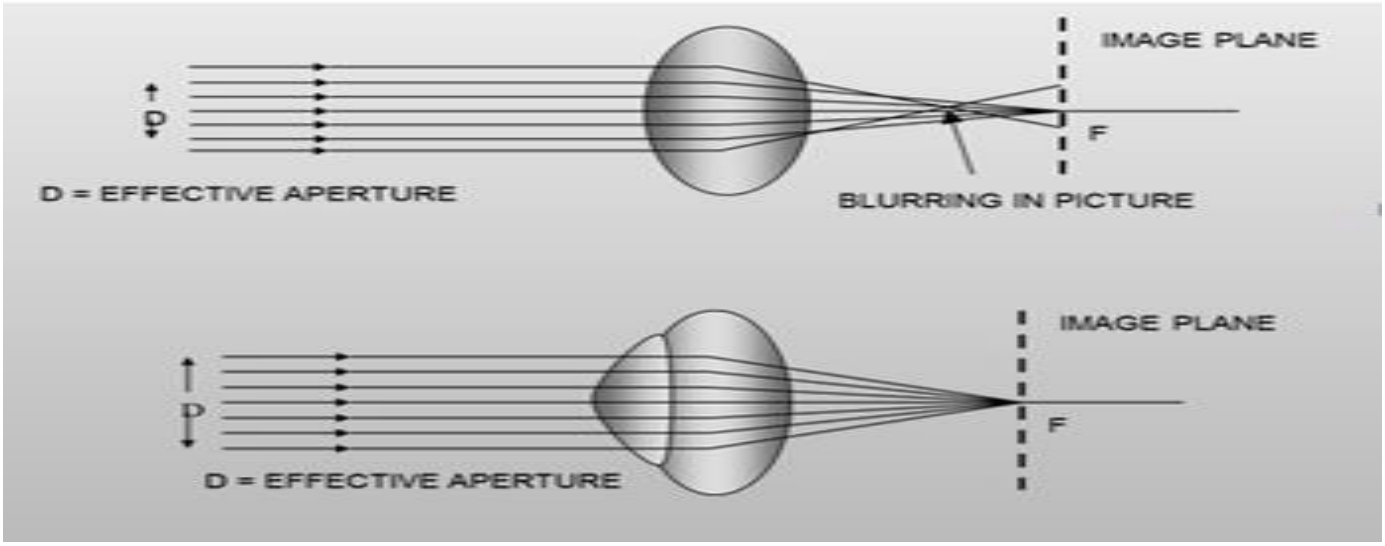

Figure 3.15 Spherical & Aspherical Lens

Figure 3.16 Lens Comparison

Type of Lens:

- **Fixed lens:**
- Is a lens are those lenses where lens size doesn't change, all we can do is focus, we can't zoom in or zoom out.
- Common sizes are -12mm -08mm -06mm -04mm -3.6mm -

2.8mm.

Figure 3.17 Fixed Lens

- Varifocal lens:

- In Varifocal lens size can be changed during the installation process and Zoom out is possible.

- Common Sizes available are: 2.5mm ~8mm, 3.0mm~12mm ,5.0mm~50mm.

- Focal Length can be adjusted by 3 methods:

1- Manual (No Cable): to be used only indoors and where the lighting condition is always the same.

2- Audio lris (with a Cable): Adjusts automatically to allow more or less light to be received by the CCD chip in the Camera.

3- Motor Zoom (with cable and telemetry receiver is needed): to be found mostly with pant and Tilt systems. The zoom and focus can be manually controlled

Figure 3.18 Varifocal Lens

 F-number & F-stop:

- F-number: the f-number of a lens defines its light gathering ability. The more light it can gather, the better the picture quality. lenses with low “f” numbers such as f/1.2 or f/1.4 pass more light than lenses with light “f” numbers a lens with a low “f” number is also known as a “fast” lens.

- F-stop: indicates the speed of a lens the smaller the number, the greater the amount of light that passes through the lens- allowing for better low light camera performance.

- Aperture size: controlled by the iris, increasing the f-stop decreased the amount of light reaching the pick –up device.

-

Table 3.2 Relation between F# and Light Transmission

LENS F #	1.0	1.4	2.0	2.8	4.0	5.6	8.0	C
LIGHT TRANSMISSION	1	1/2	1/4	1/8	1/16	1/32	1/64	0

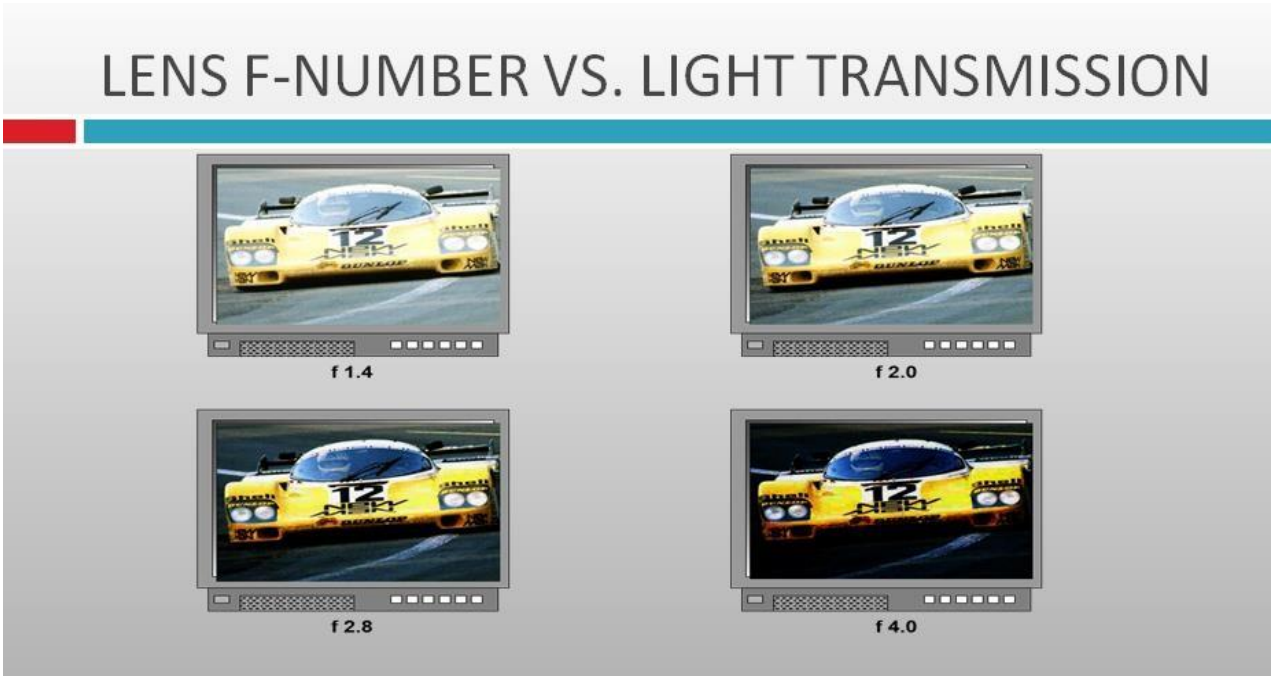

Figure 3.19 Lens F # VS Light Transmission

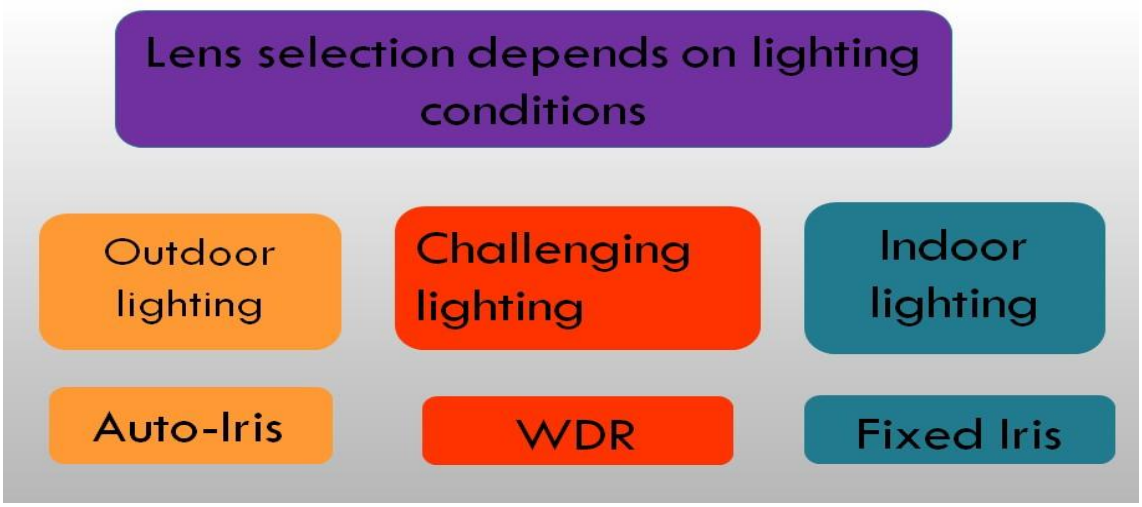

Figure 3.20 Lens Selection

The Effect of WDR In A Camera:

Dynamic Range is the difference in light levels in an image, between the darkest and the brightest areas.

