University of Hertfordshire

BACHELOR OF SCIENCE DEGREE COMBINED DEGREE WITH HONOURS IN DIGITAL MULTIMEDIA TECHNOLOGY AND COMPUTING

Final Year Project Report

School of Electronic, Communication and Electrical Engineering

Online Tutorial of Fingerprint Recognition Systems

Report by
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Date
April 2008
DECLARATION STATEMENT

I certify that the work submitted is my own and that any material derived or quoted from the published or unpublished work of other persons has been duly acknowledged (ref. UPR AS/C/6.1, Appendix I, Section 2 – Section on cheating and plagiarism)

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ABSTRACT

Online e-learning tutorial websites provide an interactive learning experience for students, allowing them to learn a specific subject at their own pace. They are becoming increasingly popular within the student culture due to the flexibility and convenience at which they can access relevant information. This report was undertaken to incorporate a multimedia learning experience into an e-learning website. This website will provide information to students who have little or no knowledge of fingerprint recognition systems. Moreover, it will give students a better learning experience through adopting multimedia functions to allow them to interactive/engage more effectively with this tutorial.
ACKNOWLEDGEMENTS

I would like to take this opportunity to thank my project supervisor Lilly Meng for her continuous support, guidance and encouragement throughout the project duration.

I would also like to thank everyone who took part in the questionnaires, which helped me in deciding the best layout and features to include within my tutorial.

Furthermore many thanks to Lilly Meng, Ashifa Tejani and Ali Khan for taking time to attend my interview which helped me to gain a better understanding as to what an online teaching tool required.

Finally thank you to my best friend Aleem who supported me and motivated me throughout my entire project especially when times were hard.
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GLOSSARY

HCI - Human Computer Interaction is the study of how people interact with computers.

Storyboard – a series of panels or rough sketches outlining a scene sequence.

Java – a high level, object oriented programming language.

Content flow chart – a system flows chart used to describe the flow of data.

Composite structure - Users can use a site freely however they maybe occasionally forced to use Hierarchal or Linear structures.

E- Learning – electronic learning generally referred to as computer based learning.

HTML – HyperText Markup Language, is a protocol for formatting and displaying documents on the world wide web.

Waterfall Method – a method of development that is linear or sequential.

RAD – Rapid application development is a software development process.

WEB – World Wide Web is a system of interlinked hypertext documents.
Chapter 1 – Report Introduction

1.1 Introduction

This report contains documentation of how the fingerprint recognition tutorial was implemented. The information is split up into relevant chapters, starting with the aims and objectives through to the system design and testing. Moreover, this report covers the total duration of the project and each stage was extensively researched to identify various techniques which could be incorporated to give the student the best learning experience. For instance research was done into Human Computer Interaction (HCI) and various different e-learning websites, to help establish best practise. In order to gain a better understanding of the user requirements and which multimedia functions to incorporate, questionnaires and interviews were carried out.

This section will provide an introduction into the proposed brief, the aims and objectives as well as a report overview.

1.2 Proposed brief

An online learning tutorial website was required to be developed. The website needed to be interactive, clear, user friendly and provide sufficient information to allow students to gain a good understanding about fingerprint recognition systems. Furthermore, it would need to include multimedia features such as interactive demonstrations of using the fingerprinting application, video based tutorials and provide students with a series of quizzes that would display wrong and right answers once answered at end of each chapter, to test there understanding of the tutorial.

Moreover, to create an effective teaching package, the website needs to be easy to use and attractive to the users. This can be achieved through; sectioning out text into small readable paragraphs, using effective imagery and colours so it is easy on the users’ eyes and comprehensible.

1.3 Aims

The aim of this project is to design and create a teaching tool for students. The e-learning webpage’s will help students to understand the fundamental processes involved in a fingerprint recognition system. The website will also show videos of these processes and demonstrate how the user can use a fingerprint reader to extract their own fingerprint into the system.
1.4 objectives

Core objectives

- To carry out intensive research into various areas of possible electronic-learning tutorials, online teaching materials, website designs and HCI models
- To plan and create an interactive online learning tutorial for students
- To teach students with little or no knowledge of the subject
- To teach and illustrate to the students the basic principals of fingerprinting recognition
- To design and implement a user friendly and well constructed website for the students to use
- To design and produce the site to cater for partial sighted students
- To design and create 2D images within the tutorials

Advance objectives

- To create a video clip demonstrating how to use fingerprinting recognition
- To create 3D images within the tutorials

1.5 Report Overview

This report has been sectioned out into seven chapters, a short summary of each chapter is provided below:

Chapter 1 – Introduction
This chapter outlines the project brief, the aims and objectives.

Chapter 2 – Background Information
This chapter outlines the background information of the project. It also describes what e-learning, HCI and fingerprint systems consist off. Furthermore, this section covers the primary research which was undertaken using various sources such as the internet, academic books and analysing other websites.

Chapter 3 – Analysis and Requirements
This section summaries the research that was carried out by the questionnaires and interviews. It also covers what hardware and software requirements are needed, and look whether the report is feasible.

Chapter 4 – System Design
The chapter discusses the design stages through a series of navigational and content flow charts, as well as a series of Storyboards to show the initial design stages.
Chapter 5 - Implementation
This chapter explains how the website was implemented. It gives details on how each chapter was created, including the video demonstrations and quizzes.

Chapter 6 – Testing and Evaluation
This chapter shows a series of tests and results which were carried out once the system was implemented.

Chapter 7 – Conclusion
This chapter summarises the arrival outcome of the project, it also focuses on whether the aims and objectives were achieved. Furthermore, this chapter discusses what problems were met and what the future developments consist of.
Chapter 2 Background Information

2.1 Subject review

This chapter explains the importance of e-learning and identifies what important HCI issues need to be incorporated in this tutorial.

2.2 Defining E-learning

E-Learning allows students to be in control of their own learning through a more flexible learning approach where they can access information in their own convenience. E-learning allows users to tailor their learning experiences to suit their needs. Moreover, it provides a more interactive learning curve than traditional teaching methods which help the students to capture and remember information more easily.

Also University of Leicester (2007:1) states that e-learning enables the user to study the contents at their own pace and to learn “in a relatively anonymous environment without the embarrassment of failure”. Furthermore, e-learning provides an effective teaching tool as it allows students to retrieve instant feedback via online self-assessments, which can be achieved through multiple choice questions.

