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Computer Supported IT Training for Managers

By

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A Doctoral Thesis

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requirement for the award of**

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Dedication

**To my parents, Harun and Halimah,
my wife Noor Rain Abdullah and
my children Johan and Adam,
for their love and support**

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ABSTRACT

It is widely acknowledged that communications and information technologies (C&IT) have revolutionised organisational life. However, although C&I technologies have extensively entered the workplace, in many organisations they seem to be making very little contribution to the achievement of the goals of the organisation. The research that has been focused in this area has suggested that potential users in the organisations are perceived (and often perceive themselves) to have inadequate knowledge and skill to utilise the technologies effectively. It also indicates that the users frequently lack motivation to use the technologies because they feel that the technologies are insufficiently supportive of tasks, which they need to perform. This latter observation appears to be particularly important where the users have the choice as to whether and when they will use the technologies (i.e. they are 'discretionary' users) as is often the case with managers in a non-C&IT focused organisation.

Service and an interest in the role of training in this process. As a starting point, a study of previous research work was undertaken which indicated that conventional training was likely to be of limited usefulness in this environment. It also indicated that C&IT based support systems in the workplace were being suggested as a possible The research presented in this thesis started from a perceived need to improve the effective utilisation of the new technologies by managers in the Malaysian Civil supplement to existing conventional training methods. These results were field tested by undertaking a survey of a sample of managers in the Malaysian Civil Service to determine their perception of existing training and to assess the potential acceptability of C&IT based support for their work.

The results of the survey confirmed the other research studies by indicating that the existing training, while satisfactory in itself, did not seem particularly relevant to the workplace tasks that the managers needed to carry out. The results also indicated that the knowledge and skill gained through training had frequently been forgotten or lost by the time it was needed in the workplace. Finally, a significant number of the managers who were surveyed indicated that they were interested in 'point of need' support and that, although they would prefer that support to come from people, they would be interested in trying a C&IT based system, if one were provided.

An examination of the requirements for point of need support indicated that any system must include both information about the usage of the C&I technologies and equipment themselves and about the application of the technologies to the tasks which needed to be performed in the workplace. Given the spatial distribution of the managers and the relatively rapid evolution of the applications that the managers would be expected to use, it was postulated that a fully distributed system with 'learning' capabilities would require. To test the principles involved a prototype Web based system was developed and released. Initial feedback has been collected and analysed and suggestions are made for the application of the findings to improving the effectiveness with which managers use communications and information technologies in the workplace.

CONTENTS

Title	i
Dedication	ii
Acknowledgements	iii
Abstract	iv
List of Contents	v
List of Figures	ix

CHAPTER 1: INTRODUCTION

1.1	Introduction.....	1
1.2	End-User Computing.....	2
1.3	Structure and Contents of this thesis.....	8

CHAPTER 2: BACKGROUND

2.1	Introduction.....	12
2.2	Training and User-Support Scenario.....	13
2.3	Training and Learning Materials and the Internet.....	24
2.4	Learning Patterns for the IT User.....	29
2.5	Distance Learning.....	31

CHAPTER 3: STATEMENT OF PROBLEM

3.1	Introduction.....	35
3.2	Training for Malaysian Civil Service.....	37
	3.2.1 Electronic Government.....	37
	3.2.2 Categories of NCTC's Training.....	38
	3.2.3 NCTC's Training Problems.....	39
3.3	Effective Training and User Support in the Workplace.....	41
3.4	Towards Learner-Centred Approaches.....	45
3.5	Summary.....	50

CHAPTER 4: RESEARCH DESIGN

4.1	Introduction.....	54
4.2	Requirements for a Workplace Support System.....	55
4.3	Overview of the Method.....	61
4.4	The Chosen Research Design.....	62
4.4.1	Questionnaire.....	64
4.4.2	The Field Work.....	65

CHAPTER 5: CURRENT TRAINING EXPERIENCE AND REQUIREMENT FOR FUTURE

5.1	Current Support Methods.....	68
5.2	Requirement for Future.....	70
5.3	The Questionnaire.....	71
5.3.1	Brief Explanation:Usage of Computers.....	72
5.3.2	Brief Explanation:Training.....	73
5.3.3	Brief Explanation: Individual Data.....	75
5.3.4	Brief Explanation: Department Data.....	76
5.3.5	Brief Explanation: Part II - After Training.....	77
5.4	The Help System.....	81
5.5.1	Initial Help System.....	81
5.5	Experimental Results.....	82
5.5.1	Questionnaire Results.....	82
5.5.2	Results on the Help System.....	84
5.6	Enhanced Help System.....	85

CHAPTER 6: DESIGN OF THE SUPPORT SYSTEM

6.1	Introduction.....	88
6.2	General Design Guidelines.....	89
6.3	Design Issues.....	91
6.3.1	Setting up the Support System.....	91
6.3.2	The Chosen Set-up.....	100
6.3.3	Information in the Database.....	100
6.3.4	Design Issues - Dynamic and Learning System.....	103
6.3.5	Design Issues - Searching the databases.....	109

6.3.6	Design Issues - Outcome from users interaction.....	112
6.3.7	Design Issues - Adding Information.....	113
6.3.8	Revising the Browse Structure.....	118

CHAPTER 7: IMPLEMENTATION OF THE SUPPORT SYSTEM

7.1	Introduction.....	120
7.2	Constraints.....	121
7.3	The improved version of the Help System.....	122
7.3.1	Adding the Search Engine.....	123
7.3.2	Feedback.....	126
7.3.3	Use Frame.....	127
7.3.4	Other Improvements.....	133
7.4	Drawbacks.....	134
7.5	Towards A Dynamic, Learning and User-Driven Help System (Step 2-Version 3).....	135
7.5.1	Implementing Version 3 of the Help System.....	136
7.5.2	Changes made in the HTML pages.....	142
7.6	Evaluation on Version 3 of the Help System.....	156
7.6.1	Experimental Procedure.....	157
7.6.2	Feedback and Comments.....	159
7.6.3	Concluding Remarks on Version 3.....	161

CHAPTER 8: VERSION 4 OF THE HELP SYSTEM

8.1	Introduction.....	163
8.2	Implementing Version 4 of the Help System.....	164
8.3	Design of the site for version 4.....	164
8.4	New Pages.....	170
8.5	Changes to Navigational Files.....	191
8.6	Changes made in the HTML pages.....	192
8.7	The Search Engine.....	200
8.8	Evaluation on Version 4 of the Help System.....	204
8.8.1	Experimental procedure.....	204
8.8.2	Feedback and Comments.....	205

CHAPTER 9: RESULTS AND DISCUSSION

9.1	Results and Discussion.....	209
9.2	Improvements on the Help System.....	212
9.3	Suggestions for Future Research.....	215
9.4	Review of Achievements.....	216

CHAPTER 10: CONCLUSION

10.1	Conclusion.....	224
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BIBLIOGRAPHY.....	229
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APPENDICES

Appendix A	Questionnaire	240
Appendix B	Questionnaire Responses	255
Appendix C	Background on Internet, WWW and other related topics	270
Appendix D	Search Engine	282
Appendix E	Navigational File .inf and .inf1	287
Appendix F	Extract of Logfile	297
Appendix G	Results of Evaluation for Version 3 of the Help System	302
Appendix H	Results of Evaluation for Version 4 of the Help System	313
Appendix I	Samples of HTML programs for the Help System	320