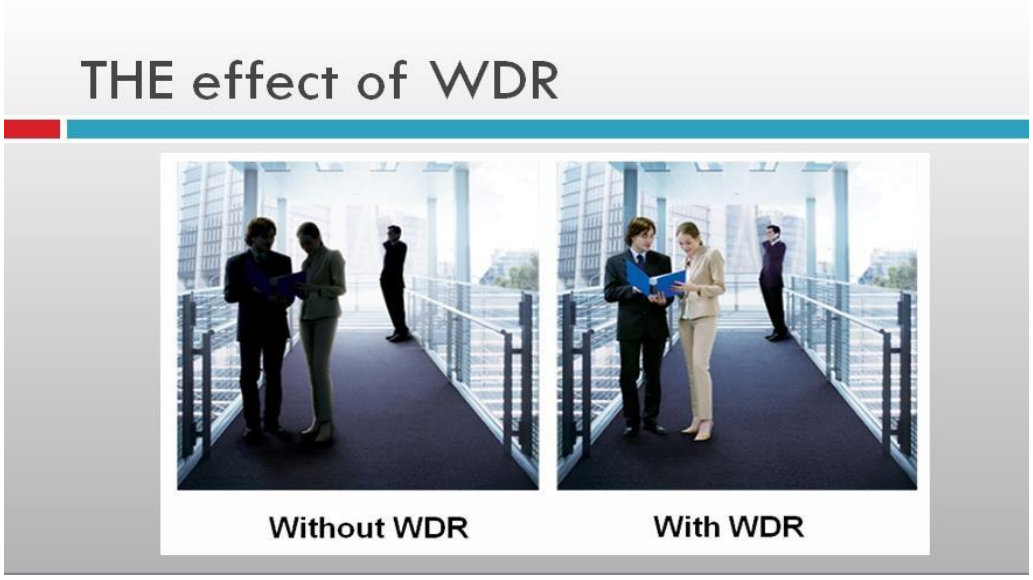

Figure 3.21 WDR Effect

Camera Sensors:

- THE SOLID-STATE SENSOR (IMAGER): FIFLD- One half of a frame, consisting of either the odd or the even numbered lines.

- NTSC vidio,1 field=262.5 lines. PAL video, 1 field =262.5 lines.

- FIELD FREQUENCY -: Number of fields transferred per second in a TV system. NTSC standard is 60, PAL standard is 50.

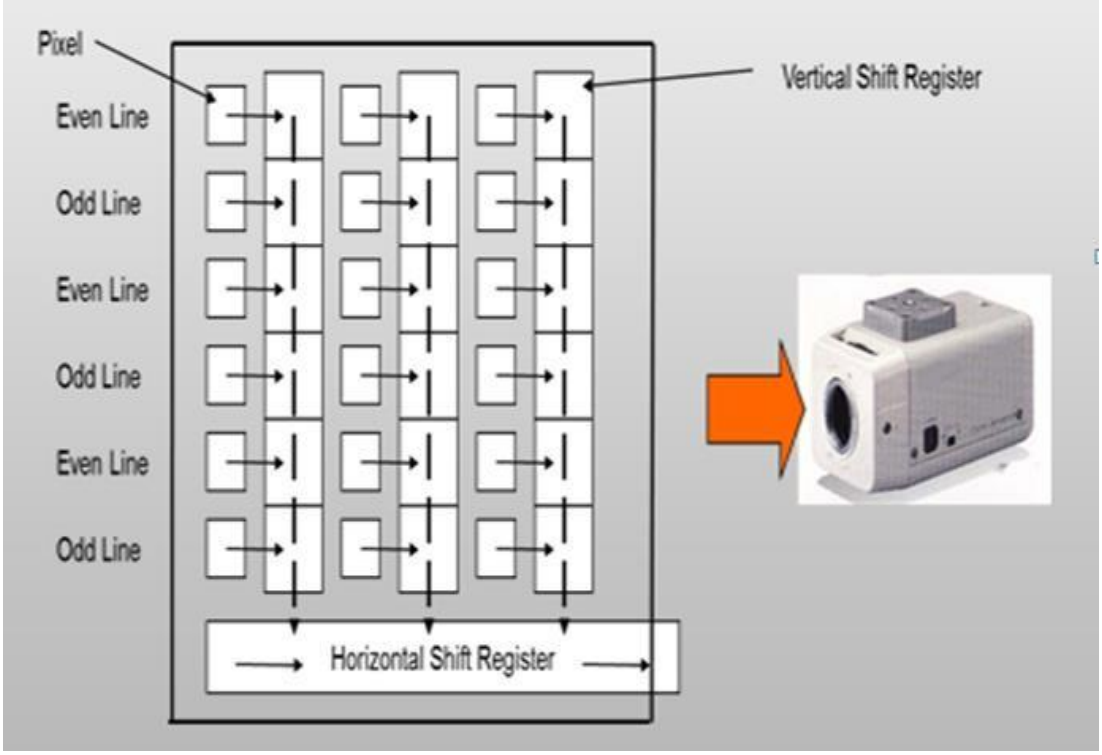

Figure 3.22 Solid State Sensor (Imager)

- The camera sensor converts the visible scene formed by the lens into an electrical signal suitable for transmission to the remote device.

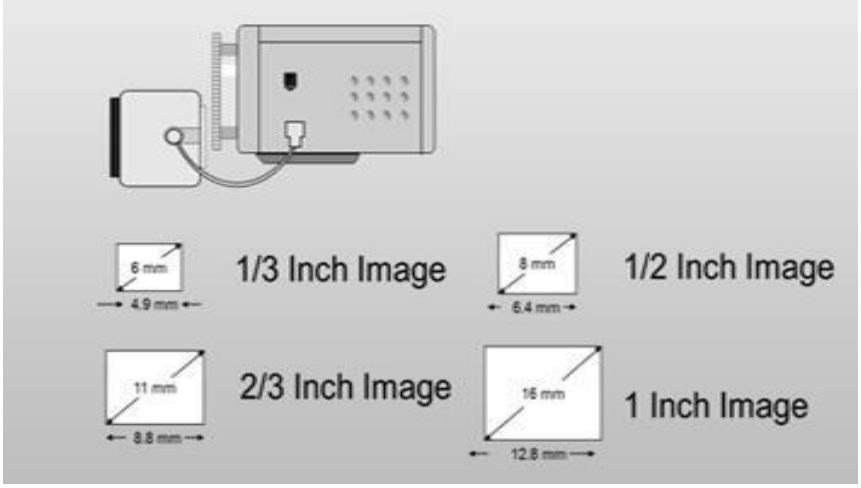

Figure 3.23 Images Size

 Sensor types:

- CCD Sensor:
- Create high-quality, low-noise images.
- Greater sensitivity and fidelity.
- 100 times more power.
- Require specialized assembly lines.
- Older and more developed technology.

- CMOS sensor:
-More susceptible to noise.
-Light sensitivity is lower.
-Consume little power.
-Easy to manufacture.
-Cheaper.

 What is CCD & CMOS?

- Array of diodes (photo sites) that produce a voltage:
- Linearly: proportional to the AMOUNT incident light.
- Non –linearly dependent to the WAVELENGTH.
- Built out of layers of silicone:
- Silicon is sensitive to light.
- Layers add functionality –different layers perform functions (called “die”).

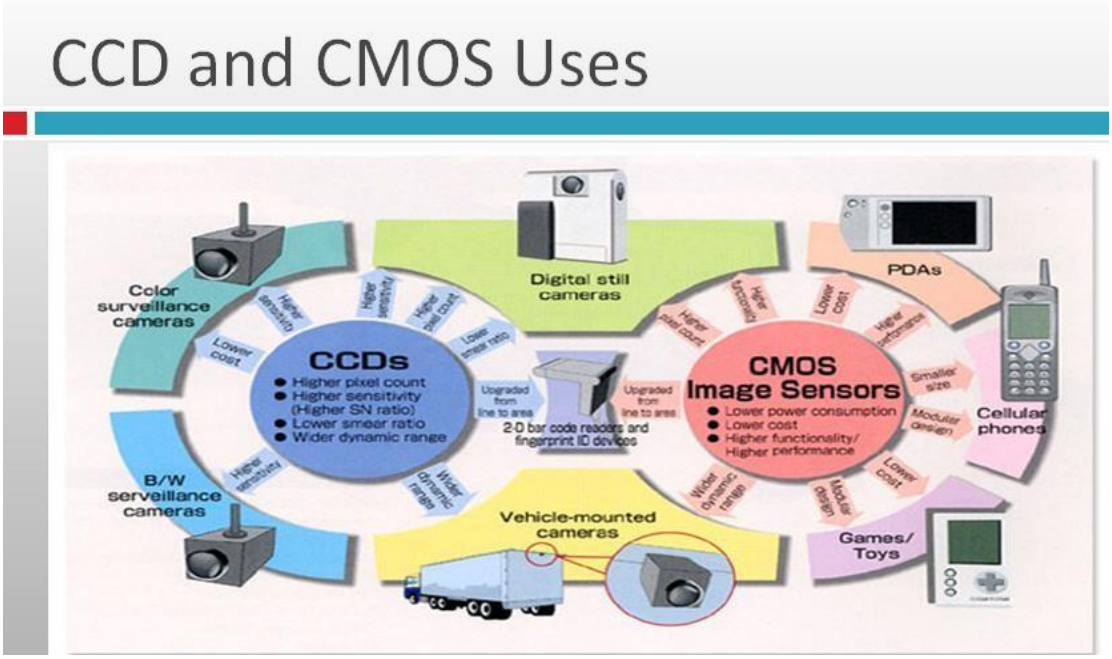

Figure 3.24 CCD & CMOS Uses

Camera Resolution:

- **VERTICAL RESOLUTION**:

Is based on the 525 scanning lines in the NTSC (National Television Systems Committee) system. (Used in NA & JAPAN).

As a general rule, 30% of the scanning lines are lost, thus the vertical resolution of a 525-line system is 340 TV lines.

In European system (PAL), there is 625 scanning lines, thus giving them 408, TV lines.

- **HORIZONTAL RESOLUTION**:

-Television industry adopted a viewing format of width to height ratio of 4 to 3

-Horizontal resolution is measured by 75% of the picture width. -Horizontal resolution depends on the electrical performance of the camera.

B- Recording Devices:

1 - Digital Video Recorder (DVR):

Is intended to work with *standard analog* security cameras, it is used to record video footage in a digital format to a hard disk drive (HDD). It usually captures video/images through coaxial cables from analog cameras. It is usually used for physical security applications. This combination is more cost effective and easier to setup. However, the resolution is usually limited to D1 (720×480). Proximity is a limitation as analog cameras cannot be more than 700-1000 feet away from the DVR without visible degradation in video quality.

The DVR comes with 4channels, 8channels, 16…… etc., based on the number of analog cameras in our site, every channel takes one camera.

