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Abstract

WXES3182 is the final year project which involves doing a thesis. The purpose of doing this thesis is to apply the techniques learned during classes. The final result of the thesis is to produce complete software. To actually produce the software, a development process will have to be followed through. Here application of the development phases are put to use such as analysis, design and implementation. In the first part of the thesis WXES3181, development in started and carried through up until the design phase. WXES3182 will continue the development process until the completed product is produced. Software development phases such as requirements, analysis and specification have been carried through the process of writing this report.

Technology has advance very rapidly in the past few years and many new technologies have sprung up. Computers are now being used very often yet very few people know how to use it well. With that in mind, I have set out to make educational software that will hopefully be able to educate people about the personal computers and promote better use of them. The software will incorporate multimedia elements and interactivity to facilitate the learning process. This software is titled E-Learning: An Introduction To Personal Computers. It is hoped that with the use of this software, more people will be able to better utilize their computers.

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1 Introduction

1.1 Overview

1.1.1 Project Definition

This project will be an E Learning software that will incorporate multimedia elements to promote learning while the content will be based on personal computer hardware. The term 'Introduction to personal computer hardware' is used to describe practical computer hardware knowledge where the word 'practical' means knowledge that can be applied. This would include knowledge such assembly, installation, component identification, trouble-shooting, and FAQ (Frequently Asked Questions) on hardware while the actual mechanics will also be explained in briefly. The research and literature review will be broken up into two distinct parts. The first of which will handle the content of the project. The second part will detail exclusively on the software portion of the project. This will include project development methodologies, programming languages, media issues and any potential material to be incorporated into the software.

1.1.2 Content Research

Software on market with similar content has already been identified and their content will be evaluated. It is hoped that evaluating them will provide insights into to amount of effort needed as well as the quantity and quality of information

to produce a better product. This will compliment any content material to be gathered from books and magazines. Relevant articles on the Internet will also be investigated.

The initial plan for the content is to produce an Intermediate level learning material, which details on the practical knowledge of personal computer hardware. A survey will be carried out to find out the level of detail required for the target audience. A decision was made early on to have a specific target audience. This will provide a guideline into the level of accessibility required in the writings. This is to ensure that level of detail of all the material is uniform and consistent. Many technical books state the level of detail as well as target audience in rating system found on the back of most books. These books use the term beginner, novice, intermediate and expert to describe their this. From the level of detail provided in those books, it has been determined that the content of this project will be accessible to intermediate users.

Constraints were intentionally put on the content of the project for several reasons. The topic chosen, 'Introduction to Personal Computers' has a very large scope. PC components, maintenance, installation, assembly, part description, driver software, trouble-shooting are some of the topics that would need to be addressed. This is complicated by the fact that there hundreds of computer components. Detailing each and every one of them would not be

practical if not impossible. The limitations and constraints that I have placed on the project are detailed in the literature review.

1.1.3 Software Research

Several types of programming languages as well as authoring tools have been identified for the development of the software portion of this project. Key features such as speed of development, in built features and multimedia capabilities of each the programming languages/authoring tools will be compared. The purpose of this comparison is to provide a realistic estimate of features that may be incorporated into the final product. The result of this comparison will help gauge to amount of effort required to incorporate features such as movie clips, animation and advance interactive elements. Potential tools/programming languages are listed below:

- Java 2 Swing
- Microsoft Visual Basic 6
- Macromedia Director

1.2 Introduction

The worlds of computers are evolving quicker and quicker as time goes by. Computers have generally gone faster and smaller. Central Processing Unit (or CPUs) have usually doubled in speed (measured in Megahertz or MHz) every 18 months stated in More's law. While CPUs have been increasing in this

somewhat constant fashion, other components have either developed a whole lot slower or a whole lot faster. The speed of memory have always lagged behind the CPU, even with the latest advancement in technology such as DDR SD-RAM and DRD-RAM the speed of RAM grow at a snails pace compared to the CPU. On the opposite spectrum of RAM are 3D graphic accelerators (or simply 3D accelerators for short) which have improved in speed faster than CPUs. While CPU speed double every 1.5 years, 3D accelerators have nearly quadrupled in the same time!

1.2.1 The Past

With this in mind, let us look to the past, present and potential future of computers or specifically personal computers. A mere 10 years ago, the 80286, was a mere glimpse in the eye of the engineers at Intel. Clocking at a (then incredible) 16 MHz it was an (admittedly) admirable accomplishment. It had what analyst at the time called as *too much* processing power. The eventual evolution to 80386 (usually called 386 for short) with 32bit processing power garnered similar praises. This was the time that the dominant Disk Operating System (also known as DOS) was the main Operating System (OS) for personal computers or IBM compatible machines as they were called in those days. Microsoft was the producer/developer for DOS called MS-DOS. Microsoft then developed MS-Windows originally as separate software that eventually became famous with the culmination of the last of its version with Windows workgroup 3.11. The next

Windows was the largest overhaul the software industry had ever witnessed dubbed Windows 95. It was a combination of Windows 3.11 and it's underling DOS encapsulated in single product that was supposedly more user friendly. Released in 1995 it was credited with the PC boom practically worldwide. The name IBM compatible machines were replaced with the term 'personal computers with Windows 95 or later' and everything else is, as people say *history*.

1.2.2 The Present

Personal computers have continually evolved in speed as software requirements grow to take advantage of more available processing power. Intel has continued releasing ever more powerful CPU from the 486, Pentium, Pentium Pro, Pentium MMX, Pentium II and today's top of the line Pentium III. While still being the market leader, there is competition from other companies like Cyrix (under VIA) and AMD. Currently the biggest two companies are Intel (obviously) and AMD. AMD has developed similar CPUs to match Intel since the days of the 486 continued with the K5 (against Intel's Pentium), K6 (against Intel Pentium II) and finally K7 (or better known as Athlon versus Intel's Pentiums III). While AMD have had very little success in fighting off Intel previously, the K7 has more than made up for it. Both Intel and AMD have CPUs that rate beyond 1.1 GHz[1] (1 GHz = 1000 MHz) as of this writing. Both have their weakness and strengths and are evenly matched in terms of overall performance; with Intel having better product

name recognition and AMD better prices. Further details of this situation will better discussed in the actual software rather than in the report. Instead let us look to the future and what it has install for everyone.

1.2.3 The Future

For one, the future brings back the low-end market (very low priced components) CPU into the fray with VIA's Cyrix III and Transmeta's low power consumption CPUs (current only referred to by a numerical codename). The top CPU developers remain Intel and AMD with both planning more advanced versions of their CPUs. Intel plans on producing Pentium IVs all the way up to 1.7 GHz (supposedly but doubtful) and AMD's Athlon Thunderbirds (Thunderbird is a Codename used for a specific model of Athlons) up to 1.3 GHz (quite likely) as well. With all this impressive CPU power comes software that ***actually*** makes use of all this processing power; 3D applications. Mainstream (normal everyday people) users have only begun to realize another component of incredible power: the 3D accelerator. They are specifically built for 3D processing and can process 3D faster than the fastest (commercially) available CPU. They make 3D scenes look better and play smoother... and are as expensive if not more than CPUs. The most advance 3D accelerators today cost anywhere between RM 400 to RM 1800. While these cards are available now, they listed in ***The Future*** section because this market has yet to take off as well as it did in the western market. The future of computer technology in Malaysia will undoubtedly include

3D accelerators in the near future and we will see even more powerful 3D accelerators being released soon (around Christmas). Not many people know of 3D yet in Malaysia but when someone sees the difference between 3D hardware accelerated (with the aforementioned hardware) and 3D software accelerated (software emulation using the CPU); usually more people are interested. For the non-believers: simply run the software → 3Dmark2000 (a benchmark utility by the company Mad Onion) to become a believer.

1.2.4 Reason

Why was the above explanation even required?

Simple. Complexity.

So much is happening in the computer world that the products and information out there will simply confuse that anyone outside the industry. That is the purpose of this software package. The objective of this project is to develop a software package that will help inform potential users about computer technology and help them make decision about them. Personal computers have become a household tool today, and keeping up with technology is difficult. Hopefully, the end result will make that task less daunting to those not professionally intimate with computers.

1.3 Project Objective

The objective of this project is to produce a software that can help people understand their computers better and help increase general public awareness to computers in general and computer hardware specifically. The general awareness about computers in Malaysia have grown considerably in the past two years but are still not what people would describe as common knowledge. Many people lack the finer details on computers because computers are complex machines that are made of various components. The range of products for any particular component itself can be great. Providing details about the various components in a way that is useful is the goal of this E Learning project.

1.4 Project Scope

This project will contain all of the following: -

- Research on the subject matter, which is Personal Computer hardware.
- Selecting the correct material for the selected target audience.
- Research on the various tools and programming languages where one will eventually be picked to develop the final software.
- Testing different forms of presentation for the software as well as GUI.
- Designing the layout and screen flow of the software.
- Evaluation.

These are the steps that will be used as a guideline throughout the project. The finer aspects of the development procedures will be explained in the methodology.

1.5 Target Users

This software package is targeted at the general users or mainstream market. People that have little experience with computers and those who want to know more about computers could be considered a good target audience. The material is intended to have a broad reach because of the way the content will be written.

1.6 Project Potential

The potential of the project will be to develop E Learning software that can be distributed via Compact Disc (CD). Currently the planned content will contain the following:

- Description of hardware components such as processors, expansion slots (PCI/ISA/AGP), memory and authenticating them.
- Instructions about installing/upgrading video cards, sound cards and others.
- Instructions on how to set up new hardware on the OS.
- General information about trouble shooting hardware problems with FAQ.
- Software related to hardware such as BIOS, Drivers, and System tools.
- Optimizing hardware for the OS (Windows).
- Miscellaneous information, such as benchmarking, performance and pricing.

The information above will be displayed using multimedia elements such images, sound and animation. It should also contain instructions guide users through various tasks like installation, setup and assembly. The software will hopefully be able to help users know their computers better and be more confident in using it. It will contain walkthroughs for complicated tasks, which will use images and animation to guide the users to them.

1.7 Anticipated Problems

During the inception of this project, the following problems have been anticipated:

1. Gathering content that would be sufficient on the topic. While there is an abundance of information on the computer in books and in the Internet, actually finding the right material and putting to use may prove to be more problematic. A lot of materials on computers are available but many seem to be targeted at the enthusiast level. These materials are usually more technical and require a level of understanding that many non-enthusiast do not posses.

2. Choosing the correct development tools are also important. This is to make sure that any features that are intended to be included are justifiable and eventually practical.

3. Determining features to be incorporated into the software is also an issue. It has been determined that pictures and animation can be used in various circumstances. Incorporating sound and music in an appropriate manner have not been determined.

1.8 Expected Results

It is intended that the software package that is the end result for this project will be able to help people understand computers better on the whole. To be able to satisfy that goal, the software package is expected to incorporate these features:

1. First and foremost it will be able teach users about computers.
2. An easy to use software which interactive in a multimedia environment.
3. Contain material that will satisfy the curiosity of most users by having a broad topic range.
4. Contain specific information that is useful to users, i.e. practical knowledge.

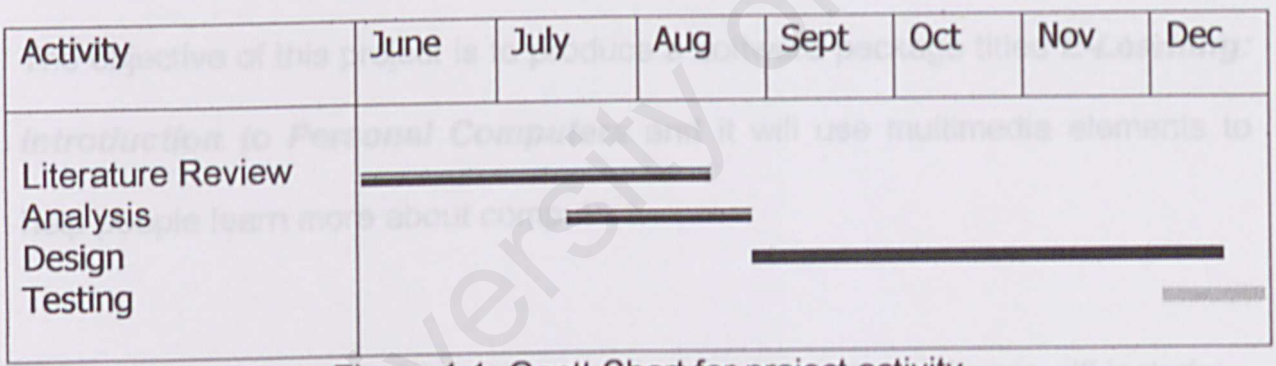

Figure 1.1: Gantt Chart for project activity

Key:

Current Activity

Not complete Activity

Completed Activity

1.9 Summary

This chapter contains an introduction about computers as a whole and how it evolved through the years to become practically a house hold object. It has become indispensable in the working world and expertise in its field is almost a necessity in most careers.

The concept of E-Learning involves the use of an electronic medium, specifically computers in the learning process. Information such in text, pictures, sound and even animation can be incorporated to aid in the learning process where previously only books were dominant.

The objective of this project is to produce a software package titled ***E-Learning: Introduction to Personal Computers*** and it will use multimedia elements to help people learn more about computers.

The scope of the content that will be incorporated into the software will include:

- Component description.
- Installation/Assembly walkthrough.
- Trouble shooting general problems.
- Other related topics to computers in general.

The software package is targeted at anyone interested in computers. Its content will be made such that it will contain introductory information, which is easy to

understand and then delve into more complex topics. In general, it will be targeted at intermediate computer users i.e. people who know enough about computers to start one up and actually use it.

Several problems have been identified during the initial planning stages include how to select content, their accessibility and the types of media to be used with each topic. Finally, the expectation of the end result will be a software package that will be capable of teaching users about computers and how to use them more effectively.

2 Chapter 2 : Literature Review

2.1 Definition of E-Learning

E-Learning is a term used to signify learning material in an electronic medium. Electronic medium could actually consist of even radio and television. Recently there is a trend to signify E with more than just Electronic rather specifically to computerized material. This term[1] would obviously include software but does not strictly specify using a computer or the type of computer. For the purposes of this project, E-Learning will represent the specific definition that is "a software used in conjunction with a computer for educational purposes that is directly related to the learning process".

What this means is that this software must contain the actual information for the learning process and not just the tool to view the material. A web browser used to view an online page about a certain topic would not be considered an E-Learning software because it merely facilitates the viewing of those pages. The actual web page on the other hand, could be considered as E-Learning material though.

[1]

2.2 Context of E-Learning with the Project

The context that E-Learning will be used in this project will be a software that assists the learning process directly. This means that information in the form of text, pictures and audio about the selected topic could be incorporated into the software. The material will be presented in a way that it facilitates learning[2] and not merely pasted together. This means that the actual content of the software (in the forms listed above) will be just as important as the underlying *engine* used by it. The word engine is used here to refer to the program and its structure. This would include GUI, data structures, executables and other pieces of software used to display any particular information. The actual content on the other hand, is the text and pictures as well as ***how*** they are presented. This takes into consideration the level of accessibility of the language used in the text.

2.3 Multimedia Elements

This project has been earlier described in chapter 1 as "E-Learning software incorporating ***multimedia elements***"[3]. The use of the word "multimedia elements" is meant to describe the fashion of which the information will be presented. Multimedia is defined as using more that one form of media present something. This will include: -

[2] Multimedia Systems Design, pg 380, [MMSD96]
[3] Multimedia Systems, pg 2, [MS94]

2.3.1 Text

This is the usual form of dispensing information. Words and phrase describe a particular event, object or merely as commentary. It is a very important aspect of the software package as most of the core components in this software package will be in this form. This has been so for quite some time even in the current commercial market and it will probably continue to be so for a while because there are many limitations to the other forms of media. This will be further described in ***selecting presentation.***

2.3.2 Pictures

Pictures[4] are used as a graphical tool to present something. It helps users identify something visually. It is most often used when describing a complex situation or object and when text may create ambiguity. Pictures can clearly show an object or particular situation exactly the way the person who creates it intended. Thus a picture of a star can clearly help users understand as well as ***see*** what the author intended which brings us to another point. Pictures are static. It shows a particular instance of something and at a particular angle. Most objects and all situations are never static.

Actions are performed and pictures on their own make it difficult to show an action without having many-many pictures showing the action step-by-step. Most of the time, displaying so many pictures is not necessary and more probable, not allowed. Pictures are usually there to complement some text, which is explaining

something about the picture. With a single (or several) picture(s), person can visualize a situation. With proper descriptive explanations, the person can visualize the evolution of that particular situation. The picture would then give the person something to visualize upon and become a mental image. This mental image could then perform an action described in the text.

For example: a car that had collided in an accident lay on its side may provide enough information for most people to build a mental image upon. On the other hand, providing a picture showing this effect would go even further allowing the reader to recreate that accident in his mind.

Pictures while being useful, is not the most important component of any material. The written text is usually more important as text can both describe an object and an action while a picture can rarely present an action. Thus, most pictures are based around a particular piece of text.

There are several small problem pertaining to pictures:

Explanations - Pictures require good explanations to make sense. This depends on the quality of the written material and is especially important for actions.

[4]Practical Computer Graphics 2nd Ed, pg 113, [PCG99]

Esthetics – A picture needs to be somewhat pleasing to the eye. This means, angle, lighting as well as size matters. A picture too dark makes the object of the picture less clearer. A picture that is too small can hurt the eyes and the picture will lose detail. An object taken from a bad angle makes it difficult to identify the object. These are mainly artistic rather than analytical and are harder to evaluate properly.

Quantity – Today's books use some pictures but rarely put pages after pages for no reason. For books, pictures especially high quality ones, are expensive to put into books in large quantities. For the electronic medium, this is hardly ever the case because even very large highly detailed pictures take a small size in space compared to the storage available in a CD. The problem would actually be getting the pictures and selecting the good one. Putting too many pictures may also cause problems as it may bore the people and waste space.

2.3.3 Audio

Sounds all contribute to the learning experience. Books did not have this option and it is mainly left to other forms of medium to explore this element. Some of the older (not that old actually) form of learning used cassettes that had recordings that would be used with the radio's cassette player. The user would listen and read a particular text. Another form of use would be simply listening like those used in radio stations where the DJ would say/tell the listeners

something. This is usually used for none complex situations and mostly used in teaching a language. With the current technology, audio is also being used in software as more and more, computers come equipped with sound capability. Learning material using sound could incorporate sounds that are descriptive of a particular object or situation. This could help user gain a better understanding and excellent in language learning software. Another use could be recorded speeches of a particular situation or simply the recorded readings of a particular text. Instead of reading, a user could elect to hear a recording of the text. The main problems regarding using sounds would be the quality of sound. Higher quality sound takes up quite a lot of space whereas lower quality sound is unprofessional and annoying. Using prerecorded speeches comes with another problem namely the quality of the ***performance*** of the reader. Bad pronunciation and other similar problems make a presentation *sound* irritating and can worsen a user's point of view towards the presentation.

2.3.4 Animation

Animation[5] is the evolution of static pictures. It is mainly a series of pictures (called frames) strung together. These strings of frames are then played at a certain rate per second to emulate movement. Cartoonists have been doing this for a long time and this page flipping technique is the essence of all movies. Animation can be almost any picture whether real-life photos or generic shapes that are 'animated'. Most people think of cartoons when the word 'animated' is used. What animate really means though is that the series of pictures mentioned above vary slightly in each frame. This variation is usually slight so that a change from one frame to the other does not make a noticeable change. When the frames change quickly enough, each particular change add up and thus make a considerable difference when added together.

The rate of which the frame changes in animation is called frames-per-second. A higher frames-per-second provides more fluidity in the animation since ever smaller changes are allowed to be made in each frame. A good smooth and visibly fluid animation can be obtained at 25 frames-per-second. Animation can present actions and evolving complex situations relatively easily compared to all other form of elements. Where pictures can show objects well, animation can present motion very well. Animation is the pinnacle of graphic presentation.

[5] Multimedia in Action, pg 93, [MIA98]

Animation also has drawbacks. Earlier in the ***picture (2.2.2)*** section, it was mentioned that a single picture did not take up too much space; even large high quality ones. That is true. Animation, in essence is a string of pictures so the actual size of most animation is very large comparatively. If we had a picture about 100Kb is size, then the animation of that particular picture (say for a small, short animation) lasting 3 seconds would amount to 100Kb x 25 x 3 (assuming we use the standard 25 frames-per-seconds technique of smooth animation) which is 7500Kb or 7.5 MB. 7.5MB is quite large for a 3-second animation!

A lot of animated formats today are capable of incorporating sound as well. As mentioned in the audio (2.2.3) portion, audio formats are themselves quite large so a file containing both animation and the accompanying sound is obviously large. In fact, several minutes of animation with sound/music can easily outstrip the capacity of even a CD. Movies in the forms of Video CDs are sold in CDs and thus prove that it is possible. Most people overestimate the size of a CD. The only reason that video CDs fit inside (usually two) CDs is that they are compressed. Another even lesser known fact is that Video CDs use low resolution. All Video CDs use the standard 320x200 pixel per frame compared to most personal computer monitors that can support 800x600 pixel. The result of using small resolution pictures/animation on these machines is either the image appear small (default size) or pixilated (stretched). The reason a picture would look pixilated is that a small picture stretched to fit the larger resolution therefore what is intended to fit 1 pixel now occupies 4 pixel. This makes the picture looks

'square-ish'. This happens to static pictures as well as animated formats but because of size constraints; animation files cannot be recorded at higher resolution. Pictures on the other hand rarely have to be stretched because they can simply be sampled (taken) from a higher resolution. Animation files consume an all ready huge size and increasing resolution would be troublesome.

As explained above, animation files are usually compressed to smaller more manageable sizes. Compression also slows down performance because it requires the computer to uncompress the file on spontaneously while playing the animation. Examples of this format would be Mpeg (mpeg format is the format stored for most movies in a compressed form). Compression also reduces quality slightly (but still noticeable). Other factors are also important in the choosing of animation such as color depth a length of a particular component. Animation files to be used in the software package have to be carefully evaluated for size, quality and practicality. Most importantly, getting or producing these animation files are also an arduous task. Nearly all of the problems associated with ***pictures*** (2.2.2) and ***audio*** (2.2.3) also apply here and they will not be explained further.