LIST OF FIGURES

Figure 6.3.1(1)	Help System is placed in central server	93
Figure 6.3.1(2)	Help System placed in a few server (developer server and Intranet server) plus in each individual PCs of users	99
Figure 6.3.4(1)	Process Flow for Updating Database	106
Figure 6.3.4(2)	CGI Process Flow	108
Figure 6.3.5(1)	List of document titles indexed by the Topic phrase: ‘weather’	111
Figure 6.3.7(1)	Existing structure for Internet Information System	115
Figure 6.3.7(2)	New root is added to accommodate new subject area	116
Figure 6.3.7(3)	A new subsite with a new page added to database	117
Figure 6.3.7(4)	A new page is added to subsite	118
Figure 7.3.1(1)	Specify an Area to run the Applet	124
Figure 7.3.1(2)	An area to run applet is created	125
Figure 7.3.2(1)	User can use the icon or e-mail address to send feedback	126
Figure 7.3.2(2)	Mail window to be used to send comments	127
Figure 7.3.3(1)	Initial version of the Help System	128
Figure 7.3.3(2)	Example of a page in second level of initial version of the Help System	129
Figure 7.3.3(3)	Layout of the Improved Version of the Help System	130
Figure 7.5.1(1)	Part of the mh1.cgi.inf file	139
Figure 7.5.2(1)	Shows where the navigational aids and target pages are placed	143
Figure 7.5.2(2)	Original navaims.html	144
Figure 7.5.2(3)	Modified navaims.html	144
Figure 7.5.2(4)	Extract from mh1.cgi.log	148
Figure 7.5.2(5)	Modified intgenX.html	150
Figure 7.5.2(6)	Modified page faqnet5.html	152
Figure 7.5.2(7)	Many to one relationship	153
Figure 7.5.2(8)	Extract from mh1.cgi.inf1 file	155
Figure 8.3(1)	Part of the mh1.cgi.inf file	166

LIST OF FIGURES

Figure 8.3(2)	Adding a FORM section in the page	167
Figure 8.4(1)	Shows from where the pages can be accessed	171
Figure 8.4(2)	Top part of the ‘advancedfeatures’ page	172
Figure 8.4(3)	Extract of file ‘advancedfeatures.html’	174
Figure 8.4(4)	Code for the middle part of advanced features page	176
Figure 8.4(5)	The middle part of the advanced features page	177
Figure 8.4(6)	Code for the Logdisplay page	179
Figure 8.4(7)	Logdisplay page	180
Figure 8.4(8)	‘View Answers’ button is created when users submitted a feedback, comment or question.	182
Figure 8.4(9)	Code for the ‘Answers’ page	183
Figure 8.4(10a)	First half of the ‘Answers’ page	184
Figure 8.4(10b)	Second half of the ‘Answers’ page where users can submit their response to feedback, comment or question	185
Figure 8.4(11)	Code for the ‘Thanks’ page	186
Figure 8.4(12)	‘Thanks’ page will be displayed after submitting feedback, comment, question or indexing	187
Figure 8.4(13)	The code for ‘searchresults.html’ page	189
Figure 8.4(14)	Search results displayed by the ‘searchresults.html’ page	190
Figure 8.5(1)	Extract of mh1.cgi.inf file which shows changes that have been made (written in bold)	191
Figure 8.5(2)	Extract of mh1.cgi.inf1 which shows changes that have been made (written in bold)	192
Figure 8.6(1)	The changed code for navaid.html	193
Figure 8.6(2)	Newly added button for navigational aids frame	194
Figure 8.6(3)	Extract of the changed code for intgenX.html	196
Figure 8.6(4)	The resulting page for the changed code in intgenX.html	197
Figure 8.6(5)	Changes made in the information page (written in bold)	198

LIST OF FIGURES

Figure 8.6(6)	Three input buttons and a reset button have been added To the information page	199
Figure 8.7(1)	Searching the word ‘Modem’	202
Figure 8.7(2)	Result of searching the word ‘modem’	203
Figure 9.4(1)	The improved ‘advancedfeatures’ page	220
Figure 9.4(2)	The improved Logdisplay page	222

CHAPTER 1

INTRODUCTION

1.1 Introduction

IT is becoming universal. Most tasks for managers involve the use of IT since almost all documents are prepared using computers. The range of tasks is extensive – preparing plans, writing reports, preparing appraisals, financial projections, specifications for projects and products, project diaries, project documentation, preparing and giving presentations. Computer supported communication is now also commonplace (e-mail, the World Wide Web (WWW), special conferencing packages, computer supported co-operative working). This means that large numbers of people in business, government, education, or at home can use the computer to maintain continuous communication and information exchanges. ~

Each task can require the user to use one or more types of computer based packages (word processors, spreadsheets, drawing packages, databases, e-mail front ends, WWW browsers) and in every case a number of different proprietary (or freeware/shareware) packages are available which could be used to accomplish the required task. Even when a single package is chosen it is normal for the package to be 'updated' (changed) on a regular basis. The major problem here is that each tool is intended to assist the user to accomplish a particular task more easily and more effectively, but often the tools themselves become a major hurdle (when a new tool is specified, or when a tool changes and no longer works in a way it used to). This is made worse when the tools are not used regularly, so even when they do not

change there is a refamiliarisation period to be gone through when the tool is used. What this means is that there is a continuing need for people to be assisted in using the tools if they are to use them effectively and efficiently.

The starting point for the work reported in this thesis is that there will both training and support issues involved in this and it will not be sufficient simply to provide training. The literature, which supports this view, will be reviewed in Chapter 2 and 3. It is also the theme of this thesis that, although support may be most effectively provided by humans at the point of need, practically, there will often be occasions where people with appropriate skills are not available. In both circumstances, and circumstances where the user is exploring possible new ways of carrying out their tasks, computer based support is worth investigating as a viable alternative.

1.2 End-User Computing

End-user computing has become an area of major importance to organisations over the past several years. Recent developments in Information Technology (IT) have brought significant changes in end-user computing. With the advent of powerful microcomputers, and the availability of user-friendly software, end-user computing is expected to grow at an increasing rate in many organisations (Davis et al., 1993). With this development more and more people will and do use and depend on information technology. A big problem with this change is that most users at some time or other have experienced frustration and difficulty when trying to use the technology. They have problems in applying the knowledge they have to the task at their workplace. For example they might have problem in attaching a file to their e-mail so that the receiver can read the e-mail, or they might have a problem in creating a table using Word. The reasons for this are due to some combination of shortcoming of the system, poor (or no) training,

poor end-user support and poor documentation. Booth (1992) makes the point that although computer technology has made great advances over the past 30 years, the designer's knowledge and understanding of the user has not significantly changed. It is now the communication with the user and good end-user support that is seen as the greatest obstacle to the efficient functioning of many systems.

Many organisations have focused on training and user support programmes to overcome the above problems and negative implications such as 'technophobia' (a fear of either new or changing technology) which have been identified by Heverly (1998). However, little is known about what factors should be considered in designing end-user training and support programs. As has been highlighted by Nelson (1991), organisations should not devote all of their resources to technological research and development but should focus instead on finding ways in which to make employees more productive with information technology. He states: - "Integration of information system (IS) and IT into the work place requires that a variety of organisational members be considered in conjunction with their performance on a wide range of tasks. For these tasks to be carried out effectively, it is important that participants possess the requisite knowledge and skills". The consequences can be argued to be that users need assistance in using IT facilities and overcoming their fears when there is either new or changing technology at their workplace. It is also reasonable to expect that users not committed to and conversant in the technology may unknowingly cause disruption in system operation because of a lack of understanding of the purposes or abilities of the system. In addition, users may revert to prior methods of accomplishing tasks if they become disillusioned with 'computing' problems, which they cannot solve. A common example might be a user using the new word processing program to draft correspondence, but still using the typewriter to prepare envelopes and labels. This is particularly wasteful and error prone since it is essential for the addresses on envelopes to be correct and to be the same as the address on the letter. Of course, not all such

problems require better training or different technology. For the second problem cited above, the most effective solution may not be training in producing labels but envelopes with a window on them.

The importance of effective training and end-user support in ensuring the success of an end-user computing and learning society has been emphasised by several researchers in information systems. Effective training and a good user support programme multiplies the value of each employee; helps keep morale high; contributes heavily to better customer service; enables an organisation to keep pace with new developments and demands and impacts profitability (Donaldson, 1986). Somekh (1997) mentioned that for the next century, the aim of many policy-makers in the UK and around the world is to encourage evolution into a learning society. Research focusing on factors and process of successful end-user training and its effects on organisation has the potential to provide new insights into the creation effective end-user training programmes, which in turn, should lead to enhanced organisational performance. Hence, for users to be as productive as possible, they should be trained and supported in all areas of computing.

Although training and development functions are agreed to be very important to an organisation, Thomas (1992) argues that effective training and development is very uncommon. There are several reasons for this. One of the main reasons has been mentioned by Rae (1997), who said that existing training was almost exclusively trainer-centred. The training programme was developed with little or no user participation in the process of end-user training programme development (Huang, 1998). Users do not have much control over what they must learn, when they must learn it, where they must learn it, and from whom they must learn what they need to know. The trainer and the IS support professionals determined the objectives of the course, how long it would last, its content and its formats. On many occasions the trainers were in complete control of the direction of the training. The views of the trainees (or

of the organisation in which the trainees would be employed) were rarely sought.