Figure 3.25 Digital Video Recorder

2 - Network Video Recorder (NVR):

Is intended to work with *digital* security cameras. It is used to record video footage in a digital format to a hard disk drive (HDD). It usually captures video/images through an Ethernet network via CAT 5 or CAT 6 cables from IP cameras. It is mostly used for physical security applications. A combination of an NVR and IP cameras is more expensive. However, it offers much higher resolution and superior video clarity when compared to a DVR & analog camera. Some IP cameras offer a resolution of up to 5 mega pixels. Proximity is not an issue and the IP cameras can be located anywhere as long as they can be accessed through a network.

NVR comes with 4channels, 8channels, 16…… etc., based on the number of digital cameras in our site, every channel takes one camera.

Figure 3.26 Network Video Recorder

3 - Hybrid Video Recorder (HVR):

Is intended to work with both analog and *digital* security cameras. It is used to record video footage in a digital format to a hard disk drive (HDD). It accommodates both IP and analog cameras and captures video/images through an Ethernet network via CAT 5 / CAT 6 cables from IP cameras as well as coaxial cables from analog cameras. It is mostly used for physical security applications. This option is a good choice when planning for future expansion into an IP video surveillance system as the existing analog cameras can be reused and incorporated into the system without any drop in coverage.

HVR comes with 4channel, 8channels, 16…… etc., based on the number of analog and digital cameras in our site, every channel takes one camera.

Figure 3.27 Hybrid Video Recorder

c- CCTV Monitors (PC) With Software:

In addition to the live CCTV camera viewing, it can be also open and playback the recorded video files on the PC's. The software in PC are monitoring and controlling all the CCTV equipment's.

The control room that includes all the PC'S is called the CCTV console.

Figure 3.28 Console Room

Figure 3.29 Monitoring Room

CHAPTER FOUR:

ACCESS DOOR CONTROL SYSTEM

This chapter presents another application of low current systems. Specifically, Access Door Control System.

4.1- Definitions:

- Is describes any technique used to control passage into or out of any area.
- Is one of the most common used systems in electronic door control using a card or a magnetic stripe which can be accessed by swiping through a reader on the door.

4.2- System Components:

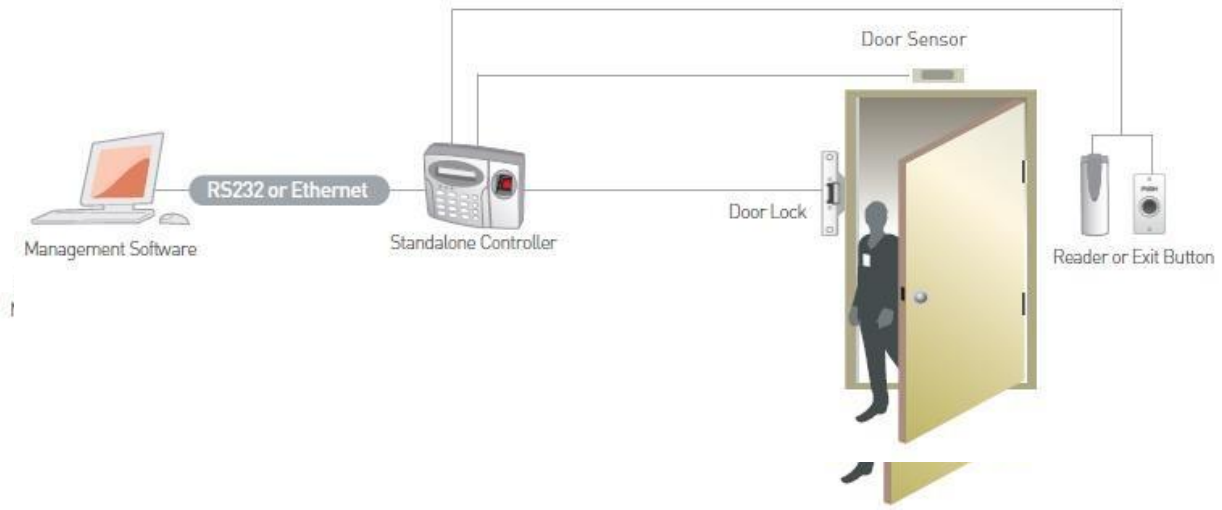

Figure 4.1 Access Control System Components.

It consists of three main components:

a. Inputs:

1. Readers: there are many types of readers such as the following:

 Barcode card and its reader: is a card which can be read by inserting it into a reader device. It consists of the reader and the barcode card.

Figure 4.2 Barcode Reader with Barcode Card

- **Proximity card and its reader:** is a "contactless" smart card which can be read without inserting it into a reader device, it consists of the reader and the proximity card.

Figure 4.3 Proximity Reader With Proximity Card.

- **Biometric Reader:** is a reader that uses a technology that is based on physiological or behavioral characteristic (finger print, eye print).

Figure 4.4 Biometric Reader (Finger Print, Eye Print).

- **Keypad Reader:** is a reader that uses a technology that based on physiological or behavioral characteristic (finger print, eye print).

Figure 4.5 Keypad Reader

HINT: some of readers may contain multi reading techniques in one reader.

Figure 4.6 Multi Reading Techniques In One Reader.

2- Push to exit button: motion sensors to trigger the door to unlock.

Figure 4.7 Push To Exit Button.

b- Access door control panel(controller): it is a central control panel that manages the process of identifying the authorized inputs through the reader and then forward the order to door sensor and door lock to be opened, if the input is authorized then the order is issued to open the door.

Figure 4.8 Access Door Control Panel.

c- **Outputs:** It is the door sensors and door looks, that receive the signal from control panel to open the door.

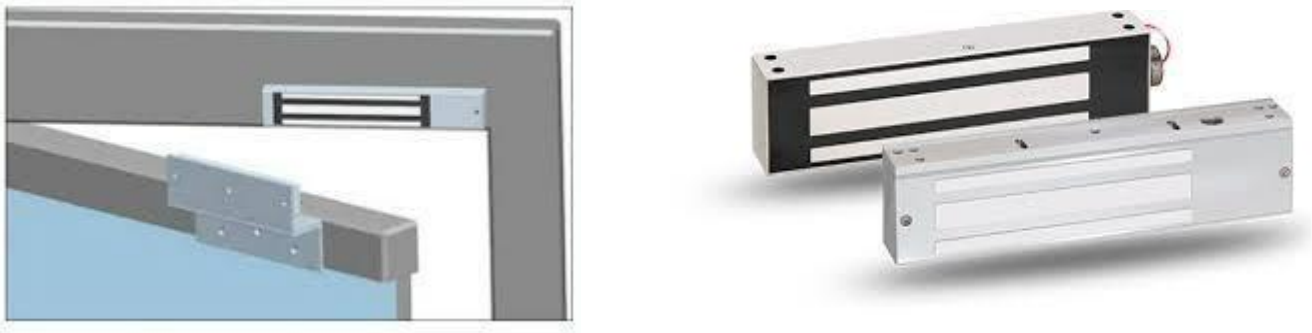

Figure 4.9 Magnetic Door Sensor and Lock

d- PC with management software: It is a PC contains software that manages all the system components, and contains all the information about the authorized persons.

4-3 Principle of work:

When the input is activated, then it will send an electronic signal to the Control Panel, where it is translated to indicate the validity of the input to access. Open if the input validity is confirmed.

Also, the control panel sends an electronic signal to the PC that include the software in the control room, then the PC will translate this signal and shows the information of input person.

