DESIGN OF A KNOWLEDGE BASED PC TROUBLESHOOTING AND REPAIRS

BY

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PGD/MCS/98/99/786

A PROJECT SUBMITTED TO THE DEPARTMENT OF MATHEMATICS/COMPUTER SCIENCE, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA. IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF POST-GRADUATE DIPLOMA IN COMPUTER SCIENCE.

SEPTEMBER, 2000

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CERTIFICATION

This project has been submitted and acceptable in partial fulfillment of the requirement for the award of Post-graduate Diploma in Computer Science of the Department of Mathematics/Computer Science of Federal University of Technology, Minna.

_____ _____

Prof. K.R Adeboye Date
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External Examiner Date

DEDICATION

To Almighty God and Lovers of progress!

ACKNOWLEDGEMENT

With due respect and humility, I acknowledge the inspirational efforts of all those who, in one way or the other, contributed to making this project work a reality.

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ABSTRACT

The Project work is the Design of a knowledge based PC Troubleshooting and Repairs that will help PC Professionals and Users to be familiar with some of the common PC error codes, Diagnostic signals and probable causes. It will also help in the act of documenting system problems and solutions at any given time.

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CHAPTER ONE

PC WORLD

1.1 INTRODUCTION

The world of personal computers christened PCs dates back to 1940 when John Attanasoff required a calculating device to perform mathematical operations for twenty (20) Masters and Doctorate degree students of a college in **IOWA at AMES in U.S.A.** None of the existing calculators was able to do that hence the need for an improved system for calculations and other repetitive functions hitherto difficult for man to complete in a short while.

Since then, several machines were developed, used and improved upon. The refinement of computing concept focused on size, speed, and cost gave the page to the computer generation. This generation was gradually intended to suggest different developments of the hardware components but; nowadays, it is being applied to both hardware and software systems of the computer and this gave way to the fine exiting generations.

For the current generation, most people hold the extreme views on computers. Some think they **(computers)** are intelligent, powerful machine that can do anything. Some are of the view that computers are machines that will give some madmen the power to destroy the world or may someday, unseat men as the ruler of the universe and so refrain from them. Others look on computers as glorified electronic typewriters and so use them for nothing more than that purpose.

Actually, a computer system can simply be defined as a combination of hardware devices and software programs assembled to accomplish some specific tasks. A PC performs basically two operations, which are simple Arithmetic **(+, -, *, /)** and logical **(<, >, =)** operations. Computers have very wide applications but are best suited for doing tasks that could be repetitive. For example, to solve a

complicated equation may easily be carried out with an electronic calculator but to solve same with 1000 pieces of sample data is definitely a job of the computer. They are typically useful for storing, manipulating, analysing and retrieving large amount of information.

Today, computers are applied widely in business for word processing, spreadsheet, database manipulation, desktop publishing, graphic representation, information transfer, accounting, electronic banking, electronic shopping, advertising, communication, electronic newspapers and in fact all facets of human endeavours. In science and engineering, for **Computer Aided Designs (CAD),** manufacturing and testing, as well as computer simulation and computer controlled machine tools etc. In medicine, for computer Bio modelling, Scanning, general administration and record keeping, medical expert systems etc. In transportation, for airline reservation, flight scheduling and monitoring, Aircraft and train control etc. In government for records reporting, communication and control. In education, for research, referencing, electronic schooling, creative teaching for which this project is intended.

Infact, every field of expertise e.g., Agriculture, Law, Medicine, Physics, Geography, Engineering, mathematics etc have databanks which hold large deposits of knowledge and can be accessed from anywhere in the world through the INTERNET. From the above analysis, it can be deduced that a PC can be used as a tool for enhancing job implementation or instrument of communication and entertainment.

Generally, what a PC can be used for depends on the components or component parts existing in the system and the application software in form of programs installed. Programs can also be developed and applied through a PC to solve a specific task as the case with this project work **"A knowledge based PC troubleshooting and repair".**

1.2 COMPONENT PARTS OF A PC:

A personal computer PC is made up of the following component parts among others: -

- Casing with Ac power and connecting cables
- Motherboard
- CPU and fan
- Memories
- Drives; HDD, Floppy
- Ports- Serial and parallel
- Mouse
- Keyboard
- CDROM
- Speakers in some cases
- Modems
- Monitors etc

PC CASING:-This is the housing unit of a PC and is normally made of metals designed to be either a stand- alone or Desktop. There are mainly two types of PC casing readily available in the market today. These are:-

a) Tower casing which comprises of Minitower, Miditower and Full Tower casing.

b) Desktop casing is the type of casing that is laid flat on a table and the monitor usually placed on top to save space. The choice of the type of casing to use while assembling a system depends on the individual and the number of peripheral devices that one needs to add to the system. Each casing comes with the power supply that converts Ac current from the wall socket to a low-voltage direct current that the computer uses. The casing no matter the type and size house the other component parts like the motherboard, memories, drives, ports, modems etc.

MOTHERBOARD:- This is the part of a PC that holds other components in place. Just like the human mother, the motherboard supplies all the needs of other peripheral devices of the computer. The board is regarded as the livewire of the PC. When one selects a computer, most of the Technical jargon refers to this one component of the system called the motherboard. The features of the board determines the type of device installations one needs to carry out i.e. whether some devices or peripheral come **onboard** or are to be slotted through the **PCI** or **ISA** slots or even attached separately as the case with external modem.

There are various types of motherboards, they are usually referenced by the type of interface slots on the board. The slots available are Industry Standard Architecture (ISA), EISA (Extended ISA) and Peripheral Component Interconnect. Since there are different types and manufacturers, one needs to look for the expendable type to suit his purpose.

CENTRAL PROCESSING UNIT:- CPU is the brain of the computer itself. The amazing piece of technology, which makes the personal computer possible. It is a sealed unit consisting of millions of transistors, diodes, and various other parts too small for the eye to see. The CPU requires a fixed number of clock cycles to execute an instruction. Therefore, the faster the clock, the more instructions the CPU can execute per second. There are various types of CPUs. This ranges from INTEL, CYRIX, and AMD to other classes. Each of the types will have a clock rate value of speed. This is the speed at which a chip executes instructions. The clock speeds are measured in megahertz (MHZ). 1 megahertz is equal to I million cycles per second.

Each of the various types has further sub-division of classes. For instance, Intel Corporation released a Pentium Processor that uses their newest processor enhancement, MMX™ Technology. A system that uses an MMX based Pentium

chip is 10-20% faster than a non-MMX Pentium processor based system, and will also receive a smoother and more realistic multimedia experience.
Nowadays, CPU comes in either slots or sockets and the one to buy depends on the motherboard type one wants to buy.

The CPU fan unit is comprised of a small fan that attaches to a heat sink. The heat sink is usually a metal that draws away heat from the chip. The fan helps to disperse heat away from the chip enabling it to keep cool.

MEMORY:- This is the PC component whose function is to remind the processor of what to do to hold on the processed data until they are finally saved to the storage device. Currently, the most common memory types are: Standard D-RAM and EDO-RAM. The configuration and installation of either type is the same. EDO-RAM is about 10% faster hence it's pricing is a little higher and better buy. `The type to buy depends on the one the motherboard will support.
Memory speeds are measured in Nona-second (ns) or one billionth of a second. The faster the memory, the more expensive it is. There are 72 pins, 30pins etc memory modules and each to use depend on the motherboard one has. Cache memory is very fast and allows the processor to store the last accessed data to utilize it more quickly.

HARD DRIVES: -Hard drives or fixed drives are the main types of mass storage devices used for the operating system, application programs and data. The selection of the hard disk drive is determined by the use of the system. The general rule is to get the largest model affordable. With the size of programs today and the programs of the future sure to be larger, space will be used quickly. The common type of hard drives today has three popular interfaces; IDE, EIDE and SCSI. Each has its own advantages and disadvantages. The IDE or EIDE interface is usually built into newer PCI motherboards and does not require any additional boards to be installed. It will only support two devices on a single connector and the types of peripherals are limited. The SCSI interface is a card

installed in a slot on the motherboard. The Standard SCSI interface support up to seven devices called daisy chaining and the devices available are varied and plentiful. There are many options available when purchasing a hard drive. Foremost are what type of drive and capacity, usually defined in megabytes. The next factor is speed or access time. Access is the time it takes a hard disk to locate and retrieve data. Te lower the access time, the faster the drive. One should try to purchase a drive that has an access time lower than 12millions seconds (ms).

SERIAL AND PARALLEL PORTS:- A serial port is bi-directional meaning that it can transmit and receive data at the same time. This is useful in devices like modems, which can transmit and receive data at the time. They are also used for communications and communicate with a device 1 bit at a time.

Parallel ports are printer ports. They receive more than 1 bit at a time, usually 8 bits or a byte. They also allow more data to be sent through at a time as compared to a several port. New parallel port device have led to the development newer types; the EPP (Enhanced Parallel Port) and ECP (Extended Capabilities Port). This new port support by Bi-directional communications for increased speeds, but are still compatible with older parallel port.

MOUSE: A mouse is considered as a pointing or input device used with program to enhance their operation and make commanding the computer easier. Instead of typing commands, the mouse is used to select from a choice of operations. There are various types of pointing devices on the market such as a trackball, drawing table, light pen and the mouse. Each device accomplishes the same task- (INPUT).

Selection of a mouse is a personal option. Try each model and type until one finds the best fit for the program is using. Most programs today require a mouse for operation.

KEYBOARD:- The key is the communication link between an individual and a computer. The commands given the computer will come from the keyboard.

Keyboards have several different options and styles to choose from. New ergonomic keyboards are designed for faster typing and to reduce stress to the hands and wrist. Some keyboards have build in pointing devices such as a trackball or mini-joysticks. Other options include build in speakers, a telephone, or a scanner. Some are even wireless but the functions are the same.