There could also be some problems during the training session. As examples:

- 1) The place on which training occurs may not be the ideal learning environment
- 2) It may be difficult for trainers and participants to remain centrally focused on learning tasks during the training session
- 3) There may be a shortage of resources: space, books, equipment, and above all time to meet the demands of many participants
- 4) Participants may experience delay
 - in waiting for the trainer's attention or denial
 - in being ignored or refused by the trainer or interruption
 - in being asked to stop work in relation to the task or /and social distraction
 - in other participant's demands for attentions
- 5) Frustration levels can be high and the authority of the trainer can be called into question.

Where these problems occur trainers have a tendency to try to control the class, to organise participants in task oriented activity and to pace their own work (for example, in keeping the participants working at the same pace rather than at the pace which best suits the student's own needs and abilities). It could be argued that in these situation trainers become managers of learners rather than managers of learning.

There could also be some problems concerning the participants themselves. A few of the participants that come for training may be not fully committed. They might just come for training because they have been asked to attend by their managers. Some of them may attend training just because they want to have a break from their office work. This group of participants usually does not contribute much in class and are not very participative. They may also disturb the concentration of the students who do want to learn.

There may be also problems after the training period. As an example there is usually no user support after the training period (particularly important for those courses aimed at improving workplace skills). To increase the effectiveness of any practical training programme it can be argued that such support should be provided either by the organisation that provides the training or by people in the organisation in which the trainees are employed. It can also be argued that the support would be best if it were available to the employee at his or her desk. In the case of IT training, the support could be 'human support' or a computer system that offers a 'help' function to the user. In this context, although 'human support' would probably be the most effective, 'computer system support' could at least partially satisfy the requirements since it can be provided when and where the user needs support which is especially valuable in an organisation which is facing a shortage of IT skills. Computer system support would then be particularly effective for discretionary users who have high workloads and tight deadlines. The term 'discretionary user' means someone who will use the system as a tool, when and where it is relevant to the task in hand. They will not use it all the time and they will only use it if they find it useful. Discretionary users are very difficult to provide with human support. They may need help in the morning before the office hours start, during meetings or after office hours and so on.

An appropriate support system could be provided as a stand-alone system on a desktop computer. User could also make use of the rapid merger that is taking place between computing (consumer electronics) and telecommunications (Mülhäuser, 1995). These advances have led to an integrated technology of distributed multimedia systems by which people – even at geographically widely distributed locations – can work together in a ‘telecooperation’ environment. One currently very popular environment (known as the World Wide Web (WWW)) is argued to be one of the most revolutionary developments to have occurred in a century of communication innovations (Pfaffenberger, 1997). The Web, together with new development in ‘data transport technology’ and ‘communication technology’ provides new approaches and development in learner-centred learning environment such as: -

Distance Learning – As stated by Mason & Kaye (1989), distance learning, in contrast to traditional classroom or campus-based learning, is characterised by a clear separation in space and time of the majority of teaching and learning activities. Teaching is to a large degree mediated through various technologies (audio, video, broadcasting, and computers). Steed (1999) said that distance learning is not a new idea; correspondence courses and programmed instruction workbooks have been around and in use for many years. But today, a variety of sophisticated communication technologies provide both instructor and learner with numerous ways to participate in learning at a distance. He further said that distance learning is now becoming a widely recognised key to meeting the challenge of delivering more training to more people on more subjects with higher impact and effectiveness, and in a much more cost-effective way.

Interactive Learning – Chacon (1999), said that the characteristic of Interactive Learning relates to person-computer and person-person interaction, both of which may be enhanced by information and communication technologies. He further added that, in this type of learning,

interaction occurs in tutorial programmes recorded on CD-ROM, simulations, computer-assisted collaboration learning, e-mail exchanges, teleconferencing and many other techniques made available through the new breed of media. The advent of the Web has allowed distance educators to take advantage of interactive learning.

1.3 Structure and Contents of this Thesis

This thesis is concerned with an investigation of the use of Information and Communication technologies to provide more effective training support for managers who need to use computer systems in their workplace as part of the management support infrastructure.

Chapter 2 reviews the literature, which has focussed on the development and evaluation of training provision. It looks at the research that has been undertaken into providing effective training in computer skills and into using communications and IT as a medium for training.

Chapter 3 looks at the training given to the Malaysian Civil Service (MCS) at present, assesses its strengths and weaknesses and generalises this analysis with the help of the literature. From the analysis a set of requirements for a workplace-based support system is derived which would complement the more formal training already being given in many similar situation.

Chapter 4 states the goals of the present research and examines how these goals might best be achieved. It then outlines the objectives for the approach that has been taken in practice. This approach consists of:

- a) An investigation (by means of a questionnaire to Malaysian Civil Service Managers) into the efficacy of the existing training programme and the requirements for a workplace support system
- b) The design, development and preliminary evaluation of a prototype support system

Chapter 5 explains the design of the questionnaire in more detail and presents the results that were obtained when a preliminary survey was carried out using the questionnaire.

Chapter 6 describes the design of the support system relating it back to the requirements specified in Chapter 4.

Chapter 7 explains the implementation of the support system, describing the two stages that were gone through, reporting the feedback that was received from the initial implementation and the changes in the design and implementation that resulted. This chapter also describes reimplementing of the system (using CGI (Common Gateway Interface) scripts) which demonstrates the system capability of monitoring users' activities. It also contains the results of users' evaluations of this version of the system.

Chapter 8 describes an extended implementation of the CGI based system whereby users can provide information in the system, ask questions and answer unanswered questions in the system. In addition, this chapter also demonstrates the system's learning capability. The final subsection of this chapter contains the results of user evaluation of this extended version.

Chapter 9 offers an in-depth discussion on the findings of this research and the shortcomings of the support system (Help System) that was

implemented. It also discusses some possibilities for improvements and finally, offers recommendations and suggestions for further research.

The final chapter, **Chapter 10**, summarises and concludes the research findings with a brief discussion of the expectations and achievements.

CHAPTER 2

BACKGROUND

2.1 Introduction

There was a time when land was the most fundamental basis of prosperity and wealth. Then came the second wave, the age of industrialisation. Now, increasingly, knowledge will not only be the basis of power but also of prosperity. Since information is a prerequisite for knowledge, information becomes an asset that must be used effectively.

Every year, as the proportion of the population that use computers increases, then the number of people who experience difficulties in understanding and using these machines also grows (Booth, 1992). Booth noted that many businesses, both large and small, are discovering that the computer systems in which they have invested large resources have become the foci for conflict within their organisations, or are not fully utilised because they do not properly support users in their everyday tasks. One possible way of overcoming these problems might be to provide users with training which is intended to familiarise them with the new technologies. Increasing the computer literacy level among the users is an important task. In the words of Booth, 'providing users with sufficiently broad-based skills and information to integrate the use of new office technologies effectively into their jobs and work is essential in order to obtain the maximum benefits from office automation'.

The term training may mean different things to different readers. Michalak and Yager (1979) defined training as an organised effort at behavioural change and not just skills training. Goldstein (1974) considered training as a systematic acquisition of skills, rules, concepts or attitudes that results in improved performance in another environment. What is concerned in this study is similar to that defined by Goldstein but applied specifically to managers in collaborative environment settings using communications and information technologies.

2.2 Training and User-Support Scenario

As organisations grow increasingly dependent on computer application systems, the ability of the end-users of these systems to use them effectively becomes critical, in some cases to the successful functioning of the whole organisation (Eason, 1995). It has been argued that training is a critical factor in enabling users to make effective, efficient, and productive use of their computers (Chrisman, 1990). Chrisman added that for users to be as productive as possible, information managers (IM) must ensure that users are trained properly in all areas of computing. Furthermore, Thomas (1992), suggested that the key to organisational survival lies in the successful utilisation of the training and development functions. Thomas also observed that although the training and development functions are very important, effective training and development is very uncommon. He advanced several reasons for his observation and these are outlined in the following paragraphs.