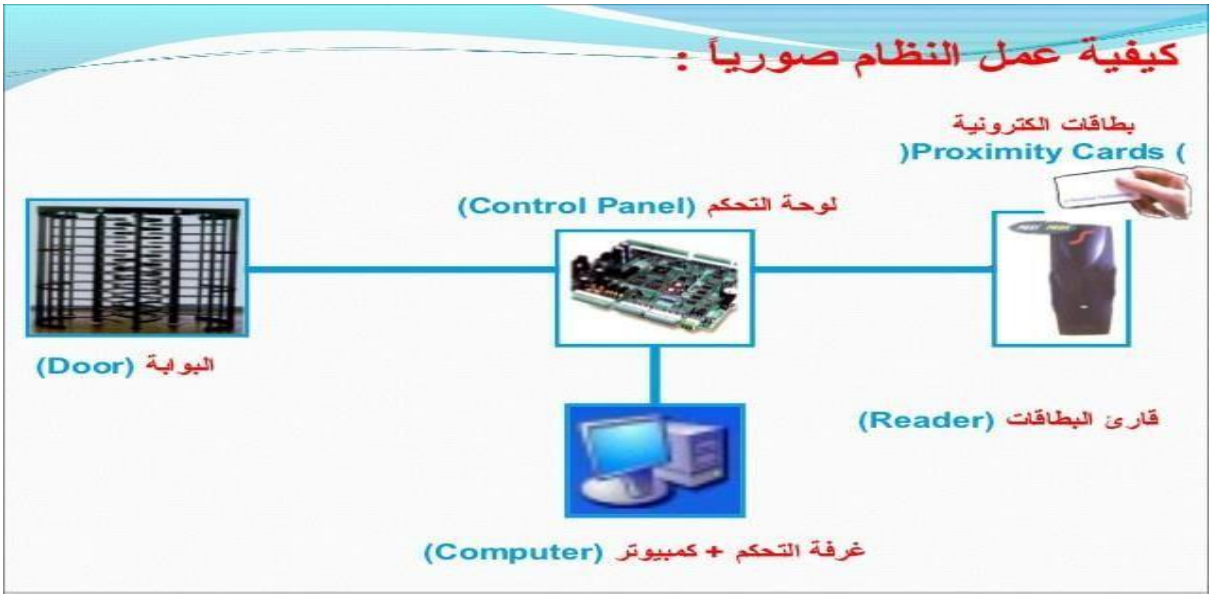

Figure 4.10 Principle of Work

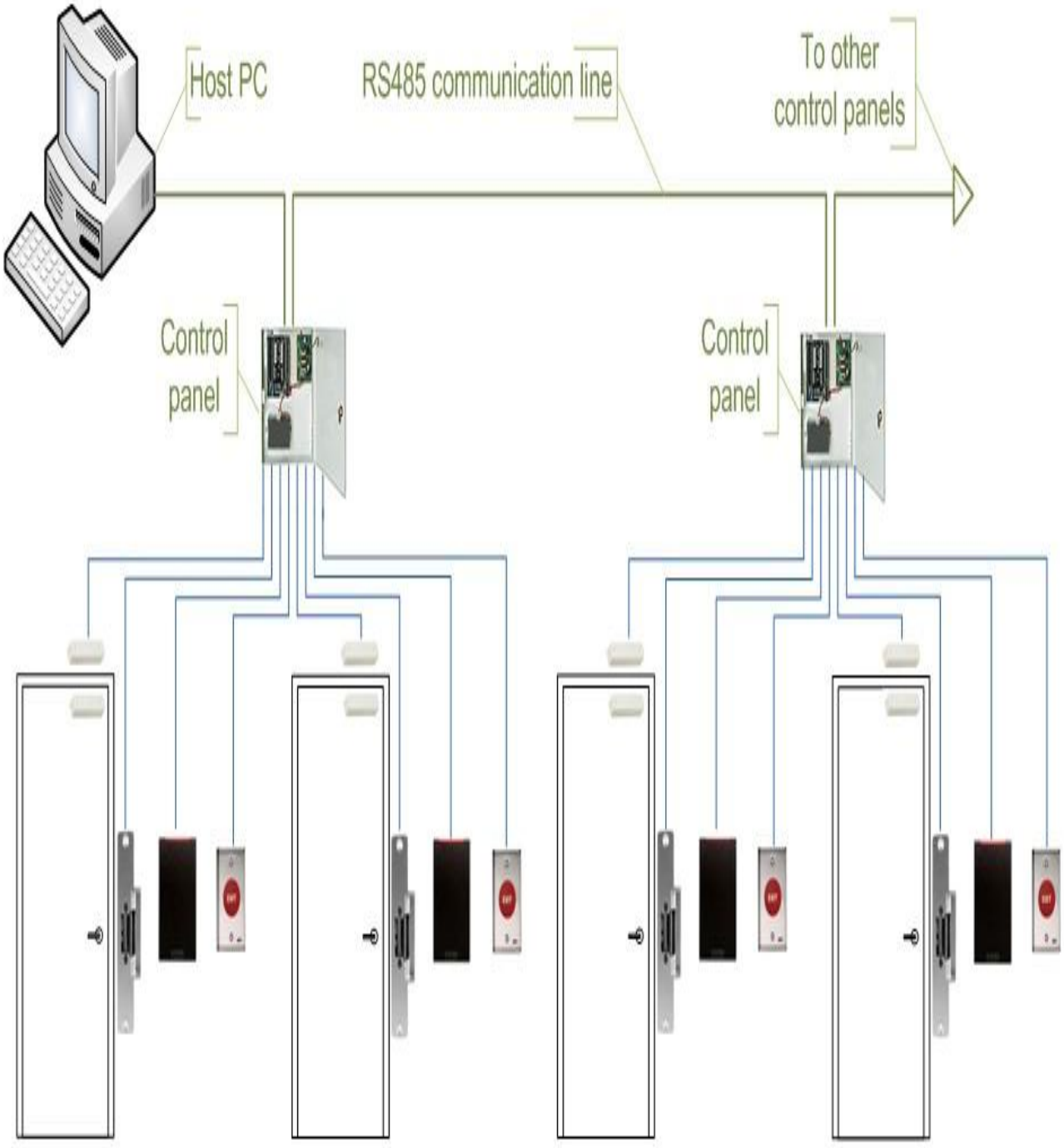

Figure 4.11 System Riser Diagram

CHAPTER FIVE:

AUDIO SYSTEM

5.1 Public address system (PAS):

5.1.1Definition:

Is an electronic system comprising microphones, amplifiers, loudspeakers, and related equipment.PA systems are used in any public venue that requires an announcer, performer, etc. be sufficiently audible at a distance or over a large area.

5.1.2 System components:

5.1.2.1 Inputs:

5.1.2.1.1 Microphone: is a transducer that converts sound into an electrical signal. There are many types of microphones:

 Dynamic Microphone: uses a coil of wire suspended in a magnetic field. The characteristics of this microphone are:

- Construction is simple and comparatively sturdy.
- No power supply is required.
- Relatively inexpensive

Figure 5.1 Dynamic Microphone

 Condenser Microphone: uses the vibrating diaphragm as a capacitor plate. The characteristics of this microphone are:

- Good sensitivity at all frequencies.

- Power supply is required.

- Vulnerable to structural vibration and humidity.

Figure5.2 Condenser Microphone

 Ribbon Microphone: use a thin, usually corrugated metal ribbon suspended in a magnetic field. The ribbon is electrically connected to the microphone's output, and its vibration within the magnetic field generates the electrical signal.

Figure5.3 Ribbon Microphone

 Carbon Microphone: uses a capsule or button containing carbon granules pressed between two metal plates like the Berliner and Edison microphones. A voltage is applied across the metal plates, causing a small current to flow through the carbon. One of the plates, the diaphragm, vibrates in sympathy with incident sound waves, applying a varying pressure to the carbon. The changing pressure deforms the granules, causing the contact area between each pair of adjacent granules to change, and this causes the electrical resistance of the mass of granules to change. The changes in resistance cause a corresponding change in the current flowing through the microphone, producing the electrical signal.

Figure5.4 Carbon Microphone

 Piezoelectric Microphone: uses the phenomenon of piezoelectricity— the ability of some materials to produce a voltage when subjected to pressure—to convert vibrations into an electrical signal.

Figure5.5 Piezoelectric Microphone

 Wireless Microphones: Wireless microphones can be moved around freely, without the cables getting in the way. These microphones require a transmitter and a receiver in order to broadcast sound. In general, handheld wireless microphones contain a built-in transmitter, whereas headset and clip-on microphones include a cable that attaches to the belt-pack transmitter. The transmitters for both types are powered by batteries (either dry-cell or rechargeable), so always make sure that ample battery power is available. It's also necessary to set the transmitter of the broadcasting microphone and the receiver to the same channel.

When more than one wireless microphones are used, the transmitting and receiving channels are set differently for each microphone.

Figure 5.6 Wireless Microphone

 Wired Microphones: is physically connected to an amplifier or recording equipment, we can be sure that the signal will never waver.

Figure 5.7 Wired Microphone

 Lavalier Microphone: is a small microphone used for television, theatre, and public speaking applications in order to allow for hands-free operation. They are most commonly provided with small clips for attaching to collars, ties, or other clothing.

Figure 5.8 Lavalier Microphone

 Desktop Microphone: is a microphone that is placed on the table.

Figure 5.9 Desktop Microphone

 Remote (Multi Zone) Paging Microphone: is a microphone that allows paging to set of zones, utilizing a single channel amplifier by activating the speaker line selector from the desktop remote microphone.

Figure 5.10 Remote Paging Microphone

5.1.2.1.2 DVD/CD/USB Player: Is a device that plays DVD discs, CD discs, USB's.

Figure 5.11 DVD/CD/USB Player

5.1.2.1.3- AM/FM Tuner: Is a device that plays AM/FM radio channels.

Figure 5.12 AM/FM Tuner

5.1.2.1.5- Azan Prayer Clock: Clock that send azan message to the Processor.

Figure 5.13 Azan Clock Prayer

5.1.2.2- Processor (Controller, Mixer, Amplifier):

Is a multifunctional amplifier that can be mounted in an equipment rack. The unit comes with audio inputs including the mics, background music input (CD, DVD, USB, AM/FM) and the speaker output section which has an internal attenuator and multi output selector. It permits not only general-purpose broadcast, but also Emergency broadcast based on the EN60849 Standard which gives pre-recorded voice instructions in the emergency situation

Figure 5.14 Processor

5.1.2.3- Speakers: is a device that produces the sounds to audience in the area. There are many types of the speakers:

 Ceiling Speaker: is a speaker installed in the ceiling.

Figure 5.15 Ceiling Speaker

 Wall Mount Speaker: is a speaker installed on the wall.

Figure 5.16 Wall Mount Speaker

 Pendant Speaker: is designed for overhead sound reinforcement of speech and music in open ceiling and mixed ceiling space.

Figure5.17 Pendant Speaker

 Line Array Speaker: is a loudspeaker system that is made up of a number of usually identical loudspeaker elements mounted in a line and fed in phase, to create a near-line source of sound.

Figure5.18 Line Array Speaker

 Horn Speaker: is a loudspeaker or loudspeaker element which uses an acoustic horn to increase the overall efficiency of the driving element.

Figure 5.19 Horn Speaker

 Projection Speaker: is cone speaker and a balanced dome tweeter. Intended for ceiling and wall installation. It has an outstandingly stylish design that is inspired by the finest lighting fixtures.

Figure 5.20 Projection Speaker

 Projection Speaker: is speaker that installed inside buildings.

Figure 5.21 Indoor Speaker

- **Outdoor Speaker:** is speaker installed outside building.