2.3.5 Interactivity

The above are the potential formats that contents will eventually be presented in. Each of the formats has strengths and drawbacks. Utilizing them in the correct place and in the right quantity will be discussed further in ***selecting***

presentation (2.4). Those formats and their combination provide the multimedia aspect to software package. The final definition to E-Learning using multimedia is interactivity. It is considered by many as the key elements to differentiate E-learning from other conventional forms. Interactivity[6] is defined as the human interaction factor in the software and is a feedback mechanism to and from the users. Interactivity is generally quite new and is not available is any other forms of media other than computerized. Interactivity allows the user to participate directly instead of merely passive learning. Interactivity allows users to take control of the learning process and decide the what, when and how of the learning process. The user can potentially adjust the level of difficulty in the learning process through selection. Interactivity facilitates the learning process even further than conventional form (reading, listening to tapes) by supplying different ways of learning. Interaction has the added benefit of allowing associations during the learning process through the users input and choices. Another key advantage is interactivity allow users to experiment and explore the topic. All these features once incorporated into a software interactivity can make the software a motivating experience for the user.

Interactivity would involve situation (or screens) that require (or recommend) users input. Their input would then change what would be displayed. Interactivity will be discussed in further in ***Analysis of a Commercial Product*** (2.5). Discussing this topic there makes it easier to comment on the software directly

[6] Multimedia Computing Communication & Applications, pg 709, [MCCA95]

as well as note the particulars of interactivity in software especially when to software is in the same domain.

2.4 Content Based on the Topic

The content of this project will be divided into the various aspects of the actual topic. Thus in this software package, "E-Learning: Introduction to Personal Computers" where the topic is "Introduction to Personal Computers". The actual content will be divided into various sub topics. The list of sub-topics touched in this software is the following:

1. Component Description

In this portion, the actual components[7] in a personal computer are described. The description will contain graphic representation, as part as text descriptions. In the text descriptions, the various tasks of the components will be detailed. A few commercial products actually in the market will be quoted and used to further explain the functionality of these products compared to the generic explanations. Any important pieces of information regarding the component that does not fall under any of the other sub-components will be included here as well.

These would include cautions about particular problems that plague various components often. Hints and tips on how to select and buy the components will also be included. These tips would contain how to analyze the component qualitatively.

2. Installation and Assembly

This portion of the content would include steps on how to put together a computer from the various components explained in part 1. Taken as a whole they would provide a walkthrough on how to assemble a computer from scratch. It will contain various pictures of the components as well as animation in the form of movie that show the actual installation of the component. It will detail steps of the installation along with any precautions that are involved. The skill that are needed to actual perform any of the procedures will also be included.

[7] Computer Dictionary, Data, Communications, PC Hardware & Internet Technology. [CDDCPHIT98]

Certain products may have exceptions from a particular company may have exceptions due to a slightly (or technically different) design and require a separate portion required to explain the different installation process. Most components have standards which they follow and therefore these cases will be few and far in between. The actual inclusion of these exceptions will depend on their popularity in the market and how drastic the process maybe from the usual. This portion will also include installation of the component in the software environment. Most components will require drivers (software that is required to use the hardware) and the process of its installation will be included. It is difficult to determine whether an actual piece of hardware actually functions correctly until testing it and thus problems with software may arise. Where appropriate, a link from installation to trouble solving will be included as most problems pertaining to hardware occurs during installation either in hardware or software.

3. Troubleshooting

This portion of the content[8] will be a collection of problems frequently met by users. It will also include instruction on how to solve these problems taken from various manufacturers. The reason this portion is included is that many people have problems and seek to solve these problems without the need of a (sometimes-expensive) technician. This portion of the software would allow the users to seek their own solutions. The whole scope of this portion may be too big for the software to contain all the answers. Evaluation of the amount of content to include will be presented during the analysis phase. In most situations, explanation in the form of text and pictures will suffice.

4. Frequently Asked Questions

This is an extension to the trouble-shooting portion of the content. In not on contain solutions for problems (it will link to the troubleshooting part where necessary), it will also contain answers to general questions such as type definition, part specification and other miscellaneous portions. This part of the content will incorporate a search function that will allow users to look for similar question to the ones they have in mind. The actual explanations will be mostly in text and will include a link to other parts of the software as necessary if the users intend to find more detailed information. The actual content of the Frequently Asked Questions (or FAQ's for short), will be gathered from manufacturers web sites, enthusiasts web sites, instructional booklets, manuals, group discussions

and other information gateways where necessary. This portion of the analysis is an on going process as accumulating the FAQ's will be large and tedious. **Note:** *This portion will not be completed during this phase and may continue well into next semester.*

5. Odds and Ends

Any other features that are not yet documented may be included in this part of the software. Further links to books and web sites will be included here for users who are interested in learning more. This portion will most likely be presented in text.

2.4.1 Level of Accessibility

"Level of accessibility"[9] is described as the complexity of the content and its presentation. This detail is determined by the target audience/user. Selecting a broad range of users will mean that even novices will pick in up. Content has to be catered around specific group of users.

For example:

> A novice may require simplistic explanations as well as metaphors to help them understand a particular object.

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[8] Troubleshooting Your PC, 4th Ed. [TYP99]
[9] Multimedia Making it Work, [MMIW99]

An expert user may just want statistics, in-depth explanation and basically complex information that a novice may not understand.

For this particular reason, a brief classification of potential users will be included here as well as descriptions as to what kind of detail they may be expecting.

Novice: Novice users know very little about the topic. They will not know most (if not any) of the terms used in the topic. They require simplistic views on the object to be able to understand it. The explanations provided must have gradual growth of complexity so those novice users are not confused. A lot of explanation and generous use of graphics may be required. Software catered around this user will require a lot of description and contain detail in a less dense form. This software would be written for someone who expected to now nothing about the topic before hand.

Expert: Expert users now a lot about the pertaining topic. It is very possible that an expert may know more than even the author about a particular sub-topic (even the whole topic! -dependent of the level of expertise). They are usually looking for very specific information and browse through introductions and basic explanation. In the context of this software package, an expert will probably be only interested in the troubleshooting aspect or FAQ's since most of the components would all ready be know. Experts tend to look for analytical explanations, statistic and important notices.

Intermediate: Intermediate users lie somewhere between expert and novice. Intermediate users are users who know about a topic enough to describe what something is but not how it does the work. The will most likely look into detailed explanations as well as walkthrough for complex tasks such as installation and troubleshooting. Intermediate users will know about a particular process and the object involved and thus could make use of the FAQ's portion as well. This would allow them to narrow their search on a particular topic. Like experts, intermediate users tend to skip basic, simplistic information and tend to have a specific topic they wish to know about.

The target audience for this software package will be intermediate users, as described above. The content will contain some basic introduction to the overall topic but not an excessive amount of information on basic product description. For the topic of this project, most of the users will mostly likely be an intermediate user anyway so the simplistic description will probably be avoided. The reasoning behind this is that is if the user is capable of installing and running the software (not to mention starting it up and putting the actual CD in the CD-drive); the user is probably an intermediate user. An intermediate user would know what a computer is as well as some of the basic parts that make up the computer. They probably have used computers before in their work and simply wish to learn more about the computer. These users are the target users of this software package.

2.4.2 Selecting Content

Selecting content is done using the steps below.

Component description: Document components in a personal computer such as CPU, motherboard, RAM, hard disk and the like. In addition to those components are accessories like printers, scanners, speakers and others. Each of these components will have varying levels of detail in their explanation.

Walkthrough: The process of assembling[10] a computer will be documented from the start to the finish. Important steps will be taken note of. Frequent upgrades or general upgrades will also be documented.

Troubleshooting: Most of the information for this portion will be gathered at the manufacturers web site, instruction manuals, and other sources for problems with computers.

Frequently Asked Questions: Most of the information here will be gathered from question frequently asked by users. It is related to troubleshooting.

2.4.3 Content references

Most of the content gathered for the component description will be gathered from books and web sites dedicated to hardware. The types of books that the content

[10] The Complete PC Upgrade & Maintenance Lab Manual, [TCPUMLM00]

will be gathered from include 'Buying and Upgrading', 'PC assembly' and 'PC introduction' books. These have been used so far but there will probably more before the project is finished.

1. Mansfield, Richardson and Petrous Evangelous., **The Complete PC Upgrade & Maintenance Lab Manual**, Sibex Publication, 2000.
2. Norton, Peter and Goodman, John., **Peter Norton's: Inside the PC** (8th Edition), SAMS Publishing, 1999.
3. Gookin, Dan., **PCs for Dummies** (7th Edition) IDG Books World Wide, 1999.
4. Shier, Mitchell,. **Computer Dictionary, Data, Communications, PC Hardware & Internet Technology**, QUE Corporation (Macmilan Computer Publishing), 1998.
5. Aspinwall, Jim and Todd, Mike., **Troubleshooting Your PC**, (4th Edition), MIS Press, 1999.
6. O' Hara, Whelley., **The Complete Idiot's Guide to Buying & Upgrading PCs** (2nd Edition), Alpha Books, 1995.

2.5 Selecting Presentation

Selecting presentation is done using a measure of importance and the type of information that need to be discussed. The following is the format of presentation with type information it is better suited to represent, displayed in a table format.

Item to be Presented	Format of Presentation
An object: components such as CPU, RAM, hard disk, monitors etc.	1. Pictures showing the object at the best possible angle. 2. Text explaining the description.
Actions like installation and assembling a computer.	1. Full motion videos in complex situations. 2. A group of high detailed pictures showing the progress with text and narrative.
Question, answers and statements.	Written Text.

Table 2.1: Format of Presentation

#Whenever there are more than one choice under ***Format of Presentation,*** the lower number represents the better choice for more important situations

Examples:
An object like a CPU (Central Processing Unit) would be displayed in a picture taken from the best angles. For the CPU that would be from the top showing the flat surface and the brand name. A second picture would be taken from the side showing the thin layer (the actual transistors) and the pins. A third picture that would not be overly important would be the picture taken from the underside of the CPU showing the pins pointing upwards.

The accompanying text would explain from the angle, which shots were takes from and which side would be inserted onto the motherboard. What to look out for on the picture. The picture could then have graphic highlights like circles pointing to certain areas where explanation could pinpoint. Another alternative would be a 'hotspot' (a place in the picture that could be clicked on) that would show the further explanation, have a narration read about the particular part of the object or bring up another page showing a detailed look at that particular object (or sub-objects). Any of the methods (or all of them) above could be mixed together to produce a presentation of the object.

An action or a situation could be presented using full motion video. An action like upgrading a CPU would show the following: -

i) The old processor on the mother board.
ii) The process of removing the old processor.

iii) The new processor.

iv) Aligning the new processor with the slot/socket.

v) Inserting the CPU in place.

vi) Testing its stability (whether it was placed properly or not)

A full motion video of the above would only take half a minute. This would be coupled with text appearing somewhere on the screen explaining what is going on. The full motion video would be paused at certain intervals with the aforementioned explanation text appearing. The software could then prompt the user to move further or skip (i.e. movie player like functions). If the user selects '***continue***', another portion of the full animation video would play with a pause and the accompanying text appearing and so on.

Other than the text appearing with the full motion video, a full explanation in text could also appear somewhere else that would complement the video. The text on its own might not be enough to allow some that have never done this actual visualize this procedure properly. Rather than risk it, the full motion video not only explains but also ***shows*** what needs to be done. It is a very powerful tool.

For situations that are not that important (relatively), a group of pictures with detailed explanation would suffice. Selecting the CPU speed using DIP switches (short switches on the motherboard) could be best presented using this technique. A picture could show the switches in their original state and another

showing them it the changed state. Since the switches cannot be switched in any other direction than it was made to, it would be clear what the user have to do. An explanation around the pictures stating the switches have to be changed gives sufficient information about the process. Having a full motion video doing this could also be possible but it seem a waste as the task is incredibly easy and having a video showing this could seem antagonizing. As with all the cases, having a text explaining the whole process would still be necessary.

Regardless of objects or task to be presented or their mode of presentation, a text explanation will still be required. This would probably be necessary (or helpful to have around) in case the user intends to perform the task and therefore prefer a printed copy. Pictures could be printed but people prefer not to print too many pictures so the text would still be important.

These are generally the steps taken to select the mode/format of presentation best suited for the occasion.

2.6 Analysis of a Commercial Product

For the purpose of this analysis, the product: **PC Maintenance: Preventive Measures** by ViaGrafix Multimedia Training[11] was chosen.

[11] ViaGrafix, , BVG. Business Video Group.

2.6.1 Product Overview

This product is multimedia software whose topic is PC Maintenance: Preventive Measures. It has a rather broad range of topics ranging from general problems to technical terms. It is available is CD format.

Product Feature:

- Multimedia Elements using sound, speech, pictures and video.
- Easy to use user interface.
- Beginner target audience
- Includes a test module which tracks result (does not work in this version though)

2.6.2 Installation

The installation of the software went smoothly. Its installation size is small (5 MB) compared to today's machine standards. There were no problems during installation.

2.6.3 First Impression

It starts up reading the CD and displays the menu. It menu (and apparently the whole application) is stuck using a small window in the center of the screen (depending the desktop resolution of the users computers). The menu screen has a graphical layout with selection buttons on the right hand side of the application. In the center is a list similar to the help list, which appears when

users use the help function (F1 at the desktop) under windows. In fact the GUI is identical to the help list except it has only two tabs; ***contents*** and ***index*** versus he windows help list which has 3 (it lacks the search command). It has the logo of ViaGrafix at the bottom right hand corner. On the left side is a tab with the heading module. It currently only has Preventive Measures listed. The words on the left-hand side are in standard text highlighted and underlined. With the background colored Grey, it stands out only partially well due to its small size. This probably due to the small resolution the application runs on.

2.6.4 GUI and Menu

It runs under the standard window box. It has a tool bar with the following items,

File→Exit

Options →Take Pre-Assessment Test

→Copy Learning Files

Help →Multimedia Help

→Display Welcome Screen

→About ViaGrafix Training

Inside the windows box, it has five main buttons with the following label:

Play

Interact

Test

Clear Marks

Help

The center area contains a list described in the First Impression.

The left-hand side contains two tabs. The first tab is labeled Modules Installed and has one item, Preventive measures. The second tab is labeled modules available and has three items, upgrading your PC, Modems and Sound Cards and Doing it yourself.

2.6.5 Usage

The usage is rather trivial. Simply select on of the topics in the list and press 0ne of the buttons on the right hand side. To select 'play' an entry, you have to select a chapter from the list and double-click it. The chapter's contents are then displayed beneath the chapter title (it expands, so to speak) and you select the appropriate entry to play that entry. The instructions are displayed on the list (just below the tabs but above the contents). It then plays a small video in a small TV in the center of the screen. Below the screen are player control buttons similar media player i.e. Next, Previous, Pause, Stop, Repeat. The small TV also seems to have buttons although they are incredibly small and do exactly the same thing.

In the video, a lady explains the topic. The screen then changes away from the lady and shows some words on the screen accompanied by her voice reading it

out. This continues until it has instructions to display like how to do a particular task using windows. It then shows a small portion of a desktop and shows a mouse doing the task at hand. This is also accompanied by a visual highlight, which shows what to click with the aforementioned voice explaining what is going on in the background. Once the 'play' for this particular entry is over, it either returns to the menu or goes to the next entry.

It has a testing module, which shows a question with possible answers that are to be selected using option buttons.

2.6.6 Use of Multimedia Elements.

This software uses a lot of video and audio playback. Every screen has a speech practically reading text displayed on the screen. Video mainly consists of a lady reading/explaining something in a small TV screen in the center. Pictures are also used during certain parts like showing static objects. Even though it uses video, it seems this product does not utilize for walkthrough like procedures. Disassembling a computer is manly a group of pictures strung together with slight variation from each picture. (these methods are discussed earlier in this chapter). There is now video other than of that lady talking. Interactivity is also practically none. The only interactivity done is using the player buttons (pause, stop, next, etc).

2.6.7 Conclusion

This is a basic product and developed using 'Stream Maker'. Stream maker is an authoring tool similar to Director but the one used here is substantially older. Its GUI is simple although somewhat too simple. Everything is too small. The main menus have certain items on the list that is very small. A large monitor at a low resolution will make the menu more visible but that requires the user to change his/her own computer settings which is not recommended. It does not use video other than showing a person reading text which can be considered a slight waste since they have proven (through the video cut scene with the lady reading the text) that have the facility to do video recording. The whole environment is using 256 palette colors and makes the pictures look blurry and not detailed. The pictures them selves are small and have sometimes unusual positions. Text that are being read are displayed on top of the pictures and are large (thankfully) are striking (usually red or yellow). Reading those are will not be much of a problem.

Positive

- It uses a simple GUI design.
- It uses audio extensively in the form of speech (a lot of it).
- It has a small installation size.
- It has good content.
- Probably cheap to develop.

Negative

- The speech has some problems. Sometimes the reader reads to fast (in an American accent). The reader also sounds boring in some of the explanations.
- The video is not utilized properly. It simply shows a person in a small TV reading. Not a particularly good way to waste video on.
- Some of the pictures are taken from odd angles and the detail is lost. Other pictures appear too small.
- The GUI has its down as well as its ups.
- No other use of sounds other than the clicking feedback (sound you here after clicking a button) and the speech.
- The viewing area is small (along nearly everything else).

2.6.8 Anomalies and Oddities

- The window box that the application sits on is not moveable.
- The help can only be accessed using the toolbar. Pressing F1 yields an error.
- Weird questions under the test section. Requires knowledge of specific software, which is not usually used by average users.
- The target audience is supposed to be beginners and lot of the information is very basic which is good. Unfortunately it uses a lot of technical terms which novices (and even myself, and I consider myself at least intermediate) will not

likely know. Its walkthrough of disassembling a computer is not detailed. It does not explain a lot of important (key) information about the whole process yet points out smaller, finer details.

2.7 Synthesis

The result of both 'literature review' and commercial product evaluation has contributed to the design of this software. From the commercial product review, the strengths and weaknesses of that system have been noted. Their implementations of the crucial multimedia and interactive elements (or lack of) are compared to the various multimedia sources that have been gathered and documented in the earlier portion of the literature review.

The following are the estimated features that this software package will incorporate: -

Speech

Use of speech is currently being evaluated. The benefits of using speech are obvious. It makes the product stand out and makes use of the sound capability on today's computers. The problem lies in getting a good reading. If the reading is done well, then the feature will make the software better. On the other hand, bad reading conversely affects people view on the software. Picking a good

reader willing to read a lot of text is also a problem. Pronunciation and intonation are important so that the reading is not received badly.

Pictures

Use of pictures, graphs and other static graphic is clearly important. Key features of static graphics are high-resolution pictures with high detail. The picture must be made large enough so that its important features are visible. Pictures can also be used in picture maps for navigation to promote interaction. The color depth of a particular product is important. Lower color depth (256 standard) is too little today and pictures using those color depth look less detailed than pictures with 16bit color. This is because most system can support this higher color depth. Those incapable of displaying higher color depth will merely have worse looking pictures (due to system configurations that are set 256 color for example) whereas those supporting higher color depth enjoy more detailed pictures.

Video

Using video for actions as defined previously. Video should be used to present complex actions. Less complex/important actions could be done using animation (a series of flipped images with text explanation and narration). Using video to show more complex and important task like assembling a computer should be

important. The restriction would be actually producing a quality video of that task being performed.

Terms and Language

The target audience has been clearly defined in this chapter and making sure that the content does not stray that area is important. Making sure topics are discussed with the appropriate level of complexity is also important. Obscure computer terms will not be incorporated until they are explained.

Interactivity

Interactivity will be a key element of multimedia applications. Earlier, it has been discussed that interactivity is important in multimedia applications especially learning software. Interactivity can take away boredom in the learning process. Chapter 4 includes key points on why interactivity is important for learning multimedia software[12].

2.8 Summary

In this chapter, the elements that will be incorporated into the software package are discussed. This discussion includes opinions from other sources such as books and other forms of written material about this particular topic. The definition of E-learning are explored here as well as the implementation of the E-Learning that this project will incorporate. The elements of multimedia that will be woven into the software are explained in detail. The instances that these

[12] Human – Computer Interaction, pg 261, [HCI92]

elements will be used as well as the reason why each are incorporated are discussed. Several examples of how the multimedia elements will be incorporated are given. The contents that will be presented in the software are discussed in terms of quality and quantity.

In the quality portion, the types of content that will be incorporated are explained whereas the quality portion explains how much information will be incorporated in each part of the software package. Their presentations using the aforementioned multimedia elements are also listed with an accompanying reason for each selection. The process of selecting content and the level accessibility that are determined by the target users groups are also explained here. Both target user groups and accessibility are discussed in terms of their relevance to the content of the software package. With the content defined and categorized, the sources for both the ideas presented in this chapter and the sources that will contribute to the content as listed.

Finally an analysis of a commercial software product that has a similar domain is presented. This includes feature comparisons, critique and overall analysis. The analysis looks at the multimedia elements described above and how they are incorporated into this particular product.

3 Methodology

3.1 Introduction

In this chapter, the development process and the underlying technology that will be powering the software package will be discussed. In the previous chapters, the contents of the software package have been determined as well as its potential mode of presentation.

3.2 Development Methodology

The most common development methodology used today is the waterfall model illustrated below. The entire development process is divided into phases, each with a goal of its own. The initial phases are requirements, specification and planning. For the purpose of this project, the requirements and specification deal with the content (Personal Computers) and the presentation elements that will be incorporated. As was stressed earlier, learning software consists mainly of presentation material that facilitates learning. Thus the most important phases will be design and testing.

Presentation has no exact rights and wrongs, and is rather an expression of an art form rather than stringent rules. While there are no hard and fast rules to develop presentation software there are key guidelines that can be followed to ensure its quality. These guidelines deal mainly with User Interface and use of multimedia elements. The use of elements (in this case, multimedia elements)

has been described in chapter 2, as have User Interface. Chapter 4 will detail the Graphical User Interface that will be used in this system in more detail. GUI design can be best tested using prototype model and thus implementation of prototyping in the software development can be effective.