First, this is due to a low level of commitment by management to training. According to Thomas, the major reasons for organisations low investment in training lies in the 'short-term gains' philosophy of management. Thomas mentioned that management are reluctant to commit substantial

resources to training because they are far from being convinced that training in general, or specific training in particular, really pays dividends. Thomas noted that management needed to be convinced that the short-term costs incurred in training and development staff would be worth while in the long term. The perceived need is cost-effective training and development services, which result in clearly relevant positive outcomes in the actual world of work.

Second, the perception that 'training costs money'. Thomas mentioned that many organisations appear not to realise that although training costs money, 'not training' may cost more. He noted that it is difficult to recognise the cost of not training in some areas of proposed training and less so in others. As an example where the benefits of training are most apparent, he quoted in the case of airline pilots, where the perceived costs of not training are obvious and dramatic (e.g. a plane crash). However, the benefits of training are less apparent with regard to IT. Since there is no comparable failure associated with not training. Thus, Thomas noted that when the consequences of a failure to train effectively are immediate, dramatic and highly visible, commitment to training is usually high. According to Thomas, some of the most obvious costs of not training are:

- failure to increase productivity
- overtime cost
- under utilisation of existing physical resources
- under utilisation of existing human resources
- unnecessary operations and systems
- failure to utilise new technology or new methods and materials
- poaching skilled staff.

In addition, Thomas also mentioned 'hidden costs' which include:

- absenteeism

- stress-related sickness
- excessive staff turnover
- inefficient staff recruitment and selection
- resistance to change and progress
- low morale
- damage to organisational image
- lack of commitment to the organisation
- minimal staff suggestions for improvements
- new market opportunities not exploited
- no quality culture generated.

The third reason for ineffective training and lack of development identified by Thomas is that 'effective training could only be achieved if it is integrated with the achievement of corporate goals'. He noted that, training cannot on its own, maximise human potential although training can (when it is successful) increase potential. He said that at the end of a successful period of training, an individual will possess an improved potential capability but whether or not this potential will be translated into actual performance improvement is totally dependent on the nature of the environment in which the person must operate. Thomas added that training has traditionally focussed almost exclusively on the human resource potential (such as individual competencies and level of motivation) and ignored or failed to influence the common organisational barriers (such as inadequate resources, lack of support and poor communications). He mentioned that if training is to become part and parcel of corporate strategy, it is necessary to recognise the fact that training cannot be effective if it is designed and delivered in virtual isolation from the realities of the operational environment. He stressed that to be truly effective training must be completely integrated with the achievement of corporate goals.

The fourth point that has been described by Thomas is related to end-of-course evaluation. He mentioned that those who have a formal responsibility for training is aware of what the most common process of obtaining customer feedback are the end-of-course evaluation. However, he questioned the purpose of the end-of-course evaluation. To determine what? Is it to find out whether the course content, structure and delivery were appropriate to people's need, or is it to find out whether we are effective as a trainer? His perception was that most of this information should have been known before the start and that it would be more appropriate to monitor effectiveness of training as it proceeds. Thomas noted that end-of-course evaluation is in some ways, actually a waste of time, since it focuses attention on the detection of errors and therefore away from the quality maxim of prevention and sometimes the same mistakes and faults are identified time and time again from post training evaluations which have been carried out over the years. His observation was that the evaluations were rarely, if ever, acted upon. He believed that they were chiefly a parting ritual at the end of a period of training.

What Thomas has discussed is on how and why making quality as the foundation of training. Building a 'quality culture' in an organisation is very important. The cost of not having a 'quality culture' is that it may lower down the productivity. In the development of computer systems there is a tendency for projects to over-run. That is, projects take longer to complete than anticipated no matter how good the staffs are. Can it be certain that a failure to meet deadlines is solely due to lack of training? Surely, a lack of training is just a contributory factor? In developing a 'quality culture' in an organisation, neither training nor quality assurance comes first. However, this study will not be focussed in quality or quality assurance.

Donaldson (1986) took the view that conducting a need analysis, is the most important ingredient in producing effective training programs. He states that, too often, training staff pull out an 'off-the-shelf' program without

identifying the real requirements. He added that training is not the answer to every organisational problem and when a problem arises, it must be thoroughly diagnosed before training is prescribed as the best solution. Donaldson also mentioned that determining training needs can be time-consuming, but the investment will pay off in a better-planned program .

Rae (1997), following Donaldson, stressed the important of 'identification of training needs' as a key ingredient in making a training program effective. He states that effective training starts with the identification of a need and it is also at this stage that evaluation starts. He added that a training need stems from an equation, which shows that a factor is missing and the training supplies that missing factor. Furthermore, he said that the existence of a training need presupposed that a change is necessary: a change from a situation or performance which is perceived to be below the level required. However, the phrase 'training stem from an equation' is not clear. In this case Rae did not mention what the equation is.

Lee and Kim (1995), have made an empirical study to investigate the factors that are essential for successful end-user training in the context of the introduction of Computer Based Information Systems (CBIS). From the study, they found that, for successful end-user training, end-user-training (EUT) managers should first accurately determine their specific information system (IS)-related needs and their job task-related needs. The end-user training program should be designed based on this needs analysis. The study also revealed that (1) overall the end-user training function was not given full consideration, and (2) the resources committed to the function were low across organisations. In the study, EUT training managers and staff of the participating organisations were also being asked about problems or difficulties they encountered during the implementation of their training programmes. Lee and Kim enumerated the three most critical success factors as: (1) top management support, (2) end-user motivation to use CBIS, and (3) communication skills of training staff. The three most frequently encountered

problems or difficulties were: (1) lack of motivation for end-users to use new information systems, (2) difficulty in communications with other department managers, and (3) lack of top management support.

Levin, (1998) discusses training approaches in information technology. He lists some of the best practice for training as follows:

- Don't delay curriculum development until the deployment phase of a project. Integrate training early into the application development process
- For nontrivial IT system development or major updates, include a training task force as part of the application development team. The task force should include curriculum developers, business managers, and end users
- When training is outsource, develop an internal mentoring programme to help employees adapt their new skills to your organisation's unique business processes. Make IT personnel mentors
- Get a grip on your business processes. A better understanding of how your business works can improve the application of newly acquired skills among student employees
- Don't rely solely on canned computer-based training. One solution isn't best for all users. Always augment video, CD-ROM, and Web courseware with custom-developed materials that reflect your environment
- Avoid crash courses. For some educational tracks, such as

programming languages and technologies, there is no substitute for properly paced instructor-led education

- When building new applications, leverage your organisation's Intranet and Web developers to develop a context-sensitive help system. Invite master users to author the help pages in partnership with HTML developers
- Track help-desk inquiries. They're an ideal measurement of your organisation's training success or failure rate. Fewer help-desk calls indicate higher training and application quality
- Don't be afraid to invest in training. Proper development of an integrated training program can dramatically cut IT costs and boost end-user productivity (or fewer people using the system).

The importance of effective training in ensuring the success of end-user computing has also been highlighted by Rivard and Huff (1988), Sein, et al. (1987), Cheney (1986) and Zmud and Lind (1985). These authors consistently point out that adequate understanding of end-user computing (EUC) tools and motivation to use them on the part of end-users are essential for the realisation of the full potential of EUC.

Bostrom and Olfman (1990) developed a research framework to study the computer learning process for end-user training. Central to the research framework is the notion that users form mental models of system with which they interact. Users' mental model is their internal representation of the system structure and function that provide explanatory and understanding power (Chrisman, et al., 1990). Studies of several computer systems such as online retrieval systems, programming languages, electronic mail systems, word processors, and other computer software have shown that valid mental models are consistently related to accurate interaction and subsequently, high

task performance (Borgman, 1984; Sein and Bostrom, 1989). Bostrom and Olfman mentioned that learning can be viewed as a process of model transformations, i.e., a progression through increasingly sophisticated mental models where each reflects a more adequate understanding of the target software. The Bostrom and Olfman research framework postulates that a novice user can form a mental model of the system in three different ways, which are as follows:

- 1. Mapping via usage:** Users can acquire a mental model of the systems merely through using it. The system interface plays a very important role in this mapping process. The mapping process is influenced by user characteristics
- 2. Mapping via analogy:** Users can acquire a mental model of a new system by drawing analogies from similar systems that are familiar to them. A user's prior referent experiences play a crucial role in this mapping process
- 3. Mapping via training:** Users can acquire a mental mode of the system through training. A user's characteristics will influence this mapping process.