Moreover, students that have learning difficulties, partial sighted or have hearing problems can benefit from e-learning tutorials. This is due to the fact that e-learning sites can incorporate various different learning tools such as web-pages implementing sounds, videos and features to increase font sizes (University of Leicester, 2007).

2.3 Defining HCI

HCI examines how users interact with computers and how this interaction can be made effective. The research conducted into HCI issues has helped establish what important features should be incorporated into the website, to allow the target audience to learn more effectively. For example when using large amounts of information in web-pages it is recommended that information should be grouped together into small paragraphs to increase the user’s short-term memory i.e. information chunked into sections. This is due to the fact that humans’ short-term memory finds it difficult to store long sequences and cannot process large amounts of data at any one time.
Furthermore, colour factors need to be considered when designing a website. Waztech (2004) states that colour schemes used in a website can affect users' judgments because a large proportion of the population “suffer from a deficiency in colour vision”. For example using black backgrounds should not be used especially in a teaching package as black creates a gothic and dark feeling and is not a good learning colour which can put students off.

### 2.4 Information on fingerprint recognition systems

Since everyone has a unique fingerprint, a fingerprint recognition system can be used to verify a person’s identity for security reasons. Fingerprint recognition technology is very cheap, fast and the most reliable way of identifying an individual. In today's modern society fingerprint recognition systems are being used widely within new technology environments/applications. For instance, they are used in personal computers, PDA’s, mobile phones and most commonly in criminal investigations.

A fingerprint contains a number of unique characteristics called minutiae. Minutiae are generally found in the core points of fingerprints, which are located near the centre of the fingertips. Minutiae include ridges, ridge endings and bifurcations. Most fingerprint recognition devices use the minutiae of a finger to identify a user (yoursdaily, 2008).

The most common method of getting an image of a fingerprint is through using an optical scanner. An optical scanner is used by applying a finger to the sensor window of the fingerprint device reader. The finger is then scanned and a grey scale fingerprint image is captured. Once the image is captured the fingerprint recognition software identifies the key minutiae points of the image. (Refer to Figure 1)

Fingerprint recognition technology is divided into two distinct processes; verification and identification. In the verification process the fingerprint is taken and compared to the users previously registered fingerprint. If the fingerprint matches the previous registered fingerprint then the user is “verified”. In the identification process the user does not need to state who he or she is. A fingerprint of the user is captured and processed into the database of registered users. When a match is made the user is then “identified” (yoursdaily, 2008).
2.5 Primary and Secondary research

Primary research was carried out at the start of this project. Primary research was mainly in the form of questionnaires and interviews which were carried out by students and teachers. Please refer to appendix C for questionnaire and interview results. The main findings of the questionnaire were that students preferred the site to be kept simple, that there should be quizzes after each chapter to test their knowledge. Secondary research was carried out after the project was implemented to find out and test if the user requirements were met and if the site was successful. Please refer to section 6.4 for the summary of the feedback questionnaire.

2.5.1 Internet

The internet was used to carry out the majority of the research. Search engines such as Google, Google scholar, and Lycos will be used to gather relevant information on; E-Learning and fingerprint recognition systems.

2.5.2 Evaluating existing websites

Various online tutorials were viewed to gain a better understanding of what made an effective e-learning tutorial. The first online tutorial site which was analysed was an ICT tutorial. This website has an easy step by step guide. The colour scheme used was simple and very effective as it had a white background with blue text which clearly separated the links from the text. Also, within some chapters of the tutorial video clips and changing images were used. This kept the user interested and was very interactive. However, this particular site did not have any self assessment tests to allow the user to check how much they have currently learnt (ICT, 2007).

Another website which was examined was a multimedia tutorial. The content of the website was really informative and set out in manageable chunks. Unfortunately the website has a lot of adverts displayed at the side of the page which caused great distraction. This particular site had no pictures and no further multimedia functions. This website was not very appealing, due to the lack of interaction (W3 School, 2007).

2.5.3 Books

The academic books used to assist me with the project are the following:

- Automatic fingerprint recognition systems.
- Automated fingerprint identification systems (AFIS).
- Handbook of fingerprint recognition.
2.6 Design methodology (find a home)

The first task involved, before beginning this project was to find a suitable methodology. Choosing the correct methodology is very important has it will assist the developer to complete individual tasks efficiently and more effectively. As this project had one developer it was easy to reach a decision on which methodology to use for this project. The following section below describes different methodologies that were researched and analysed to come to the chosen methodology used for this report.

2.6.1 Waterfall methodology

The waterfall methodology is a structured approach which is used widely in software engineering to ensure success of a project. This methodology states that each stage must be completed before the next stage can be started. In other words, all the stages have to be completed in the set order; this can be achieved with the use of Gantt charts. Please refer to figure 1 where all the methods and processes are shown clearly (Startvbdotnet, 2007).

The stages of the waterfall model are:

Feasibility
The feasibility study is used to determine whether the project is economically feasible. Within this study a Gantt chart will be produce with budget estimates for future stages of development.

Requirements analysis and Design
This stage gathers all the requirements for the system. The requirements can be obtained from the users through questionnaires and interviews. The analysis and design aspect of the waterfall approach are very important in the whole development cycle. Much attention is given during this phase due to the fact that if any mishaps occur it could be very costly in later stages as they are interlinked.

Implementation
During this stage the designs are used to start making the application. Computer programs can be written using conventional programming language or an application generator can be used to start implementation.

Testing
In this stage the system requires detailed testing to be done as a whole. The tests provide assurance to the developer that everything is running smoothly without any errors.
Maintenance

Once the system is fully completed it will need some maintaining/up dating. The software may undergo changes once it’s delivered to the customer. The software used should accommodate change that may occur after the implementation stages.

Figure 1 The waterfall model
2.6.2 The Rapid Application Development (RAD)

The RAD methodology approach is far more flexible than the waterfall approach. This is because it uses prototyping and user feedback as its main mechanisms. RAD is normally used when the requirements of the new system is unclear or when designs may change throughout the duration of the project. Figure 2 illustrates the RAD flow of processes (CreativeData Inc, 2001). RAD projects are normally comprised of small teams, including developers, end users and IT technical resources. By having smaller teams working on a project it optimises speed and complex tasks can be quickly worked out and implemented correctly first time round (21st Century Technology, 2008).