Figure 5.22 Outdoor Speaker

5.1.3- Acoustic Study:

Is a study that indicates the quantity and type of speakers that should be installed in a specified area. This depends on site data (ceiling height, area, wall material……)

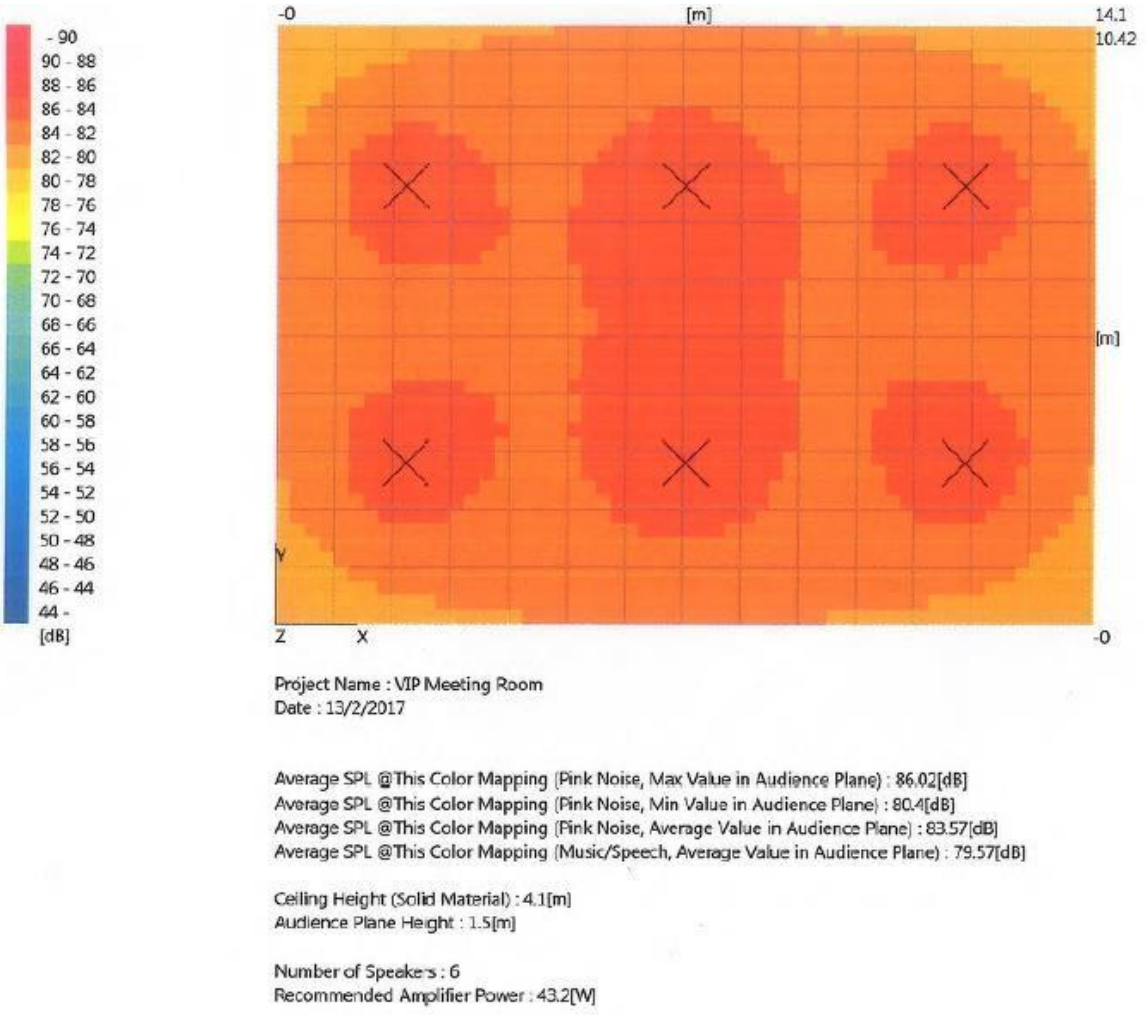

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Figure 5.23 Acoustic Study

5.1.4- Block Diagram:

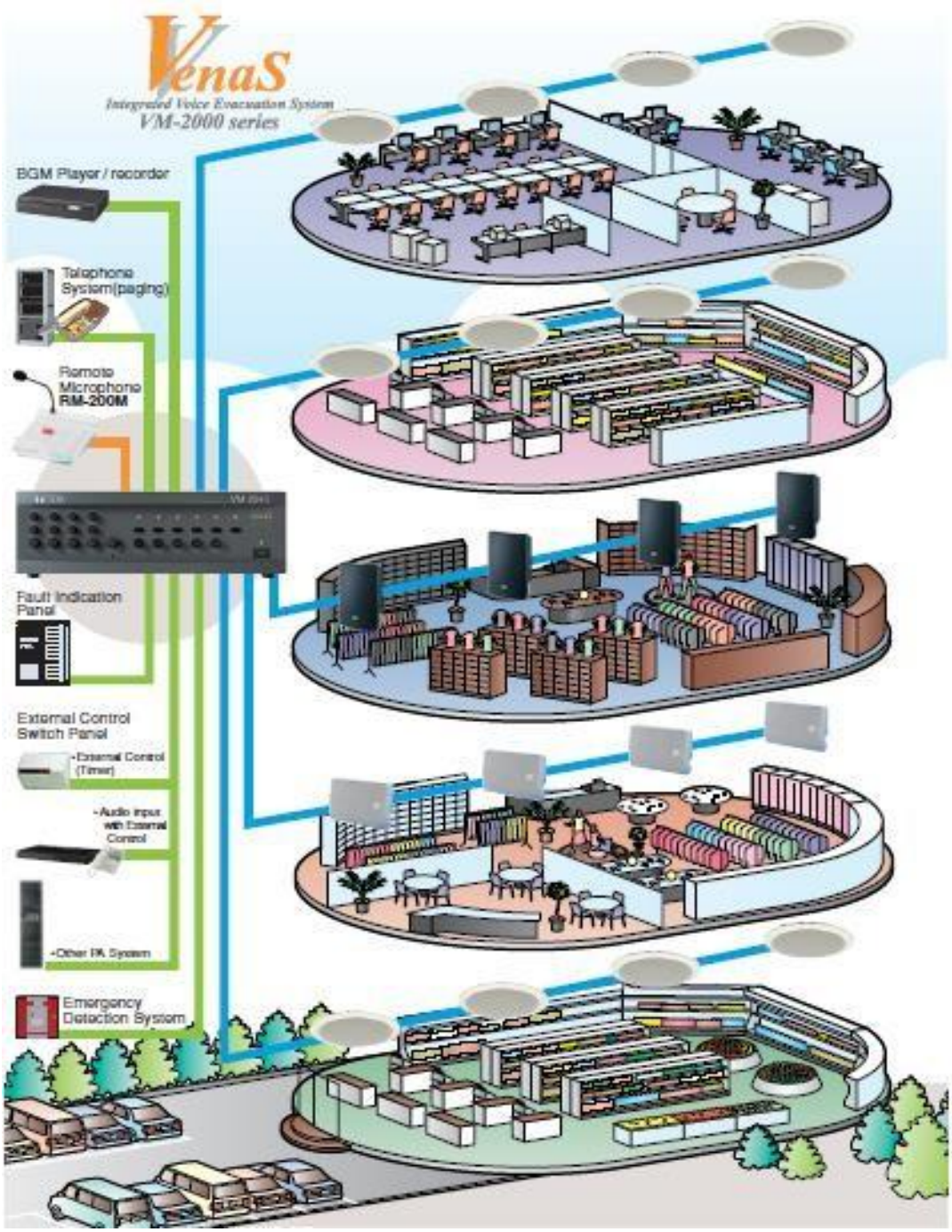

Figure 5.24 Block Diagram-1

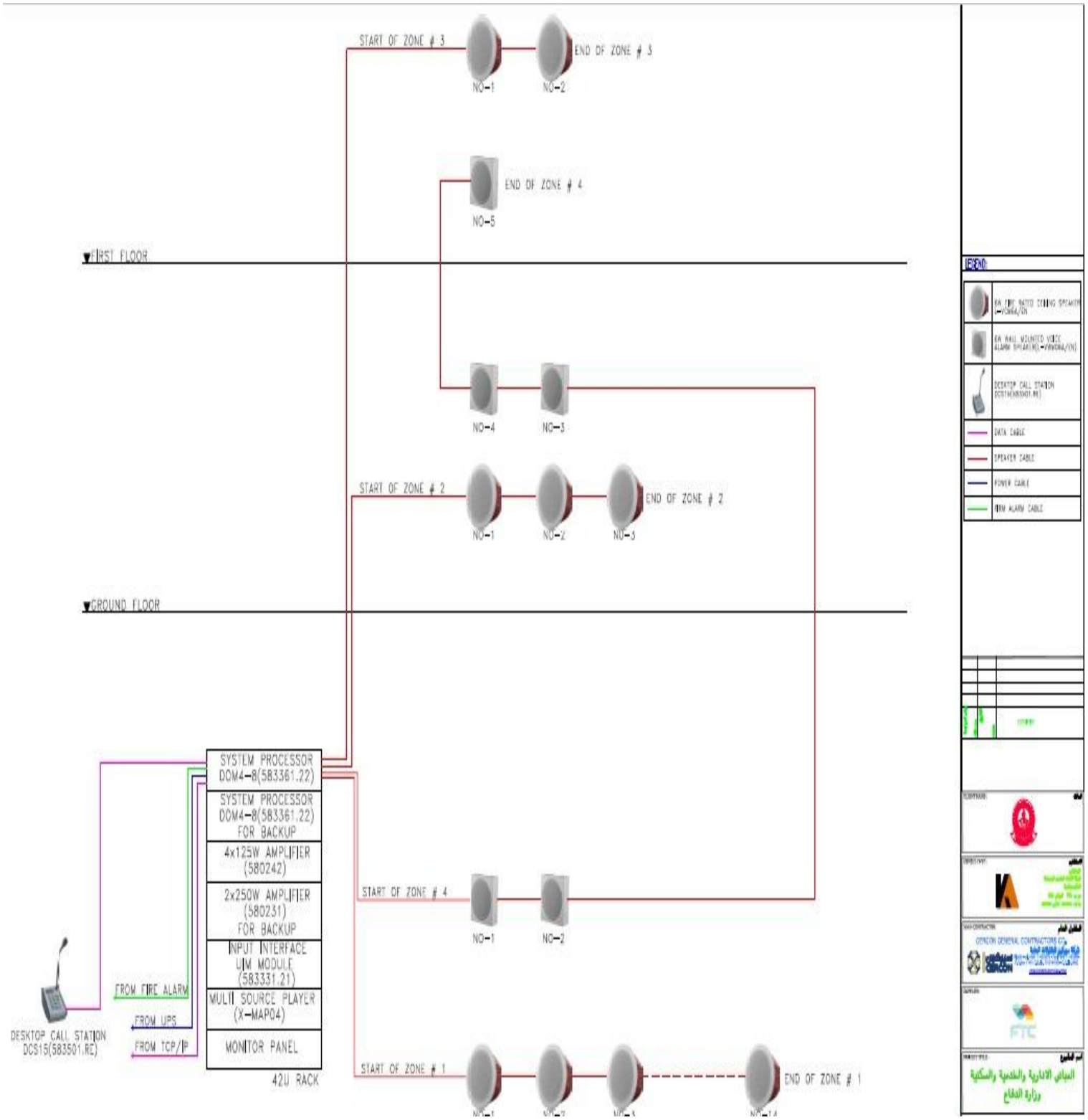

Figure5.25 BlockDiagram-2

5.2 Pro. Audio System:

5.2.1- Definition:

Is an electronic system that maximizing the emotional effects of sound in all kinds of spaces makes possible the creation of sound that is richly elegant, sensitively delicate or boldly audacious, as needed.