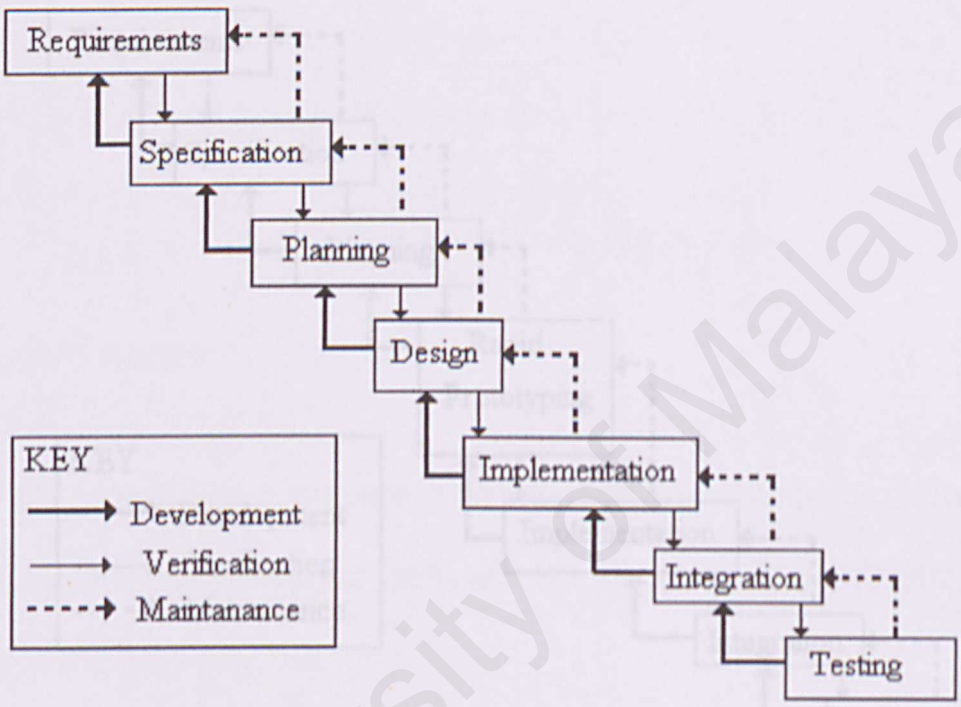


Figure 3.1: Waterfall model

Prototyping involves producing a portion of the system that tests certain features. The implementation is tested and the feedback results in another prototype with the feature corrected or improved. Once this particular feature is perfected (as best as necessary), another feature is prototyped and the steps continue. The whole feature list has been incorporated; a feature complete prototype is developed for overall testing purposes. Presentation material gain

benefits from prototyping because it provides a real working model to evaluate rather estimations and guesses.

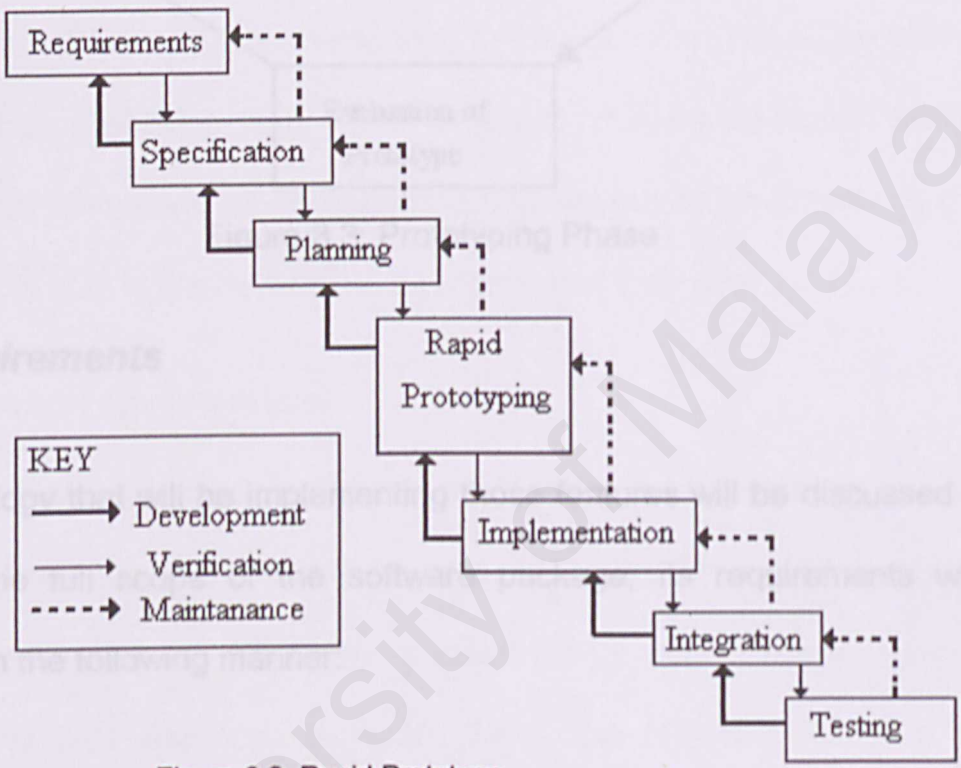


Figure 3.2: Rapid Prototype

Using the waterfall model as a basis, rapid prototyping can be used during the design phase of development. Rapid prototyping is basically prototyping that is done quickly without too much analysis between the iteration stages thus the term 'rapid'. In practice it is exactly the same as any other form of prototyping except it is done quickly. During this phase, prototyping can help determine which features are effective and which are not so effective. Graphical User Interface and presentation layout will be prototyped. Below is the prototype phase that replaces the design phase in the waterfall model.

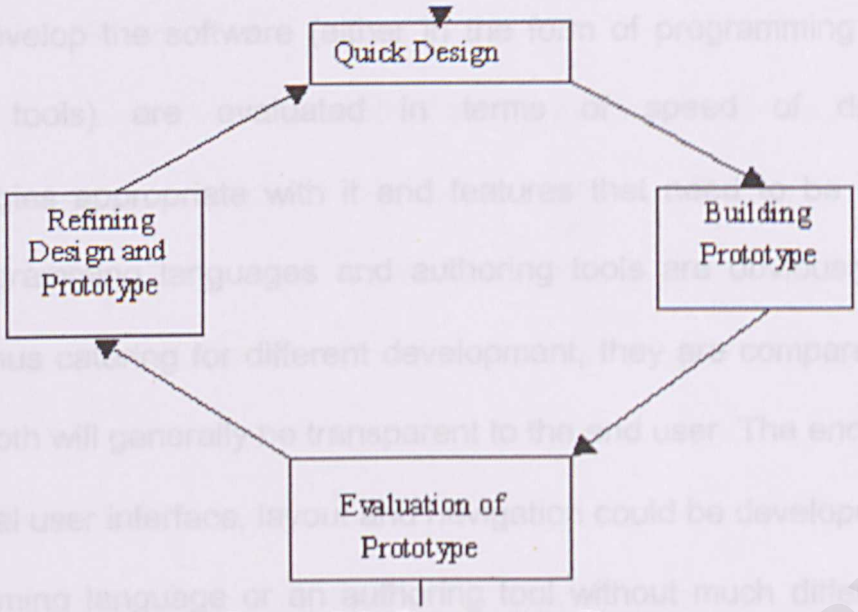


Figure 3.3: Prototyping Phase

3.3 Requirements

The technology that will be implementing those features will be discussed here. To show the full scope of the software package, its requirements will be presented in the following manner:

- Functional Requirements
- User Interface Requirements
- Programming Languages
- Runtime Requirements

The requirements are analyzed and the results will then be effect the choices made during the selection of appropriate technology. Technology in this case would be the programming language or authoring tools. The tools that will be

used to develop the software (either in the form of programming language or authoring tools) are evaluated in terms of speed of developments, methodologies appropriate with it and features that need to be incorporated. While programming languages and authoring tools are obviously in different leagues, thus catering for different development, they are compared here fairly because both will generally be transparent to the end user. The end product with its graphical user interface, layout and navigation could be developed with either a programming language or an authoring tool without much difference (to the end user). It is only in the development process that they vary.

3.3.1 Functional Requirements

The functional requirements consist of a set of tasks that the software is required to perform. From this requirement list, a guideline on the overall layout of the software can be planned. This step is important for large system, which have many requirements and complex tasks. Since this project focuses on an E-Learning software, the requirements will be quite small and comparatively simple compared to the complex requirements of a full system. Learning software is mostly a presentational tool, where information is presented in a way that it can be extracted and learned easily. The heart of this software is clearly presentation and the functional requirements reflect that. The functional requirements are broken into sub-components or modules. These modules taken together represent the actual whole software package.

User Interface Module

The user interface module will contain all the features with which the user will interact. This includes buttons and its animation and graphical layout like windows. It will be designed to be easy to learn. A more detailed discussion about the user interface can be found further in this chapter (User Interface).

Presentation Module

This will be the heart of the software. It will contain what can be best described as the engine of the software. The engine is the core of the software that all other elements are accessed from. The engine will be a coded program that will display pictures and text, play animation and sound. It will contain an interface to the "user interface module" and convert feedback from users on the interface to feedback from the software in the form of changing images, loading other parts etc. At its core will be able to:

- Display pictures and text in a formatted environment.
- Play animation and sound according to cue or user feedback.
- Control over most of the features in the software.

Quiz Module

The QUIZ module is a planned feature where question will be asked to users and require answers. The QUIZ module will be able to track correct answers and mistakes. Another feature that could be included is an analysis module that

could analyze mistakes and make recommendation to users about which part of the topic they are weak in.

External Module

This is a planned module which handles updates (if appropriate) and printing.

Aside from those technical functional requirements, non-functional (non-technical) requirements that will be contribute to the software design are listed below in the non-functional requirements.

3.3.2 Non Functional Requirements

User Friendly

The interface of the software will be made as user friendly as possible. This will include using windows interface where necessary like advance features and configuration. A graphical user interface using pictures will be used as the core navigation interface. The interface will be specially modeled for ease of learning. The concept of ease of learning is that a user will not be using this software often (like office software) and therefore will not be able to memorize the functions of too many buttons or complex navigation. Its goal will be to make the software's functions easy to recognize with visual cues. This is slightly different from ease of use where the goal is to make completing easy and fast. Ease of use includes a lot of features that allow work to be done as quick as possible but

at the expense of being complex. Some of the features of ease of learning are the exact opposite of ease of use. [1 GUI design essential]

Response Time

Response time involves the time it takes from the computer processing the user's request. The goal of this is analysis is to determine the best compromise between features and the time it takes for something to happen. It is always better to have a short response time but adding a lot of graphical features tend to be slow. The graphical features are very important in this kind of software because good presentation is absolutely a necessity to stave of user boredom.

Reliability

The system must be made stable on the target operating system specifications

Efficiency

Efficiency is defined here as making optimal use of space, time and other resources.

Effectiveness

The content of the software and its presentation must be effective to promote the learning process.

3.4 User Interface Requirements

The following are the expectations of the user interface requirements. Basically the user interface will be a graphical user interface that has a nice presentation and easy to learn.

Menu

The menu will allow users to jump around the features in the software. It will be used as the secondary for of navigation.

Picture Map

A picture map is a picture that has 'hot spots' (click-able areas of the picture) will be used as the primary means of navigation. Basically all the screens will use mostly this mode of presentation for navigation. It was chosen because it is more esthetically pleasing (with the appropriate picture) than simply words on menus. Esthetics is important for any software whose core is presentation.

Portions (Divisions)

The current layout will be divided into 2 areas. The first area will show pictures, animation and the like whereas the second are will be used to display overall text explanations. The text areas will have a scroll bar but the picture area will not have a scroll, as all pictures will be custom made to fit that area. Larger pictures will be presented in another screen with a back bottom showing back to the main screen.

3.5 Analysis of Useable Technology

3.5.1 Overview of technology

The various technologies that can be applied to this software package include the language in which the software will be developed upon and several key design objects that are related to technology.

3.5.2 Programming language

The objective of this analysis is to determine the best programming language to develop the system with. Many programming languages that exist now have support for multimedia elements. The favorites include Microsoft Visual Basic and Visual C++ among others. Both of these have roots in pure programming languages of Basic and C(C++) respectively. They have the added benefit of having a refined user interface (in the compiler/editor) and can create graphical user interfaces relatively easily. While many commercial developers prefer these programming languages because they are more stable and matured, Java is also being received relatively well. Java is relatively new compared to the other programming languages mentioned above. For a newer language, it has surprisingly comprehensive tool set (in the form of the Java SDK API) which supports many new technologies. For the purpose of developing this software package, Java has been selected as well as Macromedia Director. Macromedia Director is not an authoring tool per se but an authoring software, which was

designed specifically for multimedia presentations. Below, both Java Programming Language and Macromedia Director will be discussed separately with the appropriate comparisons.

3.5.2.1 Java Programming Language

Java programming language is a part of a larger programming set: Java 2(currently). Java 2 includes a programming language that can be used to develop programs that run on a browser known as applets and general purpose programs that are run as an application. Many books differentiate them by calling one Java Applet (runs on a browser) and Java Application (runs a standalone application, it does not require a browser). Java application will be used for creating the software. From here onwards, Java Application will be simply called Java.

Java is an object oriented programming language. This is somewhat similar to C++ but with a slightly tighter restrictions with regards to external function calling and inheritance. It is being developed by Sun Microsystems. Java can be ran on many operating systems which is one of it key advantages. While many languages have specific versions for a particular environment (dos/windows or Unix etc), Java allows a compiled program made on a Windows platform to be able to run on a Unix platform. C have many variants that are present for different platforms and are not generally compatible meaning that a code made

in C for Unix may not run for one that was compiled in windows. Java is platform independent because of the ability described above. Java continues to evolve as Sun Microsystems continually update the SDK.

As a programming language Java has these advantages:

- It is totally free!

There is no charge for downloading the SDK available at Sun's web site and using it. It does not come equipped with an editor though.

- Comprehensive documentation.

There is an abundance of information available about Java and it use available at Sun's web site. It has a complete listing of all the functions in HTML format. This documentation can be downloaded and is very comprehensive.

- A lot of Features

Out of the box, the Java SDK provides a lot of very useful library functions. Button, lists, windows, frames, audio, animation and others are all supported without too many hassles. Many of the advance functions have already been written, in fact it supports everything that this software intends to include within its library.

- A large supporting community

There are many web sites dedicated to Java programming. Another key advantage of Java was its lauded 'open source' spirit. Many supporters of Java support this and it easy to find a program (wit hits accompanying source code) that this or that particular task. Finding the appropriate programs that have been developed tested and used cuts down development time.

Disadvantages of using Java.

- Being a programming language, it requires more effort during the coding.
- Everything has to be coded properly to work as planned. The programming may be difficult.

For the purpose of comparison with an authoring tool, the following are the benefits of a programming language. Being a programming language it is totally customizable. Generally fast and the minimum system requirement required to use it are not as taxing as many authoring tool. Next is a description of Macromedia Director, which is an authoring tool.

3.5.2.2 Macromedia Director

Macromedia Director was designed to produce multimedia presentations easily. It is a visual oriented tool. Many of the objects incorporated are presented

graphically and the function or actions of those objects are set in a menu with predefined scripts rather programmed. Here are the benefits of using Director:

- It has a good development Graphical User Interface.
- It is easy to use compared to a full fledge programming language. The visual orientation is easy to grasp and can potentially lead to shorter development time.
- It supports a light form of programming in the form a scripting language: Lingo.
- It supports many multimedia formats such as pictures, sound, music and video, etc.
- As an authoring tool, Macromedia Director's main advantage of Java is that it is easier use and easier to make a software out of. Those two reasons contribute to its potentially shorter development time.

Disadvantages of Director

- Its main disadvantages are that it is not fully customizable. Additional/advance features are not available in its basic module and has to be purchased (and then downloaded) for the product.

- It generally runs slower than most (well-written) program using a good programming language.

Java	*Director*
More flexibility and control	Limited flexibility
Pure programming language	An authoring tools with scripting capability
Programming oriented	Visual (graphical) oriented
Free updates on SDK and expanded features	Has to be bought and additional module may have to be bought as well
Harder to develop with	Easy to use
Better support on the internet	Commercial product level support
An SDK developed by Java	A commercial product
Many features and supported functions	Supports many multimedia elements

Table 3.1: Comparison of Java and Macromedia Director

3.5.3 Conclusion

Between Java Application and Director, both are suitable for development of this software. This software requires extensive use of multimedia elements which director is especially good at. Java also has many features and support many multimedia elements with the added benefit of being flexible (a programming language). As of this time, the system will go through its initial prototyping phase

(first prototype phase) using both Java and Director. This prototype will contain only key design areas and is meant to test overall application. This will also allow the effort required using both Java and director to be properly analyzed.

***Special Note**: As a secondary reason not directly related to the analysis, I intend to try to use Java for this purpose because it will contribute to my programming experience with that language. It is a more of a personal gain rather than project goal but I wish to present the reasons as is including personal ones.*

3.6 Runtime Requirements

3.6.1 Estimated system requirements

The recommended computer specification required running this software has not been able to be determined 100% as of now but below is a general estimated guideline:

Any 200Mhz CPU.

32 MB RAM.

50 MB Hard disk space.

CD-ROM drive.

Mouse.

Windows 95 or later. (Windows NT NOT supported)

3.7 Summary

This chapter has touched on the technical side of development. The software development model that will be used for development is rapid prototyping. Prototyping is chosen because it can pinpoint presentation issues quickly. Prototyping is also able to determine which feature is possible, feasible and practical with visible results.

The functional requirements and non-functional requirements are discussed to give a brief idea of what the software is intended to do. The necessary goals during design are also included. The general ideas behind the implementation of the User Interface are listed in the User Interface Requirements.

The programming languages that will be used are discussed here. Their strengths and weaknesses are evaluated. In terms of development choice, the first phase of prototyping will be done with both Java Programming Language and Director. This will give a more realistic presentation of each capability. After the first prototyping phase, one will be selected to develop the software.

4 User Interface Design

4.1 Introduction

The idea behind user interface has been "is the software usable". This is an important factor in software because it determines whether users will accept the software. The user interface must make it possible for users to do what the software was made to do. If the users are not able to utilize the software because it is hard to use then the features have been wasted.

The user interface is the front end of the software. Basically this means it is the part of the software that the users 'sees' and interacts with. The whole software will depend on this portion of the software because it is the part of the software that will be judged. Designing a good user interface will make easier for users to use and ensure that the effort in the other parts of the software are not wasted.

4.1.1 Usability

Usability is the 'ability to be used'. A high usability means that users will actually be more inclined to use the software rather than be confused with it. Taking usability into consideration means relating how potential users will be using the software and designing the user interface based on how the users use the software. Key features are listed below:

- If the users want to do something on a particular screen, it is because:

  -Elements on the current screen has sparked an idea to the users to do something therefore...

  -The software must be made to anticipate this and be able to cope with that intention.
- Parts that are interactive should be obvious.
- Common tasks should be available.
- Clear concise, consistent designs that follows interface design standard.

4.2 A Presentation Software

Presentation software is very susceptible to usability critiques because they are intended to present information. This particular software is intended to help users learn about a topic. Learning is a very difficult process to promote properly. Learning process has always been described as 'boring' and thus software that is intended to promote learning cannot be boring.

4.2.1 Factors

First of all, software has to bought and used with a computer and computers are not cheap. Many computers have many features (graphical and audio) that users expect to be utilized.

The software must present a (good) reason to the user why the user should chose a software, specifically this software over other software or even books.

Books have the added benefit of being mobile and can be used practically anywhere. They importantly do not require a PC to use.

Books tire people less than computer monitors... Most people are used to reading books but not many are used to spend long periods of time staring at the computer. Most average monitors strain eyes after several hours of use (I can vouch for this).

4.2.2 Analysis of the Factors

The factors can be analyzed with the following conclusions.

Learning software on a PC ***must*** contain benefits above and beyond the experience provided in a book. This would include presentation using multimedia elements.

Audio, sounds, music, animation, and video are all-important aspects of multimedia elements that need to be given consideration because books cannot compete in these arenas.

Computer monitor tires people eyes... There are several ways to solve this problem:

1. User should get newer (somewhat expensive) monitors ***AND*** learn how to use the tuning controls on them to ensure the right amount of brightness so that their eyes do not tire as easily.
2. Users should only use the software (and computers) in short periods and have rests between sessions.
3. The software had better be interesting so that the user do not realize that are spending so long in front of the computer and (hopefully) do not get tired. This can be promoted with user interface that is easy to use so the interface does not cause frustrations. Colors cool to eyes and other design tricks.

From the above, it can be gathered that 1 is neither quite possible nor advisable. Not many users actually *know* that monitors can be changed or optimized for viewing and even less, know the procedure to do it. The second is slightly more useful, but not commercially advisable. The software could contain a warning stating that users should not use computer for more than three hours at a session. It is a nice advice and may actually help users lead a better life giving their eyes a rest but... restricting users or even giving them ideas that computer (software is directly by this including this particular one) may harm users; no matter how small, is not a marketing option. Potential users may be frighten and not use your software. The last option is clearly the 'way to go'. The key points in

the third solution are incorporating interactivity and a good user interface. The first in described in chapter 2 while this chapter will deal with the user interface.

4.3 User Interface Elements

- The user interface is will be so that it is attractive and easy to use. One of the key elements will be "**picture maps**". Pictures maps are generally used in web sites but provide easy navigation and a more visual oriented learning technique. For example, having picture of a computer that has click-able areas that would let users to get a specific component description about that component the user just clicked on.
- Buttons would be used for basic navigation that would complement the "picture maps".
- Having separate pages for detailed descriptions. These pages could contain mainly pictures and text as a web site would have. For specific task such as playing a video a standard GUI showing the player controls (play, pause, etc.).
- Animation and highlights could be used the give feedback to the user.

4.4 User Interface Mockup

These are mainly a primary mockup of the user interface and by no means represent the final interface that will be incorporated in the final product. Two

programming languages will be used to develop the initial prototype. They will probably have different GUI and this phase will allow the testing of the interface. Further in development the later prototypes will be tested using potential users.

This is the basic screen that have been designed but not refined so they do not show all the features yet.