CD-ROM:- Compact Disk-Read Only Memory has become the most popular method of distributing software. Each disk can hold a large amount of information and is one of the most reliable methods of storing data. The device which read the disk are rated by speed and type of interface used. CD-ROM devices use a number followed by an 'X' to denote their speed.
Two interfaces are available in today's machine; the IDE interface and the SCSI interface. The IDE attaches and hooks to the machine as a read only hard drive. The SCSI interface is a little faster and support various types of peripherals on one card. Both drives are attached through a ribbon cable to the appropriate interface and power is supplied from the computer power supply.

Also available are compact disk (CD) changers. These are little like the multi-disk changers available for home and car stereos. The advantage to this is you don't have to change as much.

SPEAKERS:- One cannot have the best sound card on the market without high speakers, he/she can get high quality sound . there are large varieties of speakers available for computers.
The best way to select a speaker system is to listen to it. Try to use it with programs that you and may use in the future. Because speakers contain magnet, which can destroy data on hard drives and other magnetic media, check to make

sure that the system you choose is magnetically shielded. This will add an extra bit of safety from accidental erasure of your data.

MODEMS:- A modem is a device that connects the computer to the outside world via the telephone lines. With a modem and the appropriate software installed, the computer can make or accept telephone calls with other computers. This opens up the world of other computers, bulletin boards, faxes, and the Internet. The modem is device can be installed into the motherboard (Internal) or attached to one of the serial port of the computer via a cable (External).

Internal modems require additional cable, utilize the power supply of the computer and are tucked away inside the case. They are usually less expensive and just as reliable but require some set-up and forethought to operate correctly with the rest of the system components.

External modems have their own case and power supply and attach to the computer through a modem cable. They cost a little more because of the case and power supply, but the installation and set –up ae usually easier.

Modems generally are now having variety of features. When purchasing a modem, one should get the fastest that is affordable. Currently, 33600bps (bits per second) and 5600bps modems are most commonly used over a regular telephone line. Modem speed is measured in the amount of bit per second that data is transmitted. Other options include voice and fax.

MONITOR:- This is a primary device a computer use to display information to the user. Since most of our time at the computer will spent looking at the monitor, one should get the best one can afford. The following factors can help in making a good choice.

DOT PITCH: The dot pitch is the distance between the individual picture elements (Pixels) that makes up the display of the monitor. The lower the number the closer the dots are spaced. This result in solid , sharply defined image. One should look for a dot pitch of 0.28mm or better.

REFRESH RATE: The refresh rate is defined as how many times per second the screen is refreshed or redrawn. A multi-screen monitor can accept a variety of refresh rates. Some monitors are multi-fixed frequencies, but are not true multi-screen monitors because they have a set of fix frequencies to switch between. A multi-screen monitor is a good choice because it will work with a variety of the video cards on the market.

INTERLACED/NON-INTERLACED: Monitors operate by having an electron bean start at the top left corner and continue across the screen until it reaches the right corner. To handle the high scan frequencies needed for a monitor more precise and higher quality electronics are needed. Interlaced monitors offset this added cost by drawing every line across the screen from top to bottom, then return to the top and draw the line that are skipped.

A non-interlaced monitor, which utilizes the higher scan frequencies and electronics updates the screen from top to bottom without skipping lines, so there is not any flicker.

SCREEN SIZE AND TYPES: There are basically three types of monitors available these are Monochrome, gray-scale and colour monitors. Monochrome and gray-scale monitors are used for special and commercial purposes so as to cut or keep cost down.

For most uses, colour monitors are preferred choice. The screen size is the same as when buying a Television. It is measured diagonally in inches. The larger the

screen size, the easier it is to view. When working with graphics, a larger screen size of 17 inches or better is almost a must.

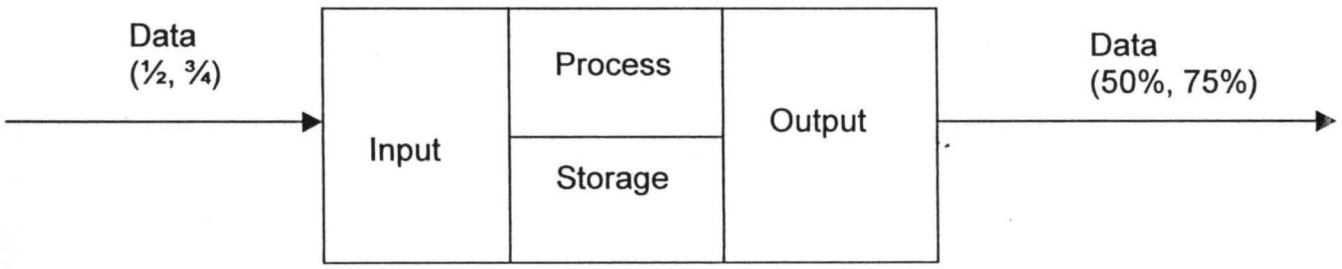
1.3 FUNCTIONAL RELATIONSHIP OF EACH PART

The above-discussed components of a PC perform functions that are interrelated. These functions make them look as if they are just a single unit. They are carried out in a shared i.e. each performs its own role and passes the output to the next stage which then does its own and then to the next and so on.

In a nutshell every other component parts with the specific function takes control from the board. Since all these components are assembled on the board and compiled into a system casing. It is regarded that the heart or brain of a PC is in the "system unit" hitherto called the CPU. Therefore a PC has keyboard, mouse and other devices as input, system unit (CPU) as the brain or ALU and finally the monitor, printer as the output. Hence a PC can be set to be made up of four main functional parts namely

i. Input -Mouse, Keyboard
ii. Process -CPU, ALU, Memories
iii. Storage -Hard Disk, Floppy
iv. Output -Monitor, Printer etc.

This relationship can be seen as shown in the diagram below.



1.4 PERFORMANCE CHARACTERISTICS

The performance of each component part of a PC is usually written on a leaflet attached and package with the component during sales. This leaflet should be read thoroughly and the instructions observe properly before use. This will enable one to know whenever there is a change from the normal behavioural characteristics of the component.

Regardless of the fact that there are quite a number of components that makes up a PC, the characteristics of each component differs from one another. Even when we have similar components or same component, from different makers, their performance differs and this depends on the design of the component.

Generally, they are genuine parts called "Branded" and non-genuine (fake) ones called "Clones". Branded components are those from original manufacturers. They are packaged with the manufacturers identity and trade marks to show that they are guaranteed. This component though expensive lasts longer and is preferred because they last longer. Clones are those usually pirated or copy from unauthorized manufacturers. Their performances in some cases are equivalent to the branded ones but rarely last long.

It should be noted that each component has a peculiar performance characteristics. This peculiarity helps one to identify the cause or causes of a fault in a system as can be seen in the next chapter- Troubleshooting.

CHAPTER TWO

TROUBLESHOOTING

2.1 PROBLEM DEFINITION

Once problem has occurred, the thing to do is to find solution to the problem. To do this, one has to think like a good doctor. A good doctor takes his time to diagnose an ailment before prescription is given.

Similarly, when there is PC problem, there is need for a systematic approach to finding solution to the problem. Troubleshooting is the act of finding fault existing in a system. There are various ways of fault finding. To carry out successful troubleshooting principles and techniques, one should be able to inspect, understand and analyse the problem existing in a given system.

Today, we are in an information age in which computers have become invaluable tools. Time and money hitherto wasted in performing some operations manually are now carried with the use of computers. Computers can also be applied to troubleshooting and repair principles and techniques to consolidate, on the gains already achieved in minimizing waste of time and money. Mastering the troubleshooting principles and techniques will therefore go a long way in minimizing: -

(a) Errors due to wrong decisions and prescription or advice on what to do to resuscitate broken down system.
(b) The amount spent on wrong choice of components to be replaced.
(c) Cost of hiring an expert each time there is a fault no matter how small.
(d) Time wastage.

With recent advancement in personal computer technology, many hardware and software that were rated best in performance and features in the past have now become obsolete. This obsoleteness seldom exists in troubleshooting principle

and techniques since there is always similarity in the working principle of PCs. The four basic steps to be considered during the course of this project work are: -

(I) Observe and understand the symptoms / problem.
(ii) Locate and isolate the cause of the problem
(iii) Change/ replaces or repairs the suspected assembly
(iv) Test the system.

It should be noted that PC problems occur through many sources. These are: -
(1) Hardware,
(2) Software,
(3) Humanware (Users).

The troubleshooter should be able to guess which one is most likely to be the problem. Routine process indicates that first guess should be **Humanware (users)**, then **software second**, and **hardware** the distance third.

2.2 GENERAL TROUBLESHOOTING RULES

There is always the need to develop a sort of guideline for every step to be taken in any assignment. This guild line has been outlined as a rule while embarking on PC troubleshooting and repairs.

The following rules have kept some people out of trouble for a long time and will be of use to many more.

i **Be Confident "I will win":** - As a troubleshooter one has to be confident of himself. Take whatever problem may occur as not much to the machines (PCs) this confidence propels one to do the right thing at the right time.

ii **Write Everything Down: -** While carrying out the process of troubleshooting, it is always advisable to write down the observation and if

possible jot down some vital points on the way forward. This will help the troubleshooter in giving the right prescription to the observed problem outside the field. The aim of writing down is to avoid forgetting the fault and its probable cause.

iii **Do the Easy Thing First:** -The proverbial saying "known to unknown" holds in this case. One should start from the easiest guess to the cumbersome one. For instance, if it is the video problem, and it is not software, then there are four things to suspect or swap: The motherboard, the video board, the cable, or the monitor. What gets swapped first is the easiest thing among the four that is the cable. Reducing it from the known to the unknown can solve so complicated faults or problem.

iv **Reboot and Try Again: -** There are cases when PCs encounter minor problems that can be solved by mere rebooting via the system tools checker (scandisk). So for one to go into serious PC troubleshooting, one needs to go trough rebooting to find out if the problem is minor or major.

v **Simplifying Your Configuration: -** The average PC has several component parts, each parts having its own functional responsibility. When there is a fault, one should be able to go through the component configuration one after the other to enable one narrow down where the fault is coming from. This attempt implies simplifying the configuration that is removing one component after another.

vi **Draw a Picture, Separate into Components And Test: -** When there is PC problem, there is always the need to diagram the areas suspected. Doing this divides the problem into various sub-components and each component can then be tested directly with test tools or indirectly by swapping with working one since system test tools are not easy to come by. Sketching the system and following the step-by-step approach helps to take a stand on whether the fault is software

or hardware based. It is advisable to first take on software problem test before going for the hardware aspect.

vii **Never assume something is Good:** -It is far too easy to assume that some components are blameless. One may wonder how can it be this or that when I just bought them?. A good troubleshooter should endeavour to be patient and calm while carrying out the act of troubleshooting. He should subject everything to scrutiny, including the documentation.

viii **Be prepared to believe that sometimes Documentation lie: -** There are situations where it will be documented that the motherboard for instance has one or two jumpers for setting things like VGA, CMOS, etc whereas there is more or less the stated number.

In this case, one should be ready to go through the rigours of reading the manual and observing directly the sketches attached and comparing it with the original/real board. If done this way, problem won't occur.

2.3 STEPS INVOLVED IN PC TROUBLESHOOTING

Having gone through the rules of general PC troubleshooting, it is pertinent to consider the steps involved in the troubleshooting proper. Troubleshooting can be described as the act of finding fault existent in a system. This fault as earlier described can be from user, software, or hardware. Whichever is the case, to trace out a fault in a PC, one should be able to first: -

i **Check for external signs: -** If the computer has indicated lights, what do they signify. ? Are all the lights showing on the modem? Does the printer indicate "ready"? Is the hard disk drive squealing or grinding? Does the monitor image look bent? Your drives and other peripheral produce hums, whirs and clicks. After a while, these noises become familiar and any variation in them signals a problem.

One should pay attention to these signs. Since the first step in successful troubleshooting is isolating the problem component, these signs can point the way and there should be documentation of the lights that are **ON** and **OFF** and the switch positions.

ii **Run Diagnostic Programs: -** Many PC type machines come with diagnostic programs, which can help pinpoint a problem (assuming, of course, that the computer is well enough to run them in the first place). Other PCs, like some "no names" (clones), do not. There are various very good third-party diagnostic programs that can pinpoint problems, repair it or proffer suggestions on how to solve some problems.

iii **Interpreting PC Error Codes: -** Many PCs complain that something is with them in English. You will see messages like "floppy controller failure, Drive unavailable" etc. a good troubleshooter should be able to decode some of this basic error codes and messages and apply this knowledge to correct an error/problem.

iv **Power On Self-Test (POST): -** A short diagnostic routine runs on a desktop computer every time that the computer is powered up. It does a check to see that the basic important hardware exists and performs memory test. This check is called the power on self-test (POST) or the BIOS listing, power on Diagnostic (POD).

The above tests are preliminary in nature but can solve some minor problems like some users or software problems. The following steps can be applied if the problem persists:

a) Check the nuts behind the system.
b) Check that everything is plugged in: power, monitor, mouse, keyboard, printer, etc depending on the type of fault.
c) Check the software.

d) Ask: "what am I doing differently? "What's new? "
e) Check external signs and make notes of them
f) Run better diagnostic disks and when the last six steps fail
g) Disassemble the machine, push the socketed chips back into their sockets, clean the connectors and put the machine back together and test again.

2.4 PC REPAIR ECONOMICS

When an electronic part in a PC goes bad, one might think it is a simple matter to identify the offending chip (component), replace it and go on about one's business. The problem with this method is that it takes time, a lot of time. The cost of identifying the fault component by component and that of the repair often exceed the cost for a whole new part.

The average component repair, as opposed to replacement takes about three hours. This time includes determining which part is bad, repairing or replacing it and testing to make sure the repair and or replacement was made correctly. Considering the above analysis, it is far more cost-effective, quicker and simpler to replace an offending board or component module.

Furthermore, it is better not to fall sick at the hospital. PC repair can only come when there is a fault. The economics of the repair should be managed in such a way that cost should be minimized if not completely eliminated. The most effective way to cut down repair bill is by good preventive maintenance. There are things in the PC environment - some external; some created in ignorance by you through inattention-that can drastically shorten your PCs life.

Now, some of the things that affect one's PCs life are common -sense thing; we do not really need to ask users not to spill soft drinks (or for that matter, hard drinks) into the keyboard. But there are other PC guideline sources that are not quite so obvious; So, obvious or not, we will get all the environmental hazards in this chapter. A few factors endanger your PC's health. These are - Excessive

heat, Dust, Magnets, Stray electromagnet, Power surges, incorrect line voltage, and power outages, Water and corrosive agents.

Part of the PC repair economics demands that users should observe with keen interest the above processes and make sure that the process are applied as at when the need arises.

CHAPTER THREE

TROUBLE DOCUMENTATION

3.1 PREAMBLE

One of the biggest favours one can do for oneself while troubleshooting is to keep log of trouble calls, problems, and solutions for the following reasons:

- It provides a record of one's contribution to the organisation.
- It can be used to justify requests for equipment or personnel.
- It allows one to track trends thus, making it easy to anticipate future problems, either with particular individuals eg ("Mr. Ozor calls us whenever he can't figure on how to turn the printer on") or situation (" we can expect a call on files called Y") from everyone with an expert system")

Documented problems and solutions can serve as an excellent training tool for new trouble-shooters.

3.2 DOCUMENTING TROUBLE CALLS:

The basic aim of documenting trouble calls is to aid us in solving quickly a problem that was once solved. Here are few things that should be on each trouble report.

a) **Trouble report identity (ID)**

b) **Preliminary Information.** This include: - Who reported the trouble?, When was it reported? , How was it reported? e.g. (E-mail, phone, walk in), Is it related to a previous trouble call? , What was the specific complaint?, Where was the trouble reported?, Will the client be able to duplicate the problem before a technician's eyes?, When did this first appear?, Does it occur periodically?

ON- SITE INFORMATION: - Comments on PC environment like power, temperature etc. Technician's observation of trouble, All the actions taken on site should be documented.

IF THE PC WAS TAKEN TO THE SHOP:- The date it was brought in, Actions taken ,Result of the actions, Was the PC retuned to the client?, On what date. All these should be noted.

SUMMARY OF INFORMATION /KEYWORDS: - Hardware, software and or Humanware (user) problem. Is it software? What package or packages; If hardware; what device or devices, If user problem; how and when did it happen etc.

3.3 DIAGNOSTIC SIGNALS WITH PROBABLE CAUSES

S/NO	DIAGNOSTIC SIGNALS	PROBABLE CAUSES
1	No beep, nothing happens	Power supply bad or not plugged in
2	Continuous beep	Power supply bad or keyboard stuck
3	Repeating short beep	Power supply bad
4	1 long beep, 1 short beep	System board failure
5	1 long beep, 2 short beeps	Failure or lack of display adapter/ cable
6	1 short beep, black screen	Failure or lack of display adapter/ cable
7	1 short beep no boot	Floppy drive adapter failure
8	Short beeps (Ps/2)	Configuration error
9	Error beeps	RAM, wrong connection
10	No boot	Power supply, VGA, RAM
11	Error codes/message	Corrupt software, incomplete installation
12	System hanging	Incomplete software, incomplete installation
13	Cursor not blinking	Mouse not detected
14	Power ON but no windows	CMOS setting not correct
15	Some package cannot be installed	High tasking package that needs high memory capacity, clone software.

3.4 MEASURES TO ADOPT FOR A HEALTHY PC

One of the best measures to adopt is to make the PC environment friendly. This involves doing the following: -

- **Check power consideration:** There should be no other heating element like heater, iron etc in the same outlet as a PC. There should also not be large electric motors (refrigerator, air conditioners) on the same line or any kind of power noise protection.
- **Check temperature ranges:** temperature range in the PC environment should be between 65 degrees F (18 degrees C) maximum.
- **Prevent dust build up:** power supplies with filtered fan that suck air in through the back should be preferred rather than the one that pull through the front.
- Make sure that there is no vibration source like impact printer on the same as the hard disk.
- Be familiar with the following:
  - (a) Packing hard disks
  - (b) Leaving the machine on all the time.
  - (c) Keeping cables screwed in and out of the way
  - (d) Basic "don't do this " on things in DOS, like formatting the hard disk.
- Protect against static electricity

Another important measure to adopt for a healthy PC is to sample a preventive maintenance program. Preventive maintenance (PM) implies taking the machine off a person's desk at regular intervals, perhaps as often as every six months, and move it to a support person's "shop" to give it a good going-over so that you will anticipate problems.

The following PM procedures are considered important for a continued healthy condition of a PC.

(1) Pickup the PC at its worksite. Yes, this takes more time than having it delivered to your work place, but you will learn a lot. Examine: -

- Are the connectors screwed in?
- Have screws disappeared from the back of the machine?
- What else is plugged into the PC outlet no heater, pressing iron? Etc
- Is the PC near a window?, Is it in a location that can get direct sun at some points in the day?.

(2) Ask if the machine is doing anything strange.

(3) Ensure that the hard disk is backed up.

(4) Pack the hard disk and take the machine to shop.

(5) Run the machines diagnostics. It is a good idea to run scans disk or chkdsk to see what percent of the users drive consist of "lost cluster"

(6) Examine Auto EXEC. BAT and configure system for any obvious problems- Lack of BUFFERS command, for example. If it is a windows machine, look at the INIs for obvious tempering. If running windows 95/98 or NT, just run the computer a bit to ensure that it is not obviously misconfigured

(7) Remark the head, if the drive is not self- packing.

(8) Disassemble the PC

(9) Clean the edge connectors with connector cleaner and a hint free cloth or a hard white artist's eraser

(10) Push the chips back into their sockets.

(11) Use canned air to remove dust from circuit board - do not forget the circuit board under the hard disk.

(12) Reassemble the PC. Ensure that all of the cables are securely in place.

(13) Rerun the diagnostics

(14) Ensure that all screws are present. If they are not, add screws.

(15) If the drive supports a low -level format, then low - level format the hard disk with a non- destructive - reformatter program like Disk Technician (prime solution), SPINRITE (Gibson Research), OPTUNE, or the like.

With all these precautions, PC hardly go bad but when it happens, one has no choice than to go for troubleshooting and subsequently repairing the faulty part.

3.5 HARDWARE DIAGNOSTIC ERROR CODES AND DESCRIPTION

CODE	DESCRIPTION
01x	Undetermined problem errors
02x	Power supply errors
1xx	System board errors
101	Interrupt failure
102	Timer failure
103	Timer interrupt failure
104	Protected mode failure
105	Last 8042 command and not accepted
106	Converting logic test
107	Hot NMI test
108	Timer bus test
109	Direct Memory Access test error
121	Unexpected hardware interrupts occurred
131	Cassette wrap test failed
161	AT battery failure
162	AT setup into incorrect (rerun SETUP)
163	Time and date not set (rerun SETUP)
164	Memory size error (rerun SETUP)
165	PS/2does not no how to configure board
199	User indicated configuration not correct
2xx	Main memory (RAM) errors
201	Memory test failed
202	Memory address error

203	Memory address error
3xx	Keyboard errors
301	Keyboard error. If followed by a number is the scan code of the key in question
302	User indicated error from keyboard test or AT key lock locked
303	Keyboard or system unit error
304	CMOS does not match system
4xx	Monochrome monitor error
401	Adapter memory, horizontal sync frequency test or video test failed
408	User indicated display attributes failure
416	User indicated character set failure
424	User indicated 80x25 mode failure
432	Parallel port test failed
5xx	Colour monitor errors
501	Colour adapter memory, horizontal sync frequency test or video test failed
508	User indicated display failure
516	User indicated character set failure
524	User indicated 80 x 25 mode failure
532	User indicated 40 x 25 mode failure
540	User indicated 320 x 200 mode failure
548	User indicated 640 x 200 mode failure
6xx	Diskette drive controller failures
601	Adapter or drive failed POST
602	Diskette test failed: boot record not valid
606	Diskette verify functions failed
607	Write-protected diskette
608	Bad command diskette status returned
610	Diskette initialize failed

611	Timeout
612	Bad NEC chip on diskette controller
613	Adapter failed DMA test
621	Bad seek
622	Bad CRC found
623	Record not found
624	Bad address mark
625	Bad NEC seek
626	Diskette data compare error
7xx	8087 or 80287 math coprocessor errors
9xx	printer adapter errors
1101	Asynchronous (RS232) adapter failure (COM1)
1102	Asynchronous (RS232) adapter failure (COM1)
13xx	Game port failure
1301	Adapter test failed
1302	Joystick test failed
14xx	Printer errors
1401	Printer test failed
1402	Dot matrix printer test failed
15xx	SDLC adapter (mainframe connection) failures
1510	Failure of 8255 port B
1511	Failure of 8255 port A
1512	Failure of 8255 port C
1513	8253 timer 1 did not reach terminal count
1514	8253 timer 1 stuck on
1515	8253 timer 0 did not reach terminal count
1516	8253 timer 0 stuck on
1517	8253 timer 2 did not reach terminal count
1518	8253 timer 2 stuck on
1519	8273 port B error
1520	8273 port A error

1521	8273 command/read timeout
1522	Interrupt level 4 failure
1523	Ring indicate stuck on
1524	Receive clock stuck on
1525	Transmit clock stuck on
1526	Test indicate stuck on
1527	Ring indicate not on
1528	Transmit clock not on
1531	Data set ready not on
1532	Carrier detect not on
1533	Clear to send not on
1534	Data set ready not on
1536	Clear to send stuck on
1537	Level 3 interrupt failure
1538	Receive interrupt results error
1539	Wrap data miscompare
1540	DMA channel 1 error
1541	Error in 8273 error check or status reporting
1547	Stray interrupt level 4
1548	Stray interrupt level 3
1549	Interrupt presentation sequence timeout
16xx	Terminal emulation errors (32xx, 5520, 525x)
17xx	Hard disk/disk controller errors
1701	POST error
1702	Adapter failure
1703	Drive failure
1704	Drive or adapter failure: cannot be determined
1780	Drive 0 failure (drive C:)
1781	Drive 1 failure (drive D:)
1782	Adapter failure

1790	Drive 0 failure (couldn't read the LAST cylinder-probably misspelled drive)
1791	Drive 1 failure
18xx	Expansion chassis failures
1801	POST error code
1810	Extender card failure
1811	Extender card failure
1812	Address or wait state failure
1813	Address or wait state failure
1816	Extender card failure
1819	Wait request switch set incorrectly
1820	Receiver card failure
1821	Receiver card failure
19xx	3270 PC communications controller failures
20xx	BSC adapter (mainframe connection) failures
2010	Failure of 8255 port B
2011	Failure of 8255 port A
2012	Failure of 8255 port C
2013	8253 timer 1 did not reach terminal count
2014	8253 timer stuck on
2015	8253 timer 0 did not reach terminal count
2016	8253 timer 0 stuck on
2017	8253 timer 2 did not reach terminal count
8253	timer 2 stuck on
8273	port B error
8273	port A error
8273	command/read timeout
2018	Interrupt level 4 failure
2019	Ring indicate stuck on
2020	Receive clock stuck on
2021	Transmit clock stuck on

2018	Test indicate stuck on
2019	Ring indicate not on
2020	Receive clock not on
2021	Transmit clock not on
2022	Test indicate not on
2023	Data set Ready not on
2024	Carrier Detect not on
2025	Clear to send not on
2026	Data set Ready not on
2036	Clear to send stuck on
2037	Level 3 interrupt failure
2038	Receive interrupt results error
2039	Wrap data miscompare
2040	DMA Channel 1 error
2041	Error in
8273	error check or status reporting
2047	Stray interrupt level 4
2048	Stray interrupt level 3
2049	Interrupt presentation sequence time out
21xx	Alternate BSC adapter failures
2110-49	(Same as above, but with 21 prefix rather than 20
2201	PC wiring cluster adapter failure
2401	EGA/VGA failure: may show text but not graphic
2901	Color dot matrix failures
3301	Compact printer failure
86xx	Mouse error

CHAPTER FOUR

PROGRAM DEVELOPMENT

4.1 PREAMBLE: - Program development involves taking cognisance of all the activities contributing to program initiation. It is concerned with adequate scrutiny of the programming languages to know the particular one that will be most appropriate for solving a given problem.

This chapter is about the development of a program in knowledge based way for a PC troubleshooting and repairs. It explains how collected data can be used to produce a program that is effective and operational. Implementation of the program can also be looked at, with a view to knowing whether it serves the purpose for which it is developed. This process involves the development of quality procedures for data security.

4.2 CHOICE OF PROGRAMMING LANGUAGE

The choice of the appropriate programming language to use depends on the features of the program the project is trying to solve and the nature of the result that is to be generated. The problem at hand requires the programming language with the following qualities: -

- Adequate keeping of data records and interrelationships between files and tables.
- Perfect handling of enhanced graphics.
- Access and handle time management.
- Setting of relationship between data and activities.
- A user capture interface
- Multi- User environment

It is noteworthy that a record –keeping relational database will satisfy the first, third and fourth point. The language of the database series such as Visual FoxPro, Clippers, and their likes will definitely be a wise choice. Considering the second, fifth and the last points will now demand for a window-based program with similar operating system.

In view of the above points therefore, I decided to use visual FoxPro that can adequately satisfy all the aforementioned conditions.

4.3 FEATURES OF CHOICE PROGRAMMING LANGUAGE

The efficiency and effectiveness of any programming language lies in the ease with which it handles problems and the flexibility of its usage. Visual FoxPro is one of the most efficient and effective programming languages in vogue today. As a relational database language which has to do with data keeping than computation on such data is referred to as a transpute- bound programming language. Among all the characteristics which make FoxPro outstanding and the best choice for this software development are:-

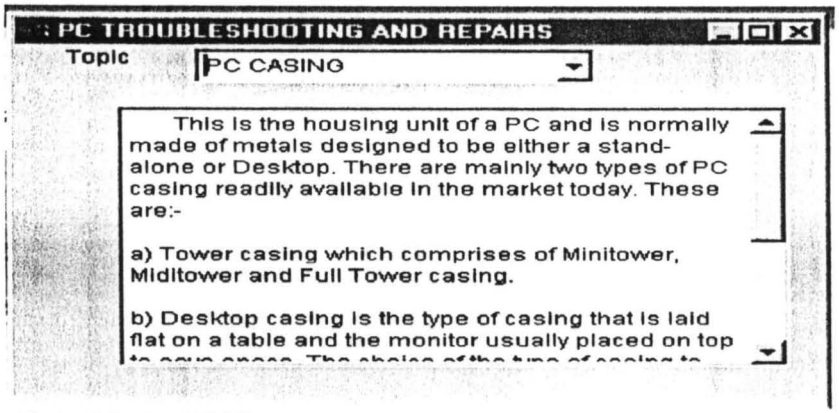
- Efficiency in multiple data management.
- High support of object oriented program- OOP.
- Perfect handling of enhanced graphics.

4.4 INPUT DESIGN

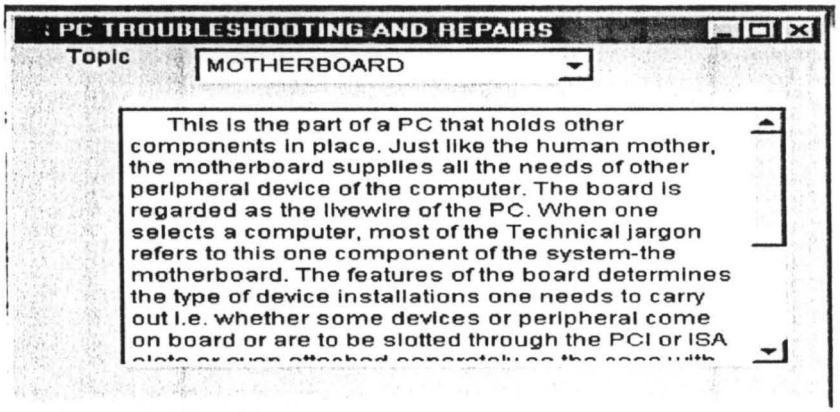
In this design, all the data about the various components hat make up a PC were keyed in. There are also brief explanations of each of the components part as can be seen in the attached printout of the forms of the "PC troubleshooting and repair." The components range from PC casing to Modem etc. Also included are:-

- Diagnostic signals and probable causes
- Steps for troubleshooting Rules and
- Measures to adopt for a healthy PC

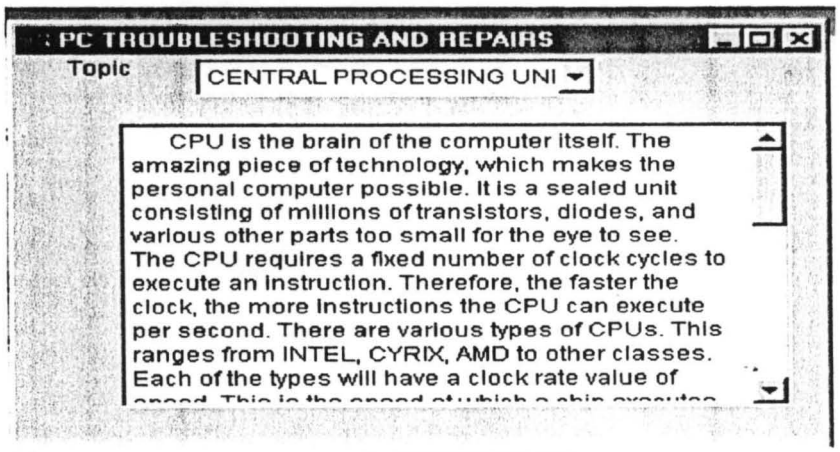
See forms from PC casing to measures to adopt for a healthy PC.



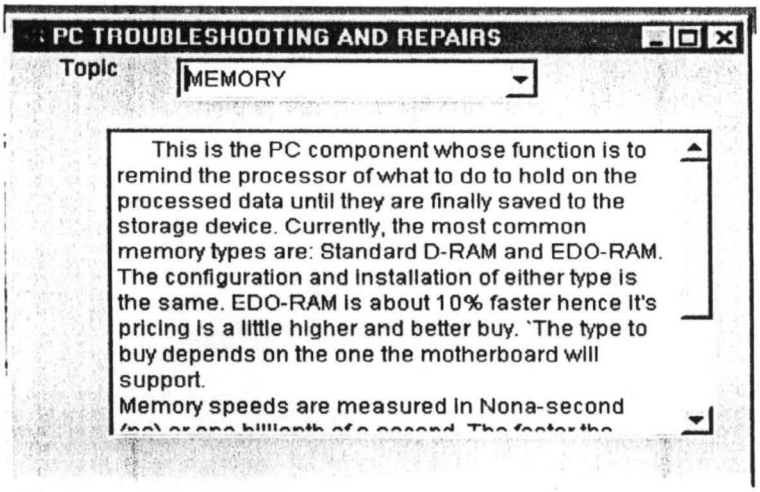
Pix1- PC CASING



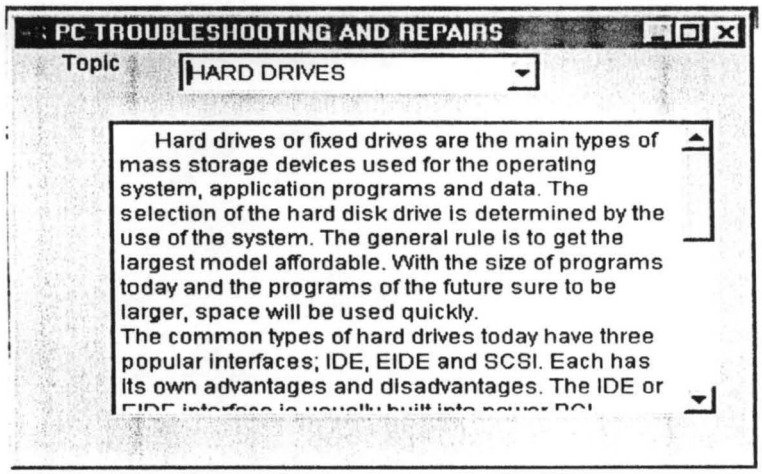
Pix2- PC-MOTHERBOARD



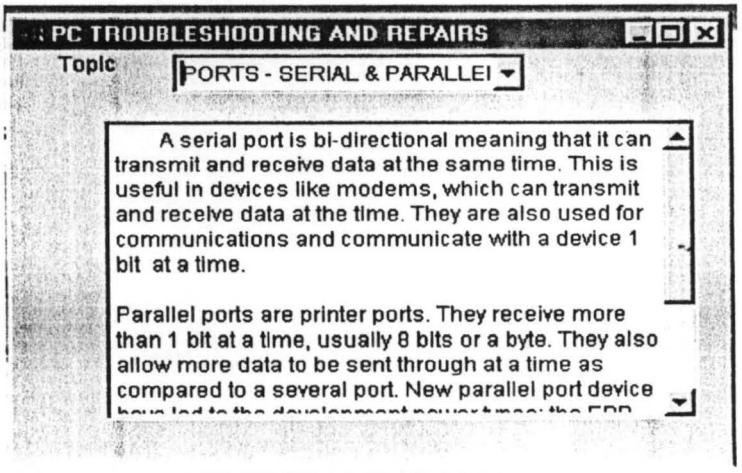
Pix3 PC- CENTRAL PROCESSING UNIT



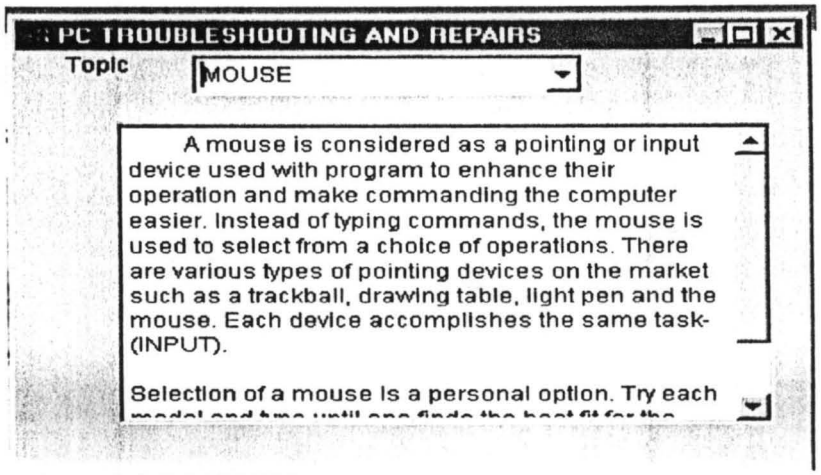
Pix4 PC-MEMORY



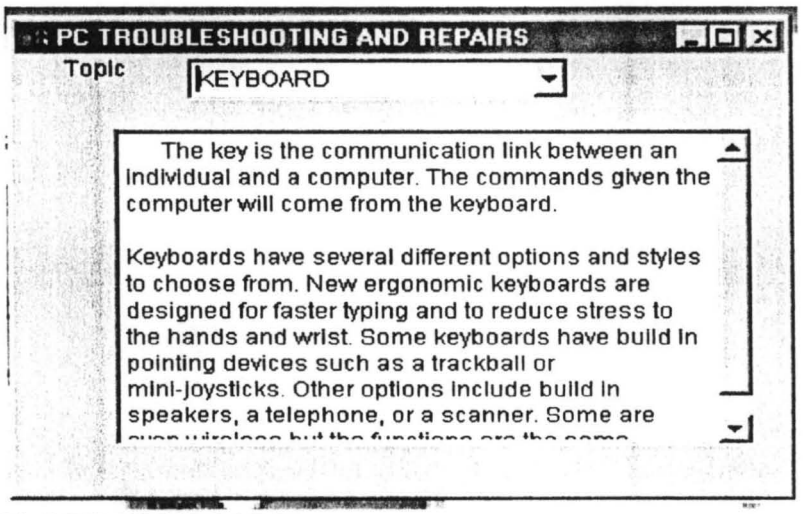
Pix5 PC-HARD DRIVE



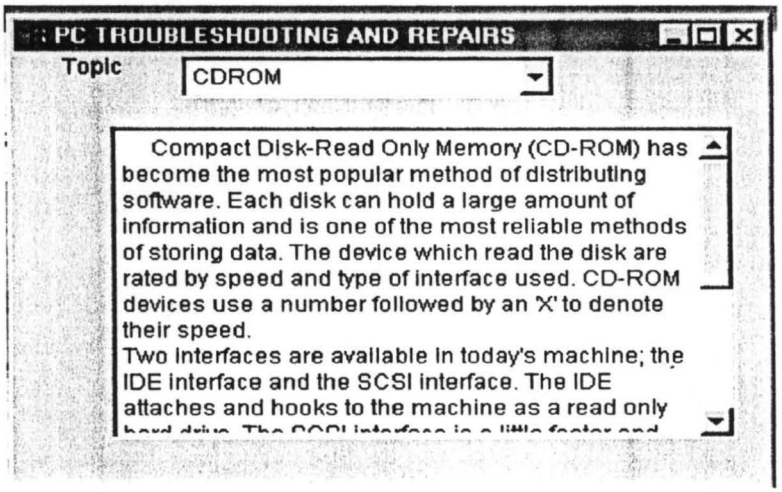
Pix6 PC-PORTS (SERIAL/PARALLEL)



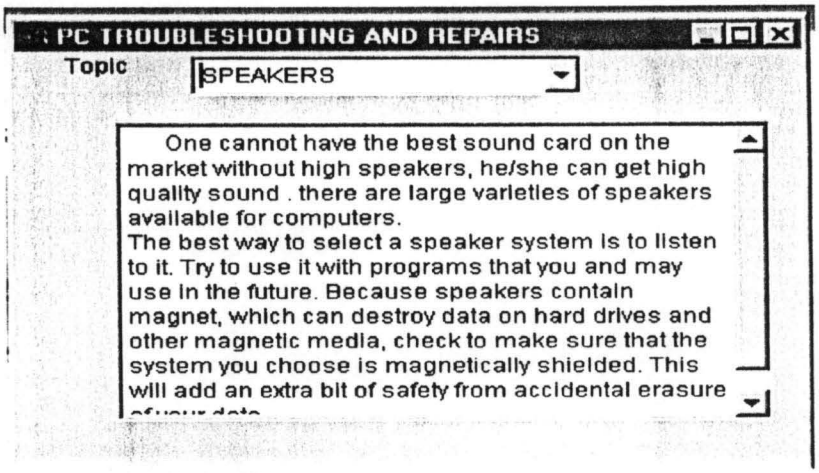
Pix7 PC-PC MOUSE



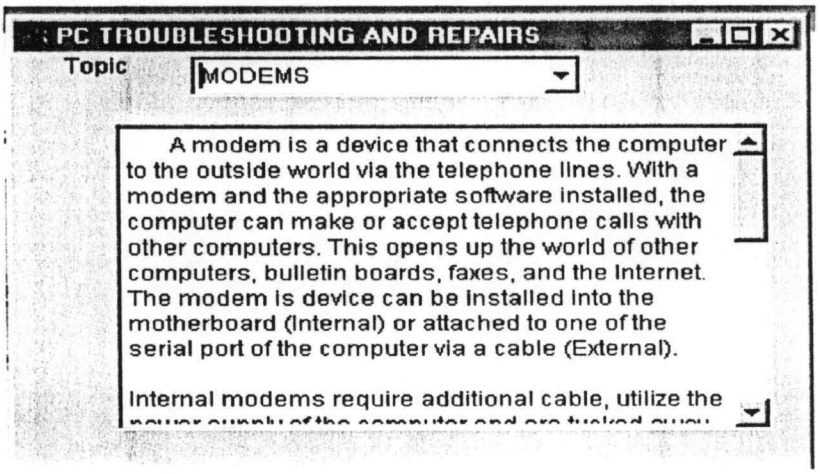
Pix8 PC-KEYBOARD



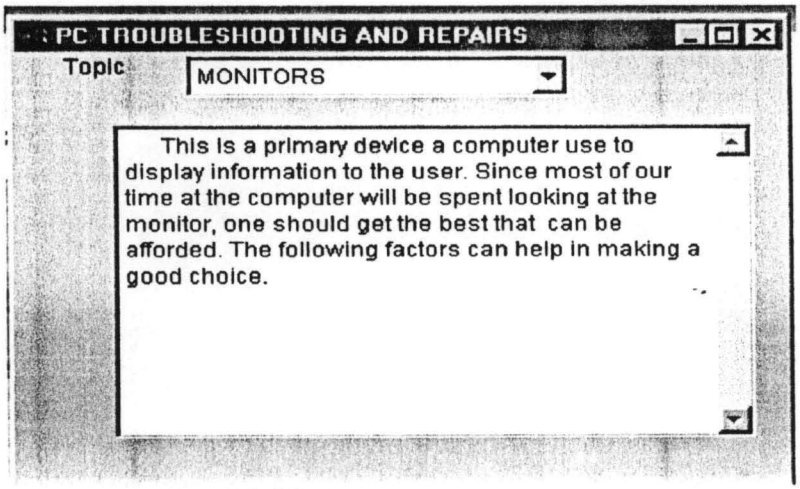
Pix9 PC- CD ROM



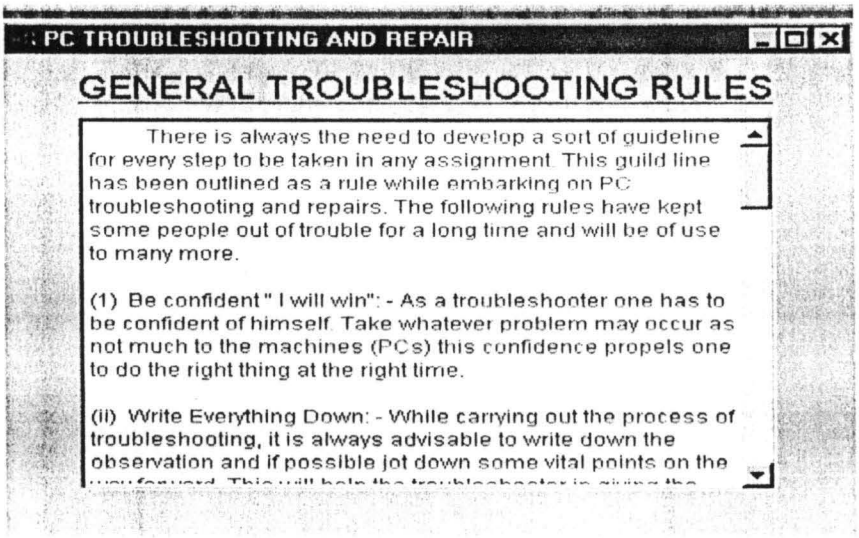
Pix10 PC- SPEAKERS

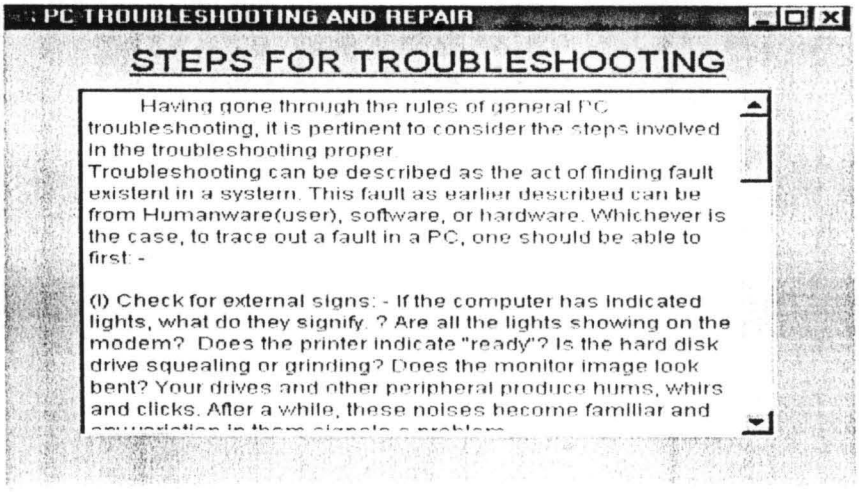


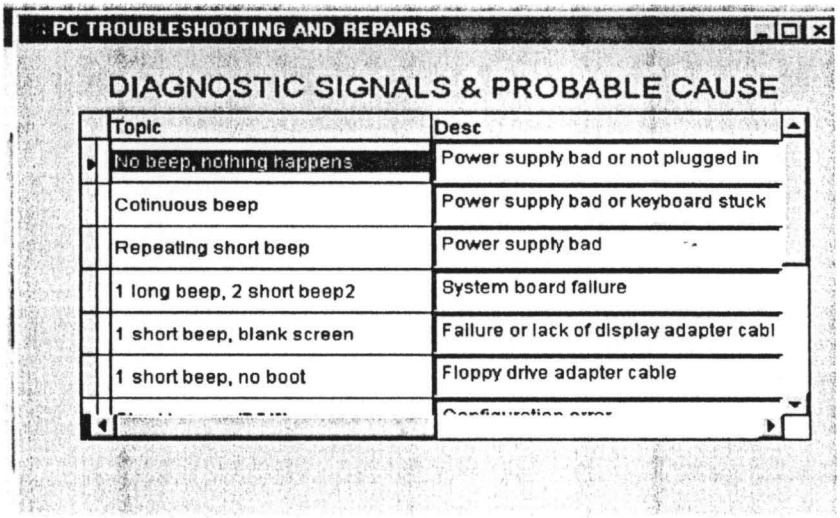
Pix11 PC- MODEMS

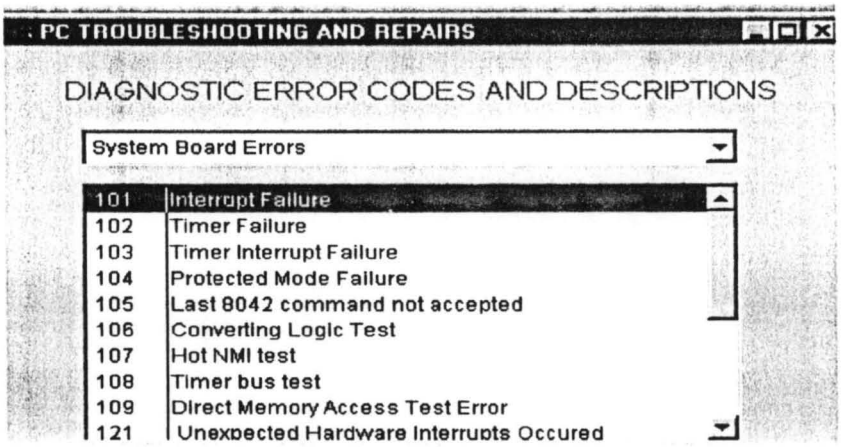


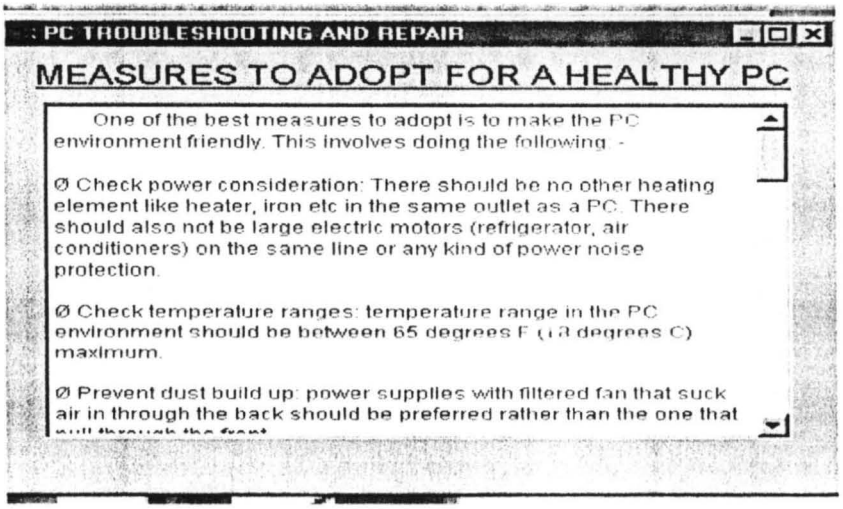
Pix12 PC- MONITORS


PC TROUBLESHOOTING AND REPAIR
GENERAL TROUBLESHOOTING RULES
There is always the need to develop a sort of guideline for every step to be taken in any assignment. This guild line has been outlined as a rule while embarking on PC troubleshooting and repairs. The following rules have kept some people out of trouble for a long time and will be of use to many more.
(1) Be confident " I will win": - As a troubleshooter one has to be confident of himself. Take whatever problem may occur as not much to the machines (PCs) this confidence propels one to do the right thing at the right time.
(ii) Write Everything Down: - While carrying out the process of troubleshooting, it is always advisable to write down the observation and if possible jot down some vital points on the


PC TROUBLESHOOTING AND REPAIR
STEPS FOR TROUBLESHOOTING
Having gone through the rules of general PC troubleshooting, it is pertinent to consider the steps involved in the troubleshooting proper.
Troubleshooting can be described as the act of finding fault existent in a system. This fault as earlier described can be from Humanware(user), software, or hardware. Whichever is the case, to trace out a fault in a PC, one should be able to first: -
(I) Check for external signs: - If the computer has indicated lights, what do they signify. ? Are all the lights showing on the modem? Does the printer indicate "ready"? Is the hard disk drive squealing or grinding? Does the monitor image look bent? Your drives and other peripheral produce hums, whirs and clicks. After a while, these noises become familiar and


PC TROUBLESHOOTING AND REPAIRS
DIAGNOSTIC SIGNALS & PROBABLE CAUSE
Topic
Desc
No beep, nothing happens
Power supply bad or not plugged in
Cotinuous beep
Power supply bad or keyboard stuck
Repeating short beep
Power supply bad
1 long beep, 2 short beep2
System board failure
1 short beep, blank screen
Failure or lack of display adapter cabl
1 short beep, no boot
Floppy drive adapter cable

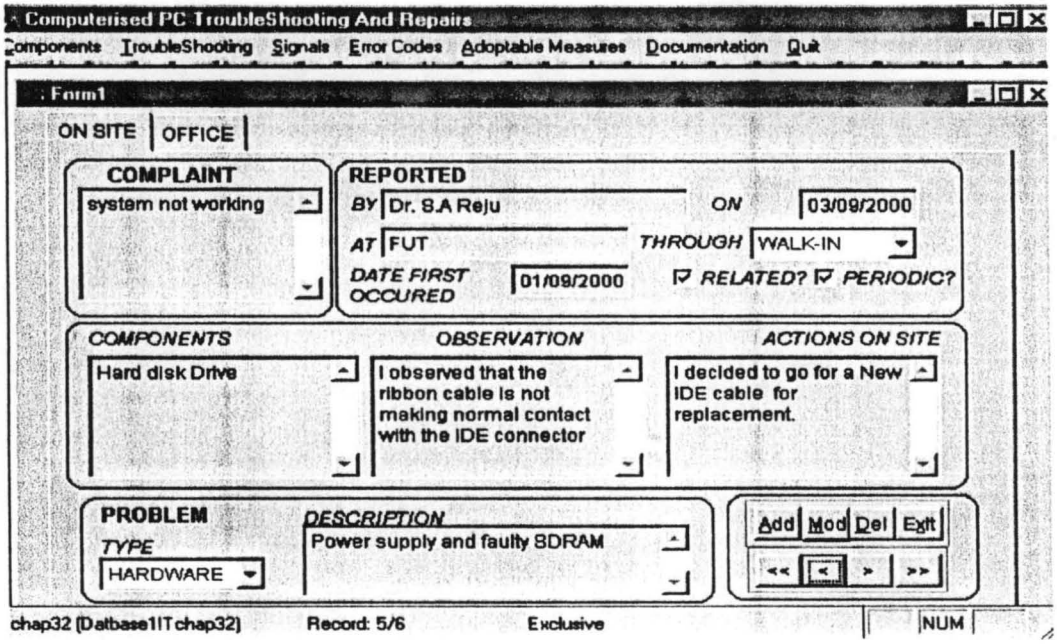

PC TROUBLESHOOTING AND REPAIRS
DIAGNOSTIC ERROR CODES AND DESCRIPTIONS
System Board Errors
101 Interrupt Failure
102 Timer Failure
103 Timer Interrupt Failure
104 Protected Mode Failure
105 Last 8042 command not accepted
106 Converting Logic Test
107 Hot NMI test
108 Timer bus test
109 Direct Memory Access Test Error
121 Unexpected Hardware Interrupts Occured


PC TROUBLESHOOTING AND REPAIR
MEASURES TO ADOPT FOR A HEALTHY PC
One of the best measures to adopt is to make the PC environment friendly. This involves doing the following: -
Ø Check power consideration: There should be no other heating element like heater, iron etc in the same outlet as a PC. There should also not be large electric motors (refrigerator, air conditioners) on the same line or any kind of power noise protection.
Ø Check temperature ranges: temperature range in the PC environment should be between 65 degrees F (18 degrees C) maximum.
Ø Prevent dust build up: power supplies with filtered fan that suck air in through the back should be preferred rather than the one that

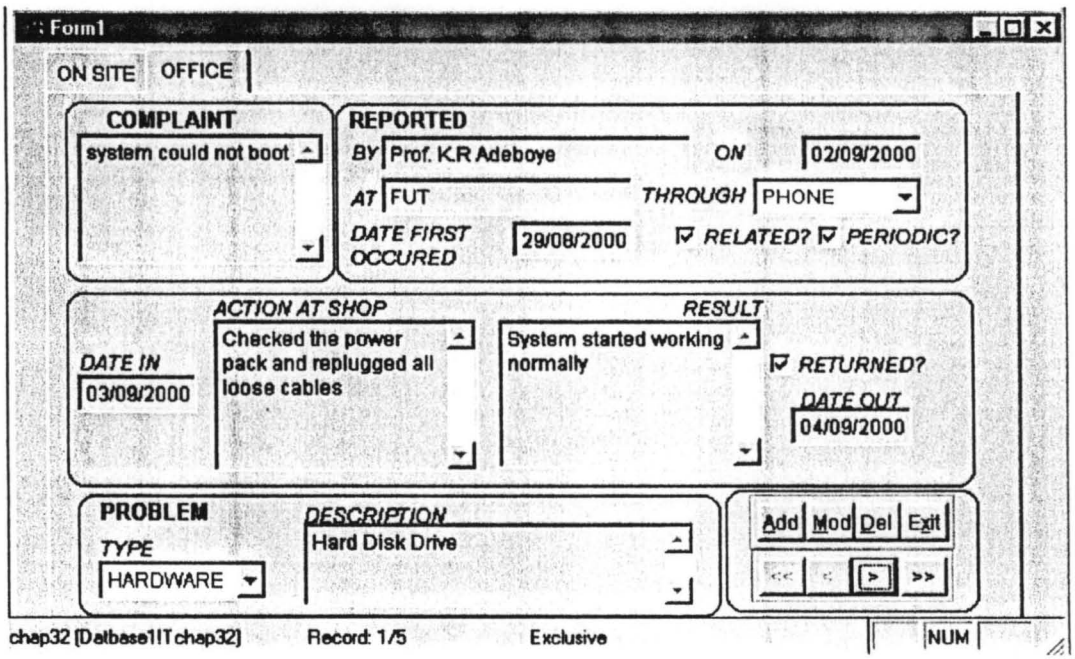
4.5 OUTPUT DESIGN

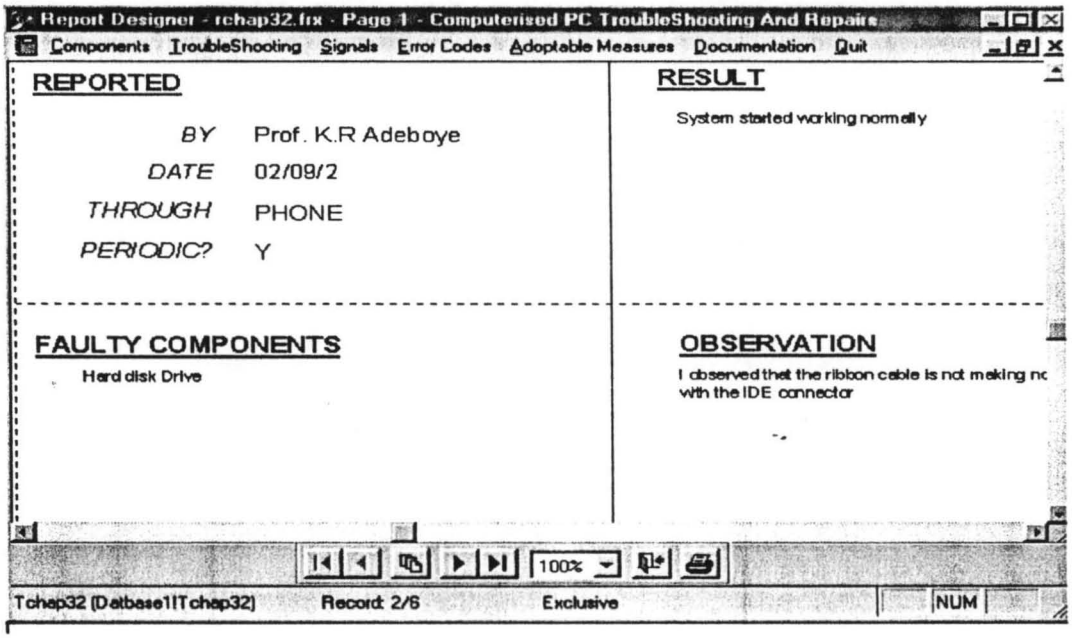
The output design is the result generated from the process of the program. In this case, the are two basic outputs and their various reports. These are: -