5.2.2- Comparison between PAS & pro. Audio system:

- **PAS System:** is interested in the volume level of the voice message.
- **Pro. Audio System:** is interested in the quality of the voice message. It is used specially in cinema & stadium.

Figure 5.26 Pro. Audio System

5.3- Voice Evacuation (Alarm) System:

5.3.1- Definition:

Is a system that assists in the effective evacuation of an area or building during a fire, bomb alert or other emergency.

5.3.2- Comparison between PAS &VAS System:

Table 5.1 Comparison between PAS &VAS

PA System	**VA System**
Stand-alone basis without any Fire Alarm Interface, it is an actual PA System.	Whenever asks for interface with Fire Alarm System then it is a VA. Follow the applicable codes.
Paging functions.	Fire Rated Cables for speaker circuits.
Background Music.	Certified Headend for VA.
Azan Functions (PC and S/W needed).	Certified Loud speaker for VA.
	Secondary PSU with 24 hours standby &15 minutes.

5.3.3- Block Diagram:

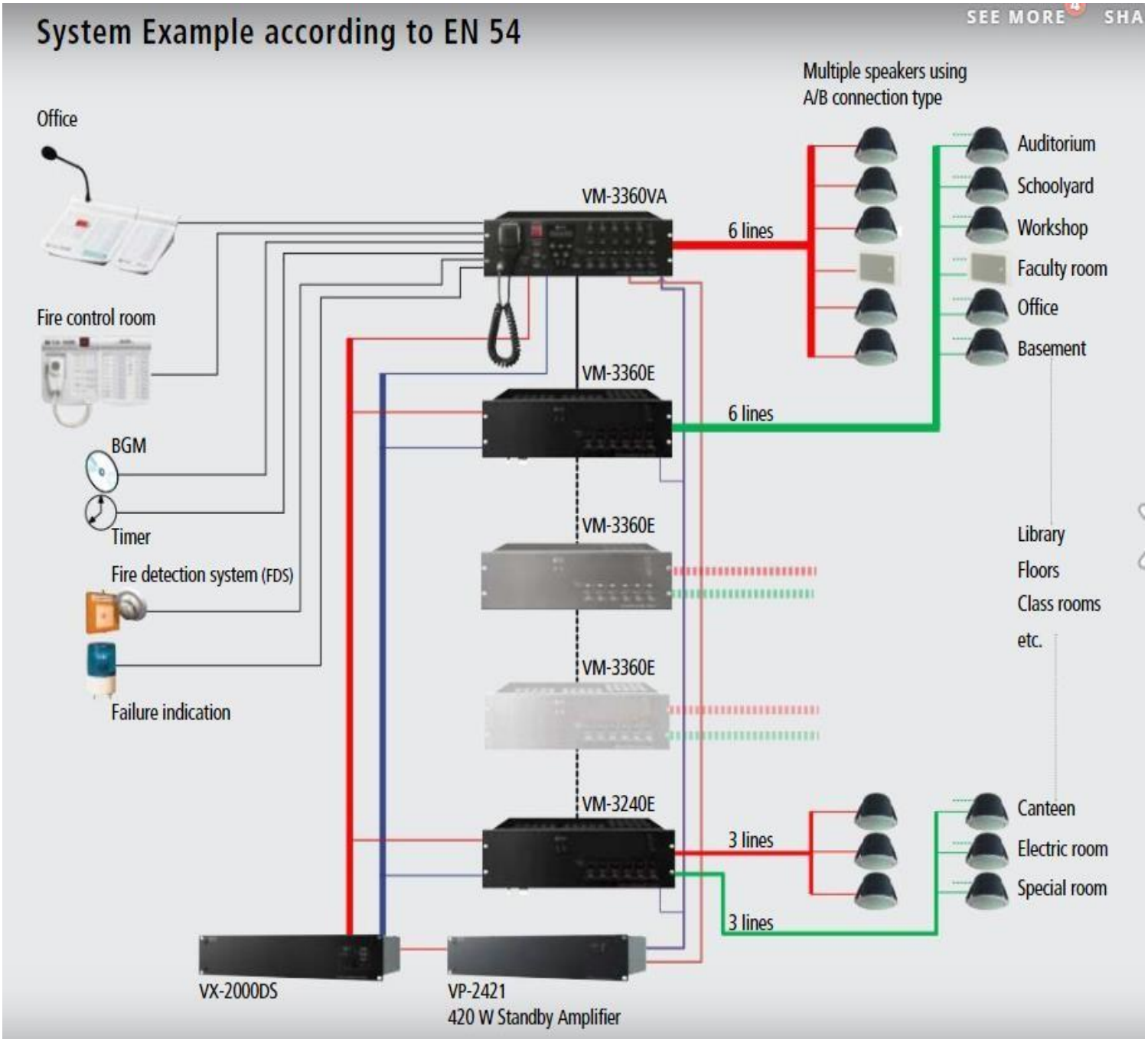

Figure5.27 VAS Block Diagram

5.4- Full IP Paging System:

5.4.1- Overview:

Instantly communicate with everyone or an isolated area/group without disrupting other areas. “Group Call” allows you to page any combination of two or more individual zones together by using IP LAN.

Overhead Loudspeaker Paging installs quickly and easily and is the most costeffective solution to complete loudspeaker paging needs! Other features include:

- Find People When Not at Their Desk.
- Reduces Call Back Times.
- Increase Safety & Security.
- Notify Everyone for Quick Evacuation.
- Single or Multi-zone, All Call & Group Call.
- Talkback Paging.
- Override Access.
- Door Entry/Security Management.
- Background Music.

5.4.2- Full IP Paging System Components:

- **ENHANCED NETWORK STATION:**

- Networked Station Port allows most loop start terminal devices to be connected to a managed IP-based LAN/WAN.

Figure 5.28 Enhanced Network Station

 ANALOG TELEPHONE:

Is used for dialing a selected speaker by choosing zone number.

Figure 5.29 Analog Telephone

 LAN SWITCH:

Is a computer networking device that connects devices together on a computer network by using packet switching to receive, process, and forward data to the destination device.

Figure 5.30 LAN Switch

 IP Speaker:

Used for enabling the sound to cover the required area.

Figure 5.31 Full IP Speaker

CHAPTER SIX:

MASTER CLOCK SYSTEM

6.1- Definition:

Is a precision clock that provides timing signals to synchronize slave clocks as part of a clock network. Networks of electric clocks connected by wires to a precision master pendulum clock began to be used in institutions, factories, offices, and schools.

6.2- History:

Diagram of electric time system was used around 1910 to keep time in factories, schools, and other large institutions. The master clock (bottom center), controlled by a temperature-compensated mercury pendulum, is wired to slave clocks throughout the building. In addition to wall clocks, it also controls time stamps that are used to stamp documents with the time, and a turret clock used in a clock tower. The "program clock" is a timer that can be programmed with punched paper tape to ring bells or turn machines on and off at preprogrammed times.

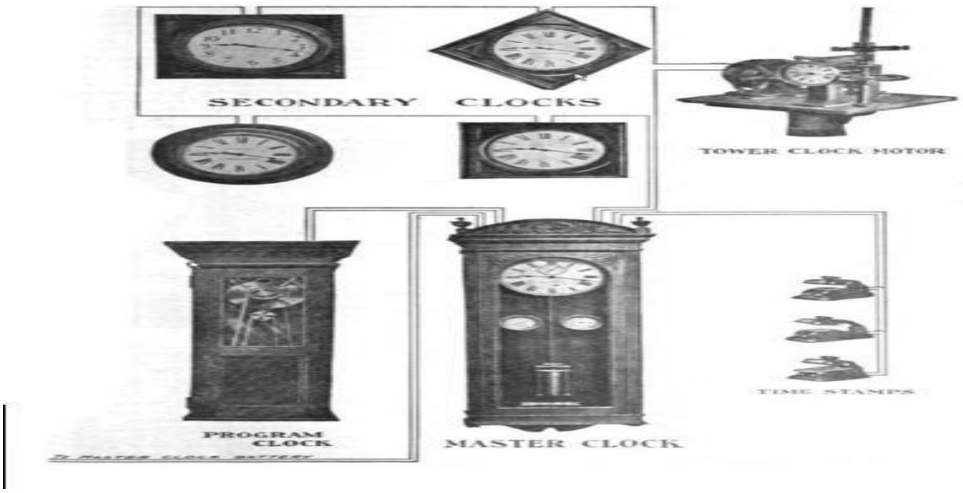

Figure 6.1 Old Electric System, 1910

6.3- System Description:

Master Clocks normally take one or more precise timing reference signals as inputs, then converts and distributes those timing references to other devices so their clocks are almost as accurate as the master clock.

Master clock systems are used in a wide variety of applications and industries including aerospace and defense, broadcast, radio, and telecom, network systems, financial services, emergency operations and call centers, and healthcare essentially anywhere reliability of data and signals are paramount.

In time-sensitive applications you must determine which clock will be used as the reference for all other clocks and understand how to transfer the time from the reference clock to all other clocks. The solution is a special timing reference clock, or master clock. The method by which the accuracy of the master clock is transferred to another, slave, or secondary clock, is known as synchronization. Typically, GPS satellite signals are utilized for synchronization to ensure accurate time, but other references such as local atomic clocks can be used.

6.4- System Standards:

- IEEE Standards Interpretations for IEEE Std 1588™-2008 IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems.

- NENA (National Emergency Number Association) Standard NENA-04-002.

- The Precision Time Protocol (PTP) is a protocol used to synchronize clocks throughout a computer network. On a local area network, it achieves clock accuracy in the sub-microsecond range, making it suitable for measurement and control systems.

- PTP was originally defined in the IEEE 1588-2002 standard, officially entitled "Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems" and published in 2002. In 2008 a revised standard, IEEE 1588-2008 was released. This new version, also known as PTP

Version 2, improves accuracy, precision and robustness but is not backwards compatible with the original 2002 version .

6.5- Popular Brands:

Figure 6.2 Popular Brands

6.6- Types of Master Clock Systems:

Wired Master Clock System:

A master clock is the means through which each individual slave clock receives the accurate time. A wires used to connect between master clock and slave clocks, and receives its time input from its own internal clock, GPS. Master Clocks insure that the time stays uniform throughout the facility, and is accurate to the millisecond with GPS receiver. Master clocks also have a variety of features, such as scheduling capabilities, automatic Daylight Saving adjustment, and the ability to employ a countdown feature in digital clocks.

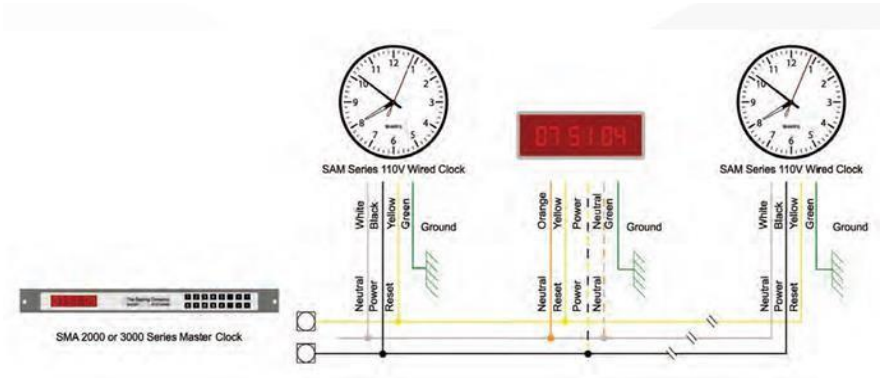

Figure 6.3 Wired Master Clock System

Wireless Master Clock System:

It utilizes a frequency-hopping technology to send the time data to all of the analog and digital secondary clocks in the system.

This system consists of a master clock, which will wirelessly transmit the time data to all of the secondary clocks in the system. Each clock that receives the time will correct itself, if needed, and will retransmit the signal to other clocks in the system. This feature eliminates the need for a high power transmitter since the clocks communicate and pass the signal to other clocks in the system once they receive the time. The analog clocks are typically powered by two D-cell, pro-alkaline batteries, which last for about 5-8 years. The digital wireless clocks are offered in 24VAC, 110VAC, and 220VAC.

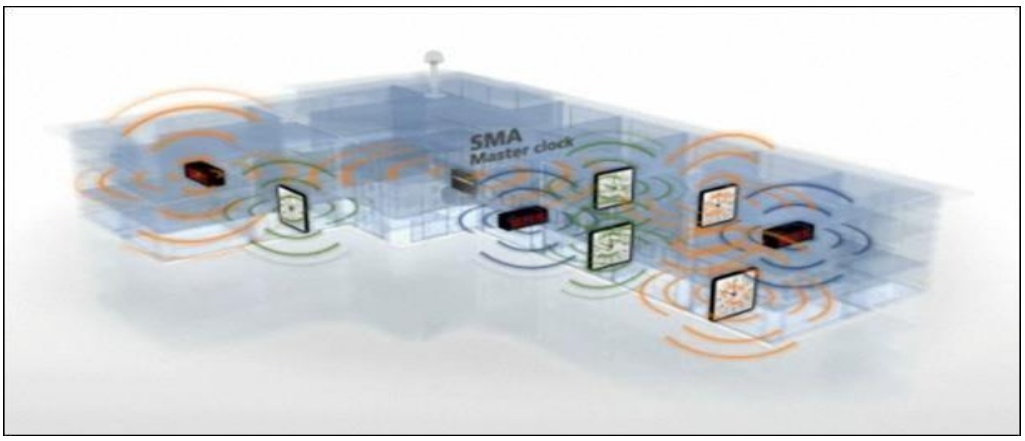

Figure 6.4 Wireless Master Clock System

IP Master Clock System:

The IP System is offered in both analog and digital clocks. It utilizes the Power over Ethernet infrastructure which provides power and data through the same CAT5 or CAT6 cable. The PoE clocks are typically powered with a PoE (Power over Ethernet) Switch or a PoE Injector. One of the biggest advantages to this system is that no master clock is required since each clock can receive the time data directly from the NTP/SNTP time source.

Another terrific feature is that the system allows the user to select up to ten NTP/SNTP servers for redundancy (repetitiveness). Each IP clock can be controlled individually using a built-in web interface, enabling the administrator to easily set up the system and/or alter the settings as needed. Each clock can be programmed individually and may send status alerts by email to the administrator.

Figure 6.5 IP Master Clock System

6.7- System Components:

The system consists of the following components:

 Master Clock (Control Panel):

Is the heart of every synchronized clock system. The master clock is an extremely advanced piece of technology that can accomplish many tasks within the system, such as automatically update clocks after a power outage and send numerical messages to digital clocks. The master clock can be configured by the system's administrator to their desired settings. Some settings include the option for NTP or GPS time updates, who is the recipient of the e-mail updates, and whether the system will run on a 12- or 24-hours schedule.

Master clock system features:

1- **NTP Server**: Each master clock can receive time from an NTP Server; this is a standard feature with all of our master clocks. A user can enter in the NTP Server address via the master clock's web interface and that's where the clock will pull the accurate time from. For added redundancy, the master clock can store up to ten different NTP server addresses.

2- **Advanced Communication**: user-friendly, web-based interface comes standard with each master clock, which allows the user to program their system's settings as desired. Once they have configured their settings, the master clock will communicate to each secondary clock, and they will update accordingly. On the very rare chance that your master clock loses communication, it will send an e-mail alert to a designated end-user. The master clock will also update administration via email when it switches an NTP server address.

3- **Daylight Saving Time (DST):** This feature also comes standard with every master clock and it allows the master clock to relay the time when Daylight Saving Time occurs. Regardless of the model, every master clock from Sapling has the ability to automatically update at both the beginning and end of Daylight-Saving Time.

Figure 6.6 Master Clock

 Slave Clock:

Is a clock that is coordinated with a master clock that operates remotely from an electrical pulse issued by a master clock. It is classified as: Analog and Digital.

Analog Slave Clock: Analog clocks use angles to tell time. They have hands that rotate around the clock's face. The position of the hands shows the time. The face of the clock is a flat disk. It will often have the numbers one through twelve on the face to make it easier to read. Analog clocks commonly have two or three hands. If it has two, there is a large hand or minute hand and a smaller hand, the hour hand. Clocks with three hands also have a second hand. This hand is usually about as long as the minute hand, but much thinner. Each hand shows the time it is named for and moves around the face of the clock one complete rotation for each movement to the next larger hand. For example, the second hand moves around the face of the clock in 60 seconds. It moves once each second. When it moves all the way around the clock, the minute hand moves forward one space. When the minute hand moves all the way around the face of the clock (which takes 60 minutes), the hour hand moves forward one section. The second and minute hands take 60 movements to move all around the face of the clock, the hour hand only needs 12 movements to do the same.

Figure 6.7Analog Slave Clock

Digital Slave Clock: A radio controlled digital clock

Digital clocks use numbers to show the time. LCDs and LEDs are common for digital clocks. Unlike analog clocks which are based on 12 hours, digital clocks can use either a 12-hour clock (often with am for morning and pm for afternoon/night) or a 24-hour clock. Digital clocks are usually smaller and easier to both use and read than analog clocks but they can also be made much larger. New digital clocks can even correct themselves using the internet or radio signals.

Figure 6.8 Digital Slave Clock

Applications:

Single Sided master clock:

A clock that has one face, installed normally on the wall.

Figure 6.9 Single Sided Slave Clock

Double Sided master clock:

A clock that has two faces, installed normally on ceiling of corridor

Figure 6.10 Double Sided Slave Clock

CHAPTER SEVEN:

AV SYSTEM

7.1- Definition:

- Is a system which possesses both a sound and a visual component, such as slide tape presentations, films, television programs, church services and live theater productions.

7.2- Applications of AV Systems:

- There are many applications of AV systems, some of these applications are:

7.2.1- Wireless Presentation System:

- Is a system that is used to present PowerPoint®, Excel®, Word, PDF documents, photos and videos by using wireless technology.

- It allows users to walk into a room and wirelessly present PowerPoint®, Excel®, Word, Video and PDF documents, as well as photos, on the room display. Sources of data include Personal Apple® iOS® or Android™ mobile devices. MacBook® and PC laptops can be connected seamlessly as well. Further, the system allows a display of data from four sources simultaneously.

- It enables multi format inputs to be displayed on any screen (smart, non-smart), so it gives the clients flexibility to show their data whatever its kind. Also, four user's data input can be displayed simultaneously in the screen.