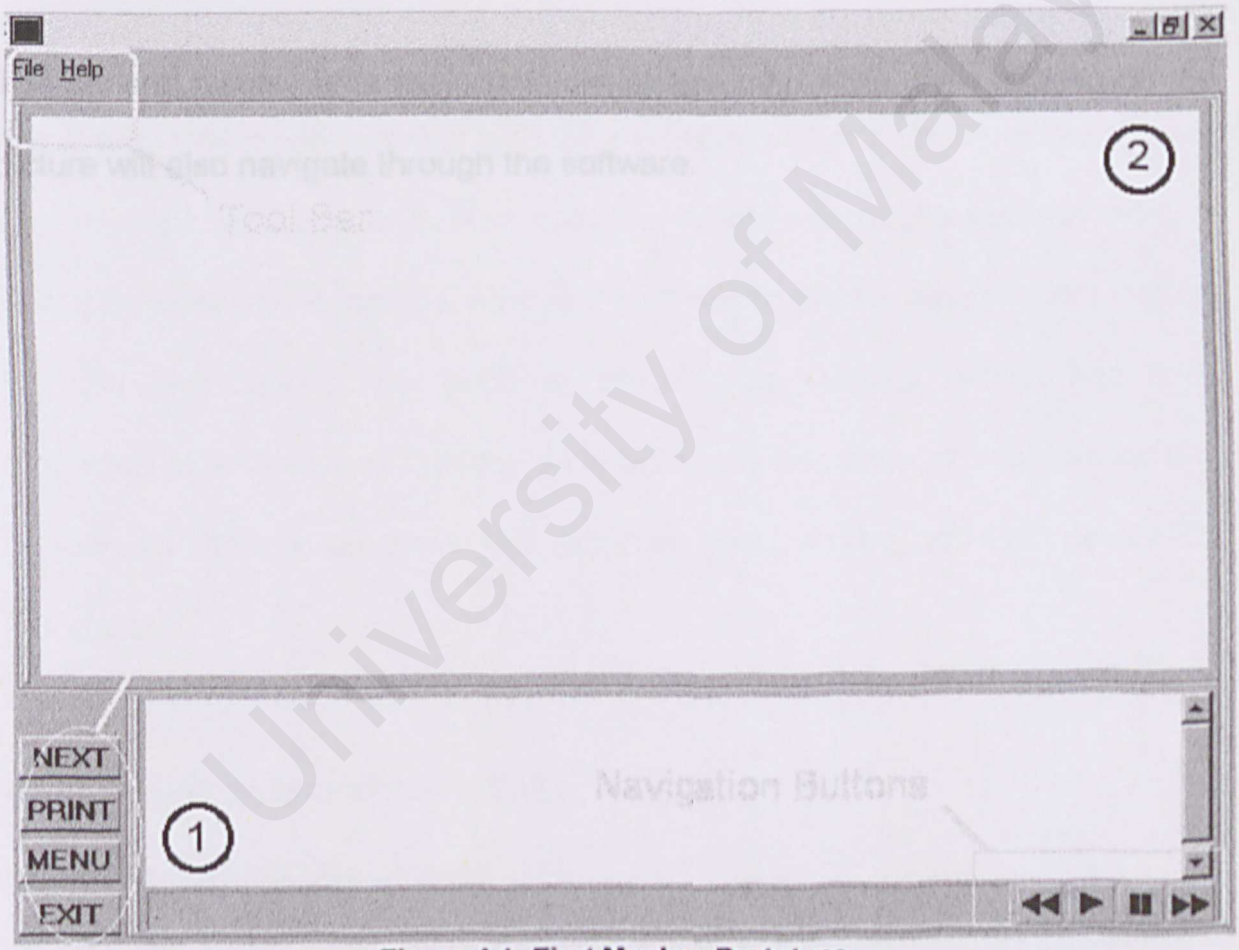


Figure 4.1: First Mockup Prototype

1) Text will be displayed here.

2) General display area. Pictures, animation and video will be displayed here.

Main Menu Buttons are buttons that relate to function of the software as a whole and not related to any one part.

Navigation Buttons are buttons used to navigate through the software. It can be used to navigate in text (by skipping areas of text using the next button) or control animation or video.

Tool bar is the standard in most windows software. All actions that can be performed anywhere in the software will be present here.

The general display area may contain a picture map. If so, then clicking on the picture will also navigate through the software.

4.5 Changes to the System

4.5.1 Reasons for change

These changes are the result of the following decisions that were made during the development process. The original design motif is clearly taken from the windows GUI. This was chosen to enable easier development using Java. Upon testing the GUI, many find it to 'boring'. Most other multimedia applications use a custom GUI that use pictures extensively. After a small test, it has been discovered that creating a GUI with the extensive use of pictures would present a lot of problems using Java. Most opinions in books recommended the using of Visual Basic or similar setups. Among the other choices for development include the use of authoring tool such as Macromedia Director, which has been discussed in the previous chapter. After some consideration, it was decided that Maromedia Director will serve this purpose. The following are the reasons for this choice: -

I) Not enough experience using Java

II) Difficult development process

III) Steep learning curve

IV) Lack of any proper IDE (Integrated Development Environment) for Java.

{Microsoft has a Visual J++ has an IDE which use a similar language to Java but is not compatible with Sun Microsystems's Java using JDK (currently at version 1.3 as of this writing)}

V) Time constraints were imposed due to 'wasted' time on previous prototype.

4.5.2 Explanation on Reasons

Java does not have 'drag and drop' capabilities of an authoring tool. Developing a GUI in Java requires positioning each item using coordinates and sequencing everything using time (as in seconds). This proved incredibly problematic as well as difficult. Another way to create this GUI is to use a shell. The shell will act as a graphical engine of sorts. This was far more complex than was initially planned for. A course that taught Java did not provide enough to even begin to start such a project. Using video and animation also proved tricky; as the shell (graphical engine) needed to use various codexes that are then needed to interface with said shell. This original Java based system was scrapped on November 2000.

4.6 New Design

The new design, which follows from here onwards, is based on the use of Macromedia Director. Director has many easy to use facilities, which make development of this project far easier. Directors 'drag and drop' allow for faster development time as well as quick testing. It is not required to create an engine-using Director. The visual based development provides faster feedback and

allows for easy changes. The new design will take into consideration the benefits of using Director. Being able to implement graphics and visual better are the main reasons for changing in the first place.

4.6.1 Adapting to new environment

The first couple of weeks of using Director was determining was from the old design is still usable as well as learning how to use the software it self. As it turns out, the software lives up to expectations as being very easy to use. Director uses promotes the use of graphics and a 'timelines' which are a departure from previous design. Below are the new design specifications.

4.6.2 Content Redesigning

The original content was divided into several key parts namely, walkthrough, FAQS, product description and miscellaneous information. The walkthrough consists of mainly an instruction presentation that helps users put together a computer. The original premise was to present users with video footage of the installation process. This has been removed due to the problems inherit in the idea. The FAQ's have been put on the back burner and has been put as less important to the other two key parts that will remain the core of the project.

4.6.2.1 Removing Features to ensure completion

The content redesigning was inevitable. The first problem was the scope, which was far larger than was originally suspected. Putting an installation of a PC

containing all the components would take quite a while. Second problem is laying in the way that the recording was to be done in. The original idea was to use a webcams (small cameras used with multimedia computers to capture live video) but it turned out that the quality of all webcams are abysmal at best. Focusing on anything other than a person's head was simply a daunting task. Lighting also proved a huge problem when focusing was not the problem. Thus the use of webcams were removed. Real digital cameras would solve this problem. The problem in that, is those real digital video cameras are insidiously expensive. There was simply no other way but to remove the feature if the project was to be completed.

The FAQ's feature had been put into a 'additional feature' list because compiling and editing those would take time that is a rare commodity currently. Since the redesigning of the GUI has taken place so late into development, this feature has been decreased in terms of importance. It remains to be seen whether or not the feature can be included.

*Author's Comment: Dr. Sellappan had predicted *and* pointed out this problem about the scope of the project during the first phase of the thesis. "Give respect where respect is due"; as the saying goes, I should have probably listened. I just learnt that being naive and over-optimistic doesn't pay therefore the content 'restructuring' is an attempt to make the project possible within the deadline. That's what you get for not listening to experienced people...*

4.6.3 Current Features

The current features include a product description and a possible "picture and text" based do-it-yourself walkthrough. The former is for more daunting than

initially thought and has dramatically altered the entire timeframe schedule. The original concept is based on a specific audience group namely the intermediate computer user. This has been changed to beginner simply due to the scope of items that most people consider intermediate. Intermediate also seems quite ambiguous. Although 'beginner' seems ambiguous too, it looks to make more sense than 'intermediate'. Where possible during product description, a rendered scene will be available.

4.7 Design Flowchart

The key feature of this project will be product description. Product description will contain text explanation about the item, pictures and rendered scenes in possible. More on the rendered scenes will be discussed later in the chapter. The product description will be able to be accessed in either of two modes.

i) Explore PC

Will display a computer image where users click on various parts of the computer to find descriptions about them and funnel down to any specific parts that users want to know.

ii) Select Part

The second simply provides a list of all the available parts which users want to view.

Below are the key elements that make up the software.

4.7.1 Elements

The software will run on a resolution of 800x600 and will force users to play it at this resolution.

4.7.1.1 The Main Menu Screen

Shown at the start of the program and will contain 5 items:

Explore the Personal Computer

Select a particular part to learn about

Do-it-Yourself Instructions

Credits

Exit

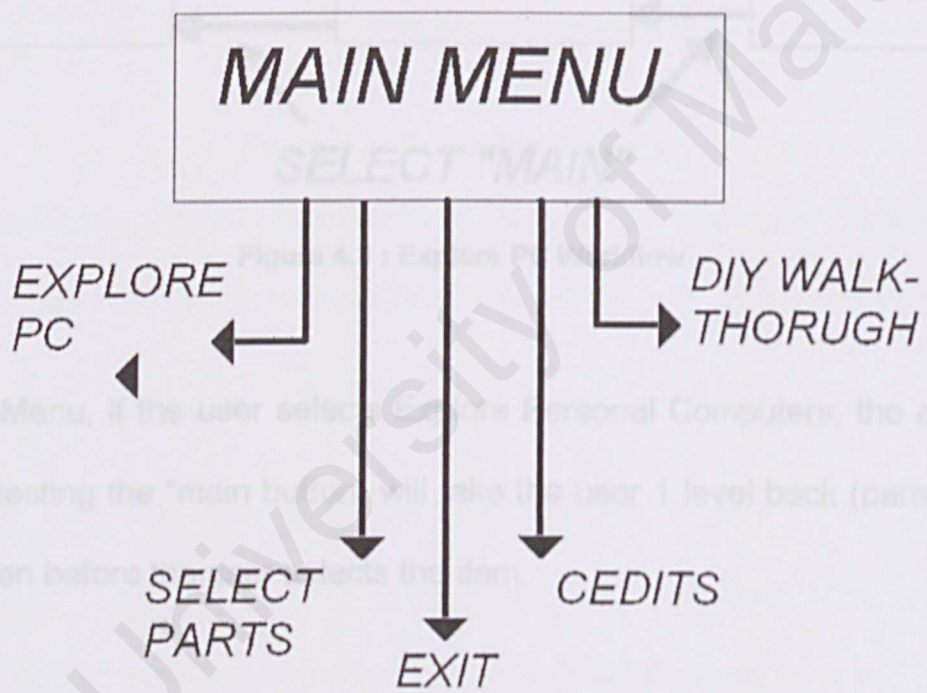


Figure 4.2 :Menu Workflow

The precious page whows the flow of the main menu.

4.7.1.2 General Screen

Used everywhere else in the software. The screen will be broken into several component areas. One component will contain the text. One area will be the image area. One area will be the movie area. There will also be a title area.

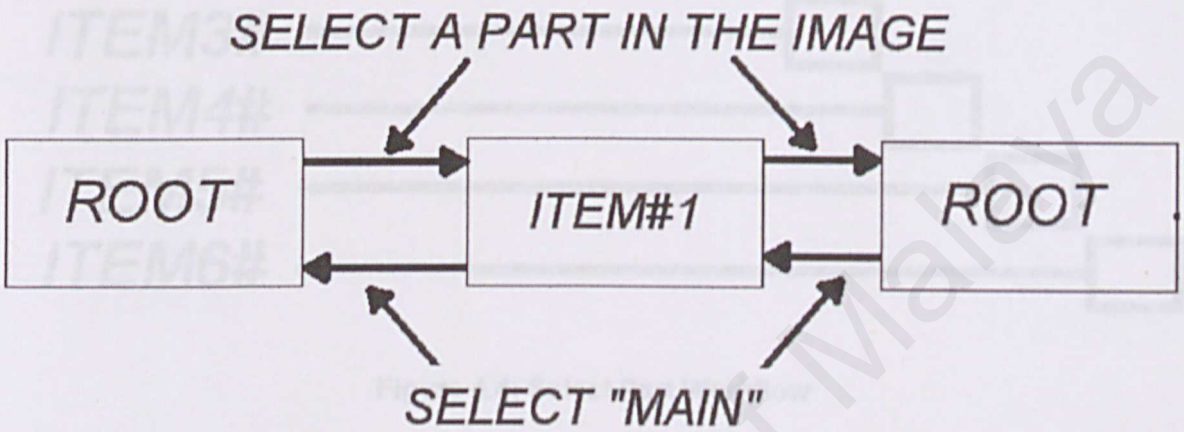


Figure 4.3 : Explore PC Workflow

From the Menu, if the user selects Explore Personal Computers, the above will occur. Selecting the "main button" will take the user 1 level back (parent) to the main screen before the user selects the item.

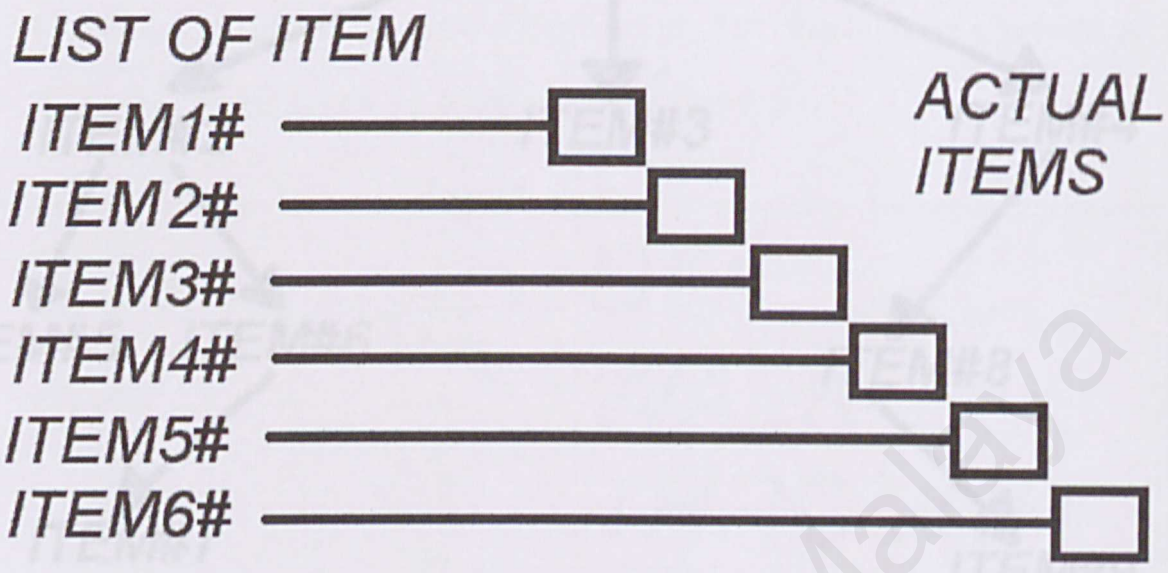


Figure 4.4: Select Part Workflow

If users select the "select particular part" option, the flow chart on the previous page describes how the screen will be displayed.

4.7.2 Navigation Flow

The reason why this is done is because selecting a part on the image that represents an item will do the navigation. This will then show about that particular item. If that item constrains important components user will be able to select further components. Using the "main" button, users will be able to go back to the parent. The following will explain it better: -

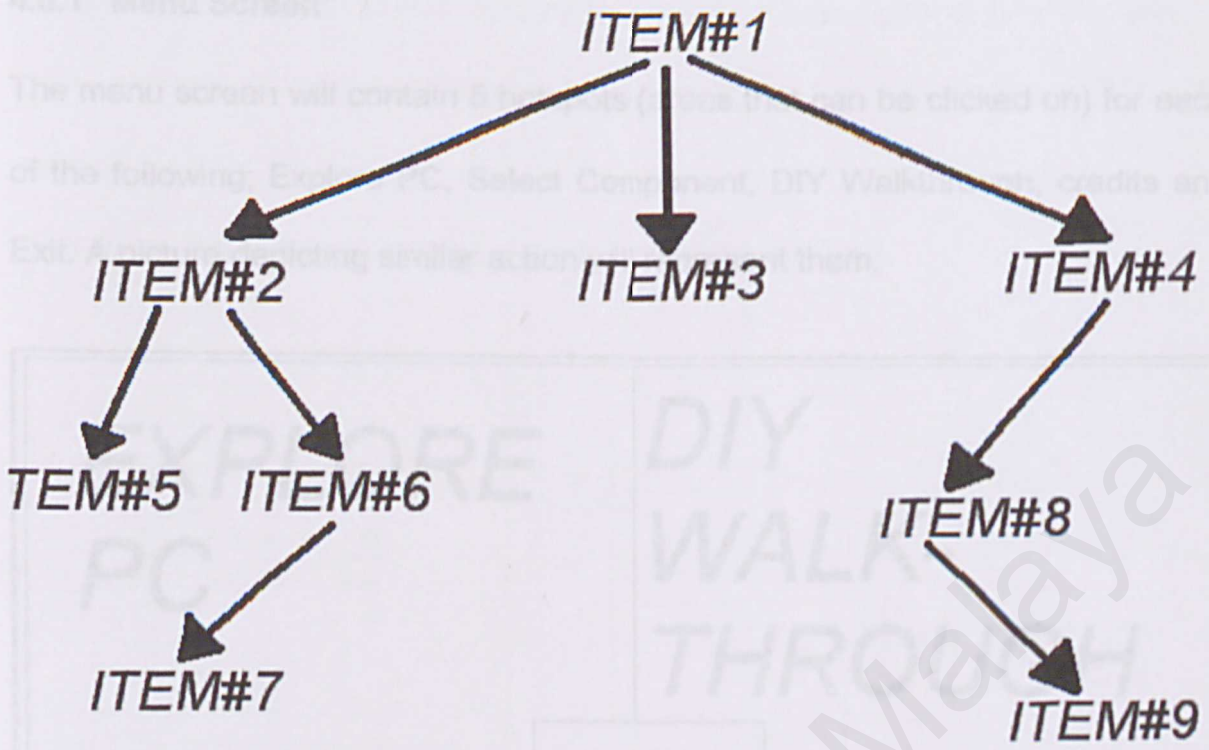


Figure 4.5: Hierarchy Like Design

The process works much like hierarchy. The arrows show navigation done by clicking on the parts of an image. For example; ITEM#1 has ITEMS#2-4 in its image. The users will be able to select those items from the image and get further details on that item. Let assume the users select ITEM#2. ITEM#2 then contains two sub-components. Similar to the previous steps, the user can dig further deeper or use the "main" button to go back 1 level the ITEM#2's parent which happen to be ITEM#1. This will be the general navigation process.

4.8 General Screen Design

The following section will detail the design of various screens in the software.

4.8.1 Menu Screen

The menu screen will contain 5 hotspots (areas that can be clicked on) for each of the following; Explore PC, Select Component, DIY Walkthrough, credits and Exit. A picture depicting similar action will represent them.

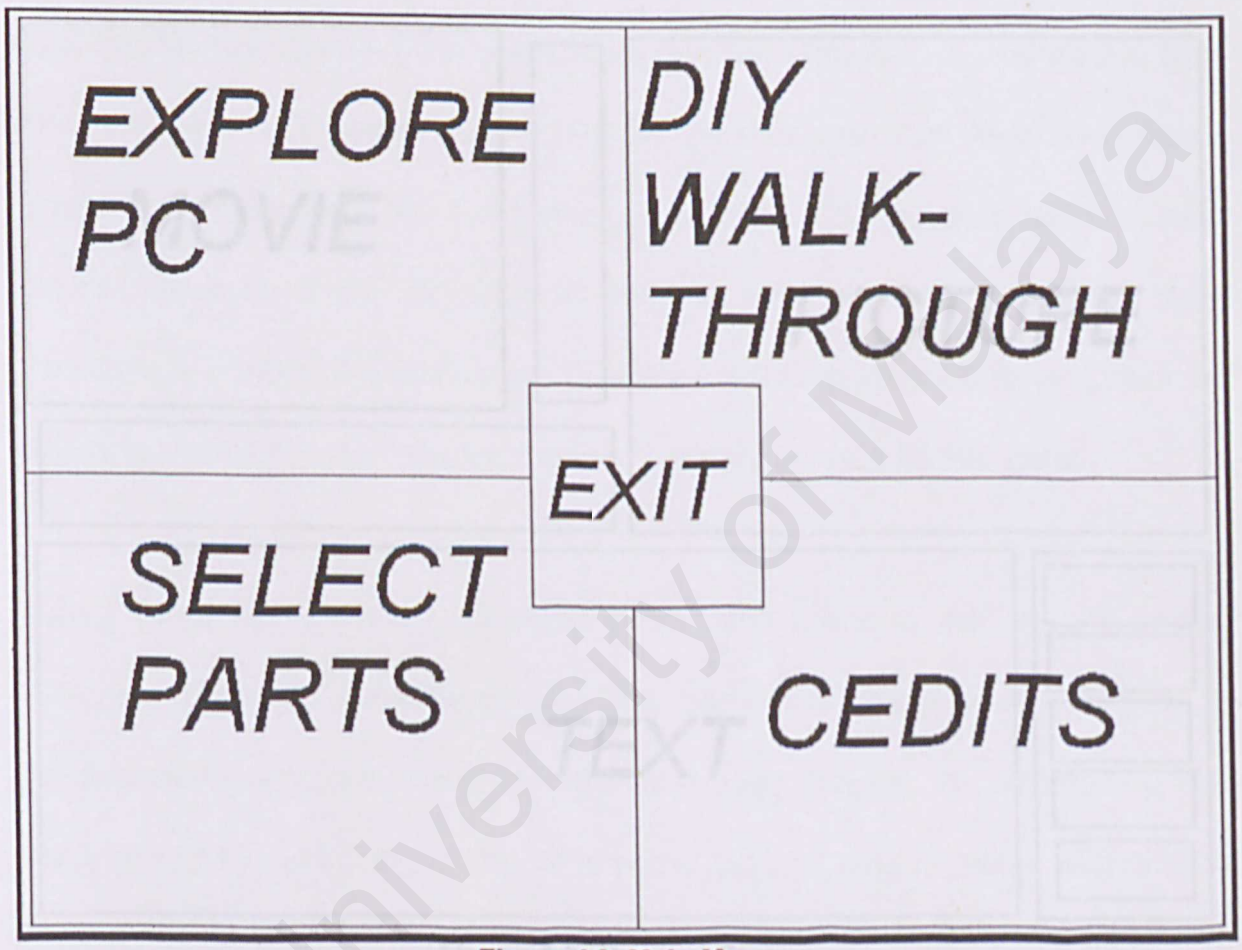


Figure 4.6: Main Menu

4.8.2 General Screen

This screen will be used every where else in the software. It contains several buttons in the lower right. The screen is broken up into several areas as shown on the picture.