Figure 2 RAD Model
2.6.3 The web design pyramid

The web design pyramid enables developers to consider all aspects of the web design process. The developer focuses close attention on the users’ requirements, which in other methodologies is often forgotten. The web pyramid shown in figure 3 is a metaphor to show all the components of web design. The foundation rests entirely on both visuals and technology. There is also a great deal of reliance on financial economic factors to assess whether the project is worth developing (Webmaster, 2008).

![Web Design Pyramid](image-url)

Figure 3 Web Design Pyramid
2.7 Project methodology

After researching different types of methodologies, it has been decided that the waterfall methodology would be the most appropriate to follow and use for this e-learning tutorial. The main reasons are that the waterfall method has a clearer structure than the other two methodologies; it allows the developer to better manage their responsibilities through setting the project tasks inline with the hierarchical stages identified through this method. Also allows the developer to check the contents after each stage to ensure quality and reliability. Furthermore, this method enables the developer to easily determine the estimated duration of each stage more precisely through the use of Gantt charts and moreover, the developer is inclined to finish off tasks in a sequence as this method encourages all the stages to be completed in a set order.
Chapter 3 Analysis and Requirements

Relevant information can be gathered in a number of various ways when developing a project. This chapter summarises the research results carried out by students and teachers through the use of questionnaires and interviews. This will enable the developer to gain a more clear understanding as to implement a successful teaching tool.

3.1 Primary research

Primary research involves obtaining first hand data directly about a product and market. The main advantage of using primary research in this project is that it provides up to date information. Questionnaires and interviews were conducted to acquire this primary research in this project as it was cheap and analysis could be generated more quickly. Questionnaires were given to 15 University of Hertfordshire students and three teachers from higher education and further education backgrounds also took part in the interview processes. (Tutor2u, 2007).

3.1.2 Analysis of results

The results of the questionnaire indicated that 87% of students have used electronic learning as part of their educational programme (Q4). This states that there is a demand for e-learning packages and shows that it is popular within the student’s culture.

Furthermore it has been established that 73% of students will learn more effectively if the site is kept simple (Q6) and also when creating this tutorial it will be more beneficial if it incorporated good range of images (5a) please refer to appendix C.

Secondly, research shows that 86% of students would consider time new roman font type to be the most suitable and preferred type to be used in this tutorial (Q7). Also (Q8) shows that the majority prefer a single colour used in the header and border and furthermore all students have stated that it is important to incorporate a continuous theme running through all the webpage’s (Q9).

Lastly, it has been established that 53% of the students believe that a step by step breakdown of information is the most effective feature for them to learn more effectively (Q10) and also 100% consider that incorporating a quiz after each chapter is a very important tool as it will help them to learn more effectively and better engage with their work (Q11). Please refer to appendix C.
The results of the interview showed that lecturers actually use e-learning tutorials as apart of their academic curriculum and further commented on its effectiveness as it enables students to learn at their own pace. Also it has become apparent that for this website to become more user-friendly lectures stated that the navigation should be easy to use and understand. Furthermore the text needs to be clear and in small paragraphs. The interviewee's responses also illustrated that in order to keep a student interested in the course material an interactive tutorial should be created which allows the student to engage with their work, which will keep them more involved and motivated.

3.2 Requirements

The main requirement of this project is to create an effective online teaching tool. The website has to give users a broad understanding as to what the processes of a fingerprint recognition system are. In order to achieve an effective and interactive website it needs to include; video demonstrations, tutorials, images and various different quizzes. Also different software and hardware’s were needed to achieve these main requirements.

3.3 Software

The software’s used for this tutorial have been listed below. Descriptions of the software’s and its function have been stated also the reasons why it has been used for this project have been identified. Also the software’s advantages and limitations are identified.

Macromedia Dreamweaver

Dreamweaver was used to create the whole website for this project. This software was very easy to use because the HTML code was automatically written when designing each web-page. Also it was very user-friendly which helped when editing the website. It allowed the developer to view the design screen in three different ways e.g. design view, code view and split view. This was extremely beneficial when creating the website as it allowed the developer to view the source code while creating the web-pages for better understanding and clarity. Dreamweaver also allowed the user to alter the HTML code if needed for consistency and gave the developer more information to use advance features on their site i.e. presenting the user with more commands and features when designing. The main advantage for using Dreamweaver for this tutorial was that it allowed the developer to easily incorporate multimedia function through manually coding each web-page to make the website more interactive. Moreover, this software was easily obtainable and was the most ideal package to use when creating this application (Arah, 2003). The main disadvantage for using Dreamweaver is that someone without editing experience may get confused with all the options available in editor, toolbar and in the properties window. (DreamweaverMX, 2008)
Adobe Premiere pro

This particular software is used to create high quality videos. The software allows videos to be edited directly within the timeline. Also Adobe Premiere Pro allows the developer to have the option of using audio through the simple toolbar. Once the video has been captured and edited it can then be rendered into many formats. This particular software was an important tool to use as it allowed the developer to edit and piece together the video demonstrations for the website (Adobe Systems, 2008).

Macromedia flash MX

Macromedia flash is used for developing a high quality visual content. This widely used package enables web developer to create and design animations with high impact interfaces. This software is the solution for developing websites that attract and engage users across all browsers. Macromedia flash is a vector based graphics and animations programme; therefore images can be re-sized and re-shaped without any distortion appearing. Macromedia flash also allows designers and developers to design interactive graphics videos and audios all in one application (Amazon, 2007). However by using flash the files sizes increase which means that the pages could take longer to load. Due to the length of the loading time an executive decision was made not to use flash for the homepage because the main purpose of this website is to give useful information and making users wait for flash images and videos to upload would not benefit my site in anyway (Adobe Systems, 2008).

Adobe Photoshop

Adobe Photoshop is a powerful tool which allows images to be edited and enhanced at an advanced level. Photoshop is ideal for this tutorial because the developer can edit 3D content with motion support, and 2D compositions can be created by painting or cloning over various video frames. Also there are many features such as image wrap, noise reduction, spot healing brush and layer control which are all added features within this software to help create better images overall. Unfortunately the disadvantage to all these options and tools is that a novice user may find it complicated to use. Due to Photoshop never being used to such extent in the past, self learning will be employed to edit images for the website (Adobe, 2008).
Camtasia studio

Camtasia studio was used to create the tutorial videos in the website because it was easy to use and very effective. It allowed screen recording and therefore the developer can make high quality videos. Camtasia records exactly what is being done by the user on the screen, once the video has been captured the playback is clear and precise. These videos can also be edited by adding callout bubbles which attract the viewer’s attention, transitions between clips can also be implemented on the timeline. Camtasia studio also allows voice narration to be inserted into the videos (Techsmith, 2008).