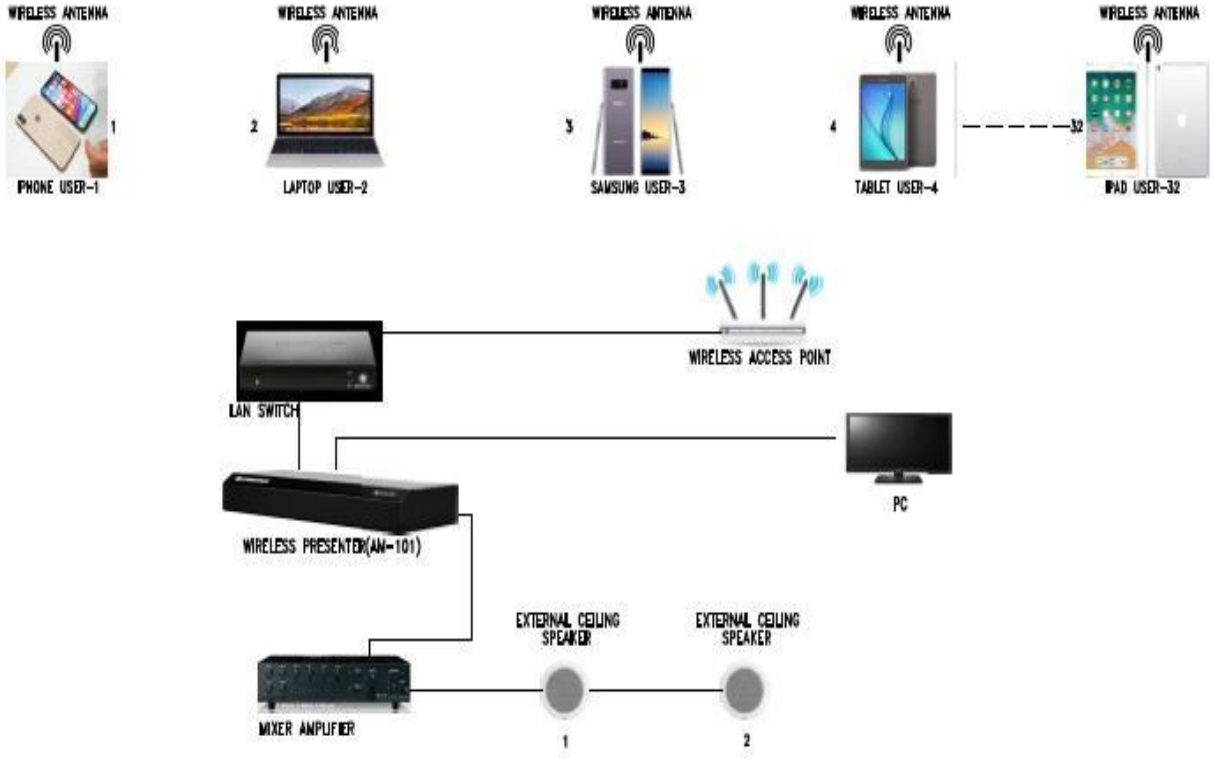

Figure 7.1 Wireless Presentation System

7.2.2- Video Conference System:

Is a system technology for the reception and transmission of audio-video signals by users at different locations, for communication between people in real-time.

7.2.2.1- System Components:

 Camera: a high-definition primary conferencing camera with advanced features such as remote-control pan, zoom and tilt features. Specialized, and document cameras may also be used in conjunction with video conferencing to convey information whose clarity needs to be preserved, such as in the case of education sectors and in medical applications. High-definition (HD) cameras are usually preferred, as they offer the highest resolutions and the largest images.

Figure 7.2 Video Conference Camera

 Video Display: The most common displays are LCD or HD Plasma Display, LCD/DLP Projector / XGA PC Type Display. Video conferencing systems may use more than one display option.

Figure 7.3 Video Display

 Codec Unit: Often called the “heart and the brain” of the video conferencing system, the CODEC (also called the coder-decoder) takes the audio and video from the microphone and the camera and then compresses it, transmits it via an IP network, and decompresses (expands) the incoming audio and video signal or viewing on the video display device.

Figure 7.4 Codec Unit

 Microphone / Audio Sub-System: Basic enterprise-level video conferencing and collaboration systems use analog microphone pods, which are optimal for the use of a small group. In intermediate video collaboration systems, there is usually a conference phone – gated “array” of digital microphones which are designed to run on integrated software. This software enhances the system’s audio capabilities. If the video conferencing is applied to larger rooms / venues, there needs to be an independent cancellation system for audio echo, and many microphones are usually connected to the integrated collaboration system to help facilitate large group interaction.

Figure 7.5 Video Conference Microphone

 Accessories: Are some equipment to fix the other components.

CHAPTER EIGHT:

TV SYSTEM

8.1- Definition:

Is a system which consists of antennas, dishes, amplifiers, multi switches and outlets.

8.2- Types of TV system:

Mainly there are two types of tv system:

8.2.1- Master Antenna TV (MATV):

- It is the means by which many apartment houses hotels, schools and other multi-unit buildings distribute TV and FM signals to a number of receivers.

- **Types of MATV system:**

- **Intermediate Frequency (IF) MATV System:**
  This system is basically to distribute the signal from different satellites to all the TV points in the building. By installing this system, it will be possible to watch the channels from these satellites using digital receiver in each TV point.

- The bandwidth of IF signal is between 950 MHZ – 2150 MHZ.

- The DB level of TV outlet is 60-70 DB.

- **IF MATV system advantages:**
  - ✓ Most economical MATV System.
  - ✓ Possible to watch a lot of channels.
  - ✓ Possible to install the PAY TV decoders in each TV points.
  - ✓ Can subscribe the PAY TV channels individually.

- **IF MATV system disadvantages:**

- ✓ No possibility for centralized channel line-up.
- ✓ Individual tuning of receivers is necessary when there is some changes in satellite parameters.
- ✓ Not possible to control the type of channels to be received. (Any channels coming through the satellite can be viewed).
- ✓ Not possible to distribute any in-house channels through the system.
- ✓ The active components are kept in various locations hence the system will be less reliable & difficult to maintain.

IF MATV system components:

1- Satellite dish: is a dish-shaped type of parabolic antenna designed to receive or transmit information by radio waves to or from a communication satellite.

Figure 8.1 Satellite Dish

2- Low-Noise Block (LNB): is a is the receiving device mounted on satellite dishes used for satellite TV reception, which collects the radio waves from the dish and converts them to a signal which is sent through a cable to the receiver inside the building. It gives four polarities (High Vertical HV, Low Vertical LV, High Horizontal HH, and Low Horizontal LH).

Figure 8.2 LNB

3- Amplifier: is a device that used to increase the signal DB in order to reach the signal with good resolution in the TV outlet.

Figure 8.3 TV Amplifier

4- Multi switch: is a device that used to switch the received signal and distribute it to the TV outlets.

Figure 8.4 TV Multi Switch

5- TV outlet: is a connector used to connect coaxial cables with each other and with terrestrial VHF/UHF roof antennas, antenna TV sets.

Figure 8.5 TV Outlet

6- Coaxial cable: is a cable that used to connect between all system components, the losses in system signal depends on the used cable types and the distances.

Figure 8.6 Coaxial Cable

Radio Frequency (RF) MATV system: this system is basically to distribute the signal from different satellites to all the TV points in the building by using RF modulators.

- The bandwidth of RF signal is between 5 MHZ – 950 MHZ.

- The DB level of TV outlet is 55-65 DB.

RF MATV system advantages:

- ✓ The channels are tuned in modulators station. Hence specified channel list can be created.
- ✓ Possible to distribute the PAY TV channels through the system.
- ✓ In-house channels can be added in the system.
- ✓ No receivers in the rooms hence single remote for the TV.
- ✓ The channels can be tuned directly on the TV.

RF MATV system disadvantages:

- ✓ The numbers of channels that are able to distribute are limited as per numbers of modulators.
- ✓ The distribution network is analogue hence the disturbance of local channels and others are common.
- ✓ Due to analogue distribution network, it is not possible to ensure the same picture quality in the all the TV's.
- ✓ The HD reception is not possible using this system.

There are two types of RF MATV system:

- **Quadrature Phase Shift Keying (QPSK) RF system:** this system is basically to

Distribute the signal from different satellites to all the TV points in the building by using RF QPSK modulators.

- **Audio Visual (A/V) RF system:** this system is basically to distribute the signal from different satellites to all the TV points in the building by using RF A/V modulators.

RF MATV system components:

1- Satellite dish: as mentioned in IF MATV.

2- Low-Noise Block (LNB): as mentioned in IF MATV.

3- Amplifier: as mentioned in IF MATV.

4- Multi switch: as mentioned in IF MATV.

5- Receiver: is a device that receives the TV signal from satellite dishes (it is used just in A/V RF).

Figure 8.7 TV Receiver

6- QPSK Modulator: is a modulator used in QPSK RF MATV.

Figure 8.8 QPSK Modulator

7- A/V Modulator: is a modulator used in A/V RF MATV.

Figure 8.9 A/V Modulator

8- TV outlet: as mentioned in IF MATV.

9- Coaxial cable: as mentioned in IF MATV.

8.2.2- Internet Protocol TV (IPTV):

 It is the advanced and latest TV system available in the market. This system will have an IP head-end station which will convert the signal from the satellite to IP stream and will be distributed to various TV points using data network. A Middleware server will be added to the system to make it possible to add a lot of interactive services along with TV channels.

IPTV system advantages:

- ✓ Higher picture quality.
- ✓ Unified communication medium.
- ✓ More TV channels.

- ✓ Interactivity: unlike analog MATV which is a one-way system, IPTV solutions provide 2-way interaction giving access to great features such as internet browsing, Video on Demand (VoD) and customized hospitality features.

- ✓ Wide distributions.

IPTV system disadvantages:

- ✓ Need a good LAN infrastructure.

- ✓ High equipment costs.

List of interactive services:

- ✓ Personalized welcome message.

- ✓ Personalized channel list.

- ✓ Viewing and ordering the menu from hotel restaurants via TV.

- ✓ Video on demand service.

- ✓ Alarm facility.

- ✓ Internet browsing.

- ✓ Messaging via TV.

- ✓ Viewing guest accounts via TV.

IPTV system components:

1- Satellite dish: as mentioned in IF MATV.

2- Low-Noise Block (LNB): as mentioned in IF MATV.

3- Amplifier: as mentioned in IF MATV.

4- Multi switch: as mentioned in IF MATV.

5- Headend: a main device that converts the signal from satellite to IP stream and will be distributed to various TV points using data network.

Figure 8.10 IPTV Headend

6- LAN switch: an IP switch used to connect between the system equipment in one network.

7- Set top box: is a device that demodulates the TV signal. It is normally fitted between the outlet plate and a TV that doesn't have appropriate tuner.

Figure 8.12 STB

8- TV outlet: as mentioned in IF MATV.

9- Ethernet cable: is a cable that used to connect between all system components,

Figure 8.12 Data Cable

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