Movie Area: This area will display any movies/animation about the particular item when the "MOVIE" item is clicked on.

Picture Area: This area will display the main picture representing the item. If there are more than one picture, users can cycle by clicking in the "IMAGE" button

Text Area: Will contain the text description about the item.

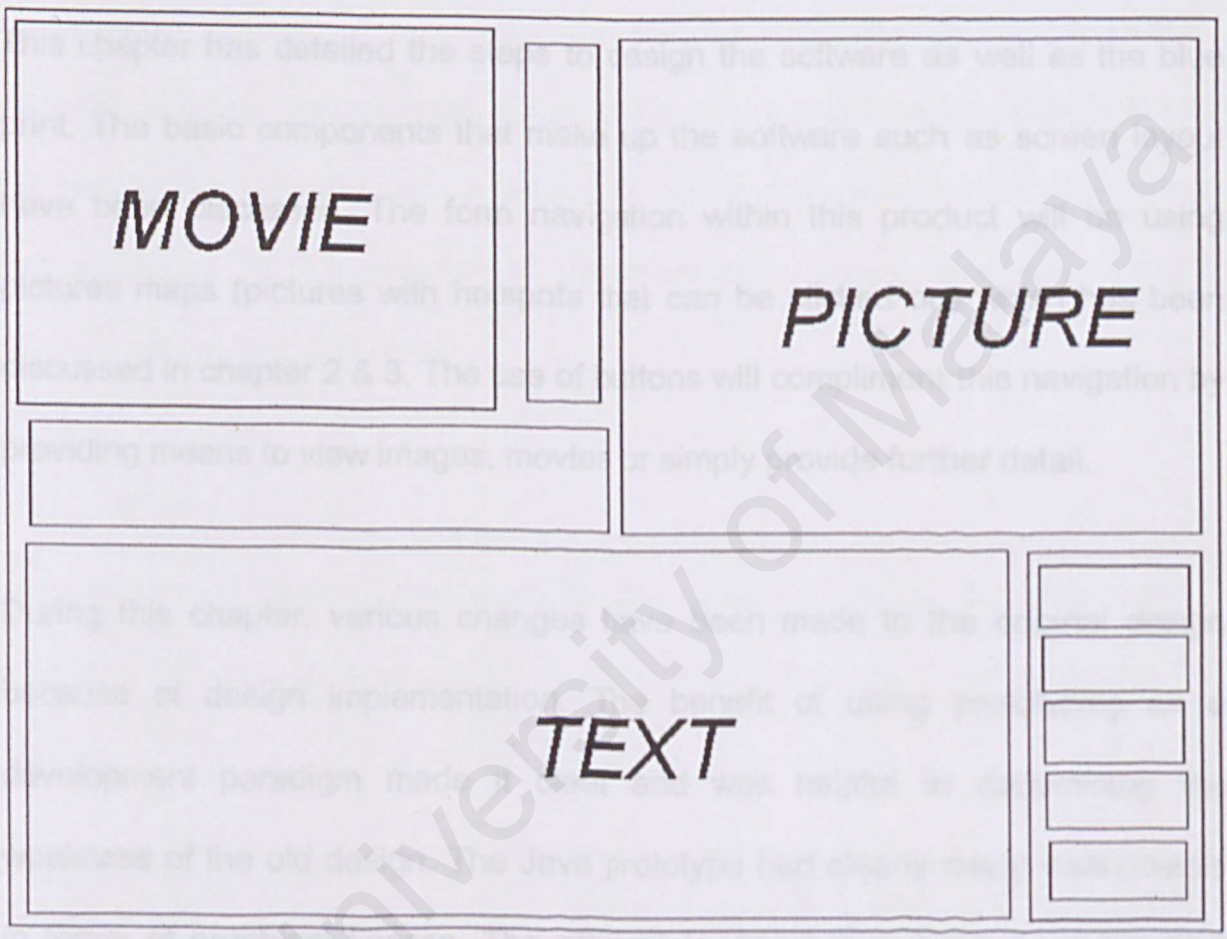


Figure 4.7: General Screen

4.8.3 Buttons

The lower right of the picture shows several rectangular boxes that represent where the buttons will reside. The buttons are in the order of up-to-down are: -

Movie –Displays any video/movie available for this particular item, if any.

Image –Displays any images about the item

Main –Returns to Main item part

Menu –Return Main Menu

Exit –Exits Application

4.9 Summary

This chapter has detailed the steps to design the software as well as the blue print. The basic components that make up the software such as screen layout have been discussed. The form navigation within this product will be using pictures maps (pictures with hotspots that can be clicked on) which has been discussed in chapter 2 & 3. The use of buttons will compliment this navigation by providing means to view images, movies or simply provide further detail.

During this chapter, various changes have been made to the original design because of design implementation. The benefit of using prototyping as a development paradigm made it clear and was helpful in determining the weakness of the old design. The Java prototype had clearly many weaknesses in terms of graphical finesse. The attempt to adapt to a more graphical GUI within the prototype proved to difficult. Even rewriting a new prototype using Java would be difficult and a little too time consuming. The result is the final design would use ***Director.*** The following chapter **IMPLEMENTATION** will show the final incarnation of design shown in this chapter.

5 Implementation

5.1 Introduction

This chapter will show the result of implementing various designs introduced in the previous chapter. It will show the various incarnations of that design implementation as well changes down to the actual graphical representation of the design. The following section will detail the tools, application and other items that contribute to the creation of the resources. These resources include pictures, sound and animation.

5.1.1 Tools

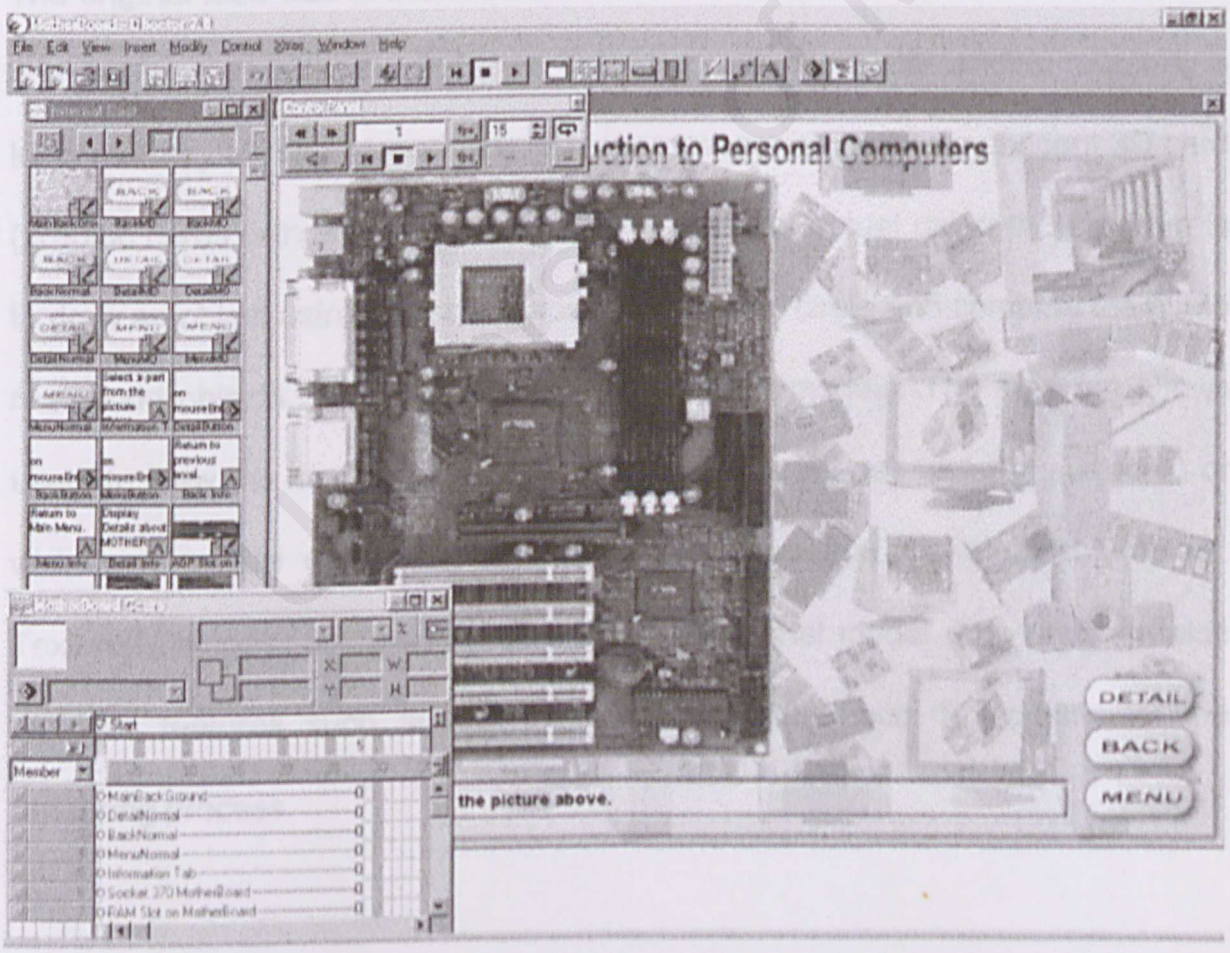
Tools are the programs used to create the design elements (pictures, sound, etc.). The following table shows the tools (software) that were used to create the results.

Resulting Resources	Software Tools Used
Graphics	1) Adobe PhotoShop 2) JASC Paint Shop Pro 3) Microsoft Paint 4) Image Stiller
3D Rendered Graphics	1) 3Ds MAX R3
Animation	2) Macromedia Flash
Sound	3) SonicFoundry SoundForge
Authoring Tool	4) Macromedia Director

Table 4.1: Resources

5.1.2 Director as an Authoring Tool

Director makes use of a unique approach to design. The name itself stems from the fact that its design elements borrow heavily from real world productions, namely films. Director uses a 'stage' that represents an area that user will see. This area is then filled with pictures, animation, sound, and text that are called cast members. The finished integration of sound pictures text and such are arranged using a time schedule appropriately name score. It is quite obvious now that director uses many descriptions, which would not look out of place in a film production. It should be to no surprise that the final result of all this is called a 'movie'.



To appropriately choreograph the movie, navigation must be handled either in changes in the stage or jumping movies. The result is best being described as movies that each posses different areas of the software. As users click to navigate throughout the different areas of the software, users will be navigating through several movie files transparently. To incorporate all this into software requires designing the elements to fit into Directors way of handling elements.

5.1.3 3D Max

The original idea was to include 3d rendered scenes to show various aspects of some of the computer components. This program is very demanding requiring a lot of memory to run appropriately, a fast processor as well as a descent 3D card (graphic cards with 3d capabilities). The process of actual using the program is to draw an object using various shapes like square, circle and combine them into real world objects. These objects are then called models. The program allows users to view the models as either polygons (bare shapes with flat surfaces) or wire-frame where everything is broken into lines that make up the object. Textures (images) are then applied to the polygonal model. The program also provides features such as cameras, lighting and effects to compliment the rendering process.

The rendering process occurs when the said models are taken as a whole turning the creation into an image or movie. The results are anti-aliased to produce high quality images. The problem with this program is that it is very complex, hard to learn and very UN-user-friendly. Demanding system requirements don't help either. The actual rendering process takes a long time and rendering a sequence of images to produce a movie, take even longer (half an hour to several hours is not a bad estimate).

Authors Note: I have to confess that this probably took 99% of the development time. I am interested in 3D animation and spent far **too** much time working on the 3d models. While it was probably unnecessary to indulge in this part of the project, I was simply addicted to using this software. It was a lot fun creating a model and the final result is satisfying very much like an artist drawing a picture. Unfortunately, this probably nearly killed this project as a whole too.

5.2 Graphical Implementation

This section includes the GUI and the screens taken from the design and translated into working GUI.

5.2.1 Main Menu Screen

This screen is shown at the start of the application.

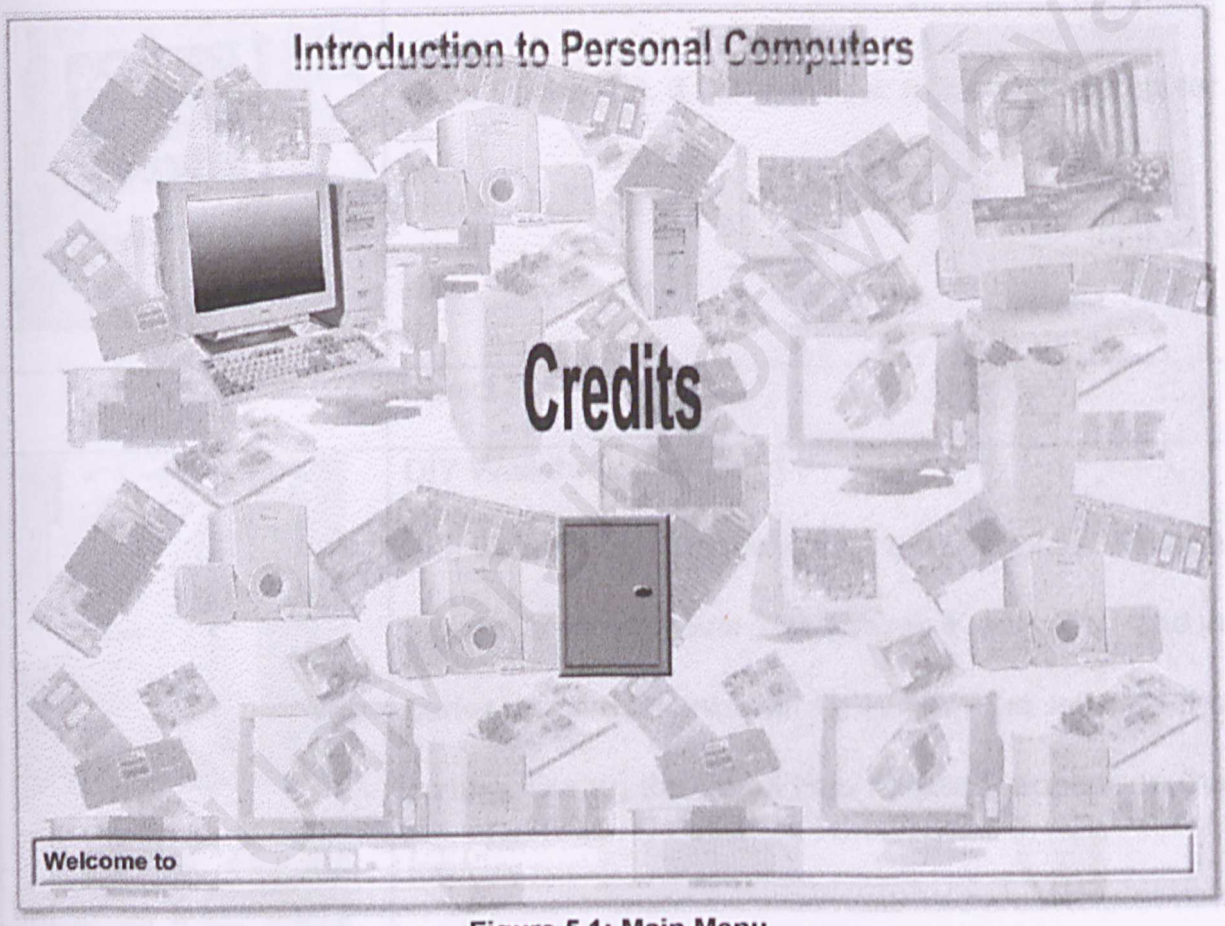
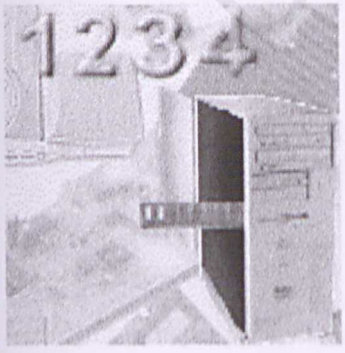


Figure 5.1: Main Menu

Here are the components.

Item	Item Description
 	Explore PC This item contains a picture of a computer. If a mouse is moved over it, animation will be shown as if the computer were to start. Once Clicked on, it will take user to the main computer area.
	Select Part
 	DIY Walkthrough Section The walkthrough area shows a tower casing. When a mouse is moved over the casing it will open and a series of components will fly in from the left into the casing. During the same time numbers appear on the top. One clicked on, it will show the contents of the walkthrough area.

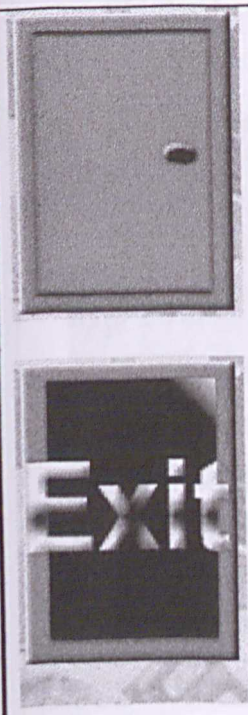
	Credits The credits word simply contains text flying in the background. Clicking will show the credits page.
	Exit The Exit area shows a door, which will open with the words exit flying through. Clicking will exit the program

Table 5.1: Menu Components

Next is the general screen area. All other section of the software uses this screen (walkthrough, part description, and details).

5.2.2 General Screen

This screen is used everywhere else in the software.

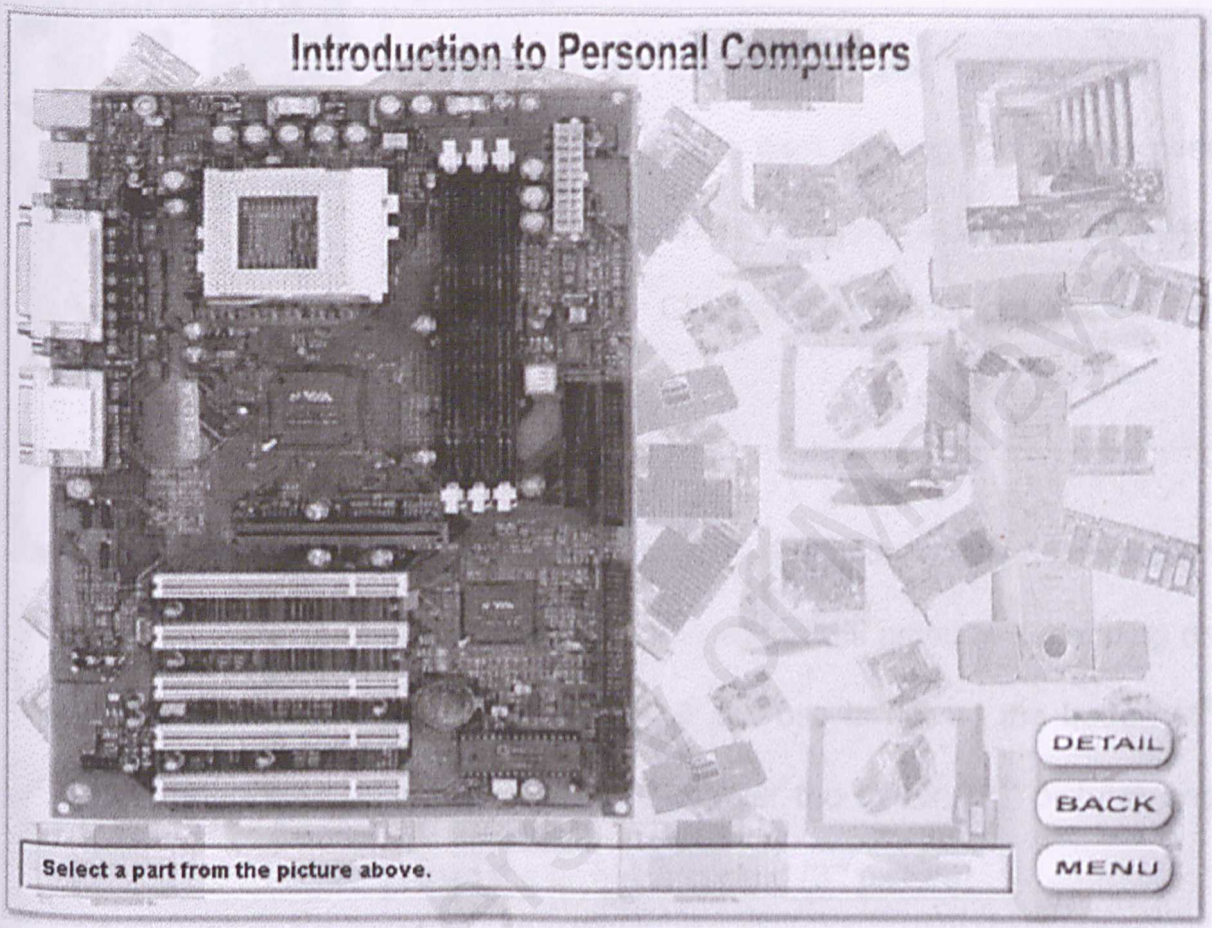
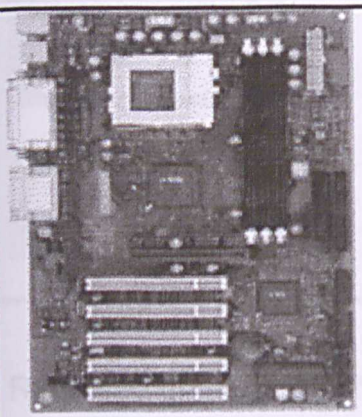
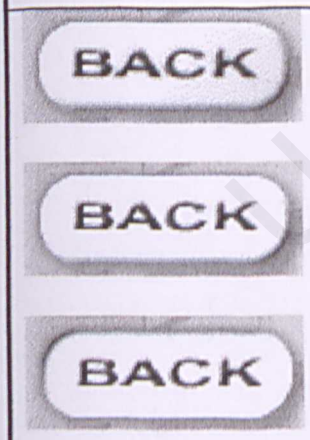


Figure 5.2: General Screen

Its components include:

Item	Item Description
	**Item Image** Depending on the item, this will contain a picture/pictures of the item. Moving the mouse over that particular hotspot on the image displays the name of that hotspot. Clicking on the hotspot shows that item.
	**Detail Button** Clicking on this button will display detailed information about this item. The button will animate depending on the mouse whether the use is not on the button (1st picture); the mouse over the button (2nd picture) and when the button is clicked (3rd picture).
	**Back Button** Clicking on the button takes users up one level. This process is explained in chapter 4. Buttons are arranged from top to bottom, Normal, mouse is over the button and finally when clicked on.

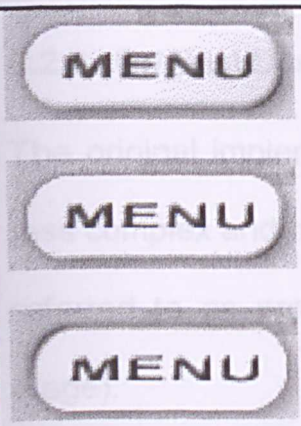
	**Menu Button** Clicking on these buttons return users to the main menu. Buttons are arranged from top to bottom, Normal, mouse is over the button and finally when clicked on.

Table 5.2: General Screen Elements

Removed components from the design documents

Image: If a particular item has multiple images, they can be viewed under Detail.

Movie: Any movie will be displayed on the detail section and the controls will be integrated with the image.

Text: Displayed on the right side of the picture. A full text area is available in the 'details' area.

5.2.3 Original Design

The original implementation has gone through several revisions to make them less complex and easier to use. They have been included as reference. The are referred to as prototype No2 (Second to the Java Prototype during design stage).

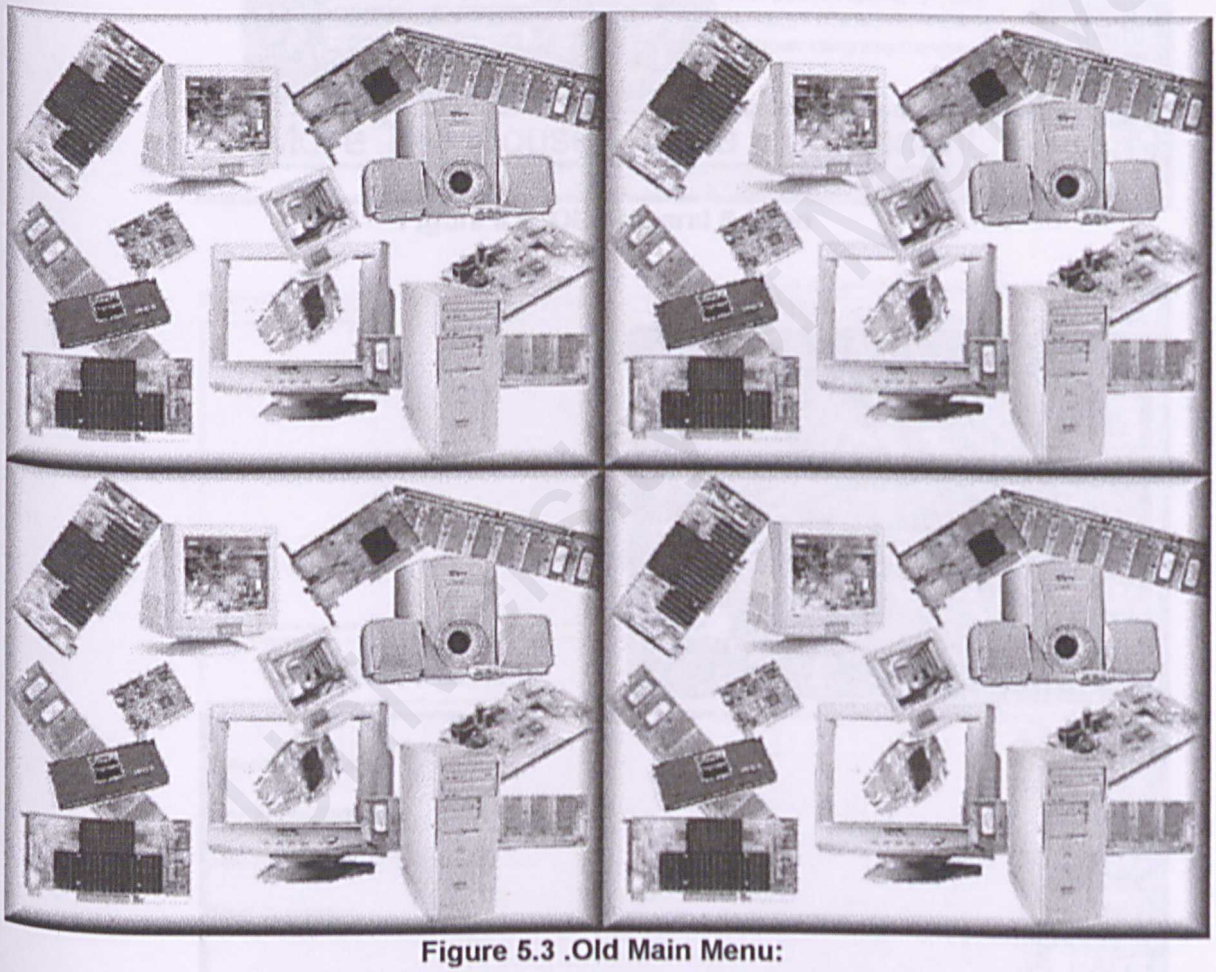


Figure 5.3 .Old Main Menu:

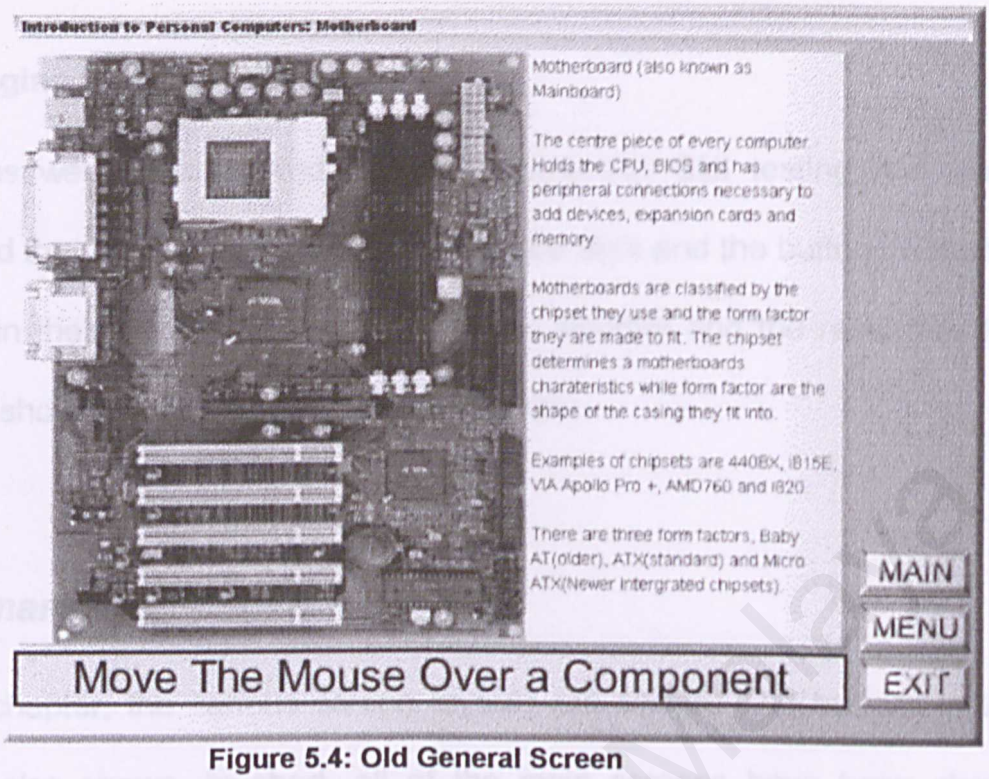


Figure 5.4: Old General Screen

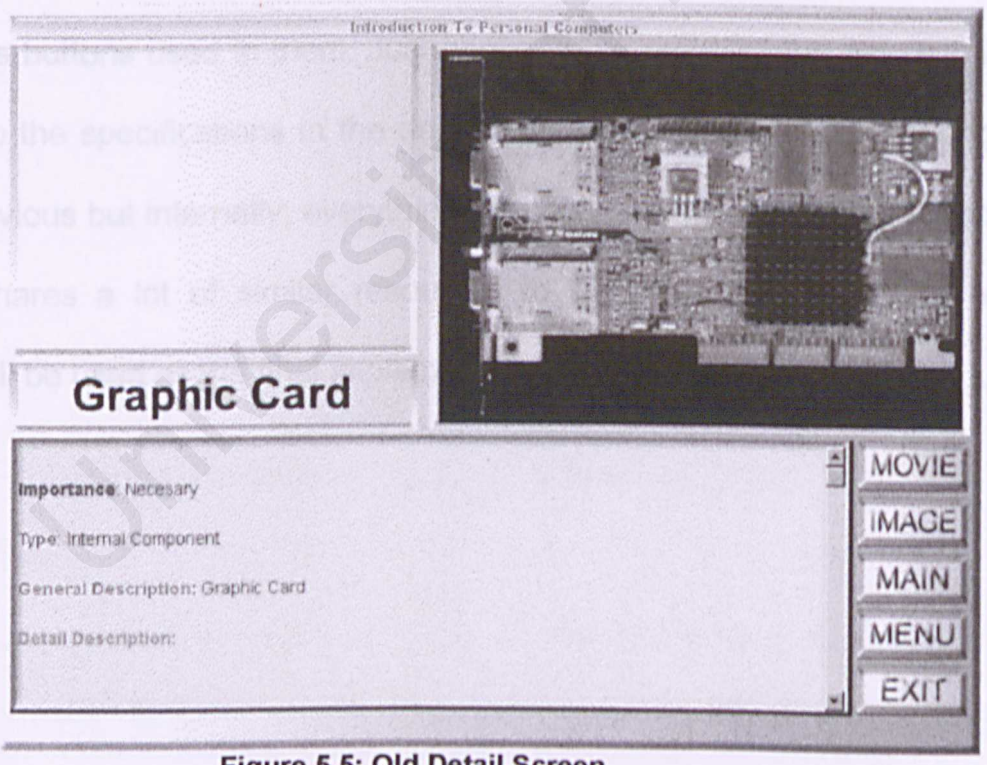


Figure 5.5: Old Detail Screen

5.2.4 Changing from the old GUI

The changes were implemented because during the GUI testing, too many critiques said that the old menu design looked too dark and the buttons were too ambiguous in their meaning. One thing lead to another and the result are the current GUI shown at the beginning of this chapter.

5.3 *Summary*

Inside this chapter, the various screen layouts are shown. The buttons in the program is also shown. In short, all of the main screens have been shown including the buttons used in them. Just above is the recap of the old GUI that correlates to the specifications in the design shown in chapter 4. The changes are quite obvious but internally; everything else remains the same. The previous prototype shares a lot of similar resources to the new prototype. This new prototype will be used as the final implementation.

6 Testing

6.1 *Objective of Testing*

The objective of the testing phase of development is to test the program. Various stages of testing are carried out at various stages of development. Testing is done to ensure the quality of the product in terms of technical errors, design errors, implementation errors and esthetics. The esthetics test user-friendly aspect of the product and its appeal. The testing is carried for the following reasons: -

Identify Errors

Inspecting the functions of each part does the process of identifying the errors. Once the errors have been identified, the reason that causes the errors are determined that lead to the next possible action.

Removing Errors

This process involves fixing the problem found during the first phase, above. The actual process of solving problems will vary with different problems.

Regression Tests

Regression tests are test carried out to see whether the error is fixed with the solutions that were applied. This test is also done to see if the solution incorporates any further errors it self.

6.2 *Stages of Testing*

The testing is carried in several stages of development.

6.2.1 Initial GUI Testing

The initial testing is done in the design testing. This is carried out on the GUI prototype. The GUI prototype was created to be a working mockup of the product. The first prototype was the Java GUI test that was incorporated into design chapter. The original purpose was to test usability. This meant that nearly all of the features are not available. It was a simple design of windows, buttons and text. This prototype was critiqued as being too boring for a multimedia application due to its window like interface and overall bland design.

During this test procedure it came to light that implementing earlier specified features was quite difficult. These problems will be discussed in chapter 8. The result of this testing phase is a massive overhaul of the design specification. Incorporating a lot of graphics like pictures was incredibly difficult and so the prototype was scrapped. The replacement would be implemented using Director.

6.2.2 Testing 2nd Prototype

The 2nd prototype created using director was tested using the same technique as in the first Java prototype. The usability test showed that there was an improvement in terms of acceptance to the new look. As testing continued, more

features were included and incorporated into the prototype. While most found it better than the previous prototype, many pointed out several rooms for improvements. The result of this is listed below: -

i) Right side of the screen is too dark.

ii) The names for the buttons are not clear enough.

ii) The block divisions made the GUI look complex.

The changes resulted in a change in the GUI for the final time. The accumulation of changes made the change larger than anticipated. The resulting GUI was incorporated into the last testing phase. Because of time constraints the final GUI was not tested as vigorously as the precious prototypes.

6.2.3 Overall testing

The final test occurs when the product is completed and all the features are tested. The product is then judged as a whole to determine its effectiveness. The overall testing will be used to gather the following information: -

6.2.3.1 General Tests

i) Looks and Appeal

This tests how users react to overall layout, background and overall feeling by simply looking at the software.

ii) Navigation flow

This tests whether the proposed navigation is logical from the user's point of view. If the users cannot figure out how to get to somewhere; then there is a problem.

iii) **Features**

This tests the use of animation, sound, graphics that are incorporated into the software. Whether they serve their purpose or merely distracting.

iv) **Content and Language**

This test to see if users can find out what they want or whether they can understand what they received.

6.2.3.2 Functional Test

i) **Performance**

This tests the performance of the software in terms of loading time, within the application. Test response time.

ii) **Reliability**

This test to see if the software is stable or prone to crashing.

iii) **Maintainability**

Test whether the structure of the software makes is easier or more difficult to maintain.

iv) **Installation Test**

Test the installation procedure.

v) **Usability**

This is similar to the GUI test. This tests how users use the software.

6.3 Types of Testing

6.3.1 Unit Testing

Unit testing is done on each individual component. They are tested individually to ensure the work the way the are supposed to. This is a major test procedure that will ensure that further testing is possible. This is done extensively during the GUI testing for the purpose of testing the GUI without other features.

6.3.2 Integration Testing

Once individual components are tested to ensure they work independently, they are tested together as a whole to see the interaction between various components. All the features are included during this test to ensure the closest test to real world tests, in terms of technical specifications.

6.3.3 Overall Test

Overall users carry test. It tests the installation right up to the using of the software without any help from the developer (namely me).

6.4 Summary

This chapter details on the process of testing that was carried out through out development. This includes the use on unit testing, integration testing and finally overall testing. Each step tests a far more complete version of the same product. GUI testing falls under unit and integration testing because the GUI was tested using prototypes extensively. The various reasons for testing are discussed here. The procedures of the test are also discussed. The main reason tests are carried out is to ensure quality from any point of view. The use of prototyping has helped to improve the software with the use of testing. The prototype allowed testing at an earlier stage which can help curb problems later on.

7 Maintenance

Maintenance phase happens after the completion and delivery of the product. It is done to ensure the product is of high quality throughout the product life span. Maintenance is often considered apart of the software package because of inherit nature software products. Not all maintenance is fixing errors but also include improvements. Maintenance is more of big issue for system based where important data processing occurs. On a static software such as this, maintenance most be kept to a minimal simply because users expect such. The complexity of software like this is minute compared to system based software. That said, minor implementation has been included into the software to ensure that maintenance is possible without drastic changes.

7.1.1 Features that can be Improved with Maintenance

Many of the characteristics which affect maintainability is done well before the maintenance phase. How software is design will also affect maintenance. Due o the scope of this software, there are only two characteristics of this software that may require maintenance.

i) GUI may need to be changed if after the release too many people find it unusable.

ii) Content will probably need to be updated. This may not be a possibility due to the nature of this software and would best be served as a new version (one year perhaps). Small updates might be possible but since

the content is makes up the bulk of the software, this could prove problematic.

7.1.2 Improving Maintainability

The solution to the first situation is to test the GUI extensively. This is probably the best course of action. The solution to the second situation is to ensure design fits the requirements. Below are the steps to ensure maintenance is possible.

1) Small program files that can be altered separately. The actual program files should be small so that each can be edited separately. It is also recommended to make the software components independent as much as possible. This can be done by not incorporating the actual resource components like sound, graphics and text in different files. Keeping the files small ensures that updates too will equally small. Keeping updates small is important.

2) Structure the actual program file according to standards to ensure altering them later will not be a daunting task.

Since Director is used for the development, the above needs to be incorporated into the design. Here are the solutions implemented in the development to make as maintainable as possible: -

1) The actual director movie files are kept small.

2) The core application called 'projector' in director will call another movie (namely an intro) before calling the menu file. This insures that the if the menu files needs changing, the projector does not need to be update because the projector file is quite large.

3) Use external cast members to ensure that actual movie files are kept small.

With the above implemented, maintenance for updating could be possible by altering the menu files and incorporating the new files. This could be helpful since technology improves very rapidly.

7.2 *Summary*

The maintenance phase in this software is not a very large issue in this software. The key features that could utilize maintenance would be improvement maintenance. The two key improvements are improvements to the GUI and updates on the content. Following certain design issues can ease both. These include small, structured file system with coherent standards applied thought. This will help to make updates a pleasant experience.

8 Product Evaluation

The product evaluation phase is important because it provides feedback about the product. This evaluation is a self-evaluation of the product as the developer. It compares the resulting product against what was originally planned. The evaluation will take into account all the feature of the product that was incorporated and evaluates the success of said feature.

8.1 How the Product is Evaluated

The evaluation process takes into consideration the final result as whole compared to the initial specification. Very few products come out 100% as planned and theses variations have both good and bad impacts. Earlier in chapter 2, other similar products were evaluated. This chapter will try to evaluate the final products against the 'competitors'. A comparison about the feature of the products will help explain where the weakness of each product is.

PC Maintenance: Preventive Measures by ViaGrafix Multimedia Training was originally chosen as a similar product to compare to. This was probably not the best choice but it was the only product available at the time. As of now several other products have been available (they were released a while back but only were recently available in Malaysia). The other products are taken as a whole and not individually compared with this software. The reason is that this is not a

comparison of which product is better. It is merely a comparison of the success of the implementation in this software compared to what has all ready been done.

Before the comparisons are done, several key aspects need to be considered. Firstly, many of this software were not produced by a single person (as can be seen by an extensive credit list). Many of these products were developed with funding (which this developer does not have). The developers had access to proper tools and equipment (that fact is arguable). On a positive (should that be negative?) Note that they probably had very strict deadlines. They did not make us of tools like Macromedia Director. Finally, they probably had more experience then this developer.

This software: Introduction to Personal Computer	All other 'competitor' software
Has average amount content	Had varying amount of content. Some too much while others made little sense.
Used (tried to) use graphical GUI that was not very boring	Again varying results. Most however do not have very graphical GUI. Many used only words. And many had problems with display.
Used average amount of sound and	Many had bad (if any) sound effect bar

Aural effects	one.
Has no Videos	Many has videos, unfortunately most are very bad quality. Some sounded bad and actually looked worst. Except one.
Interactivity is quite minimal	Interactivity is minimal if any.

Table 8.1: Finished Feature List Comparison

From the above comparison, the competitors seem to win. Clearly given the pros and cons, it was inevitable. Certain features clearly marked weakness to this product. The following section will detail on what this software did right and what it didn't do right (I just don't have the heart to say wrong...). Or what it didn't do at all.

8.2 Pros and Cons

This section will discuss the pros (good things) and cons (bad things) about this software.

Pros

- It has a pretty good GUI.
- It is quite easy to learn to use.
- Makes good use of graphics.
- Has little bit of interactivity.
- Uses sound.

Cons

- It has a boring name/title. Introduction to Personal Computers just seems boring to practically every tester.
- While a lot of graphics were used, not all of them are very good quality. Sometimes the quality had to be compromised for other features.
- Interactivity was somewhat less than spectacular. Many of the ideas originally planned just could not be done within a reasonable time frame.
- Sound cues are a little tame and the music is never quite 'right'. Every tester said something is not right with the music but just can't explain.
- (This is probably the biggest cons.. and it will hurt, plenty) No videos. That's right. The original plan of having wonderfully caught video images of a computer being assembled from scratch; never materialized. Not even voices of people reading text even though they sound bad (at least they tried).

Many of these happened due to problems that will be explained in the following chapter.

8.3 Summary

This chapter contains an assessment on this software product. It contains a list of pros and cons about which explain where the software lacks a feature. A comparison is also made with an array of competitor software. Generally, the lack of the video feature sticks out like a sore thumb.

9 Problems and Suggestions

This section will discuss problem that were faced during the development of this software.

9.1 Problems

Problems that plagued the development of this software started as far back as the initial design stage. The problem are listed below in the order which they were encountered (the higher on the list, the earlier they were found).

1) Problems using Java for the development.

The problems first surfaced when the real coding was written to make the first prototype. This prototype was made as a mockup of the real GUI. A lot more effort was actually required to get the prototype fuctioning. Here several problems had occurred that was not paid heed to. Most of Java GUI designing capability cam from the fact that it had pre-made functions that allow drawing buttons, frames, lists and other windows based components easy to create. The problem was originally that it had no IDE (Integrated Development Environment). Whereas Visual Basic could create GUI with simple drag-and-drop, Java required coding. This proved troublesome but the original plan went through with a successful (marginally) prototype. Later during the GUI testing, it was found that many testers found the GUI very unattractive (read: boring).

The purpose of the software was to promote learning so this proved to be a huge set back. Rewriting the Java prototype to include background image was easy. Adding animation with which moved around the screen, altering color blend alpha channels proved not so easy. Making animation blend with the background smoothly required creating an animation engine that was far more complex than initially envisioned. After 3 months work, the Java prototype was scrapped in favor of easier to use software like Macromedia **Director.** A friend's early prototype using Director had blown this developer with its beautiful GUI and convinced this developer to follow suit.

Author Comment: This friend is Azrul whose work I have yet to come close to beating. Clear concise background and almost soothing blend of colors can only be attributed to his artistic skills. Unfortunately, this author has very little of those artistic skills and was forced (self-imposed) to revise his GUI for the umpteenth time. Until of course he (recently) ran out of time doing that.

2) Learning to Use Director

It looked easy. That's what everybody says and they can't all be wrong. Or can they? Adapting to an animation/moving like development proved easy enough. Finding resources that made it look professional and not amateur-like is another question. Being image/picture based GUI; it is heavily dependent on artistic graphical arrangements of said images and pictures.

3) Gathering Images to use as GUI and Background

To put it simply, this developer had no idea how to make a GUI feels nice and soothing. The processes of gathering the pictures and editing them proved very

tedious and incredibly time consuming. Learning to work with an image processing software is not that easy. Especially when time constraints start to kick in. After creating a basic GUI set with supposed graphical finesse, the new prototype, using director was then tested.

4) Testing and reworking the GUI

During the testing of this GUI, it was learnt that while most users prefer it to the previous bland look. On the other hand, many found small details to be a little irritating and convinced this developer to rework them. This reworking consist of altering the lighting since many thought that the right side was a little too dark. IT then led to change of color. Later, change in shape of buttons and soon the change of the whole design. This was because the process seemed so easy that changes were made instantaneously. On its own, each particular change is small. Each change then required a little reworking in other parts to make function properly. Add up all the time these little changes and they seem to have taken way too long. The final design was completed with several inputs from testers. As of this design no further design changes have been done (or allowed) to the GUI.

5) Video Problems

During the same time as the reworking of the GUI, problems with producing a video of someone building a PC occurred. The initial idea was to use a small webcams to capture the movie. Bad idea. Webcams have very bad quality

picture and worst focussing capability. The other option was to buy a cam-recorder (camera-video recorder) but this turned out to be financial inappropriately. Digital cameras are worst costing around RM 2000. By the time a reasonable solution appeared it was already too late do this. It was scrapped so that the software might be completed.

6) Finding Good Images of Computers

Finding and acquiring a good set of images of computer parts is depressingly difficult. The pictures on the Internet are usually too small. Enlarging them caused the quality to degrade rapidly. The other option is to take the picture using normal picture camera and then scanning those pictures in. The problem? No choreography skills + bad lighting + little experience with cameras = bad pictures and wasted film.

7) The initial design called for having a voice reading the text wherever possible. This has been removed simply because of time constraints.

8) Anything else missed? Probably a lot more but these are those that ***need*** to be officially recognized.

9.2 Suggestions

The following are the suggestions recommended to solve/avoid the problem above.

i) Have more discipline

ii) Don't underestimate work

iii) Don't procrastinate

iv) Don't rework too many things too many times even if people tell you - they're probably wrong.

v) Get experts to do the video/sound – they are harder than people think

vi) Get help early

vii) Listen to advice from experience people – and not inexperienced colleagues

Viii) More development time wouldn't hurt either

9.2.1 Suggestion on Software

Here is a list of features that I wish could have been included to make this software better than it is now.

i) A working DIY section which features a video footage of beautiful person putting together a computer. With the addition of a commentator making remarks along the way.

ii) Better design in terms of the way items are presented using high quality images and good text description. A working voice reading description feature.

iii) Overall, better software at all angles.

9.3 Summary

This section describes the problems that were faced during the development of this software. Ideal solutions are also provided for those problems. Finally, any suggestion to improve the software is provided.

10 Conclusion

The thesis has proved to be a very unique experience and will probably on of the most challenging course throughout the degree program. It lets students feel the whole development process as well as deal with many of the management issues. It presents it self as a test to practice all of the theoretical skills that have been taught in the other courses. The students fill many shoes of many people during the whole development process from writing requirements, designing, coding and testing. This will greatly help the student in preparing them to the real world scenarios once in the working arena.

Throughout the development, many problems have arisen that requires solving. Many of these problems may be the first time encountering such problems and provides excellent exposure. This project was developed using Macromedia Director as a multimedia application. From a project stand point of view; the software would have been called a variable success. Some areas have succeeded while some other has failed. For most of the problems that was faced, most presented them selves as implementation problem where the actual process of implementing was not really considered during requirements. Others happened to be problems dealing lack of experience and knowledge.

Taken as a whole this course has succeeded in providing a useful training ground for undergraduates to test the mettle with problems that they will face as they go out into the working world.

Table of Contents

Introduction

Welcome to E-Learning: Introduction to Personal Computers!

Computers have gone through several changes in this past decade alone and many of these changes have direct impact on the way we live our lives. In the 80s, computers were viewed as merely tools for programmers and other technical jobs. I the early 90s, computers were viewed as toys people fooled around with as a hobby. Today computers are a necessity in many jobs. Computers have also become more user-friendly allowing novices to be able to use computer more easily. Computers now incorporate multimedia elements such as sound, animation and interaction. While computers were already using primitive graphics in the 80s, today's computers are capable of graphics that make yesteryears computers look like Stone Age paintings!

One of the most famous words used around computers is multimedia. Multimedia technically is the use of many media elements together. Today's multimedia goes beyond that explanation by providing interactivity. Interactivity allows to way communication (or simulate that) so that the users are actively participating rather than simply watching. A good analogy would be real life to watching movies. One merely involves (preferably) siting somewhere watching a sequence of actions while the other depends on people and ***their*** actions with objects and one-another. The later allows interaction people while the former simple consists of watching.

Enough about that, you probably have this to learn more about computers! This manual will teach you how to use the product (called software, which comes in a CD format). This manual will contain instructions from the initial installation process all the way to 'How do I use this program'.

Installation

This section will guide you through the process of installing E-Learning: Introduction to Personal Computers. It will also provide you on tips of how to prepare for the installation procedure. If you have any problems please go to troubleshooting area that is at the end of this section.

Requirements

The requirements of E-Learning: Introduction to Personal Computers is:

Any 200Mhz CPU.

32 MB RAM.

50 MB Hard disks space.

A CD-ROM drive.

Mouse.

2MB Graphic Card

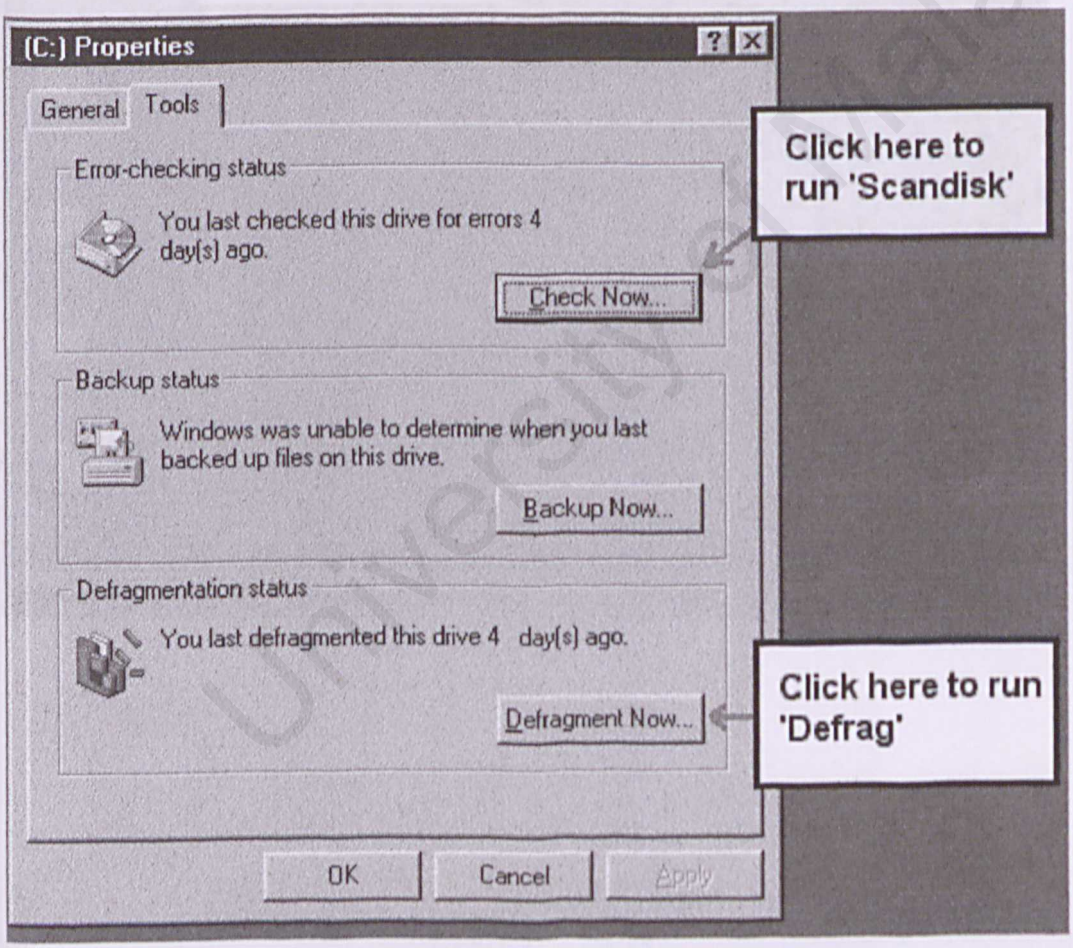
Windows 95 or later. (Windows NT NOT supported)

Preparation before installation

You are recommended to prepare you hard disk before installing any software (including this). To do this, go to 'My Computer'. Right-Click on the hard disk you wish to install to and select 'Properties' (which is the last option). Select the 'Tools' tab from on the top left side of the window. This brings you to a screen with several options. Select the 'Check now' button from the window. The application called 'scandisk' will start. At the bottom of the window select 'Start"

and let the program do its work. If you are not familiar with process, go to the Troubleshooting area.

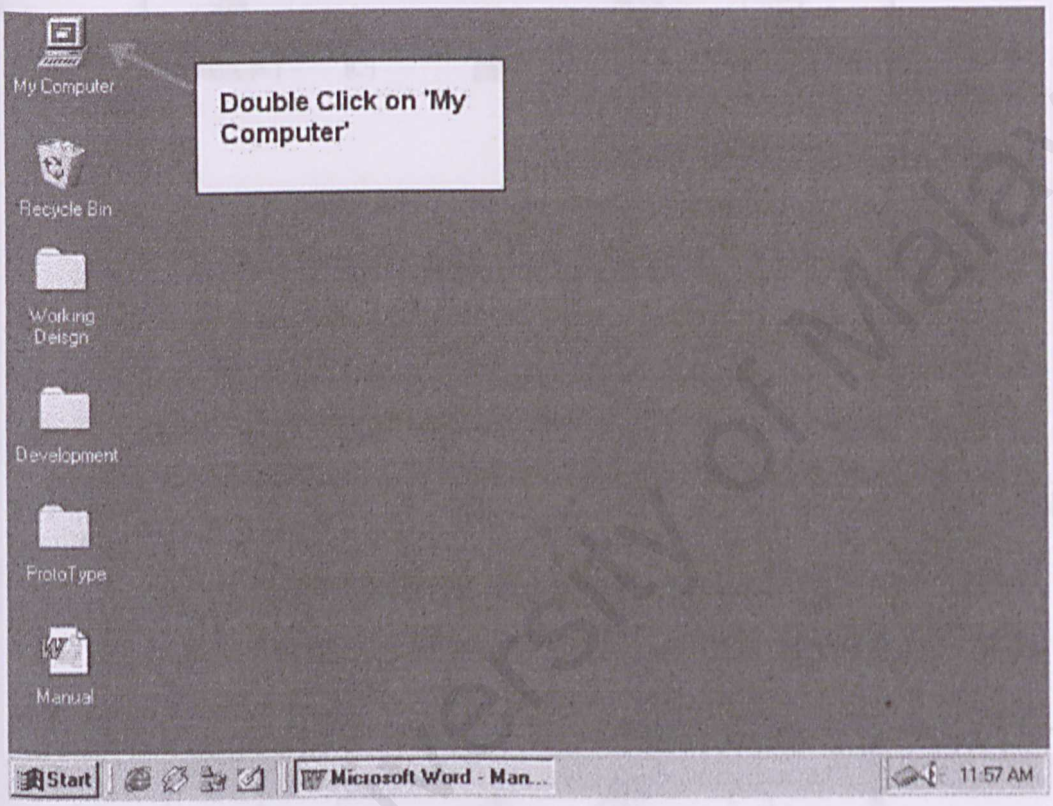
The second task to prepare you hard disk is to run 'Defrag'. This helps keep your hard disk tidy and speeds up your application. Follow the same steps as above but instead of selecting 'Check now' from the list; select 'Defrag Now'. The 'Defrag' program automatically starts. While the program is running it is recommended that you leave you your computer to do the 'defragging' as interruptions will slow down the process. This process will take some time.



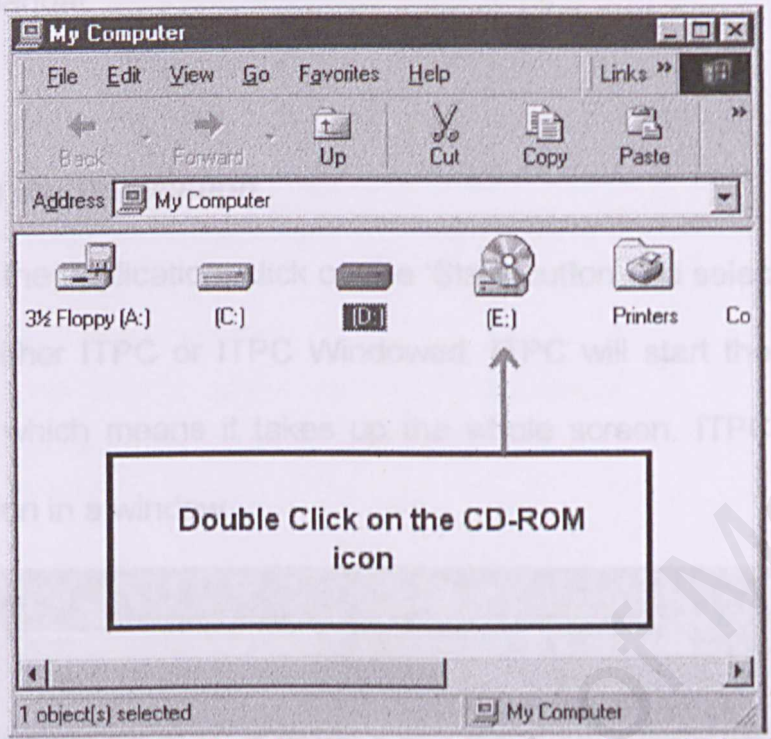
How to install and start using the program

To install the E-Learning: Introduction to Personal Computers, first insert the CD-ROM in to your CD-ROM drive.

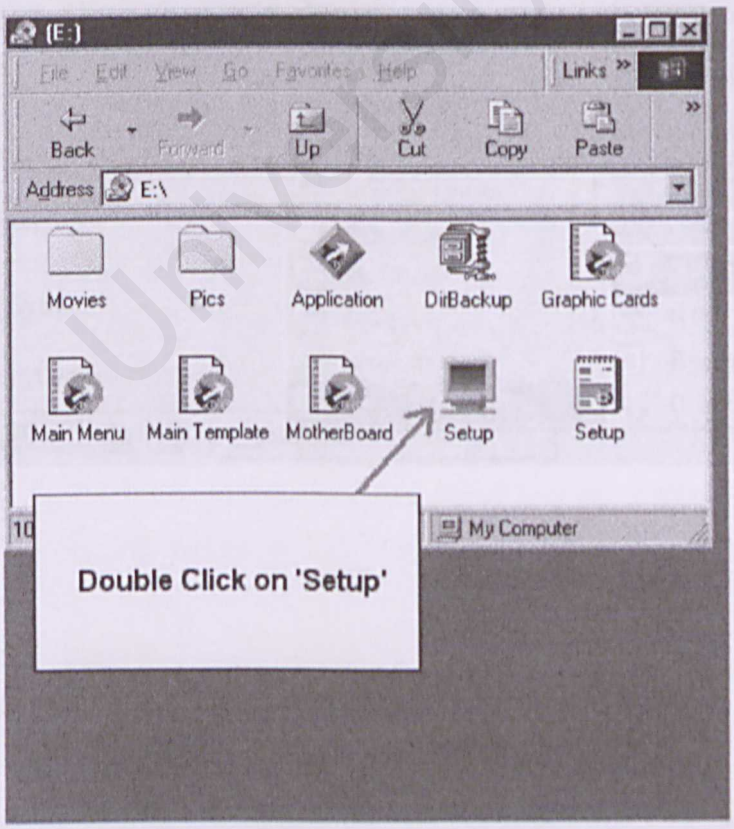
1) Double Click on 'MY Computer' (Note: If you have Active Desktop enabled, you need only click once).



2) Double click on the icon representing your CD-ROM drive under 'My Computer'. This will bring up a listing of the files on the CD-ROM.



3) Find the 'SETUP.EXE' file and double click to launch the install application.

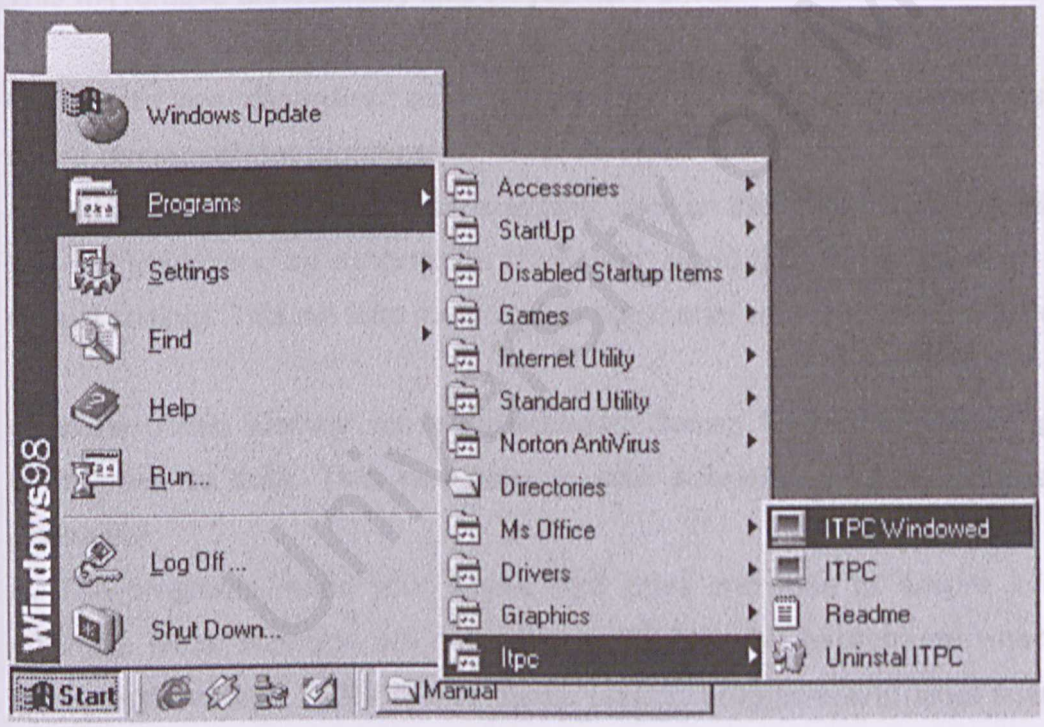


Follow the instructions in the application to install the software on your computer.

If you failed to install the application, please read me the troubleshooting section of this manual.

Starting the Application

To start the application, click on the 'Start' button and select the ITPC and finally chose either ITPC or ITPC Windowed. ITPC will start the application as a full screen, which means it takes up the whole screen. ITPC Windowed runs the application in a window.



Troubleshooting

Q. *Why can't I install this program?*

A. Make sure you have enough disk space for the whole installation and its temporary files. Windows also requires some hard disk space for virtual memory. To be on the safe side, have at least 200MB. If you do not have enough hard disk space, try freeing used space by deleting unused files. If you have Windows 98 or later, you can do this by running the 'Disk Cleanup' program. To run this program, do the following:

i) Go to 'My Computer'

ii) Right Click on the hard disk.

iii) Select Disk Cleanup on the lower right of the screen.

iv) Tick all the squares on the left by clicking on it.

v) Click 'OK'.

This will remove unnecessary files on you hard drive.

Q. *When I ran 'Scandisk' as recommended I get pop up messages about files being damaged/lost clusters/etc, what do I do?*

A. Just before clicking start to run scandisk, click on the option 'Automatically fix error'. If you still get errors, try running the 'Thorough' mode (just below standard which is the default setting). This will take much longer but should solve problems with bad sectors.

Q. When I ran 'Defrag' as recommended Defrag keeps on restarting and never completes its task. This can happen with scandisk as well. How do I fix this problem?

A. The programs reads your whole hard drive and tries to ensure it doesn't miss anything. Make sure you are not using anything in the background when running the above applications. This includes music playing programs and virus scanners. If you have online connection, make sure there aren't any applications that use auto updating. Whenever something writes to the hard disk, those programs (defrag, scandisk) will restart.

Q. *When I click on ITPC the program won't start.*

A. Try running ITPC windowed. If it works, then maybe your computer has problems with the function used to set the resolution. This program forces a resolution of 800x600. To

see what resolution you are running, go to 'Display Properties'. On the lower right is the resolution your computer is running on. Make sure your computer/monitor is capable of at least 800x600.