Bostrom and Olfman demonstrated the importance of learning style in learning about EUC software. Their findings indicate that learning modes are an important predictor of learning performance, both by itself and in interaction with the training method. Their findings also suggest that in the design of training, it is essential to match training methods to individual needs. Bostrom and Olfman recommended that concrete learners be provided with analogical conceptual models. They noted that abstract learners perform equally well with both analogical and abstract models, but benefit most from abstract models, while reflective observers may require a more generic and guided instruction of the type provided by construct-based training. Finally

they suggest that active experimenters benefit more from a discovery mode of training provided by the application-based method.

Ruble and Stout (1993) disagree with the results of research by Bostrom and Olfman (1990). They disagree because they argue that Bostrom and Olfman's results do not indicate a consistent pattern of findings. Furthermore, they noted that the measures of learning styles were derived from an instrument with very poor psychometric properties. Hence, they said that the conclusion that learning styles are important factors in end-user training is unsupported at the present time. However, Bostrom and Olfman (1993), argued that: (1) research on important issues cannot be (and is not in practice) suspended until highly valid instruments are constructed, and (2) that imperfections in the instrument used did not significantly affect the operationalization of learning styles in their studies. Thus they claimed that their findings are credible.

Chrisman and Beccue (1990), explained the importance of integrating appropriate concepts with skill training in end-user training programme. They state that many training programmes concentrate on teaching skills in the use of a tool and exclude teaching conceptual understanding and suggest that this emphasis is likely to create major problems in the long run. They said that when users are taught to use a particular tool, they are taught the syntax rules and how to operate the package. Little explanation is given about why a particular command is used. Furthermore, they mention that the training tends to concentrate on how to do something, not on why it is done. They claim that users who receive this type of training are limited in their ability to adapt to new situations, and add that teaching users the underlying concepts, in addition to specific skills, should provide a proper foundation for learning how to use a particular tool. Furthermore, they suggest that teaching concepts also helps the learner form an appropriate conceptual model and the basis for forming a mental model is having a conceptual model of the system that provides a framework for organising information about the tool. They

mentioned that, often, the conceptual model allows the learner to transfer prior knowledge to the new situation and thus become comfortable with the tool more quickly.

According to Chrisman and Beccue, after forming an initial mental model of the system, users (through interaction with the tool) revise and enhance this model to form a more accurate and useful mental model. Only by providing users with both skills training (i.e., how to do it) and conceptual training (i.e., why one does it) can they acquire the necessary experience and mental model to become competent users. Furthermore they add that as the users use computer tools more extensively, they may need some additional information systems training which is directed at producing more proficient users but not users who are professional data processors. According to these authors, users with this higher level of systems knowledge can nevertheless, be considered as expert users.

The authors conclude that training should and can promote the effective use of computing tools, stressing that training that has learning objectives that rely on both factual knowledge and conceptual understanding will enable users to become more effective than will training that addresses only one of these areas. They also added that management support is essential if appropriate training and education programmes for users are to be developed and implemented.

Shepherd, (1989) claimed that training solutions in IT situations should be flexible to meet individual learning needs and adaptive to enable training to be matched to the current level of skill of the learner. He added that, to exploit both of these features, it is necessary to have the capability to monitor performance and adapt subsequent training to an individual learner's real needs. Moreover, he said that training should be carried out in the context of an effective representation of the task, either through simulation or training in real situation and conventional approaches to training IT skills, such as short

courses, are ill-suited to these purposes. Shepherd recommended an 'embedded training system' which could incorporate this range of features at the design stage to support the training needs of the intermittent users. According to Shepherd, in an embedded training system, training facilities are installed within the system itself, available to trainee as and when required. He postulated that applications should incorporate a variety of useful ideas in computer-based learning, including appropriate areas of artificial intelligence. However, he noted that much of the work to date in this general field has focussed on teaching academic subject matter rather than supporting an occupational task.

Ruiz Quintanilla (1989), reviewed computer technology from the point of view of its usefulness in training. According to him, applying the traditional techniques of training on the job in organisations with high-level automated systems is unlikely to be successful for at least two reasons. First, he said that mistakes in these systems are very costly and dangerous and this will prevent the novice from gaining experience by using, for example, trial-and-error strategies. Second, the complexity of these systems does not facilitate learning. Thus, according to Quintanilla, because of the complexity of such systems and because much of the process is hidden, the novice needs a learning environment with clear guidelines to be able to develop the required knowledge and skills. Quintanilla mentioned two approaches, which could realise this guidance. One approach is known as 'training wheels'. In this approach, he said, interfaces are modified for training purposes in such a way that troublesome error states are unreachable. The system also blocks any side tracks which could confuse novices and which could lead to error states of the system. In the demonstration system he developed, the learning system informs users that the required function is not available when they try to follow a blocked path. He further added that the 'training wheels' approach gives shorter learning time (due to the time saved for error recovery) but offers only a limited possibility for mastering very complex systems such as a propulsion engine system.

The second approach discussed by Quintanilla is by simulation. In training, simulation is where the subject performs exercises on a model of the conditions in which this subject practised an activity (Leplat, 1989). Furthermore, he added that, the phenomenon to study is the process of learning, in order to understand and improve it. The word 'model' indicates that only some of the features of the situation studied are retained. Quintanilla noted that simulation seem to offer opportunities for learning to control the complexity of tasks. The same viewed is shared by Baker and Marshall (1989), and Norros, (1989). They suggested that simulators could be valuable tools in training if they are well integrated in the learning process.

In addition to the two approaches to training mentioned above for high-level automated systems, Quintanilla also discussed the possibility of an intelligent tutorial system (ITS). He states that ITS is a system that provides users with a personal tutor, which enables them to learn according to their prior knowledge, individual abilities and preferences. It would also adapt to users' motivational state, needs and learning rate. He suggested that ITS should be able to achieve characteristics similar to that of the human tutor due to development in hardware and software. He also said that in books, film or video, learners' choice of learning an appropriate subject is based on their prior evaluation of the subject matter. However, in Intelligent Tutorial System (ITS) it goes one step further in which it can gives analysis, diagnosis and sometimes advice about the subject matters.

2.3 Training and Learning Materials and the Internet

Dugan (1998) has argued that during the past decade, the evolution of technology has slowly eroded the significance of a classroom and a teacher and replaced them with audiocassettes, videotapes, and CD-ROMs. He added that, in the next few years, the growth of Web-based training would

have an even greater effect on classroom training, particularly in the corporate world. Furthermore he states that classroom instruction will not disappear, but as the Web infiltrates school, home, and work, Web-based training will become an acceptable, and preferred, alternative.

Dugan also noted that the catalyst for the rise of Web-based training is the increasing need for corporate training, particularly in the area of technology. He said that whenever a company upgrades its OS, e-mail package, or word-processing application, the staff must be trained (or retrained). Similar ideas have also been expressed elsewhere (InfoWorld, 09/07/98, p72). They asserted that if employees are dispersed across the country, managers either have to set up training at each site or move employees to the training location, which is costly and inconvenient. To combat this problem, corporations are tapping the Web to lower the cost of on-the-job training. This article also asserted that Web-based training is cheaper, more efficient, and sometimes more effective than classroom training.

Forsyth (1996), looks at educational and administrative considerations of offering courses, course materials or course delivery via the Internet. He notes that, there is a great deal of hype about the Internet and the ability of the service to open up access to information for all. He agreed that the Internet does offer possibilities to support alternative learning settings, but was sceptical about much of the current use of the Internet as a means of providing education and training. This is because he had examined materials on the Internet as an alternative means of the delivery of educational and training material and found that these materials do not fulfil the claims. In reality he said, most of the material on the Internet is at best an electronic book with some of the random access search facilities and index attributes of a book or, at worst, an electronic page-turning. Furthermore, he added that one so-called educational and training site is pre-book technology. The information is available and presented in the form of a scroll, where he/she

clicks on the mouse at the down or up arrow to 'scroll' through the content. He commented that many of the 'courses' offered on the Internet are a 'knee-jerk reaction' or an 'increasing the institution profile' exercise. In other words, he said that most of the courses are not purpose-designed but consist of existing materials 'retrofitted' to the technology.

However, Forsyth comments that having taken issue with some forms of the presentation of teaching and learning materials on the Internet, there is no denying that it does allow access to information. Furthermore he said that if the Internet is a means of accessing information then it has the potential to be a tool for teachers and learners. Consequently, he said that the use of the Internet changes both the roles of the teacher and the learner. He added that if the Internet is a source of information for the course, then this is a significant change in the role of the teacher who in a face-to-face course delivery has been the primary source of knowledge. Furthermore he added that the use of the Internet as a tool in face-to-face teaching turns the delivery into a more flexible educational and training setting and this becomes an alternative mode of delivery.

Forsyth notes that in the literature on education and training there is talk of a paradigm shift. This shift is from the expectation that education provides the basis for a job, to an emphasis on education and training as a lifelong process. According to him, this shift means that the process of education, which could be described as teachers telling, is changing to a process of teachers facilitating access to information for the learner. As a result of that, he added that this shift places a greater emphasis on the learner, who is expected to take control of their learning. The paradigm shift also changes education from an ordered or imposed process on the learner to a more eclectic activity by the learner. Furthermore he added that this learner-centred learning also places delivery of the learning materials as a shared responsibility of the learner and the course deliverer. He states that in this setting, the Internet has a role to play.

The possibilities of using the Internet as a tool for facilitating teaching and learning seem encouraging. However Forsyth cautioned that there is the potential to repeat all the mistakes of the implementation of other electronic media and end up with electronic page-turning, limited or no interaction and the inability for the teacher and learner to interact in real-time or even communicate. So, he said there is a need to recognise the changing role of teachers and learners in education and training. According to him one of the initial changes in the role of teachers is that the teacher becomes a monitor and mentor, less instructional and more supporting. He added that as a mentor, the 'teacher' may need to provide high-level support for the learner and as the learner gains confidence, these levels of support can be negotiated down. Forsyth lists some of the functions that are not usually part of a face-to-face teachers' repertoire and skills and that they will need to develop such as follows:

- the use of electronic mail for messages
- participation in chat and bulletin board session
- the use of computer managed learning applications for test generation
- scoring and updating learner records
- the electronic receipt of free text submission such as essays and open-ended questions.

While the ability to use the technology will facilitate the new skills required by teachers, Forsyth stressed that what is important is the ability of the course developers to make the material into accessible information. According to him if the design of materials does not support learners' ability to learn and teachers' ability to be mentors and guides, then learners will become frustrated and disillusioned and ultimately drop out of the Internet-

delivered course. Inevitably, he said this would result in teachers also becoming anti-Internet.

Forsyth mentioned that with course material on the Internet, the role of the learner changes from one of primarily being a recipient to one of being a participant. He further added that if the course materials are designed for optimal interaction, the learner becomes a searcher with a level of responsibility for their learning that is generally not expected in face-to-face teaching. In this situation according to Forsyth, just as the teacher will have to learn new tools, the learners will also have to use new tools if they are to fully capitalise on using course materials and related sources of information available on the Internet. This will include:

- search and enquiry design
- ability to download material to work offline
- the use of electronic mail
- the use of file transfer for test and assessment tasks and for communication with class peers and teacher.

Forsyth mentioned some of the strengths and weaknesses of computer-based education and training which can be brought to an Internet delivery. They are as follows:

Strengths

- ability to work on a course at a time convenient to the learner improves motivation
- the 'patience' of the computer when testing and retesting learners for appropriate drill and knowledge
- structured nature of computer-based materials gives learners the view of the content as a professional would view the content;

- ability to provide simulations prior to real world experience provides a learning environment and saves expensive equipment or consumables;
- segments of course offered on computer provide variety, may stimulate learners and promote positive attitudes to learning;
- courses originating from a central source mean that content versions are minimised, quality is controllable, and reporting, evaluation and record-keeping may be facilitated;
- a degree of individualised instruction is possible particularly if the learner is able to navigate the content; and
- when properly constructed the computer-based learning is able to provide almost instant feedback.

Weaknesses

- putting material that is not appropriate into computer (electronic page-turning). Possibly this is related to design issues
- Interactivity requires both the learner and the notional teacher to actively use the facilities and options provided. Sometimes this does not happen. If there is no interaction there is no communication. But more importantly this is evidence of no commitment to the use of technology
- limitations such as computer power or screen size or ability of operating system to cope.

2.4 Learning Patterns for The IT User

Shepherd (1989) has described the characteristics of typical users of IT systems. He focussed on casual and intermittent users. These features are pertinent to their preferred pattern of learning and hence, the types of training provision that should be offered to them. They apply equally to people using a

purpose-built application, such as a revenue recording system or to people using a piece of general-purpose applications software, such as a word-processor or a spreadsheet.

First, he mentioned that different users have different operational needs for the different functions available in the system. He noted that over a period of time some functions will be used frequently, some rarely and others not at all. Moreover, the pattern of usage will vary between users, dependent on the operational demands placed on them. This means that training should be adaptive to the needs of different users. Shepherd added that an initial period of concerted training to try to cover all skills, such as the 'short course' so often favoured by organisations, is unsuitable for these applications. According to Shepherd, even if such courses were economical to run, it is unlikely that a user will encounter a less-frequent operation in sufficient time following a training period to ensure that the correct response is remembered. Hence, he noted that some form of 'point-of-need' training is essential, at least to train usage of the less-frequent functions.

Second, according to Shepherd, there are considerable individual differences between users regarding their capacity to learn new IT skills. He noted that, people vary in their motivation, confidence, familiarity with similar products and procedures and the extent to which they are able to make use of teaching facilities offered.

A third general feature that has been mentioned by Shepherd is that intermittent users are rarely interested in learning a computer application for its own sake. He noted that they are ill-disposed to spend time learning when they could be 'doing'. It means they will favour 'point-of-need' learning so that they can either seek, or be prompted to seek, training when they need it.

A fourth point is that users become satisfied with a small set of functions which enable them to meet their requirements even if they are

inefficient in doing so. As we know that most systems offer several ways to achieve specific goals. Shepherd noted that, most users become satisfied with a low level of efficiency if it means getting the job done and avoiding further learning. This is often quite satisfactory for individual operators, but often less satisfactory for the organisations in which they are working, since time is lost - compare the efficiency of using a mail-merge program with copying out a list of addresses one by one.

A final characteristic that has been described by Shepherd is that, the tasks people are required to carry out in computer-based systems are idiosyncratic.

2.5 Distance Learning

Distance learning has expanded dramatically in recent years across the world, across the spectrum of subject areas, and across educational levels. The concept of distance learning has many possible meanings. However, for the purpose of this thesis the definition of flexible learning provided by Brande (1993, p. 2) will be used as a starting point. He defined flexible learning as a type of learning which enable learners to learn when they want (frequency, timing, duration), how they want (modes of learning), and what they want (that is learners can define what constitutes learning to them). If this definition is extended to include “where they want (at home, in the office, at a training centre, etc.)” then it becomes an inclusive definition of distance learning.

The developments in computing and communication technologies and especially the integration of these technologies have made it possible to have access to a wide range of information sources and to participate actively and interactively in distance learning schemes from even the most remote areas

(Brande, 1993). Mason, 1999, has suggested that four categories of support for distance learning can be identified. They are as follows:

- 1) text-based systems such as electronic mail and computer conferencing
- 2) audio-based system such as audioconferencing and audiographics
- 3) video-based systems such as videoconferencing and
- 4) The Web, which integrates text, audio and video, both as pre-prepared clips and as live interactive system, both real time and stored to be accessed later, and furthermore which provides text-bases interaction as well as access to education resources of unprecedented magnitude.

The Web is also playing a major role in providing support for student centred learning in conventional higher education settings (e.g. University campuses). It is thus not surprising that it has been argued that the new electronic technologies have encouraged the convergence of distance education methods and systems with those of face-to-face teaching (Moran, L., Myringer, B. 1999, p. 57).

Distance learning has been one of the major contributions in the expansion and growth of higher education. Many leading companies have policies to support the continued education of their staff but the limiting factor is the time to attend University. Many are exploring the services they could offer their staff through distance learning (Lawson, 1995). Many universities have therefore implemented distance learning programmes either as an alternative for, or a supplement to, expansion of campus.

Several issues need to be addressed in the context of distance learning. Some of them are the implications and support for students. As mentioned by Mason, 1999, almost invariably reports are enthusiastic on

evaluation studies on educational uses of conferencing regarding their reactions to learning from the medium. Students are usually positive about the advantages the medium has brought them - a wider curriculum choice, less time and money spent travelling, more interactivity with teacher and their peers. In terms of support, Mason stated that the organisation must consider the preparation and delivery of training materials to students. He also suggested that institutions should offer their distance students telephone office hours for direct queries with their teacher. Other forms of support would be individualised feedback from faculty on assessments; electronic accesses to library resources; a help desk for queries about equipment and communications system.

There is a very substantial body of literature on distance learning and on the use of technology to support it (e.g. Harry, K., 1999, Mason, R., 1994). However, the primary focus of the work described in the thesis is on the feasibility of building a computer supported collaborative community, rather than the learning possibilities, which the existence of such a community would open up.

CHAPTER 3

STATEMENT OF PROBLEM

3.1 Introduction

Scotti (1988) said that teaching and learning play a vital role in our modern society, above all in organisational systems where transferring know-how is essential in company competition and effectiveness. He further added that nowadays, all jobs require some knowledge of, and skill in, using computers to be able to interact with our information-based society. With the arrival of the Internet and the flexibility of IT equipment, non-professional computer users come to rely on computer systems to perform more and more of their basic tasks.

Bainbridge and Quintanilla (1989), said that the flexibility of IT equipment, the many functions which can be carried with it, means that users do not just need to know standard operating procedures. The users of IT equipment need to work out for themselves what to do to meet their particular needs, on the basis of understanding how the equipment works.

However, understanding how the equipment works is difficult, both because, typically, systems are multi-functional and their workings are invisible. They are unobservable (c.f. car engine, where one cannot see inside the engine block) and have to be described at a more general level and translated into physical analogies which may be more or less misleading. IT equipment also conceals the relation between action and effect. When one

throws away a real (paper) file, one can see and feel it happening. The impact is not the same if we type a command or move a file to the trash directory.

As has been said by Bainbridge and Quintanilla, planning how to use unfamiliar equipment involves thinking for oneself, which is one of the most difficult and least understood of cognitive skills. Knowledge about equipment, what it does and what to do to it to get certain effects, must be organised within a framework of understanding both the task goals and the methods available for meeting them. These skills of knowledge, understanding and problem-solving are not ones that are conveyed by conventional training methods. Bainbridge added that, training for tasks in which people have to work out for themselves what to do requires a different approach. He added that it is not only a matter of training people in working methods but also of developing their mental models of the equipment and the task, which they must then use in choosing and devising their own working method.

This chapter examines problems in IT training from two viewpoints. Firstly a practical illustration is given related to training for the Malaysian Civil Service (MCS). This examines the need for training followed by the type of training given to managers of MCS and finally the problems of IT training that have been identified given by National Computer Training Centre (NCTC) of Malaysia.

This specific example is generalised in the second part to examine some problems, which affect end-users when using IT technology as a result of changes in the nature of work at their workplace.

3.2 Training for Malaysian Civil Service

3.2.1 Electronic Government

The Government of Malaysia has launched the Electronic Government initiative to reinvent itself to lead the country into the Information Age (MAMPU, 1994). Electronic Government presents an opportunity to update all elements of government to ensure the public sector continues to meet the evolving needs of the public and the private sectors. The Electronic Government effort is intended to bring to the public sector the benefits of multimedia and the IT revolution that are leading to new paradigms of performance improvement in the private sector around the world. A fundamental changes where IT is being used in improving their performance.

The Electronic Government initiative is also concerned with improving the productivity of the internal workings of government. Specifically the performance of government will be improved through better processes and better systems. These processes and systems will be applied to both services between government agencies as well as services delivered within an agency. Electronic Government involves deploying multimedia applications within government agencies. The application will be supported by comprehensive change programmes that will simultaneously impact the strategy, skills, system, and structure and culture of government. Thus moving to an Electronic Government will require enhancements of the civil service skill base. All government workers will go through a basic IT literacy program. They will be trained in technologies to support their specific jobs. In line with this the National Computer Training Centre of Malaysia (NCTC), has been given the task of providing IT training.

3.2.2 Categories of NCTC's Training

One of the NCTC's training aims is providing IT training to managers. The training for these groups has been designed into two categories. They are as follows:

i) Mandatory Training

This training is given to selected managers who are due for promotion. The Public Service Department in accordance with seniority carries out the selection. The people chosen come from various departments and backgrounds. During the first two weeks, they are given a series of talks, which cover some general education, which will update their knowledge about information technology. In the last week they are given at least one hands-on session.

ii) Open Training

This type of training is usually run in the form of seminars. Some of the participants are selected and invited by NCTC, however requests are also accepted from an individual manager. Open training sessions are held five or six times a year and are conducted usually in a hotel, so that full concentration can be given to the seminars without intervening calls from their offices.

The seminars usually take from three to five days. In the seminars the managers are exposed to a series of talks given by some invited speakers. The speakers are either locals or invited from overseas which are experts in their respective fields.

During the last day of the seminar, a case study is given for them to work out. The case study is designed to make them consider current

problems in the public service. They work in groups and a presentation of the solution is given at the end of the seminar. There is no hands-on session.

3.2.3 NCTC's Training Problems

The following are difficulties that can be identified with the current methodology of NCTC's IT Training.

i) The Task Match

Training given is not user-centred. The training, in most of the cases, does not match with the manager's previous experience or their actual task. As a result of this, the knowledge gained during training may not be used and applied in their offices. The reason for this problem is because there is no training need analysis being done by NCTC before conducting any course. The course contents and materials are decided based on the discussion between co-ordinator and project officer which on the other hand refer to the contents on previously run courses. Course contents are often technology led. Although the course contents must go through an evaluation by a curriculum committee, however during the evaluation the discussion mostly focused on budget rather than the suitability of the topics with respect to the task of the participants at their workplace.

ii) No Follow-up Analysis

There is no follow-up evaluation being done with the participants after the course. The only evaluation that is being done is immediately before the end of the course. There should be an evaluation of the course after a certain period of time, may be one, two, or six months after the course. This will assess the suitability of the course contents and effectiveness of the training.

iii) Uncommitted Participants

A few of the participants that come for training are not fully committed. They just come because they have been asked to attend by their senior officers. Some of them even attended the training just because they want to have a break from their office work. This group of participants usually do not contribute much in class and are not very participative and probably there is no change to their work pattern.

iv) Methodology of Training

It has been said that people learn best when engrossed in the topic, motivated to seek out new knowledge and skills because they need them in order to solve the problem at hand. NCTC lack this kind of training, 'learning by doing task'. Effective training should be active exploration, construction and learning rather than the passivity of lecture attendance. As has been said by Reay (1994), in order that training to be effective it should involve the learners. Only if we involve them, rather than merely present to them, can we enable them to learn. The focus should be on the needs, skills and interest i.e. learner-centred training.

v) Training is not integrated with the achievement of corporate goals

Training given by NCTC focused on the human resource potential e.g. individual competencies. According to Thomas (1992), training cannot be effective if it is designed and delivered in virtual isolation from the realities of the operational environment. To be truly effective, training must be completely integrated with the achievement of corporate goals. Training must become a catalyst for positive change in all aspects of organizational development and not limit itself to the human resource dimension only.

3.3 Effective Training and User Support in the Workplace

As discussed above, managers and other professionals have varied work and only occasionally need to use the computer tools available. They are also largely autonomous with respect to how and when they will engage in their tasks, which means they have choice about the degree to which they use the available equipment. They may have well-developed expectations about how tasks should be undertaken but know little about how they are undertaken with computers. They will also be exchanging the information they generate and use with other managers or professionals.

Davis (1993), said that although a lot of research has been focussed on measuring the effectiveness of training, very little is known about how to design effective end-user training. In spite of many recommendations to enhance the efficiency and effectiveness, in particular cases, Davis noted that many trainees still encounter problems. Such problems are inability in recalling and using command syntax, difficulty in applying software packages to specific tasks, frustration with the complexity of training materials, and confusion about how to recover from errors. He further states that, while inappropriate and ineffective training may be blamed for these problems, it cannot be regarded as the sole source of users' learning difficulties.

Looked at from this perspective, it can be argued that the underlying assumption of most existing training is that what users need to know is how to operate the new equipment and how to use word-processing or spreadsheet software, such as 'Word' or 'Lotus' independently of the tasks they are undertaking. This kind of training is inadequate to cope with user learning need, because of the following;

i) Occasional or Intermittent Users

Most of the user population are occasional users, who will not see the value of attending a full course (Eason, 1995). Even if they did attend such a course, they would have forgotten the detail before they got round to using it. Many systems provide multiple functions and it would be a very long training course to cover them all in detail. Occasional users also see very little reason to spend a lot of time learning a system, which will make only a marginal contribution to their work. It can be argued that what they need is a system that could provide point-of-need support.

ii) Adaptation to Learners

Mühlhäuser (1995) said that today, the strategy and style of interaction between learners and learning environments are to a large extent prescribed by the trainer. Training is almost exclusively trainer-centered. The trainer determines the objectives of the course, its content and its format. Once a course is chosen, the precise choice of topic is restricted. Typically, the pace of learning is geared to the 'average' trainee, making it too fast for some and boringly slow for others. However, users at their workplace, have different operational needs for the different functions available in the system. Some functions will be used frequently, some rarely and others not at all. This suggests that training should be adaptive to the needs of different users. Mühlhäuser added that adaptation also means allowing the learner to express their preferences in terms of user interface, perception channels (like audio, visual information, abstract representation), and feedback style (no feedback, abbreviated feedback, tailored feedback).

Surrounding environment and friendly atmosphere created by trainer is also important in contributing successful learning. A comfortable, less threatening, less formal environment and good rapport between trainer and learner facilitate learning and encourage involvement of learners. If the

learner feels comfortable, safe and respected by trainer, good participation and learning will result.

Using examples from the learner's world also helps in enhancing the learning. Examples for learners to work through should be based on their own work and not on some imaginary 'generic' tasks. This would be able the learners associate new information with things they already know about. When this happens, the material comes to life and seems more real, more concrete and therefore more easily remembered.

iii) People focused on task not software

The novice user will want to know what can be done with the system to support the task in hand. The problem with this is that general-purpose systems are not geared to support the specific task. The training, to be cost effective, teaches people how to use a package but not for a particular task i.e. they are not 'task-matched'. Typically the training concentrates on command structures, for example the command words, menu items, etc., which are needed to operate the system and the physical skills to evoke them.

iv) One Place Training

Today, most training takes place at a training center, which inevitably is located at a center at an inconvenient distance from the most learner's home or workplace. Due to declining personal mobility (traffic congestion, environmental problem, labor-time too valuable to be spent traveling) this type of training is problematic to the learners especially for a person who occupies a leading position in an organization. Time is very precious to them. Affordable periods of absence are rather short and absence for a training week tends to pose significant problems.

v) Closed Training

In closed learning schemes, there are often entry qualifications and conditions, which close learning to certain people. Similarly as above, course contents, pace, times and length of study is usually dictated to the learner by someone else. In addition, the fees are too high and unaffordable to the average person. This sets a further barrier to participation. All these limitations set up barriers to learning.

Closed training is disruptive. The need to conform to set times and locations may well not suit the demand of the work. Travelling time, in particular, is unproductive.

vi) No user-support after training programmed

The majority of training programmed has no user support after the training period. To increase the effectiveness of any practical training programme it can be argued that such support should be provided either by the organization, which provides the training, or by people in the organization in which the trainees are employed. In the case of IT training, the support could be 'human support' or a computer system that offers a 'help' function to the user. In this context, although 'human support' would probably be the most effective, 'computer system support' could at least partially satisfy the requirements since it can be provided when and where the user needs support. This is especially valuable in an organization, which is facing a shortage of IT skills. Computer system support would then be particularly effective for discretionary users who have high workloads and tight deadlines. Discretionary users are very difficult to provide with human support. They may need help in the morning before the office hours start, during meetings or after office hours and so on.

3.4 Towards Learner-Centred Approaches

Training is much more complicated than simply telling or showing someone how to perform a task. Donaldson (1986) said that, training is an attempt to transfer skills and knowledge to trainees in such a way that the trainees accept and use those skills in the performance of their jobs. Hence it is vital to choose the most appropriate method for conducting training. It has been said by Reay (1994) that inappropriate methods lead to ineffective learning and that the learning process is largely a matter of what goes on inside the learner's head. He also pointed out that although trainers are tempted to think that because they have presented something clearly, it has been learnt clearly, this may not be the case.

Very often in a training environment it is common for a trainer to deliver a lecture lasting for one or two hours. According to Reay, lectures, even if delivered well, offer minimal opportunity for learner involvement and consequently minimal opportunity to learn. He also said that a straight lecture leaves the learners uninvolved: anyone can learn to look attentive while staying 'switched off'. Furthermore he noted that six minutes is thought to be the maximum time during which most people absorb and retain information.

To enable good learning to take place Reay suggested two ground rules. They are as follows: -

i) Involve the learners

- only if we involve them, rather than merely present to them, can we enable them to learn.

ii) Vary the diet

- given that each individual learner has a limited concentration span, we cannot expect him or her to spend all day involved in say, a

demonstration or a role-play or any other single activity. Presenting the same material in different ways also aids learning.

Reay's work mentioned above offers no empirical evidence. In the context of training in the Malaysian Civil Service and from personal experience there is some truth in what he says. However, motivation is not included and as stated by Coe (1996), motivation is the **why** behind learning.

The problems that have been discussed in this chapter are problems that have been affecting managers at their workplace. Based on these problems, it is obvious that there is a need to enhance training effectiveness and efficiency for the managers so that they will be more effective, efficient and productive in the use of their computers. As can be seen from the discussion in the earlier sections of this chapter, managers who have to learn to use IT as an integral part of their job really require this type of approach (hands on, delivered when they have the need).

The requirement for the learner-centred training delivered in the workplace is the primary focus of the remainder of this thesis. It will draw on the context of the managers in the Malaysian Civil Service but will be generalised to be applicable in any situation where the person who needs to learn has access to computing facilities in their workplace and needs to use these facilities as part of their work.

Work reported in the thesis focusses on the use of networks for collaboration between managers and the delivery of material is making use of the big advances in networking discussed in Chapter 6.

What will be investigated is a computer based support system in the workplace to supplement the more conventional training process already in existence.

The requirements for a support system can be summarised from the literature as follows: -

i) Support system should be match with the task of learners

A number of authors e.g. Booth (1992), Eason (1995), have noted that most existing training is not well matched with the users' task.

ii) Open learning approaches should be taken

Depending on the characteristics to be stressed, open learning has also been called on-demand learning, Mühlhäuser (1995). Reay (1995) provide a theoretical definition of open learning as an approach which takes place in a way and at a time, place and pace convenient to the learners. To some, however, open learning is related to the involvement of telecommunication. In the context of this study, this aspect is covered by the term 'distance learning' (discussed briefly in Chapter 1).

Reay (1994) said that open learning has become effective as a training method over the last ten years, as trainers have learnt more about it and the quality of material has improved. He listed some of the benefits of open learning, which are as follows:

- a) They are freed from conventional time plans and centres. They choose to study at their own time, place and pace
- b) Objectives enable learners to skim over things they can already do, then study carefully when something new comes up
- c) Activities, checks and self-assessments let learners know how well they are progressing, praise correct responses and guide the learners if they've made any errors – in security of privacy

- d) Regular summaries enable learners to review or revise something they studied some time ago
- e) Good materials are stimulating and friendly! The learner wants to carry on
- f) Learners have more control of the learning itself. A good package will help them to develop study skills useful in any future context, and give each one the feeling: 'I'm getting there myself'
- g) Standardization of high quality training throughout a company, without the costs of face-to-face training 'off-the-job'
- h) Minimizes the geographical barriers for national or large regional companies
- i) Shorter lead-time to respond to training needs as they arise
- j) For many smaller companies open learning material can be the first real chance to make essential training cost-effective.

iii) The learner should be able to collaborate with others

Alavi (1994) in his study of collaborative learning identified three attributes of effective learning processes. They are as follows:

- a) Active learning and construction of knowledge
- b) