TITLE PAGE

DESIGN AND IMPLEMENTATION OF A LOCAL AREA NETWORK FOR SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY

BY

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NIGER STATE

IN PARTIAL FULFILMENT OF THE REQUIREMNET FOR THE AWARD OF BACHELOR OF ENGINEERING IN ELECTRICAL AND COMPUTER ENGINEERING
FEDERAL UNIVERSITY OF TECHNOLOGY
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FEBRUARY, 2002

CERTIFICATION

This is to certify that this project has been examined and approved having met the requirements for the award of Bachelor of Engineering (B.ENG) Honours Degree in Electrical/Computer Engineering of Federal University of Technology Minna.

Engr J.Kolo Project Supervisor	Date
Engr Y. Adedeiran Head of Department	Date
External Examiner	Date

DECLARATION

I hereby declare that this project is a record of my own research work, which was designed and constructed by me.

.....atolagbe..... .....28/02/2022.....

Atolagbe Omotayo Date

DEDICATION

"Giving God all the Glory for he has done great things"

This project is dedicated to Almighty God, the most precious, and my loving parents, Dr and Mrs. S.A.B Atolagbe.

ACKNOWLEDGEMENT

Firstly my profound gratitude goes to God the father, God the son and God the Holy Spirit for all the love, guidance and protection showered on me all my life, and for satisfying my mouth with good things.

My profound gratitude goes to my parents (Dr and Mrs.S.A.B Atolagbe), sisters (Funmi and Bisayo Atolagbe) and brothers (Ayo and Bayo Atolagbe) for the love, moral, spiritual and financial support. I wouldn't trade them for anything.

My appreciation goes to my project supervisor, Engr Kolo for the encouragement and support during the duration of the project.

Also not forgetting my project partners, Izuka Vincent C and Shittu Omolara for their hardwork during the length of the project.

Great thanks goes to my special one Olugbenga Oni and my friends Bukola Oladapo, Aisha Ahmed, Gloria Idumije, Isaac Salami, Nnemso Chukumerije, Adepoju Lydia and Musa Pauline for always being there for me.

My aunty (Taiye Oyinloye), grandparents and well-wishers are not exempted for their love and prayers.

I LOVE YOU ALL.

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ABSTRACT

This project implemented the design of Local Area Network in the School of Engineering and Engineering Technology. Ethernet is a type of Local Area Network that uses Carrier Sense Multiple access with collision detection (CSMA/CD) was used.

A star topology was used for the implementation of the LAN that enables the use of 10BaseT adapter card, which accepts an unshielded twisted pair cable and also a coaxial cable. This topology was chosen for its ease and advantage over other Network topologies.

An 8-port active hub was used for the connection of the star topology and it has an electronic component that amplifies and cleans up data transmission as well as enabling signal regeneration.

Windows NT Server software was used as the Network Operating system (NOS). The client computers and workstations uses Windows 95, Windows 98, Windows Me, as their Operating System.

The design was carried out and tested which satisfied favorable Local Area Network and the limitations and recommendation was also stated.

CHAPTER ONE

PREAMBLE

1.1 HISTORY OF COMMUNICATION

We live in a world of communication, which is the sharing of information and entertainment either by speaking, writing, listening and other various means. Communication is very important both in early and modern age because without it we would be isolated.

In the beginning before the industrial age, messages were sent by walking, running, using of horses, using of smoke signals, torch signaling, heliographs (which is the flashing of mirrors), signal flags used by navy, coding of information for secrecy, cryptography and secret writing.

However, in the 18th century a faster means of conveying messages known as Optical Telegraph called (Wigwag) was invented in France. This was used in the French Revolution and Napoleonic wars.

The electronagnetic telegraph was invented in 1884 by Samuel F B Morse known as the Morse code system of transmission, which led to the development of submarine telegraph in the 1850`s and 1860`s.

In order to circumvent the existing national monopolies for telegraphic lines, Marconi invented a wireless means of communication media, which is the radio. In 1901, he spans the Atlantic with long wave transmission and discovered the ionosphere, which led to Marconi's wireless monopoly Radio.

In 1876, another means of communication was demonstrated by Alexander Graham Bell, which is the Telephone system. He built telephone

network with switches of twisted copper wires. The telephone system was improved on in the 19th century, which enhances ease of communication because people sited at different locations can converse at the same time in spite of the long distances.

At present day, Technological advancement has made it possible to communicate at a very fast speed with the invention of Computers. This is an electronic device used for sending, processing and receiving of information. The computer and other hardware peripherals can be connected together in a network so that everybody can share information, data, and equipment at the same time. This can be a Local Area Network (LAN) where twoor more computers are connected using a physical media or a Wide Area Network (WAN) which is connecting links between local area network to form a super network by wireless means.

1.2 MOTIVATION

Mainframe computers adopted by business organization is very costly and institutions owing the mainframe need full personnel to run them not to mention the large sum of money for software systems.

Also the public for its ease of use and relative affordability likes personal computers, but if several computers were placed in a room, it was difficult to get them to communicate with one another.

These shortcomings of communication motivated me to engage in a LAN for ease in communication, which enables personal computers, and other hardware peripherals in the Department communicate with one another.

1.3 OBJECTIVES

The use of Local Area Network for the School Of Engineering and Engineering Technology has the following objectives

(a) To make means of communication in the Engineering sector faster.

(b) To enable two or more people exchange and process information through the computer system.

(c) To make the expensive software affordable and usable both for the lecturers and students.

(d) To remove monopoly of computer usage as work started on one could be completed on another.

1.4 PROJECT OUTLINE

This project report is organized having its.

(a) Introduction and definition of the scope of project in chapter one.

(b) Chapter two discusses the literature review.

(c) Chapter three presents the design and implementation of local area network.

(d) Chapter four contains insight and application of local area network.

(e) Chapter five has the conclusion, limitations, recommendation and references.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION TO LOCAL AREA NETWORK

A LAN is a high-speed, fault-tolerant data network that covers a relatively small geographical area. Here, two or more computers are connected together via a cable for the process of sharing, receiving and processing of information. These types of network spans a relatively small area and are confined to a single building or group of buildings, which are separated by several feet to as much as a mile.

A Local Area Network connects workstation to a server. Each node (individual computer) in a LAN has its own CPU with which it executes programs, it is also able to access data and devices anywhere on the LAN.

A LAN enables many users to share expensive devices or hardware such as printers, scanners as well as data. Users can also use LAN to communicate with each other in the Offices, Departments, and Business organizations and also in the lecture room.

There are different types of LAN, Ethernet is the most common for personal computers that is a packet radio network that uses the carrier sense multiple access with collision detection (CSMA/CD) protocol and is used for the design of this project. Apple Macintosh LAN is based on Apple's apple talk network system, which is built into mackintosh computers.

2.2 ESSENTIAL PARTS OF A LOCAL AREA NETWORK

(a) Network Interface card, which is installed in a server, and desktop computers that serves as a medium for communication

(b) Sever: The server provides file storage space for users, e-mail services, and print queue services. The only thing that distinguishes a server from a workstation is the extra processing power, additional memory, large capacity hard drives and "server" version of Windows NT. A server typically has one or two processors, over 150MB of RAM, and 6 to over 12GB of hard drive storage.

c) Workstation: These are desktop computers that are connected via a hub to receive information from a central domain known as a server.

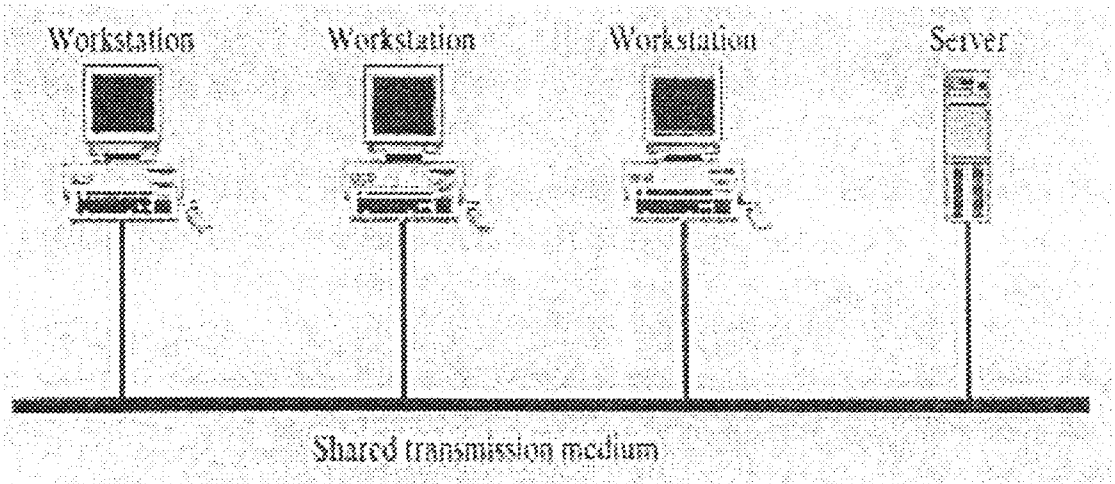


FIGURE 1.1 A Simple Local Area Network.