Q.*I don't hear any sound at all when the program starts.*

The intro does have music/sound. If you don't hear any, sound make sure your PC plays sound. Does the starting windows chime play? If it plays try increasing the volume when the program is running. If it doesn't play any sound; go to the lower right of the screen and click on the 'hailer' icon and make sure you do not have 'Mute' selected. Make sure your computer is capable of playing MP3s. If you cannot play MP3s nor do not here any sound during windows startup; there maybe problems with your sound card drivers. Go to 'Control Panel'→ System→Device Manager. Look under '*Sound, Video and Game controllers*' and select on of the options under that heading. Once selected, click on the 'Properties' button. It should have the words 'This device is working properly'. If it doesn't, read the documentation that came with your computer to find out how to update you sound card drivers.

Q. ***When the program starts has one of these problems: the screen is blocky, there are lines very visible colored lines across the screen, or the color looks washed out.***

This program requires that your computer is capable of at least 16bit color in 800x600 resolution. If you have an old monitor that does not support high enough resolution, the screen will look broken. In this case, there is nothing else to do but get a new monitor. Make sure that you have set an optimal refresh rate for the 800x600 resolution. If the optimal setting gives these problems, try using the Refresh Rate. To do this, go 'Display properties'→ Advanced → Adapter. In the lower center is the setting for your refresh rate. Set this at least 60Hz. Anything below and your eyes may ache after extended use of the computer. For the best results, set this at 85Hz that is known to reduce eyestrain. Make sure your graphic card supports 800x600 16bit (high color) color. If you're having problems with the program, try updating you graphic card drivers. The manual, which came along with the computer, will have instructions on how to do this. If your graphic card does not support this mode, the only solution is to change graphic cards (or live with the problems).

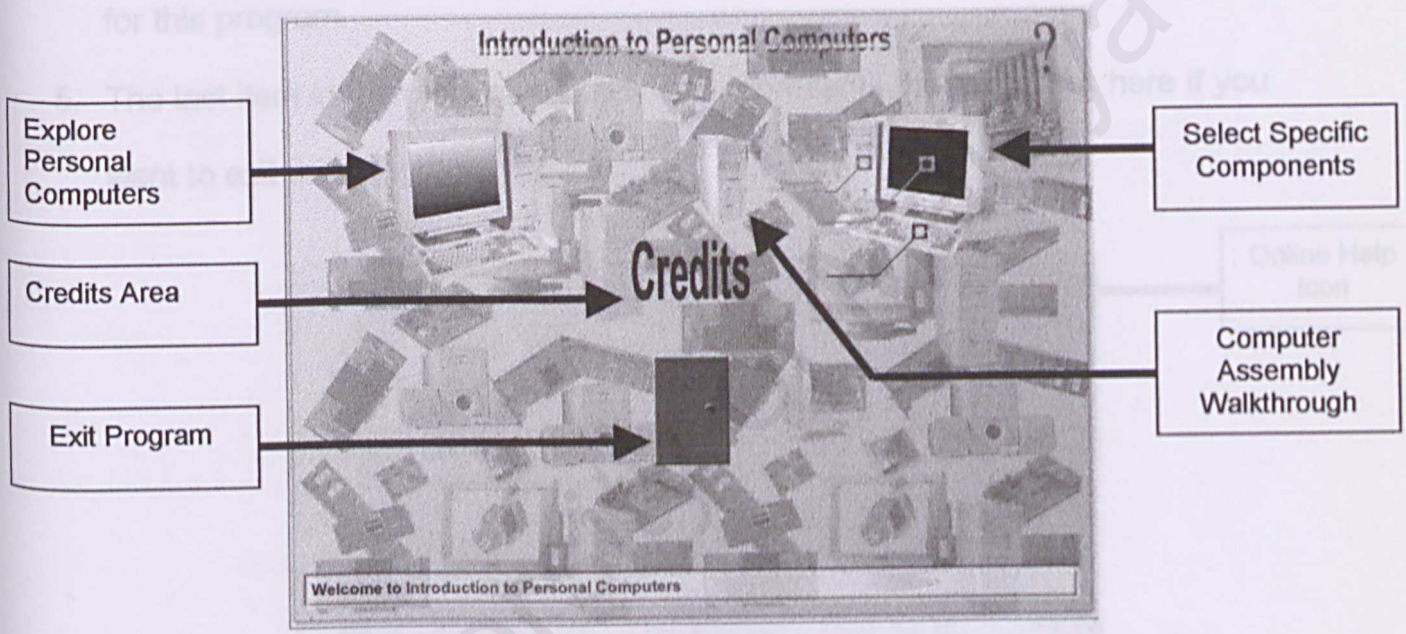
Q. ***The pictures looked washed out and the screen updates very slowly. Animation breaks the screen with lines or the programs animation runs very slowly.***

Make sure you meet the systems requirements. Make sure you have a graphic card with at least 2MB RAM (4MB recommended). If you have an in-built graphic card that uses system memory, this will probably be the cause of slow performance. Make sure you are not running application (too many) in the background. I the performance is too slow, try disabling your virus scanner for the duration of the program use. So long as you do not use program/files from the internet/diskettes/untested-CD-ROM, you should be safe. If you do not trust this program's CD-ROM (but why?..), you can use your virus scanner to scan the CD-ROM. After you have scanned it (and are sure there are no viruses) you can disable the virus scanner for the duration of the time you are using this program. After use, you may switch it on again. This is important because virus scanners take a lot of CPU resources that are needed elsewhere.

How to use the Program

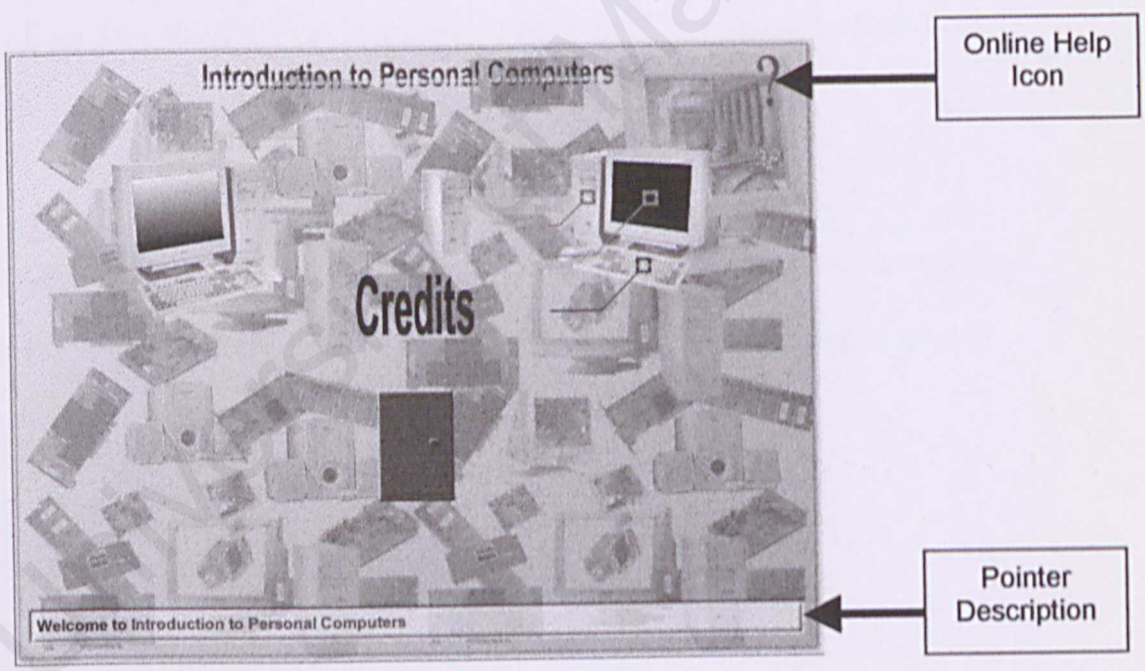
Main Menu

The program starts with an introduction and then deposits you at the main menu. The main menu looks like the picture below. There are several key items of interest, which are labeled on the picture below.



1. The item on the top left of the screen is the 'Explore Personal Computers' icon. It looks like a normal computer that is switched off. Clicking here will take you to the 'Explore Personal Computer' area. This area allows you to explore computers and learn about them using pictures as navigation. Turn to page for more information about this area.
2. The center top is a picture showing a tower processing unit (the box without the monitor). Click here to go to the 'Computer Assembly' area. This area will give a walkthrough process on how you can assemble a personal computer by yourself (Do-it-Yourself).

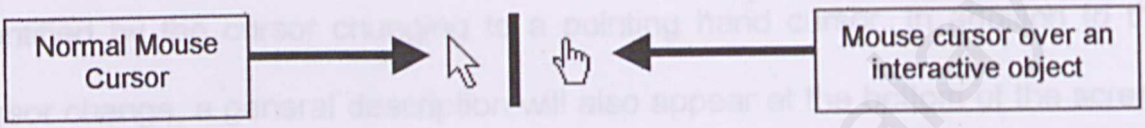
3. In the upper right is a picture of a computer with colored lines coming out from them, which is the 'Select Specific Component' icon. Click here to enter the 'Select Specific Component' area that allows you to select specific components of the computer that you may wish to view in a list format. Go to page for further information about this area.
4. The 'Credits' area is pretty much self explanatory and just display the credits for this program.
5. The last item in the picture is a door and represents the exit. Click here if you want to exit this program.



6. The online Help is available at all screen and is represented by the small blue question mark (?) at the top left corner of the screen. Click here and the online help will show all the items, which are usable, onscreen.

7. In addition to the help, a pointer description area is available on screen. Simply move the mouse pointer over any area on the screen that is usable (interactive) and a description will appear to explain what this item represent.

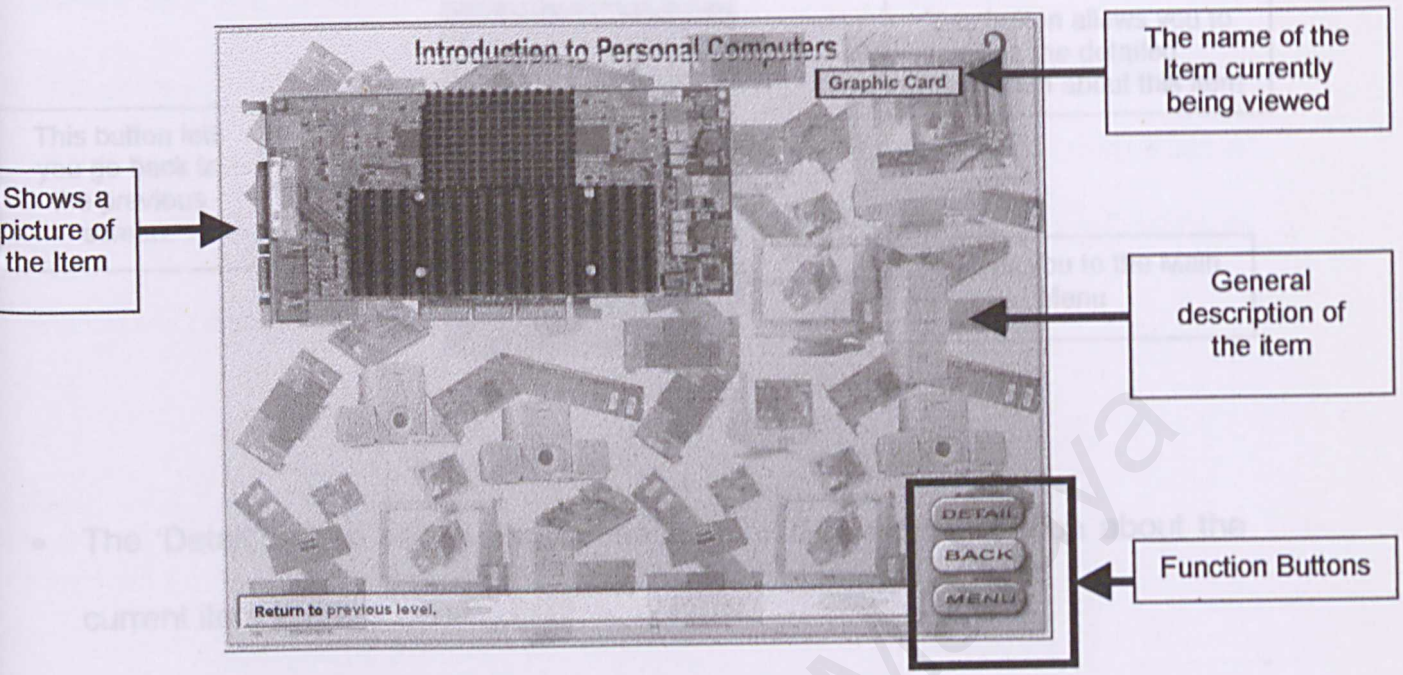
8. To further help you navigate; the mouse cursor will change from the normal arrow to a pointer hand when the mouse is moved over an interactive item.



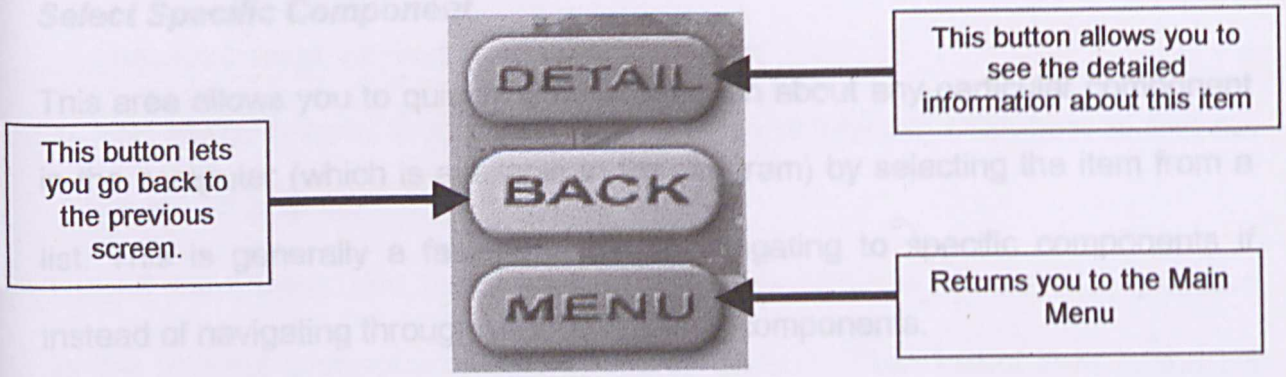
Explore Personal computers

This area will start by showing you the screen with a computer in the center. The picture is interactive and various components in the picture can be clicked on. By clicking on one of the components, you will be taken to that particular item's description area. Move your mouse cursor around to find out whether a part of the picture can be clicked on. Hotspots (area that can be clicked on) can be identified by the cursor changing to a pointing hand cursor. In addition to the cursor change, a general description will also appear at the bottom of the screen telling you what that part is called. Some sub-components can have further sub-components that can be clicked on so explore!

This area also contains an online Help represented by the same blue question mark as in the menu area. The following figure shows the overall layout of this screen.



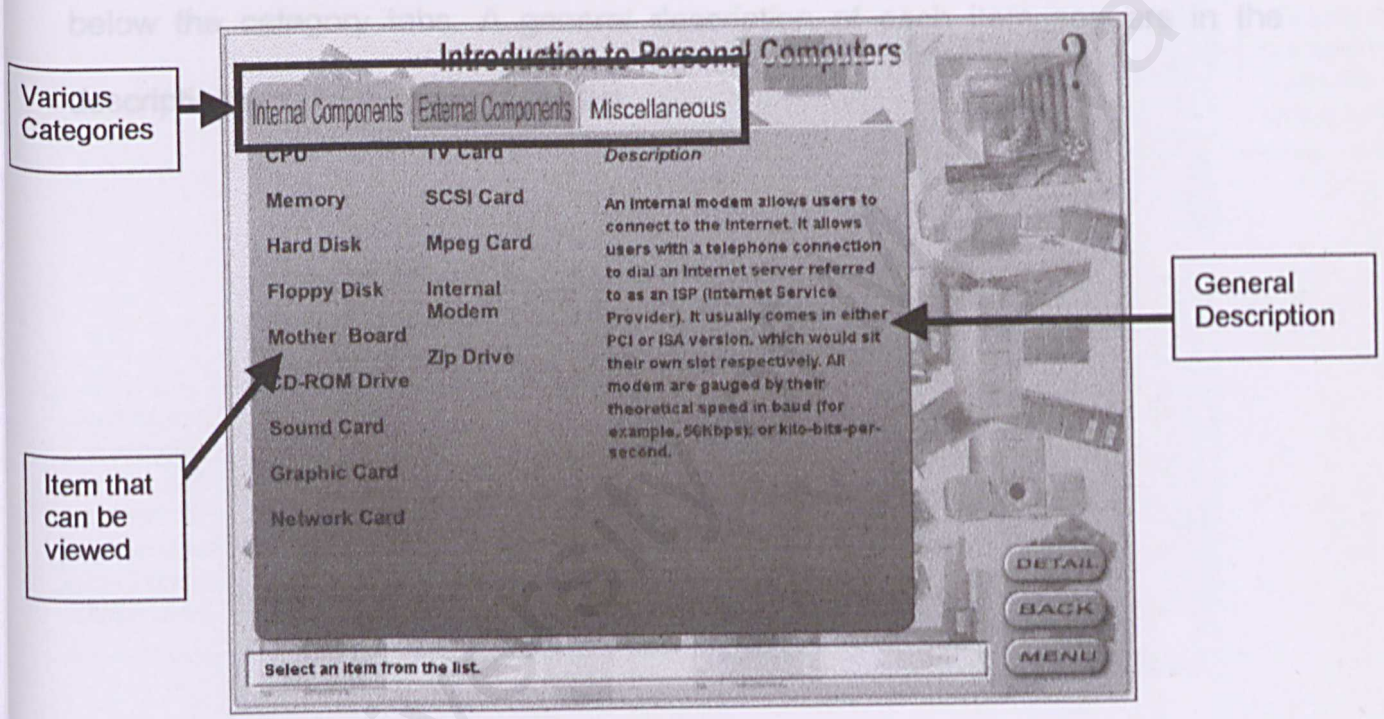
1. A main portion of the screen will usually contain a picture of the currently viewed item. If the item has any sub-components, you can view them clicking on the corresponding part of the picture which will be represented a hotspot.
2. The upper right hand corner of the screen is the name of the item that you are viewing.
3. This will contain a general text description of the item you are viewing.
4. Function buttons allow you to do various navigation tasks.



- The 'Detail' button allows you to see a more detailed description about the current item you are viewing.
- The 'Back' button returns you to the previous screen.
- Finally the 'Menu' button returns you to the main menu.

Select Specific Component

This area allows you to quickly view information about any particular component in the computer (which is available in the program) by selecting the item from a list. This is generally a faster means of navigating to specific components if instead of navigating through various levels of components.



The area contains three categories that the items are sorted by, specifically 'Internal Components', External Components' and 'Miscellaneous'.

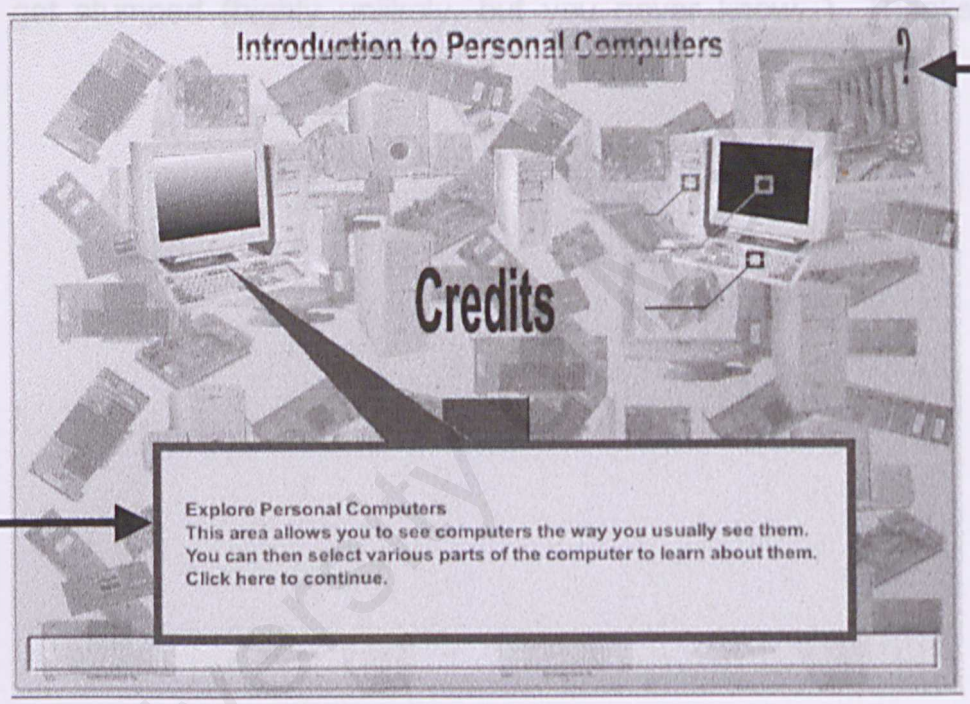
1. Internal components are items that are inside the Processing Unit (that big casing other than the monitor).

2. External units are anything outside the Processing Unit like monitor speakers, mice, keyboards and so on.
3. The miscellaneous are contain special items of interest. Click here to find out what's so special.

To use this screen, first select the correct category if it is not currently selected as the Internal Components is selected by default. Then select item in the list below the category tabs. A general description of each item appears in the description area to the right of the list.

The Help Area

The help are is available throughout this program. Anytime you wish to know more about the screen, simply click here. A message box similar to the screen below is displayed.



Clicking on the help icon starts the online help.

A series of message boxes will appear to explain what each item on screen does.

To view the next item in the Help, simply click on the message box. You can end the Help by right clicking. The Help will end normally when all objects have been explained.

Final Reminders

Remember that any thing that can be clicked on will have changed the mouse cursor to a hand. A general description about what that item does will also be

displayed in the description box (the long white box at the lower portion of the screen).

THE END

This should help you get the most of this program. Remember to use the online Help if you get stumped (highly unlikely, but you never know...). Thanks for reading.