Windows media player

Windows media player will be used in conjunction with Camtasia studio to view the videos, to check whether there are any faults during playback. This software also is very easily incorporated into Dreamweaver and will be the best format for the videos for this tutorial (Microsoft Corporation, 2008).

Microsoft Office 2000

Microsoft office 2000 professional edition includes:

- Word 2003
- Access 2003
- Excel 2003
- Outlook 2003
- PowerPoint 2003
- Publisher 2003
- Front page 2003

The main programme which was used more intensively was Microsoft word as it was used to create the content for the online tutorial (Geekzone, 2008).
3.4 Hardware

In order to benefit fully from the online tutorial a Microsoft fingerprint reader was required, so that students can use the fingerprint software for themselves to gain a better understanding of how it works. The fingerprint scanner device can be used along side the video demonstrations; this will benefit the users by allowing them to fully understand the principals of fingerprint recognition. Below is an image of the fingerprint reader used for this project and its specifications.

![Microsoft Fingerprint Reader](image)

**Figure 4 Microsoft Fingerprint Reader**

The Microsoft fingerprint reader is a smart way to prevent unauthorised users from logging onto PC’s, laptops or PDA’s. Traditional passwords are no longer needed through the use of a fingerprint reader. The scanner captures the fingerprint image when a finger is placed onto the glass plate and the internal camera takes a picture. The scanner has its own array of lights which helps to illuminate the ridges of the finger. The scanner processor checks that the image captured is clear and readable; if the overall image is too dark or very light the picture is rejected and taken again (HowstuffWorks Inc, 2008).
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The PC specifications which are needed for this tutorial to work are listed below:

- Pentium 4 processor
- 64MB memory
- 56kbps modem
- 15" monitor
- 4 USB ports
- Dual layer DVD-RW drive
- Mouse
- Keyboard

3.5 Target Audience

The intended users of the system are:

Gender: Male/Female
Age: 18 – upwards
Cultures: cross cultural
Disabilities: maybe visually impaired
Language: English

Educational background: Students that are computer literate, can use mouse and keyboard and have basic knowledge of using internet explorer

Aim: students

Students and lectures will be interested in this website tutorial. This website will allow them to understand the principles of fingerprinting recognition and will cater for users who have no or very little knowledge of this subject. Visually impaired users will also be able to use this website since it allows the font to be increased.
3.6 feasibility study

The feasibility report was completed at the beginning of the project. This study determines whether or not the project can be justified, and whether it is feasible. The following three sections below need to be met in order to complete a successful project, the following sections are:

- Technical
- Economical
- Operational

3.6.1 Technical

The technical aspect of the feasibility report refers to the hardware, software and equipment specifications that are required for the development of the website. A great deal of time was spent deciding what effective web authoring tools was going to be used to implement this online tutorial. All the possible packages were discussed in section 3.3 along with there specifications and why were they used.

3.6.2 Economic

The economical part of the feasibility study is determining the actual costs of the entire project once it has been completed. This has to be taken into consideration to identify whether or not the project is affordable. If the total cost of the project is too high then this project will not be economically feasible. All the hardware and software requirements for this project are available either within the university computers or on the developer personal computer. For this reason no extra cost was made in regards to resources.

3.6.3 Operational

The operational aspect of the feasibility study is to determine whether there is a demand for the project. The operational aspect also identifies exactly what is required for the target user to operate this package successfully. After extensive research it was evident that producing an online tutorial was beneficial as there was demand for this package and incorporating multimedia functions would help make this tutorial more interactive then previous e-learning websites which would be an overall benefit to the students and teachers.

3.8 Conclusion of feasibility study
3.8 Conclusion of feasibility study

In conclusion, the feasibility study has shown that this project is feasible. This is due to the facts that the hardware and software requirements for this project were easily attainable through the university. Also there was clear evidence that e-learning tutorials are becoming more popular amongst the student culture and moreover there were no extra financial costs in producing this project. The detailed analysis of the results of the feasibility report can be found in section 3.1.
Chapter 4 System Design Stage

The design stage transforms the detailed requirements of the definition stage into a complete detailed specification of the system. The functional and data requirements are implemented within the design stage. The most significant elements of this stage include:

- Designing the components of the system: system interfaces, system navigation, colour schemes, database structure, system manuals and overall architecture of the system
- Selecting the correct software packages that will used as part of the system
- Walkthroughs of the design should be completed to ensure that the system is working correctly and that all technical aspects are completed (EPA, 2007).

4.1 System Navigation

The first step was designing the overall navigation of the website. It was very important to have a fully working and easy to use navigational structure. In order to achieve the navigation diagram the figure 4 below shows the flow in which users can navigate throughout the entire website.

After researching various different navigational maps it was considered that the best structure to use was the composite structure. This is because the user is free to navigate around the site but in certain pages the user will be restricted to follow a sequence. This was necessary as some of the course material used within the tutorial was created in a sequence manner. The aim of this particular layout was to allow the users to have flexibility by accessing any pages they wanted. Looking at the navigational diagram in figure 4, the two way arrows indicate that the user can go back and forth between pages. There are ‘back to site map’ links situated on individual pages to allow the user to go back to the chapter site map to choose what direction they want to go to next.
Figure 4 Navigation Flow Diagram
4.2 Content flow chart

A content flow chart illustrates the flow of data throughout the whole system. Figure 5 shows the main topics which are going to be implemented in the website.

Figure 5 Content Flow chart


4.3 Storyboards

In the design stages, storyboards have been used to identify the layout for each template used for this project web-pages. The direction of the content flow of how each page will be set out is determined. Storyboards will help the developer save time and money as it is very easy to implement and moreover is very useful for spotting design problems more effectively though this process. Furthermore the storyboards will show where the hyperlinks, borders, text and frames will be placed and picture layouts will also be sketched to show the exact positioning of where they will be situated when implementing the web-pages (Andriole, 1987).

The whole website will consist of three main chapters with text enlargement applications, a tutorial to show the user how to use the fingerprint scanner device and to further explain the processes of fingerprint recognition, a demonstration of actually using a fingerprint device, quizzes after each chapter will be created and a contact page.
Figure 6 Homepage

This page will be the opening page of the online tutorial website. This home page will be kept simple so that users are not overwhelmed and are able to understand the structure of the website as a whole. The links will always be visible on the left hand side of the website this will be consistent throughout all the web-pages so the users can easily navigate around the site. Tables will be used to section out information and to keep the layout consistent.

On the top border, the title of the page will be clearly visible so that students know exactly what page they are on. In the middle of the web-page the image/ context box will state the title of the web-page. The colour scheme throughout these pages will be kept simple with a white background with blue and green two tone links for consistency.
The chapter sitemap pages for each chapter will have the same layout and structure. The border on the top will always have the title of the page, for example which chapter the user is currently on. Images will be displayed with relevant links at the bottom to the pages which can be accessed in that chapter. This structure has been chosen for simplicity and to allow users to navigate quickly around each chapter and easily familiarise themselves with the website. Moreover, this layout has taken into consideration the users requirements from the results of the questionnaire as most students preferred a simple colour scheme. Therefore the page links will be blue due to the fact by having a white background, these colours contrast very well together. The links on the web pages are blue to begin with however once they have been clicked they turn purple this is so that students are aware of what pages they have already visited.
The pages which contain all the information within the chapters (figure 8). The principals of HCI were taken into consideration when designing these pages. The information is kept in the centre of the page and is clearly set out in small manageable chunks, so the reader does not loose interest as mentioned in section 2.3. Above the text are buttons labelled small, medium and large, these buttons were created for partially sighted users to allow them to increase the font size. At the bottom section of these pages there is a hyperlink which allows the user to click onto the next page. When the last page has been reached the link at the bottom of the page reads ‘back to sitemap’ this enable the user to go back to the beginning of the chapter’s.
The demonstration web-page contains a video of how each stage works and is displayed clearly in the middle of the page. These video’s all open up in windows media player format which is compatible with all PC’s, by using windows media player the video’s can be easily paused and then played again, without the video re-starting again from the beginning. However the software demo page opens up within its own software package called Grfinger tool through Java application software. There is also link to the next page at the bottom of page which allows the viewers to skip to the next video demonstration i.e. process. These pages are all kept within the current colour scheme of white and blue for consistency.
Quiz Homepage

![Quiz Page Diagram]

**Figure 10 Quiz Page**

The above figure displays how the quiz site map will be structured. On this page each quiz is set out horizontally in the middle of the page. The text colour of each quiz title is black however the links below are blue. The links below the quiz title headings allow the user to visit whichever question they prefer throughout the site. On the left hand side of the links is an image which shows the user that they have entered the quiz section. Once a quiz question is selected the layout has one question per page, with a link to the next question as shown in figure 11.
This page was layout with the question in bold and a chose of three answers. The users had to select one correct answer from the three using radio buttons. Each page had only one question for clarity.
The contact details page is kept to a bare minimum. The page has the title in the border at the top, with the links on the left side of the page as usual. There are two contact details which are given for users that wish to get more information, further assistants or general information on this tutorial. The background is kept white with blue and green streaks that are part of the colour scheme of the background used.

4.4 colour schemes

A suitable colour scheme was researched and adopted in this website to give the user a good feeling about the website as a whole. As different colour schemes have different meanings to the user. It was identified that using white, blue and green colours acted as pastels which give a light and airy feel to the site. These colours were the best to use as it linked into the users specification of keeping the website theme simple and using minimal colours schemes. The text colour was kept black so that information could easily be read by all users even colour blind students. The colours of the links are blue so they are easily noticed and stand out from regular text. (Marshall, 2001).
4.6 Content

The following section describes the decisions which were made for the content and structure for the website.

4.6.1 Tutorial structure

The content for this website is split up into four sections:
- Chapter 1
- Chapter 2
- Chapter 3
- Tutorial video

Chapter 1 gives an in depth description as to what fingerprint recognition is and where it can be used. In this chapter the three stages of fingerprint recognition are described and examples of how the different stages work within a system are also explained. The three stages consist of enrolment, verification and identification.

After gaining background information from the first chapter, the tutorial then proceeds to chapter 2 where technical information is given about the automatic fingerprint recognition system (AFIS) and explains where and how it is used.

Chapter 3 consists of real life examples of where fingerprinting is being used and the benefits of it. This chapter also allows helps the user to understand how fingerprinting had been invented and how it relates with the given examples. This interlinks to the other chapters.

During the tutorial webpage videos are used to demonstration how a fingerprint recognition systems works. Moreover, it shows how each of the three processes involved in fingerprint recognition work and is executed. The video content is clear and understandable with an audio narrative of each stage and instructions on how to use the fingerprint scanner device in the demonstration web-page along with the software. A complete layout of the content can be found in section 4.2.
4.6.2 Quiz structure

After completing and understanding each chapter the student is presented with a quiz. The quiz consists of multiple choice questions. There is one question per page so that the user does not get confused and can concentrate on one question at a time. This was one of the user requirements brought out from the primary research in section 3.1.2. The questions test the users on each section read of each chapter. There are three possible answers for the users to choose from and click and only one correct answer. A message will appear in a dialog box to the user once a question is answered and will state if the answered question is wrong or right.
Chapter 5 Implementation

This chapter looks at exactly how the design specifications were implemented and how the WebPages were created along with the video tutorial and software demonstration.

5.1 Creating the Web Pages

The web-pages were created using macromedia Dreamweaver. By using Dreamweaver the pages were created with minimum difficulty and to a professional level. Please refer to section 3.3 for a detailed explanation of why this software was chosen to create the web-pages.

Templates

Below are the standard templates used for all the web pages for this tutorial. Tables were used for consistency and to section out information, images and links. The navigation on the left side is present throughout all the web-pages for easy navigational use. The colour scheme and title were created to match the background colour scheme which always stayed the same throughout the pages.
Tables were used to create the layout of the website. This layout was used for all the web-pages for consistency and professionalism. The content in the middle table was changed depending on which chapter/web-page was created. Also an image was designed to be used as the background for all the web-pages. Layers were used to hold images to allow the developer to have better control of positioning them correctly.

Chapter sitemap template
5.2 Creating video tutorials

The video tutorials were created using software called Camtasia studio 3. This software was user friendly and very effective. This is because Camtasia Studio allowed the developer to record exactly what the mouse curser was doing and to extract it into a movie click. By using this software the video tutorial were very clear and precise with no distortion. Moreover this software allowed the developer to use advance features such as callout captions which could easily be added to the videos to help clarify where certain information should be entered and when certain buttons had to be clicked.
This software allowed the user to highlight exactly which area needed to be recorded by clicking region of the screen. This ensured that all the relevant information was recorded when using the Java application for the demonstration purpose. Please refer to Figure 16 which shows the setup up of the recording wizard.

Once this was selected the software was ready to begin recording, by clicking the red circle which was the record button. To stop recording the demonstration the F10 button on the keyboard was pressed.
After the recording had been captured the video could be edited within the software, a title page could be added at the beginning of the clip to section out the different process of the fingerprint recognition system. Moreover a voice narrative could was added through a microphone to allow the students to better engage with the demonstration as a whole and to allow this video tutorials to become more user friendly.

**Figure 16 Camtasia recorder screen**

After the recording had been captured the video could be edited within the software, a title page could be added at the beginning of the clip to section out the different process of the fingerprint recognition system. Moreover a voice narrative could was added through a microphone to allow the students to better engage with the demonstration as a whole and to allow this video tutorials to become more user friendly.
Figure 17 Task List

The above toolbar is from Camtasia most the advance features can be accessed from this toolbar a video tutorial is also available when using this software to help the user become more familiar with the software as whole. This project incorporated a variety of these advanced functions to help the students understand and follow the tutorials.
The screen shot below shows one of the stages of the recording for the tutorial.

![Figure 18 Tutorial recording](image)

The above image is taken from the demonstration web-page. As you can see there is Callouts added to guide the user. Also this demonstration zooms in to relevant information to help the user understand what procedures are going on and to highlight the steps needed to take when they use the Java applet themselves.
5.3 Creating Demonstration

The Gr finger tool software was used to create the tutorial demonstration. This software was incorporated into the website through using Java applets and manual coding to allow the website to open the fingerprint recognition software. This allowed the students to have a chance to gain first hand experience of using an actual fingerprint device and to test and understand how the processes work.

![Java Applet]

Code which was manually inserted

Figure 19 Java Applet
Template to increase font size

![Figure 20 Template to increase Font](image)

To allow partial sighted students to use this website, HTML code was created to increase the size of the font to three different sizes. The three sizes where small: median: large:
5.4 Creating the Quiz

The quizzes were created at the end of each chapter. This was done by manually creating HTML code into the web-pages to allow the user to select an answer through radio buttons. Once the answer is selected by the user, the student then clicks the ‘Submit Answer’ button. A dialog box appears and states whether the answer selected answer is correct or not.
Chapter 6 Testing

Testing has been conducted once the application was fully implemented. Various methods of testing have been adopted to ensure that the website tutorial is functioning properly and is free of errors.

6.1 System Testing

This test involves testing the functionality of the web pages.

<table>
<thead>
<tr>
<th>Test</th>
<th>What was tested</th>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homepage</td>
<td>Do all the chapter links on the left hand side work correctly?</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tutorial</td>
<td>Do all the videos at each stage load and play when the page has loaded?</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quiz</td>
<td>Do all quiz questions function, by giving correct and in-correct answers, when appropriate?</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Navigation links</td>
<td>Do all links within the chapters direct you to the correct pages?</td>
<td>No</td>
<td></td>
<td>Chapter 3 quiz link redirects you to the ‘examples page’</td>
</tr>
<tr>
<td>Images</td>
<td>Do all images correctly load?</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software demo</td>
<td>Does Gr finger tool load correctly and does it work when fingerprint reader has been attached?</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Video narrative</td>
<td>Can the video narration on the tutorials be heard clearly?</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.2 Platform Tests

One of the requirements was to load this website tutorial on many different browsers. A platform test has been used to test this website tutorials on; Internet explorer 6, Mozilla Firefox and BT version 7. The results of this test were that the website tutorial loaded successfully with minimum amount of time. Moreover, the BT browser used a 56k dial up modem which proved that this site functions well even with a slower internet connection.

6.3 Usability Test

A usability test was carried out to ensure that the user requirements were met. This was done through a second feedback questionnaire the summary of the results are shown in 6.4 below. Ten target audience users took part in this assessment and majority of them concluded that their requirements were met.

6.4 Summary of feedback questionnaire

The overall outcome of the questionnaire was very constructive. The feedback from the students questioned thought that the website was informative and very easy to use. In particular the video demonstration was deemed to be most educational and help kept them interacted within this tutorial. The majority of the students also enjoyed using the Microsoft fingerprint reader device through the Java applet and commented that the Gr finger tool software made was very interactive and was different to other e-learning tutorials they used as they were mainly just theory based.

However it was suggested that a few changes need to be made to the quiz questions. This was because some of the students questioned stated that the answers to the quiz questions were tricky because all the options had similar answers.

Overall majority of the student’s feedback was positive, claiming that they would definitely revisit the site again because the website was far more interactive than previous e-leaning sites they have visited.
6.5 Evaluation

From the developers tests that were carried out it was evident that all the functions and features used in the website worked correctly. From looking at the table in section 6.1 it is apparent that the tutorial videos loaded correctly and the Gr finger tool software demonstration was fully functional.

Although the website is well-designed it became noticeable by some students that when the website was minimised the actual website did not reconfigure its size to that scale. Therefore they would always have to maximise the page window to view the website effectively. Furthermore, it was also acknowledged that one of the navigation links does not direct the user to the correct page. Therefore these are the changes that will have to be made in future developments.
Chapter 7 Conclusion

This following chapter explains whether the aims and objectives have been met. The project timescale will also be discussed as well as what problems where encountered and the solutions recommended. Moreover, the possible future developments will be distinguished and the knowledge gained from this project will be outlined.

7.1 Conclusion of aims and objectives

In order to assess whether this project was a success the aims and objectives need to be referred to from chapter one to see if they have been met.

7.1.2 Aims

At the beginning of this project the aim was to create a user friendly and interactive e-learning website, within the time scale allocated. The website had to incorporate effective multimedia functions which were determined by the users to allow them to engage fully with the tutorial. The original aim was met due to the fact that the website was fully functional and very easy to use. This is because website incorporated effective use of HCI issues, easy navigation and effective colour schemes. Moreover, the multimedia functions were implemented correctly and were working properly which helped the user engage better with the course material as a whole.

7.2.3 Objectives

Each of the objectives which were set during the initial stages of the development has been listed below with a brief conclusion as to whether they have been achieved.