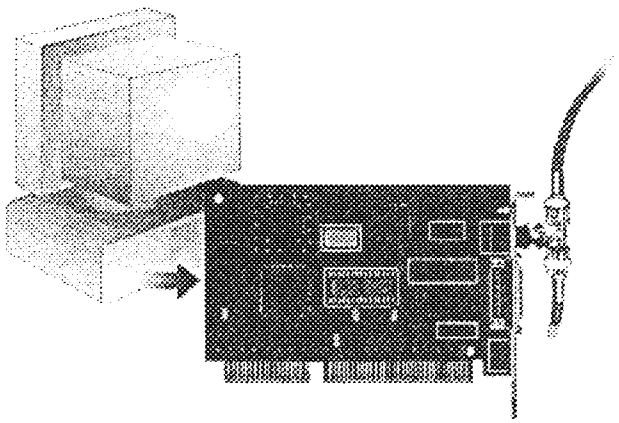


FIGURE 1.2 Workstation And A Network Interface Card

(d) Network operating system (NOS) interprets data from the network and presents it to the local operating system as an output.

(e) A communication path or network medium e.g. copper.

(d) Data and services to share.

The following characteristics differentiate one LAN from another.

(a) Network topology

(b) Protocols

(c) Media

2.3 NETWORK TOPOLOGY

This is a geometric arrangement of devices on the network. There are two types of topology:

Physical topology: The physical topology of a network refers to the configuration of cables, computers and other peripherals.

Logical topology: The logical topology is the method used to pass information between workstations.

2.3.1 MAIN TYPES OF PHYSICAL TOPOLOGIES

2.3.1.1 linear bus: A linear bus topology consists of main run of cable with a terminator at the end. It is a linear LAN architecture in which transmission from network stations propagate the length of the medium and are received by all other stations. All nodes (file server, workstations and peripherals) are connected via a linear cable.

Advantages of a Linear Bus Topology

(a) It is easy to connect a computer or peripheral to a linear bus.

(b) It requires less cable length than a star topology.

Disadvantages of a Linear Bus Topology

(a) Entire network shuts down if there is a break in the main cable.

(b) Terminators are required at both ends of the backbone cable.

(c) It is difficult to identify the problem if the entire network shuts down.

(d) Not meant to be used as a stand-alone solution in a large building.

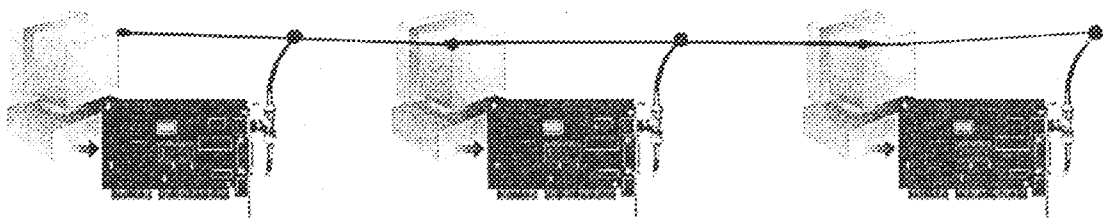


FIGURE 1.3 Linear Bus Topology

2.3.1.2 **Star topology**: A star topology is designed with each node (file server, workstation, and peripherals connected to a central network hub or concentrator. It is also an architecture in which the end points on a network are connected to a central hub, or switch by dedicated links.

Advantages of a Star Topology

(a) It's easy to install and wire.

(b) There is no disruption to the network when connecting or removing devices.

(c) Easy to detect faults and remove parts.

Disadvantages of a Star Topology

(a) It requires more cable length than a linear topology.

(b) If the hub or concentrator fails, nodes attached are disabled.

(c) More expensive than linear bus topologies because of the cost of the hub.

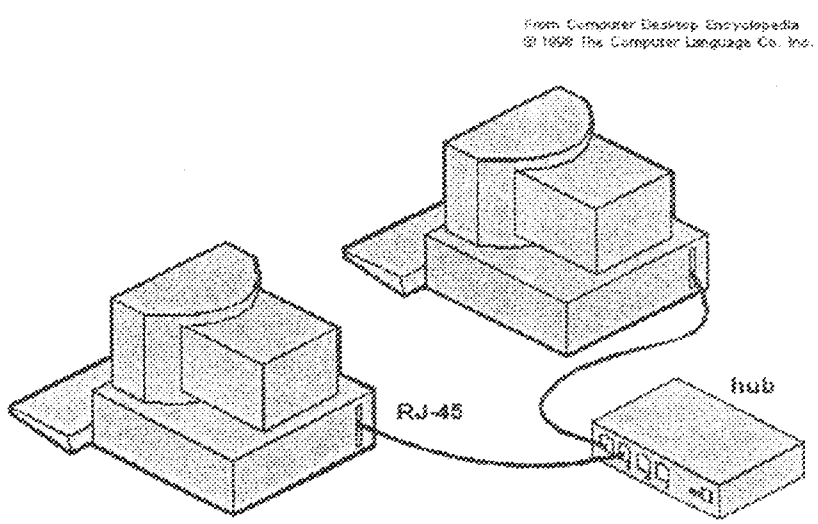


FIGURE 1.4 Star Topology

2.3.1.3 **Ring topology**: A ring topology is a LAN architecture that consists of series of devices connected to one another by unidirectional transmission links to form a single closed loop.

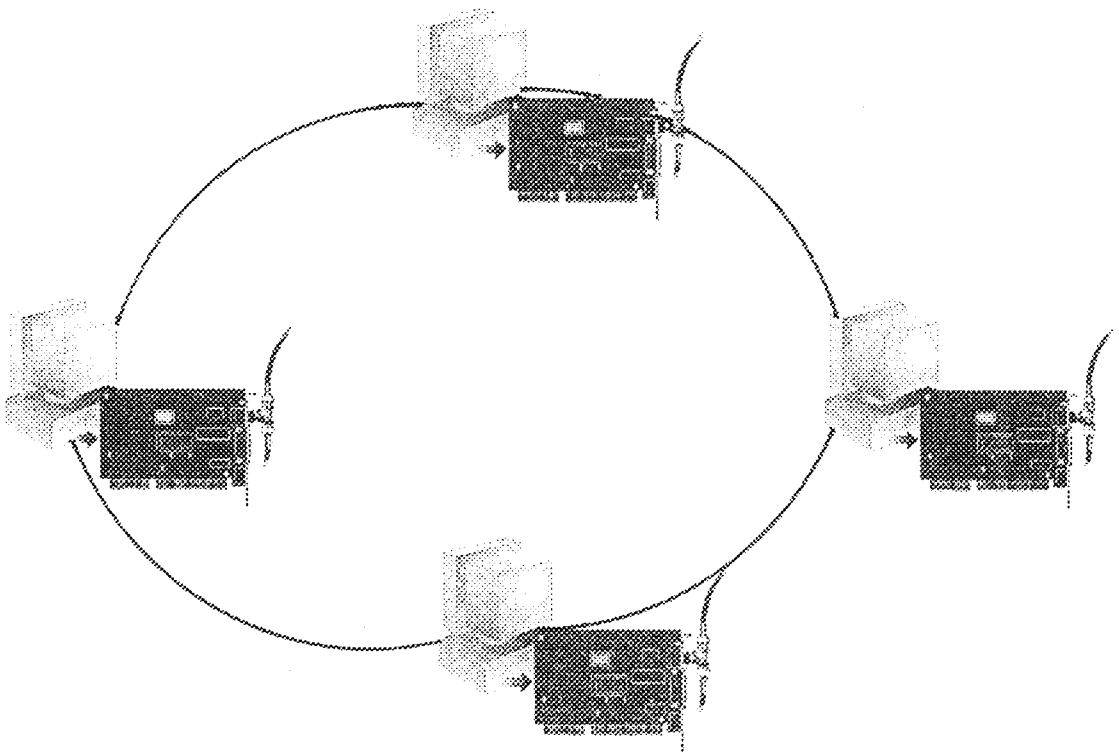


FIGURE 1.5 Ring Topology

2.3.1.4 **Tree topology**: A tree topology is a LAN architecture that is identical to the bus topology, except that branches with multiple nodes are possible in this case. It consists of groups of star configured workstations connected to a linear bus backbone cable. It allows for the expansion of an existing network and enables schools to configure a network to meet their needs.

Advantages of a Tree Topology

(a) It allows for point-to-point wiring for individual segment.

(b) Several hardware and software venders support it.

Disadvantages of a Tree Topology

(a) Overall the type of cabling used limits length of each segment.

(b) If the backbone line breaks, the entire segment goes down.

(c) More difficulty is encountered configuring and wiring than other topologies.

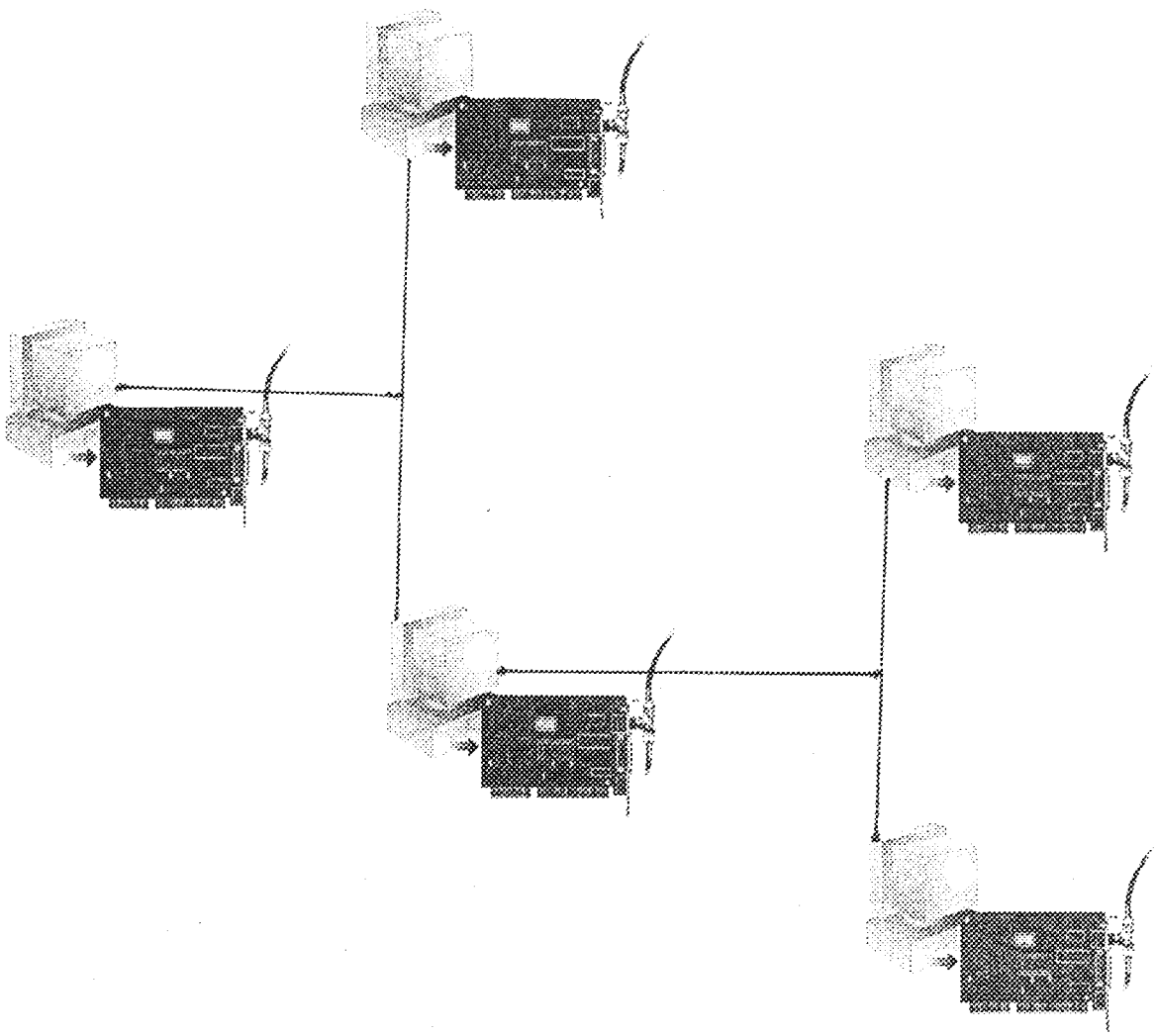


FIGURE 1.6 Tree Topology

2.4 PROTOCOLS

These are agreed upon ways that computer exchange information. It is the rules and encoding specifications for sending data.

Protocols are broadly divided into hardware and software categories.

2.4.1 HARDWARE PROTOCOLS

These define how hardware devices operate and work together. The 10 Base T Ethernet is a hardware protocol devices specifying exactly how two 10 Base T Ethernet devices will exchange information and what they will do if it is improperly transmitted or interrupted.

2.4.2 SOFTWARE PROTOCOLS

Programs communicate with each other via software protocols. Network client computers and network servers both have protocol packages that must be loaded to allow them to talk to other computers. These packages contain the protocols the computer needs to access a certain network device or service. Examples of protocol packages for different networks include Microsoft Windows NT server and Microsoft Windows 95.

2.5 NETWORK MEDIA

A transmission media is the physical path through which computers send and receive signals. The computer sends electronic signals to each other using electronic currents, Radio waves, and microwave or light spectrum energy from electromagnetic spectrum. These signals represent network data as binary impulses (0's and 1's).

CABLE MEDIA

This has a central conduction that consists of a wire or fibre surrounded by a plastic jacket. It is typically used for small LAN's. Cable media transmit signals using the lower end of electromagnetic spectrum, such as simple electricity, radio waves. Examples are twisted-pair, coaxial and fibre-optic cable.

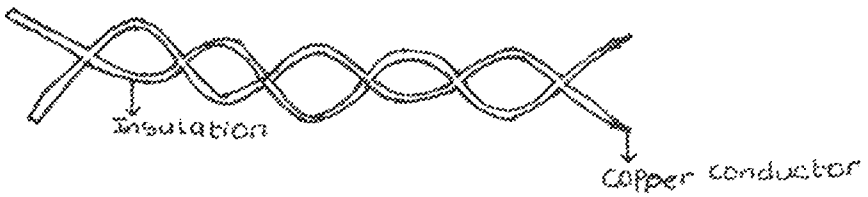


FIGURE 1.7 TWISTED-PAIR CABLE

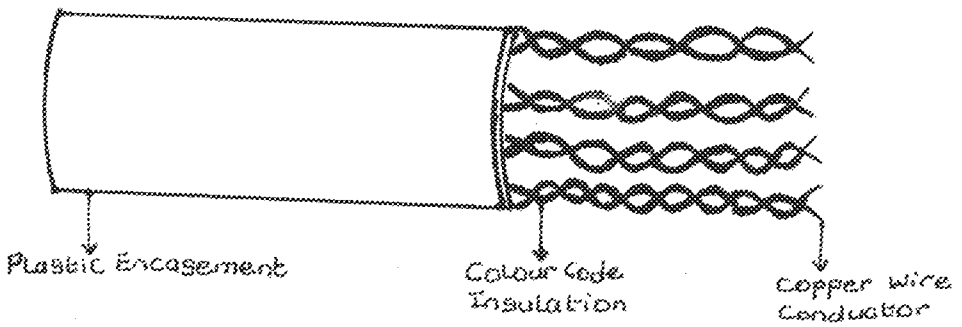


FIGURE 1.8 Unshielded Twisted-Pair Cable

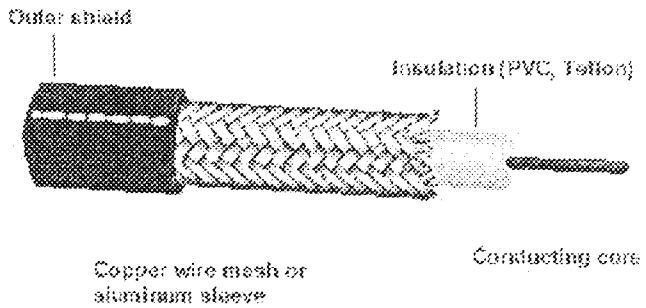


FIG 1.9 COAXIAL CABLE

FIBRE OPTICAL CABLE

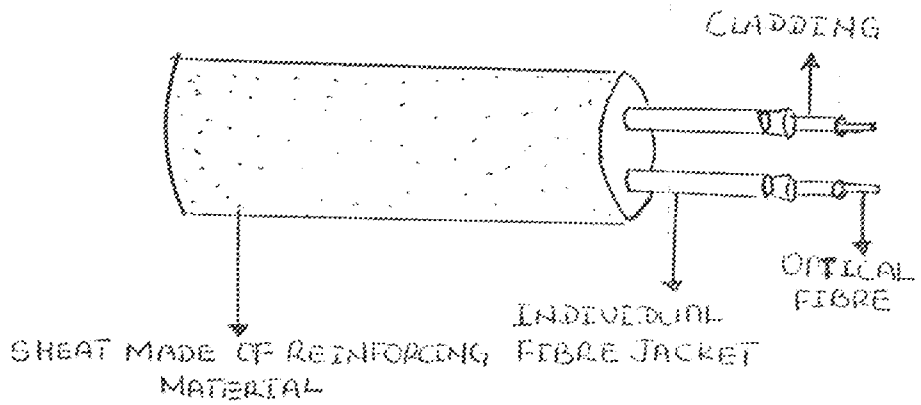


FIG 2.0

The characteristics of cable media are summarized in table (1.0) below.

FACTOR	UTP	STP	COAXIAL	FIBRE OPTIC
Bandwidth capacity	1-155Mbps	1-155Mbps	Typically 10Mbps	2Gbps
Installation	Easy	Fairly easy	Fairly easy	Difficult
Node capacity Per segment	2	2	30(10 base2)	2
Attenuation	High	High (range of hundreds of Meters.)	Lower (range of few Kilometers.)	Lowest (range of tens of Kilometers.)
Cost	Lowest	Moderate	Moderate	Highest
EMI	Most vul-nerable to EMI	Less vul-nerable than UTP	Vulnerable to EMI	Not affected by EMI

Table (1.0)

CHAPTER THREE

DESIGN OF LOCAL AREA NETWORK.

The design of local area network for School of Engineering and Engineering technology was grouped under the hardware and software design.

3.1.1 HARDWARE DESIGN

In the hardware design, an Ethernet type of LAN was embarked upon and implemented using a star topology has shown in **fig 1.4and drawing no 1,2,and3**. This consists of:

i) Network server

ii) Network interface card

iii) Workstations

iv) 8 port active hub

v) UTP and co-axial cable

vi) Connectors and terminators

Other additional components that can be used are Router, CSU/DSU, external transceivers, repeaters, bridges, and multiplexers.

3.1.1.1 NETWORK SERVER

The server is the focal point of the network. A network server is dedicated to perform specific tasks in support of other client computers (workstations) in the network. The server provides file storage, space for many clients requiring it's services, a more powerful processor, more memory, a longer hard drive and more powerful network adapter cards which all help the network server to keep

information flowing. The server computer must have at least a Pentium processor and 16-32 MB of RAM.

The requirements of server and client hardware are shown in Table 1.1 below:

COMPONENT	CLIENT	SERVER
Memory	At least 8MB.	At least 16MB.
Hard disk space	About 50MB plus the storage Space for a single user and app- Lication.	about 90MB(110 for RISC) Plus storage space for a Single user.
Processor	486 or greater.	Pentium or RISC-base Preferred. 486/66 for Small networks.
Display	VGA or better	VGA or better

Table 1.1

3.1.1.2 NETWORK INTERFACE CARD (NIC)

A network interface card (NIC) is a computer circuit board or card that is installed in a computer so that it can be connected to a network. Sever, personal computers and workstations on a local area network (LAN) typically contain a network interface card specifically designed for the LAN transmission technology, such as ETHERNET or TOKEN RING. Network interface cards provide a dedicated, full-time connection to a network.

The procedure for installing a network adapter card on NOS like Windows NT, windows98 and windows ME is as follow.

(a) Shut down the computer and remove the power cord.

(b) Remove the computer's casing.

(c) Find an unused expansion slot on the motherboard. Most computers have two types of expansion slots. The Industrial standard architecture (ISA) and peripheral Component Interconnect (PCI). The PCI slot network interface card is preferable because of its speed.

(d) Remove the slot protector from the casing by unscrewing.

(e) Insert the network card into the PCI slot.

(f) Secure the network card with the screws removed in step d.

(g) Put the casing back.

(h) Power on the computer. For plug and play Network Operating System (NOS), the network interface card (NIC) is automatically detected.

(i) Follow instructions for configuration.

3.1.1.3 **IIII**

The hub fig (2.1) provides a central point of connection in an Ethernet network when using star topology. An active hub has electronic components in them that can amplify and clean up data transmission as well as enabling signal regeneration. The work of the hub is to receive signals from the server through one port and transmit them to all other ports on it. If port 1 is sending traffic to a server on port 8, all ports on the hub will receive the traffic whether they need it or not. With an active hub, the computers networked are less subjected to data degradation (errors) and they are located further apart.

Stacking is the process of increasing the size of hubs by the use of stacker's cable or Chassis links to create a single logical hub.

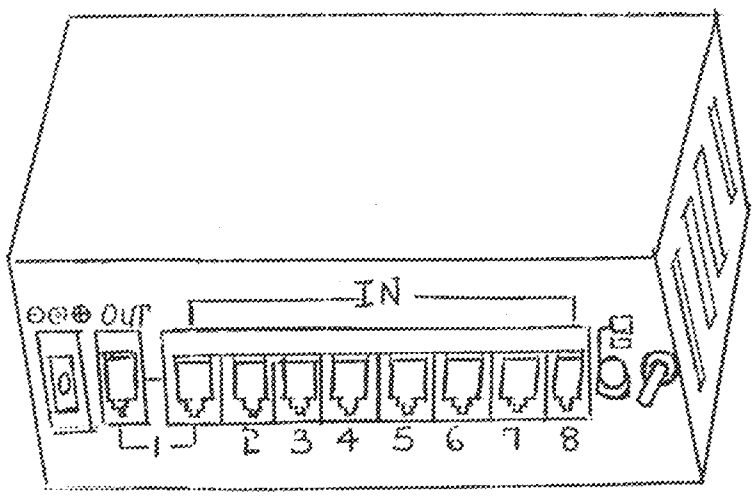


FIG 2.1 8-PORT HUB

3.1.1.4 ROUTER

The router's job is to stop all local traffic from being broadcasted to the rest of the coastguard. It analyzes the address of all traffic coming in through its Ethernet AUI ports. If the traffic is not local, it sends the traffic out trough one of the other ports. The incoming and outgoing ports are determined based on the requirements outgoing ports are determined based the requirements and are identified during the programming process.

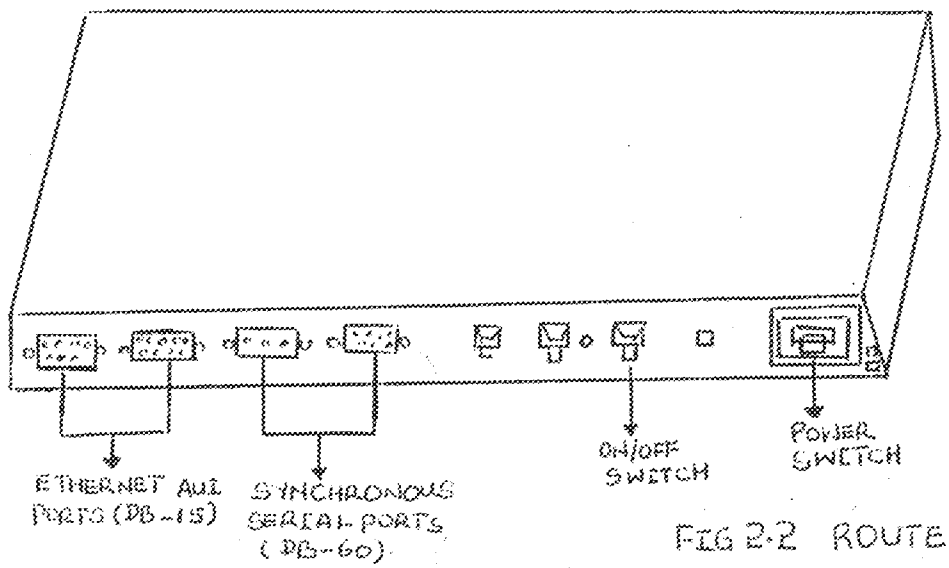


FIG 2.2 ROUTER

3.1.2 CABLE IMPLEMENTATION

An untwisted shielded pair cable is used in an Ethernet 10 Base T (10 megabits per second) LAN connection using a star topology. It accepts a RJ-45 connector (fig 2.3), which is crimped on the end of the cable with a crimping tool (fig 2.4). Looking at the RJ-45 male connector from the front with the clip on the top, the pin locations are numbered 1 on the left down to 8 on the right as shown in (fig 2.3).

The Jack or node (fig 2.5) is the female component in a network device, wall or cubicle path panel. In order for electricity to run between the connector and the jack, the wires must follow the EIA/TIA standards, listed in table 1.3 and 1.4 The node connection for the jack is shown in Fig (2.6).

UTP EIA/TIA 568A WIRING STANDARD.

Pin 1	Pair 2	White/Green.
Pin 2	Pair 2	Green.
Pin 3	Pair 3	White/Orange.
Pin 4	Pair 1	Blue
Pin 5	Pair 1	White/Blue.
Pin 6	Pair 3	Orange.
Pin 7	Pair 4	White/Brown.
Pin 8	Pair 4	Brown.

Table 1.2

PIN	WIRE PAIR (T is Tip, R is Ring)
1	Pair 2T2
2	Pair 2R2
3	Pair 3T3
4	Pair 1R1
5	Pair 1T1
6	Pair 3R3
7	Pair 4T4
8	Pair 4R4

Table 1.3

UTP EIA/TIA 568B WIRING STANDARD

Pin 1	Pair 2	White/Orange
Pin 2	Pair 2	Orange
Pin 3	Pair 3	White/Green
Pin 4	Pair 1	Blue
Pin 5	Pair 1	White/Blue
Pin 6	Pair 3	Green
Pin 7	Pair 4	White/Brown
Pin 8	Pair 4	Brown