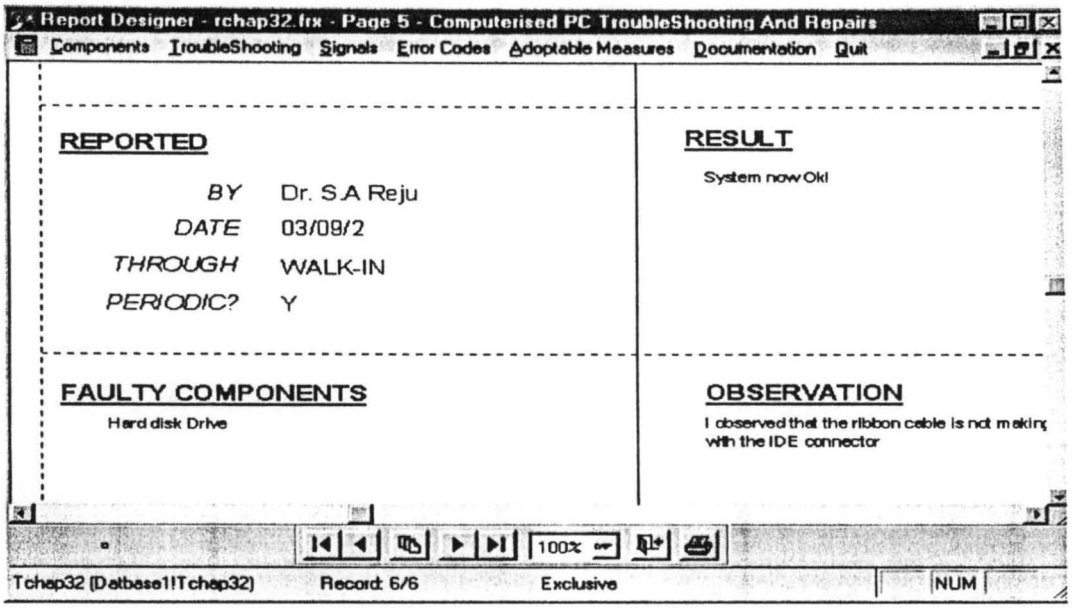
ON-SITE: From here, the record of the complaints, who reported, where it was reported, method of reporting, date first occurred, components affected and all other necessary details were taken. There are also facilities to modify, add, revert, delete, and exit as the case may be. **See highlighted ON-SITE for details.**



OFFICE: The outputs here include Actions at shop, Result, Date in Returned, Date out, and type of problem and description among others. **See highlighted OFFICE for details**







4.6 PROGRAM PROCEDURE/IMPLEMENTATION

The developed program is put in a project called "Newmike" as an executable file. The reason for using one special directory for all the files i.e. databases, forms, codes, etc is

- To create a direct path for Visual FoxPro to check in case of the needs to generate a setup disk or an executable file.
- For faster compilation at runtime.

Forms and their controls is the central object which troubleshooting and repair of systems solely depend upon. They are exclusively used for the following operations;

1) Data entry and
2) Generation of the reports of the data entered showing details of the client's/handler's view.

Besides the aforementioned, they give users familiar interface for viewing and entering data into the database, provide a rich set of objects that can respond to users' events so as to enable them accomplish their information management task as easily as possible. They are also objects with their own properties, events and methods that can be set in the designer.

4.7 FORM MAINTENANCE

The maintenance of forms is used for data input and record keeping of the record table. It allows records of operations performed either daily, quarterly, etc. be kept and also the description of what is actually performed. The two command boxes included in the forms are:- **Editing and Navigation buttons.**

4.8 EDITING BUTTON

This contains the command buttons such as Add, Revert, and Delete, Save and Exit buttons. When the form is first loaded, revert and Save buttons are not highlighted, i.e not visible. The operations performed by the editor are so tailored that any command not needed at any point in time is not available for use. It is either invisible or disabled. When "Add" button is clicked, it appends a blank record to the end of the table maintenance and refreshes the form to display the current status. This then allows new data to be entered into the empty controls.

Changes made on the maintenance table and the form can be undone. This is performed by the "revert" button, that is only enabled, and visible when between the "Add" and "Save" process (after Add is clicked and save is clicked). The same function is performed immediately after enter key is pressed. Data duplication is controlled using two distinct methods.

a) No record can be entered twice.

b) Any data input cannot be stored in the table twice since "Add" button is disabled whenever "Save" is enabled and vice versa. In deleting the record display on the form, all one need to do is to click delete button and that is done. A message box will appear to ask you about the validity of what you are doing. If you pick yes, the record will be absolutely deleted from the disk.

4.9 NAVIGATION BUTTONS

These buttons are used to display records on form maintenance. The following is the list of navigator buttons and their functions.

- << is used to display records in data table.
- < is used to display the previous record.
- > is used to display the next record.
- >> is used to display the last record in the table.

It is important to note that, if the record displayed on the screen is the first, then < and << is invisible or no highlighted. Also, if the last record is displayed, then, > and >> are invisible. The Navigation button is such that you cannot access the beginning of a file or end of the file. There can be as many forms as possible, depending on the program in question. For example, in this program, there is form for **"ON-SITE"** and another for **"OFFICE"**. Each of this form has a unique parameter that differentiates it from the other. The process of display remains the same in each case.

CHAPTER FIVE

SUMMARY,CONCLUSION AND RECOMMENDATION

5.1 ANALYSIS OF RESULT

The result to be analysed in this case is the forms, which are of two types, namely; ON-SITE, and OFFICE.

- ON-SITE: - This has a peculiar feature of allowing user take record of faulty, all the observations made and the necessary actions taken. There are basically three blocks for the records as tabulated in the form shown.
- OFFICE:- This has about five features that include; The actual Date the job (faulty system came in), Actions taken at the Shop, Result of the action, Date the faulty or repaired system was returned to the Client (owner).

5.2 PROBLEMS ENCOUNTERED

On carrying out this project work, I had so many obstacles ranging from access to systems with visual FoxPro to design problems. When I finally succeeded in getting a system, I encountered further problem in the project design. I found it difficult linking diagrams of the different component that make up a PC page by page. Attempts to get the problem solved really delayed the early completion of the work,

Also a setback to the project work was the crashing of the disk I started with, hence my resolve to start afresh on a standard and well protected system.

Above all, the major contributor to the delay in completing this project on schedule was finance as prices of accessories went up. This restricted my wide area of coverage of data collection, testing and printing of hardcopies of the forms.

5.3 SUMMARY

The main aim and objective of this project was to design a knowledge based PC troubleshooting and repair.

Sometimes, troubleshooting is full of wrong decisions and consequently wrong prescriptions or advice on what to do to resuscitates a broken down system. This gives rise to time wastage and hence may result in going for a professional each time there is minor/ little fault.

With the advancement in PC Technology, many softwares and Hardwares came into being. To consolidate on the gain of these welcome developments, hardware specialists now have more responsibilities in making sure that systems are available for use at all times. This forms the decision to produce the program to aid users in mastering and keeping records of maintenance processes and procedures besides reducing the stress in trying to remember error codes and probable causes. All that is needed is to quickly run the program and then access formally the defaulting component.

5.4 CONCLUSION AND RECOMMENDATION

The rapid growth and development of Information Technology is in the increase. The dynamic nature of the InfoTech tool -(computer) should and must be followed by individuals, private and public organisations in general.

Recently, the awareness on the use of the computer is rising by the day. The application of the system to the day-to-day functions of our time must be encouraged at all times if we must follow the committee of Nations that value computer as a tool of the Information age.

In view of the above therefore, and bearing in mind the use of application programs and customised software, the need for the use of the computerised PC troubleshooting and repair cannot be over-emphasised because of the following reason: -

- It provides guide for technicians, thereby enhancing easy repair.
- Minimise error due to wrong decision and prescription.
- Helps professionals in trouble documentation.
- Helps an average PC user in knowing common faults and necessary precautions.

This work is therefore recommended for all PC users.

REFERENCES

1. Mark Minasi — The complete PC Upgrade & Maintenance, Published by Sybex of London, 1999

2 Phillip Laplante — Easy PC Maintenance and Repairs, second Edition-- 1998.

3. Stephen J. Bigelon — Troubleshooting, Maintenance & Repairing PCs; A technical guide—1998

4. Technical Reference Library — Master Tech; An interactive video tutorials, utilities & Diagnostic software-1999

APPENDIX A

TROUBLE DOCUMENTATION

05/09/2000

PROBLEM TYPE: **HARDWARE**

CUSTOMER'S COMPLAINT

system could not boot

PROBLEM DESCRIPTION

Hard Disk Drive

REPORTED

BY Prof. K.R Adeboye

DATE 02/09/2

THROUGH PHONE

PERIODIC? Y

RESULT

System started working normally

FAULTY COMPONENTS

Hard disk Drive

OBSERVATION

I observed that the ribbon cable is not making normal contact with the IDE connector

APPENDIX B

TROUBLE DOCUMENTATION

05/09/2000

PROBLEM TYPE: **HARDWARE**

CUSTOMER'S COMPLAINT

system not working

PROBLEM DESCRIPTION

Power supply and faulty SDRAM

REPORTED

BY Dr. S.A Reju

DATE 03/09/2

THROUGH WALK-IN

PERIODIC? Y

RESULT

System now Ok!

FAULTY COMPONENTS

Hard disk Drive

OBSERVATION

I observed that the ribbon cable is not making normal contact with the IDE connector

APPENDIX C

TROUBLE DOCUMENTATION

05/09/2000

PROBLEM TYPE:

CUSTOMER'S COMPLAINT

System cannot copy a diskette

PROBLEM DESCRIPTION

REPORTED

BY Ugwu Romanus.E

DATE 01/09/0

THROUGH WALK-IN

PERIODIC? N

RESULT

The copuing is Ok!

FAULTY COMPONENTS

Hard disk Drive

OBSERVATION

I observed that the ribbon cable is not making normal contact with the IDE connector

APPENDIX D

TROUBLE DOCUMENTATION

24/09/2000

PROBLEM TYPE:

CUSTOMER'S COMPLAINT	PROBLEM DESCRIPTION
REPORTED *BY* *DATE* / / *THROUGH* *PERIODIC?* N	**RESULT**
FAULTY COMPONENTS	**OBSERVATION**