Core objectives

- To carry out intensive research into various areas of possible electronic-learning tutorials, online teaching materials, website designs and Human computer interaction (HCI) models.

  This objective has been met as extensive research has been done into HCI issues, different e-learning tutorials packages, teaching materials as a whole and various website designs. This was achieved by using many different academic books and extensive use of different internet sites.

- To design and create an interactive online learning tutorial for students.

  A fully functional online learning tutorial was achieved, which helped students to understand the fundamentals of fingerprint recognition through effective multimedia functions to allow them to better engage with the material.
• To teach to students with little or no knowledge of the subject. This objective was met by producing a website that was simple to use yet very informative for students to understand the basics.

• To teach and illustrate to the students the basic principals of fingerprint recognition. The basics were taught through different learning median i.e. by implementing multimedia software within the website such as videos and demonstrations to illustrate how fingerprint recognition processes functions.

• To design and implement a user friendly and well constructed site for the students to use. This particular objective was met by keeping the composite navigational structure of the system simple to prevent any confusion from first time users has it restricted web-pages that were sequenced based through linear structure.

• To design and produce the site to cater for partial sighted students This objective was met by incorporating a HTML functions to allow the users to increase the text in three different sizes.

• To design and create 2d images within the tutorials. Images were used throughout the website to keep the user interested and to help understand the contents.

Advance objective
• To create a video clip demonstrating how to use fingerprinting recognition. This was achieved by using Camtasia studio software to record the Java applet so that students could see exactly how fingerprinting works.

• To create 3D images within the tutorials. This objective was not met due to the fact that the user's requirements from the questionnaires and interviews illustrated that the need for 3D images was not vital for their learning experience and due to time resource it was not seen as a vital tool to have.
The initial stages of the project including the feasibility study, research, analysis and the design specifications were all completed within the timescale given. However the feasibility study was completed in earlier than estimated. However the system design took more than 33 days which balanced the time out. All the sections were completed within the overall deadline given. The research aspect of this project was on going throughout the project therefore the days in which were given for this particular section increased dramatically.

The main area in which delays were encountered was within the implementation stage. The templates of the website pages were completed well within the allocated time. However, the implementation of the tutorial videos and the Gr finger tool software took longer than the given time period. The creation of web-pages created in dreamweaver overran by 6 days due to unforeseen problems which were encountered with incorporating the Java applet for the Gr finger tool software into the website and also the positioning the narration to the exact timeline in the video demonstration.

Due to the delays with the implementation stages the evaluation of the website began late. With all these delays it was a necessity to begin the testing stages a week early by organising times with students when to test the site and fill in the feedback questionnaires. From these time constraints a decision had to be made to begin the write up of the report earlier than planned in order to complete the project documentation on time. As a result of these decisions the report writing had overlapped with the testing and evaluation. However the overall project had been completed within the timescale and proofread. Therefore it can be concluded that this aspect of the project was a success.
7.3 Problems encountered

Throughout this project various problems were encountered and solutions were found, details of the problems and solutions are outlined below:

Problems with tutorial videos
The main problem which was encountered when recording the tutorial videos was trying to do the narration along with the video. The solution was to record the video at a slower pace so that it would make it easier to firstly allow the users to keep up with the demonstration and secondly to allow the narrator to give a better and accurate commentary as to what was going on. Moreover, the timeline was used to position the narration accurately and to pinpoint where to insert these audio clips.

Problems with incorporating Gr finger tool software
The difficulty with inserting the java applet into the website was trying to incorporate the code into a HTML website and to ensure that it uploaded from the website. To overcome this problem the code was broken down into steps and the folders were copied and pasted within the website folder. The webpage was coded to access the Java applet from this website folder. Many attempts were taken to configure and implement this software into this website tutorial; however through perseverance and many adjustments the Gr finger tool was fully functional.

7.4 Achievements

Overall this project has helped me gain a better understanding of how to approach a project of this size in the future. The key attributes learnt from this project were firstly time management and organisation. I learnt that doing a project of this size, one had to plan out their activities i.e. through the use of gantt charts effectively to manage ones tasks properly. Moreover, to make sure that these tasks set were completed in the time allocated to ensure that this project was complete successfully to the deadline sated.

Secondly, efficient and effective research of the main topics within the project is researched intensively and correctly in order to know exactly how to approach the project properly and confidently. Moreover, the right methodology has to been chosen for guidance for any project of this scale so that it is successful and done appropriately.

Lastly, motivation and self perseverance needs to been adopted too ensure that unforeseen circumstances and challenges are met and overcome rationally. These skills will help an individual to keep focused when times get hard and stressful and leasing properly with the project managers is also a vital tool to overcome challenges and to ensure a project success.
7.5 Future Developments

There are many developments that could be made in order to improve the website further. Listed below are future developments that would have been implemented in the system if time allocation was increased.

- Develop the quiz further by updating it with new questions and adding a results page to show the user their overall scores and percentage.
- The homepage would have had a video clip to explain what the website is about.
- A page would have been created with links directing students to other fingerprinting websites.

7.6 Conclusion of Project

In conclusion, it was evident that the project was an overall success as the main aims and objectives of this project were met. For example students whom had little or no knowledge of this subject were able to clearly understand the fundamentals of a fingerprint recognition system through the use of multimedia functions. Furthermore, the website was interactive and very user-friendly.

From analysing and evaluating all the various aspects of the project a number of conclusions can be made. In order to complete the project effectively it was necessary to carry out extensive research by using many different sources. By analysing the user requirements through questionnaires and interviews, it allowed me to create an effective website and through the use of detailed storyboards helped me to create an effective system design and moreover helped to produce a fully functional website.

Thorough self teaching and self motivation I was able to learn new skills by using new software which I have never used before such as Camtasia Studio and Adobe premier pro. The difficult part of the project was trying to understand how these software programmes functioned and how they could be incorporated within my project successfully. With the time limit given this was a great challenge and there was increased pressure, due to the fact that these software programmes had to be used at an advanced level in order to achieve a high standard.

By completing this project it has provided me with great knowledge in regards to how to manage many different tasks at the same time. Moreover, it can be concluded that the project was successful and completed to its deadline.
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BIBLIOGRAPHY

APPENDICES

Appendix A Primary Questionnaire

<table>
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<tr>
<th>QUESTIONNAIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What degree are you studying?</td>
</tr>
<tr>
<td>2. What gender are you:</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>3. Which age category do you fall into:</td>
</tr>
<tr>
<td>Under 20 yrs</td>
</tr>
<tr>
<td>20 yrs – 30 yrs</td>
</tr>
<tr>
<td>30 yrs – 40 yrs</td>
</tr>
<tr>
<td>40 yrs and over</td>
</tr>
<tr>
<td>4. Have you used any form of electronic learning (e-learning) anywhere in your educational programme?</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

If yes please answer questions 5a and 5b. If No please state why?

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

5a. what features did you like about the website?
5b. What features did you dislike about the site?

---

6. Which features below do you think is important for to learn more effectively would you prefer a website that is:

<table>
<thead>
<tr>
<th>Colourful</th>
<th>Simple</th>
<th>Textual</th>
<th>Animated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. What font type would you consider to be the best to use in a web page:

- Arial Black
- Times New Roman
- Berlin Sans
- Century Gothic
- Other

8. What colour scheme would you think is the most appropriate and easy on the eyes?

- A) Grey background with Dark grey tabs
- B) White background with blue header and border
- C) Yellow background with grey Font
- D) White background with green border
- E) Dark Blue, Orange & Grey text box
| F) Light blue header and border with white background | ☐ |

*Please see attached sheet for examples*

10. Do you think it is important to have a continuous theme running through each page?

   Yes ☐
   No ☐

9. What features below would be a useful tool to help you learn more effectively?

   - A step by step breakdown of information ☐
   - Lots of Images ☐
   - Quiz’s after each chapter (to see how much you have learnt) ☐
   - Video clips with sound ☐
   - Narrator ☐
   - Combination of all ☐

11. Would you think a self test quiz would be a good learning tool?

   Yes ☐
   No ☐

Thank you for your time, are there any further comments you would like to add:

-----------------------------------------------------------------------------------------------

-----------------------------------------------------------------------------------------------
Appendix B Interview Questions

1. Have you ever used e-learning as part of your teaching material? If so what are the benefits of using this approach and the drawbacks i.e. advantages and disadvantages of e-learning?

2. What do you think of using a video clip in my website to demonstrate to the students on how to use a fingerprinting system and did think that this would be more effective as a learning tool?

3. What steps would you take if you had to create a teaching package for students?

4. What features on a website would make you think that it is user friendly?

5. In your opinion what features would make a website more interactive for students?

6. What methods do you use to keep your students interested in the material when you are teaching?

7. Do you think a self test would be a good learning tool if I adopted it in my web pages?

8. Is it better to have sound on the website to keep the user interested?
Appendix C Questionnaire Results

Question 2 Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>MALE</td>
<td>12</td>
</tr>
<tr>
<td>FEMALE</td>
<td>4</td>
</tr>
</tbody>
</table>

Question 3 Age Groups

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>under 20yrs</td>
<td>2</td>
</tr>
<tr>
<td>20yrs-30yrs</td>
<td>10</td>
</tr>
<tr>
<td>30yrs-40yrs</td>
<td>7</td>
</tr>
<tr>
<td>40yrs and over</td>
<td>1</td>
</tr>
</tbody>
</table>

Question 4 Have you ever used E-Learning

<table>
<thead>
<tr>
<th>Options</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>12</td>
</tr>
<tr>
<td>No</td>
<td>4</td>
</tr>
</tbody>
</table>

Question 6 important features to learn more effectively

<table>
<thead>
<tr>
<th>Feature</th>
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</tr>
</thead>
<tbody>
<tr>
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<td>13%</td>
</tr>
<tr>
<td>Simple</td>
<td>73%</td>
</tr>
<tr>
<td>Textual</td>
<td>7%</td>
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Question 7 Font Types preferred

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Question 8 - Colour Schemes

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<td>7%</td>
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<tr>
<td>E</td>
<td>13%</td>
</tr>
<tr>
<td>F</td>
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</table>
Question 9 - Is it important to have a continuous theme running through?

Number of students:
- Yes: 15
- No: 0

Question 10 - Important Features

- Step by step breakdown of information: 53%
- Lots of images: 0%
- Quiz after each chapter: 0%
- Video clips with sound: 7%
- Narrator: 13%
- Combinations of all: 27%

Question 11 - Is self test quiz a good learning tool?

Number of students:
- Yes: 15
- No: 0

Options:
- Series 1
Appendix D Feedback Questionnaire

Please take your time in completing this feedback questionnaire, there are step by step instructions given.

Please read chapter 1 and complete the following questions.

Q1. By reading chapter 1 did it give you enough information in regards to what fingerprint recognition is?

Yes [ ]
No [ ]

If No then please explain why.

………………………………………………………………………………………………………………
………………………………………………………………………………………………………………
……………………………………………………..

Q2. Are the three stages well explained?

Yes [ ]
No [ ]

Please read chapter 2
Q3. Do you think there enough information as to what AFIS is?

Yes ☐
No ☐

Please read chapter 3

Q4. Do you find the examples of where fingerprint recognition is used helpful?

Yes ☐
No ☐

If No then please give examples of what could be more helpful.

……………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………

Please could you click on the tutorial chapter and work your way though each of the stages, by viewing each video. Once read please answer the following questions.

Q5. Were the videos beneficial and easy to follow?

Yes ☐
No ☐

Q6. Was the narration of the video loud enough and understandable?

Yes ☐
No ☐

Q7. Did you find the videos educational?

Yes ☐
No ☐

Please move onto the demo chapter and use the fingerprint reader which is attached to the PC to complete the three stages of fingerprint recognition.
Q8. Did you find using the software more beneficial than just reading about how it works?

Yes ☐

No ☐

Please move onto the quiz chapters and try completing a few questions to see how much you have learnt.

Q9. Did you enjoy completing the quiz questions?

Yes ☐

No ☐

Q10. Would you visit this particular e-learning website again?

Yes ☐

No ☐

Q11. Was the navigation of the site easy to use?

Yes ☐

No ☐

Please state any further comments below.

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

Thank you for your time and effort.
Appendix E Gantt chart

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<tr>
<td>research and Analysis</td>
<td>34 days</td>
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<tr>
<td>System design</td>
<td>33 days</td>
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<tr>
<td>Implementation/Testing</td>
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<td>Evaluation</td>
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<tr>
<td>Project Report</td>
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<td>Poster session</td>
<td>3 days</td>
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