TABLE 1.4

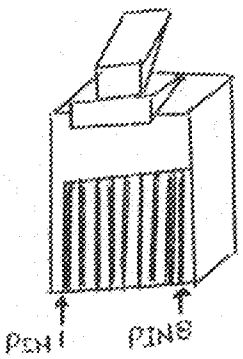


FIG 2-3 RJ-45 JACK PLUG

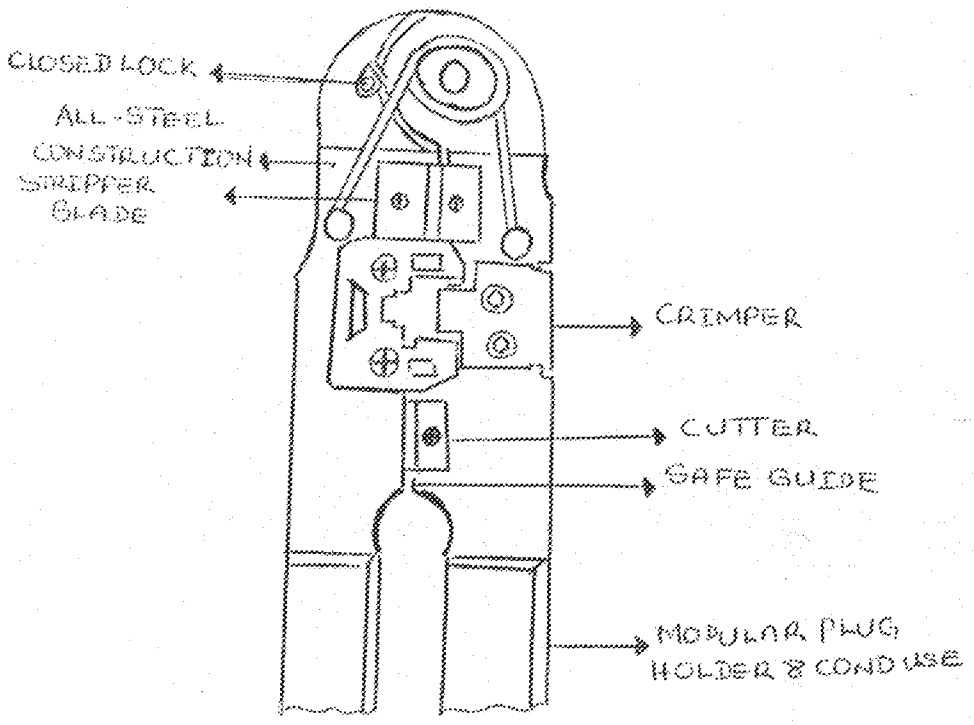


FIG 2-4 CRIMPING TOOL

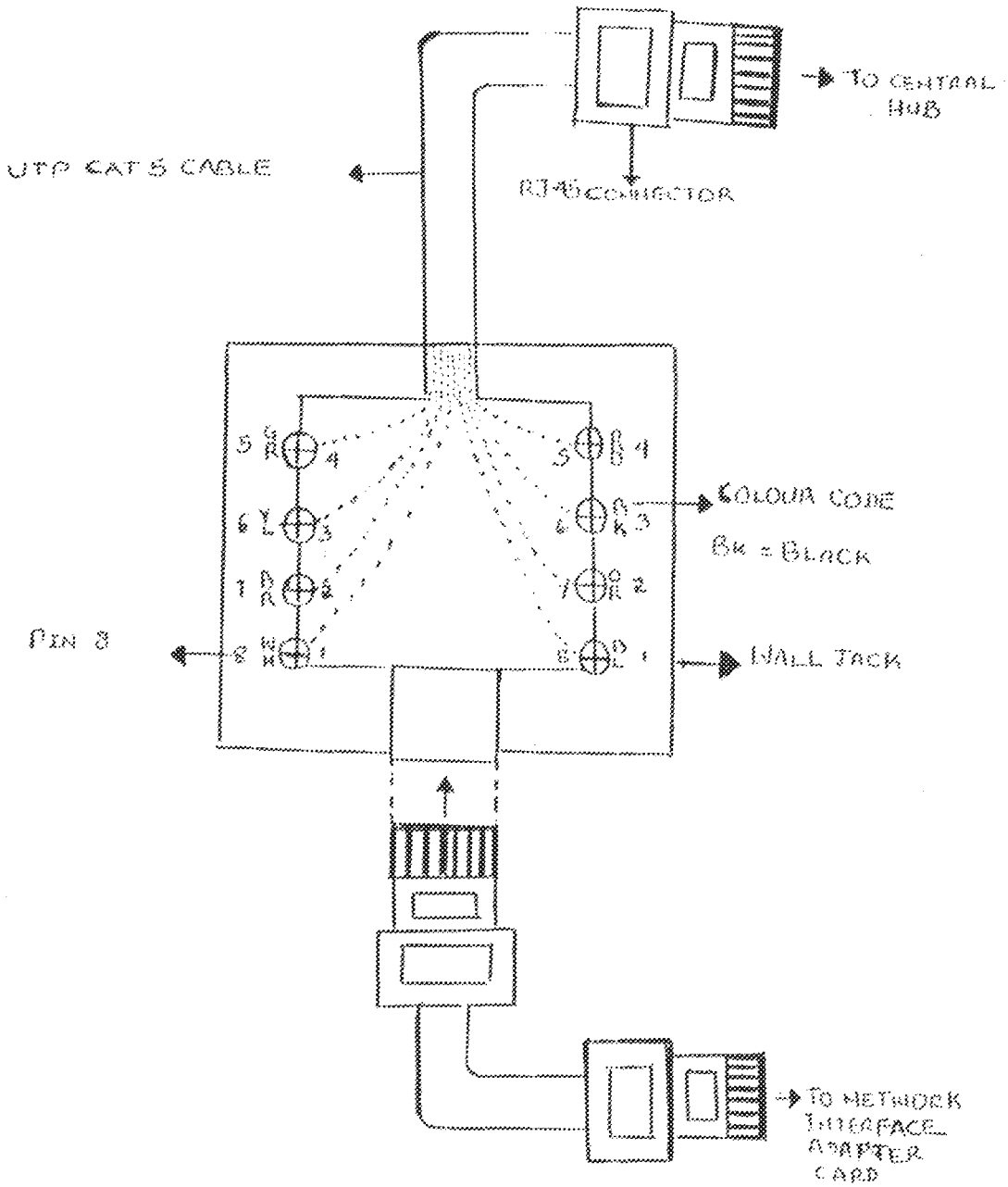


FIG 2.5 WALL JACK CONNECTION

For correct identification of EIA/TIA category, a straight through cable (fig 2.7 used for this design) and crossover cable connection can be used.

Straight-through cable connection maintain the pin connections all the way that is pin 1,2,3…8 is the same on both ends of the cable.

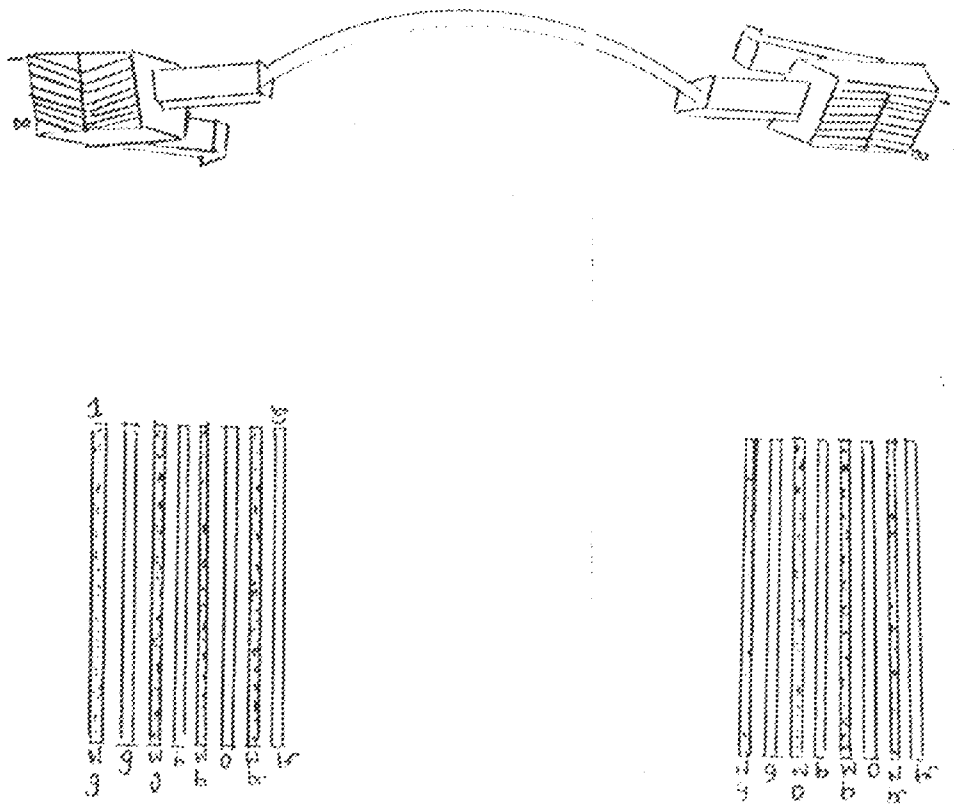


FIG 2.7 STRAIGHT-THROUGH CABLE (WIRES ON CABLE ENDS ARE IN SAME ORDER.)

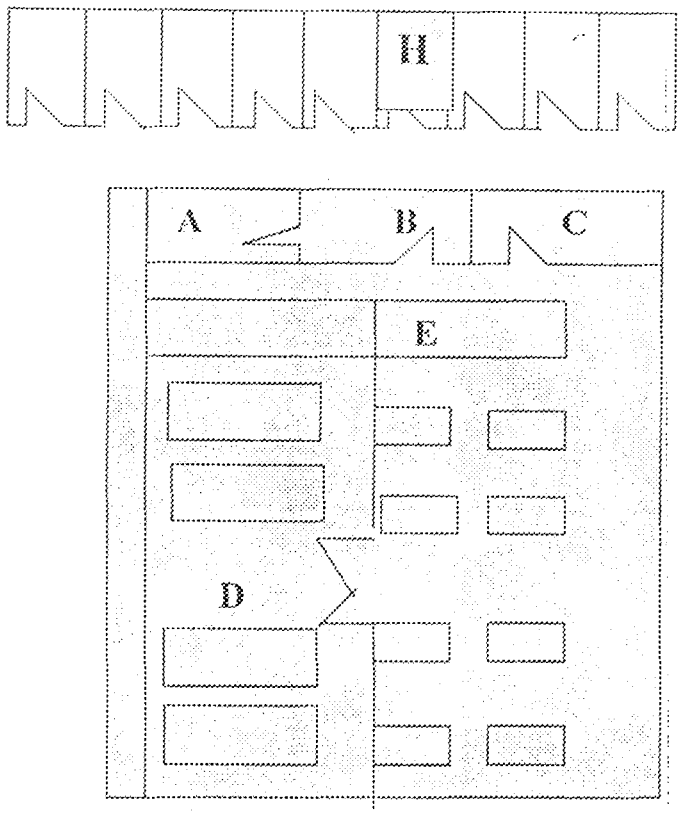
3.2.1 NETWORK OPERATING SYSTEM (NOS)

In the software design for a Local Area Network for the School of Engineering and Engineering Technology, a Windows NT Server was used as the Network Operating System (NOS). A Network Operating System (NOS) is generally reserved for software that enhances a basic operating system by adding networking features.

Windows NT server, as the name implies, is a server operating system. It is optimized to provide network services to client computers. It can also

be used as client operating system. Windows NT server is the home at the center of the network providing file and print services, routing mail, network traffic and security features.

SITE LAYOUT



LEGEND	
SYMBOL	DESCRIPTION
A	SERVER LOCATION
B	SECRETARY'S OFFICE
C	TECHNICIANS OFFICE
D	COMPUTER LABORATORY
E	ELECTRICAL LABORATORY
H	OFFICE THE H.O.D ELECT. AND COMP. ENGINEERING.

PROJECT TITLE:
DESIGN AND IMPLEMENTATION OF LOCAL AREA NETWORK (LAN) FOR SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY

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DEPARTMENT: ELECTRICAL AND COMPUTER ENGINEERING TECHNOLOGY.

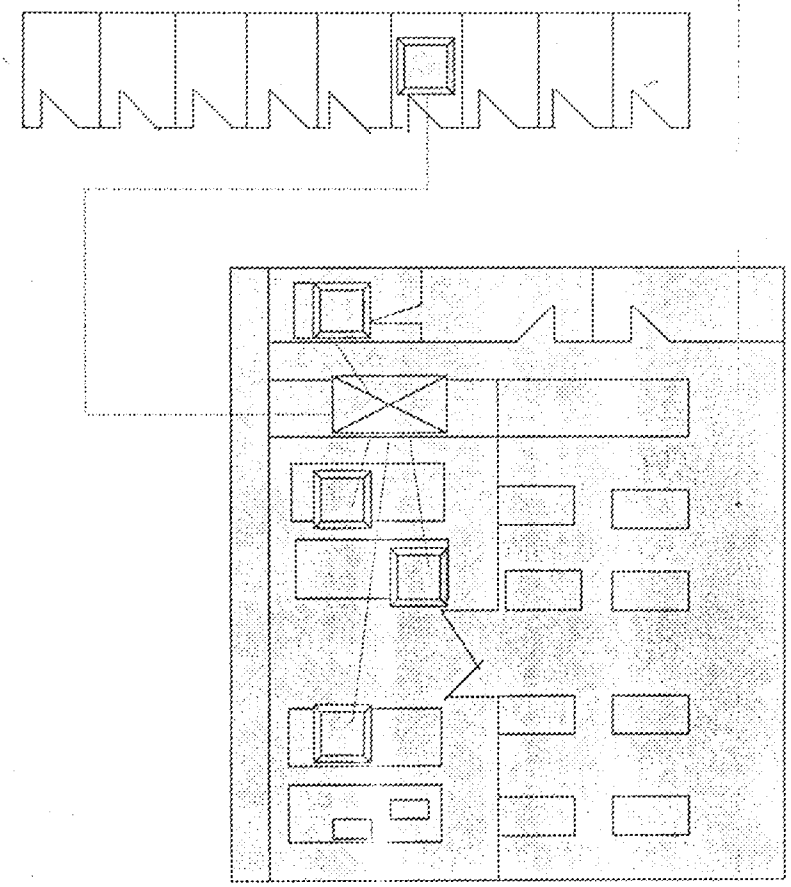
SUPERVISOR: MR J-KOLO

COURSE CODE : EEE 515 / EEE 525.

DATE : 07/01/2002

DRAWING NO: 1

CABLING LAYOUT



LENGEND	
SYMBOL	DESCRIPTION
	CABLES
	9 PORT HUB
	SERVER
	WORKSTATIONS
	EXPECTED COMPUTERS
	EXISTING COMPUTERS

PROJECT TITLE:
DESIGN AND IMPLEMENTATION OF LOCAL AREA NETWORK (LAN) FOR SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY

NAME OF STUDENT	**REG. NO :**
IZUKA VINCENT C.	*97/6455EE.*
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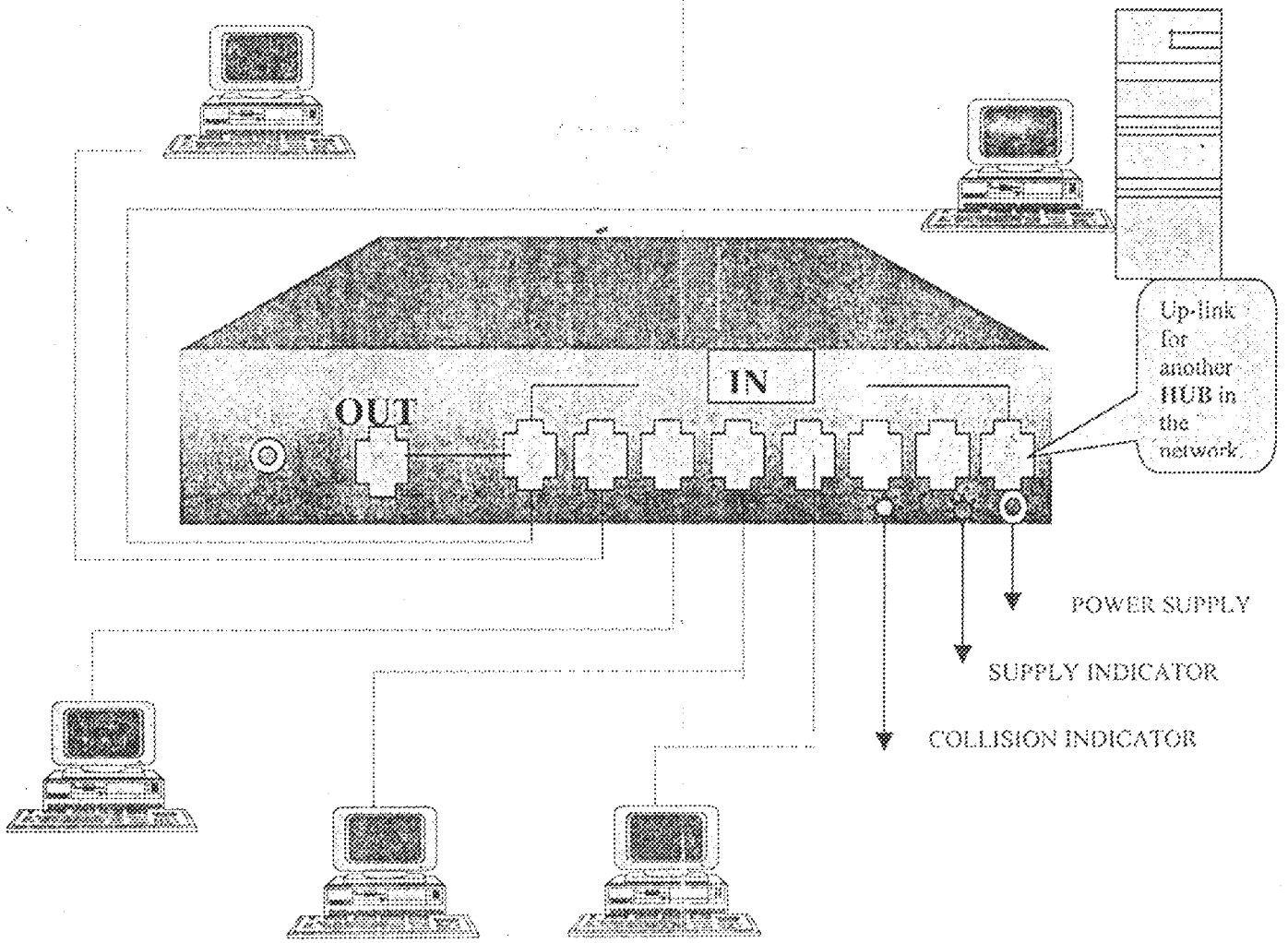
DATE : 07/01/2002

DRAWING NO: 2



PROJECT TITLE:
DESIGN AND IMPLEMENTATION OF LOCAL AREA NETWORK (LAN) FOR SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY

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DRAWING NO: 3

CHAPTER FOUR

4.1 SIGNAL TRANSMISSION

Signaling is the way data is transmitted across the medium in a network. It uses electrical energy to communicate. In signal transmission, encoding (modulation) is the process whereby data or the bits and bytes are represented in a way that the sender can create a message and the receiver can understand it.

Information to be communicated can exist in two forms, which are analog and digital signaling. Analog signaling is the one that changes continuously while digital signaling consists of discrete states (on or off) represented by binary numbers 1 and 0 respectively.

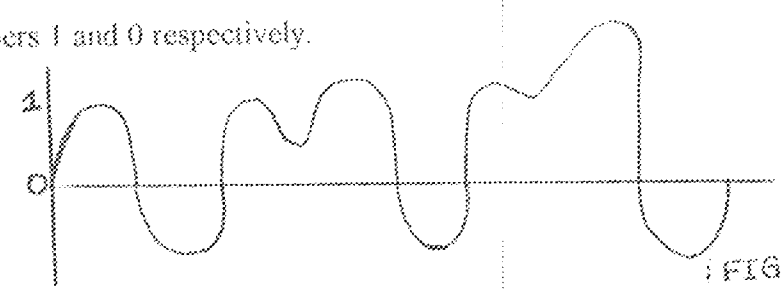

FIG 2.8 ANALOG SIGNAL

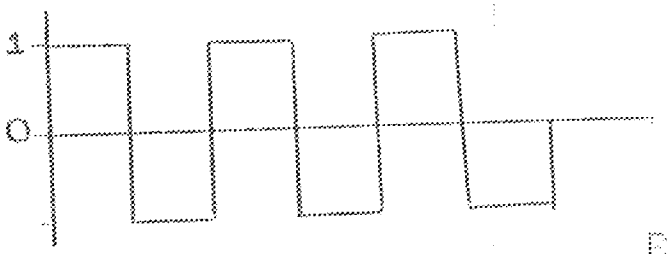

FIG 2.9 DIGITAL SIGNAL

4.2 DATA TRANSMISSION IN A LAN

There are two ways by which information are transmitted in a local area network. They are:

(a) **Parallel transmission**: The parallel mode of transmission enables

signals to be transmitted at the same time along a bundle of lines called highways. Highways vary from 8 bits in microcomputer to about 4 bits or more in large computers. Parallel transmission is the most used type of data transmission in a Local Area Network.

(a) Serial transmission: In serial mode of transmission, signals are sent down one after the other in the same line. This makes a serial transmission a very slow method in sending information

4.3 THE OSI MODEL

The international organization for standardization began developing the open system interconnection (OSI) reference model in 1977. It has since become the most widely accepted model for understanding network communication. For effective data communication, some standards and rules are defined by the OSI that apply to the following rules.

How bits are represented on the network media.

a) How physical transmission media are arranged and connected.

b) How to ensure that network devices maintain a proper rate of data flow.

c) Methods by which a device on a network knows when to transmit data and when not to.

d) How network devices contact each other and if they have different gauges, how they communicate with each other.

e) Methods to ensure that the right recipient receives network transmission correctly.

The OSI reference model has seven layers:

(1) Physical layer

(2) The data link layer

(3) Network layer

(4) Transport layer

(5) Session layer

(6) Presentation layer

(7) Application layer

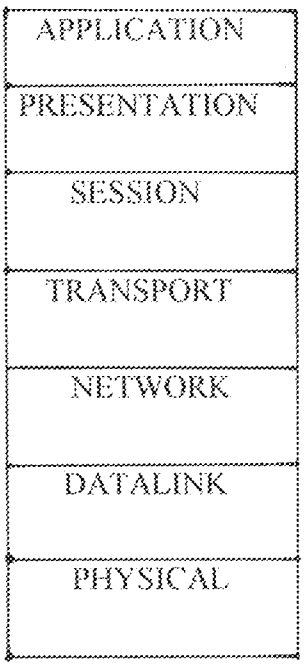

FIG 3.0 OSI SEVEN LAYERS

4.3.1 UPPER LAYER

This layer deals with the user interface, data formatting, and application access. The three are:

APPLICATION LAYER

This is the highest layer of the model. It is the point where the user application interfaces with the protocols to gain access to the network. For example, a word processor is serviced by the transfer services at this layer.

PRESENTATION LAYER

The presentation layer provides a variety of coding and conversion functions that are applied to application layer data. These functions ensure that data sent from the application layer of one system can be read by the application layer of another system. Examples are coding functions of data after it leaves an application and the Jpeg/gif formats of the images displayed on web pages.

SESSION LAYER

The session layer is responsible for establishing, managing and terminating communications session between presentation layer entities. Communication at this layer consists of service request and response that occur between applications located in different devices. An example is the co-ordination between data base server and a data base chart.

4.3.2 LOWER LAYER

The lower layer is responsible for redefining how data is transferred across a physical wire, through Internet work devices to the desired end station, and finally to the application on the other side. The four types are:

PHYSICAL LAYER

The physical layer defines the media type, connector type and signaling type. It specifies the electrical, mechanical, procedural, and functional requirements for activating, maintaining and deactivating the physical link between end systems. The physical layer also specifies characteristics such as voltage levels, data rates, maximum transmission distances and physical connections.

DATA LINK LAYER

The data link layer provides details on how traffic can be placed on a network. The purpose of the data link layer is to provide the communications link between the workstations at the first logical layer above the bits on the wire. The physical addressing of the end stations is done at the data link layer to help the network devices determine whether they should pass information up the protocol stack. Fields also exist in this layer to tell the device which upper-layer stack to pass the data (such as IP, IPX). The data link layer provides support for connection oriented and connectionless services for sequencing and flow control.

NETWORK LAYER

The network layer defines how to transport traffic between devices that are not locally attached in the same broadcast domain. The information required in this layer is the logical address associated with the source and destination stations and a path through which the network reaches the desired destination.

The logical addressing scheme is used to identify network in an Internet.

TRANSPORT LAYER

The transport layer defines the end-to-end station establishment guidelines between two end stations. It uses a reliable connection oriented relationship between the communicating end systems to accomplish the following:

(a) It ensures that segments delivered will be acknowledged back to the sender.

(b) It provides for retransmission of any segments that are not acknowledged.

c) It provides congestion avoidance and control.

(d) It puts segments back into their correct sequence order at the receiving station.

4.4 APPLICATIONS OF LOCAL AREA NETWORK

A Local Area Network has the following basic uses. These are:

(a) **Electronic mail:** E-mail allows users on the network to exchange mail electronically. The idea is similar to the U.S. postal system except it is paperless, cheaper, more efficient, and quick. Programs use the simple Mail Transfer protocol (SMTP) to implement this.

(b) **Resource sharing:** Networks allow the sharing of printers, files, programs, and file systems enabling a few resources to serve a large number of users.

(c) **File Transfer Protocol (FTP):** File transfer protocol permits network users to move files to different computers. A Host allows users to anonymously transfers and distributes files.

(d) **Terminal emulation (telnet and rlogin):** With terminal emulation, one computer can connect to another over the network as though connected by a terminal. The computers involved can be very far apart.

(e) **USENET News:** USENET is an electronic news system. Thousands of bulletin boards ("news groups") are setup for every topic under the sun. Users can read and post articles to groups and their postings will be distributed to computers around the world.

4.5 NETWORK SECURITY

Security is an important part of any network. The importance of Network security is overemphasized since it guide against theft, prevents system from exposure to unauthorized users from accessing files, directories, and critical data resources on the network.

Windows NT model provides a safe environment security for the network. The scheme was designed to offer a high level of protection for data and shared resources.

The security scheme is as follow:

- The logon process and user identity.
- Password.
- Objects and security.
- Permissions
- Access control list.

4.6 TEST CARRIED OUT AND RESULTS

In order to ensure that the network components and features were in good working conditions, some test were carried out with the aid of Digital Multimeter and their result was also noted. They are:

(a) **Continuity test:** For the UTP CAT5 cable using RJ-45 connectors, the pin-to-pin test was carried out on each drop cable and tested for continuity using the Digital Multimeter. The beeping sound indicates there is continuity in the cable connection. The result is shown in table 1.5

Pin-to-Pin	UTP Cat 5 cables								Meter Indication	Result
	1	2	3	4	5	6	7	8		
1 to 1	"	"	"	"	"	"	"	"	Beep	Pass
2 to 2	"	"	"	"	"	"	"	"	"	"
3 to 3	"	"	"	"	"	"	"	"	"	"
4 to 4	"	"	"	"	"	"	"	"	"	"
5 to 5	"	"	"	"	"	"	"	"	"	"
6 to 6	"	"	"	"	"	"	"	"	"	"
7 to 7	"	"	"	"	"	"	"	"	"	"
8 to 8	"	"	"	"	"	"	"	"	"	"

Table 1.5

(b) **Communication Test:** This test was carried out to view network performance and objectives such as sharing of hard disk, floppy drive,

printers, Cd-Rom and so on. The output gives proper communication link between the devices.

(c) Connectivity test: This is carried out to show communication link between the computers in the Local area network via a cable and hub. The "ping" command in MS DOS prompt is used to achieve this. This command is used for sending out Internet control management protocols (ICMP). The syntax is as follows: "C:/> Ping<IP address>.

CHAPTER FIVE

5.1 CONCLUSION

A Star Topology was used in the implementation of this project, which was designed having the network server, workstation (client computers) connected to a central hub. An untwisted shielded pair cable was used that accepts RJ-45 connectors. The star topology was chosen because of its advantages over other types of network topologies.

At the end of the Design and Implementation of Local Area Network for the School of Engineering and Engineering Technology, Communication means was faster in the Department. This was made possible because the computers networked were able to share components of the system unit such as Cd-Rom drive, Floppy drive, and hard disk. Other computer peripherals like printers and scanners were also being shared on the network. This enables expensive software and hardware usable by both the lecturer and student.

5.2 LIMITATION

(a) The RAM size of some workstation is 32Mb Ram. This makes the speed of the PC system unit very slow.

(b) The hub used for the implementation of the project is an 8-port hub. This implies that only eight computers can be networked.

(c) Some computers are situated faraway from the central hub. This brings about signal degeneration, limitation of segment size and equipment like repeaters, routers and bridges are very expensive.

5.2 RECOMMENDATION

For a future improved LAN, it is advised that the following recommendation should be put into consideration.

(a) Government should provide funds for Universities Institutions for the development of their practical laboratories.

(b) A 16-port hub and switches should be provided by the Department to allow for expansion of the network.

(c) Regenerative equipment like the router, bridges, repeaters must be included in the network.

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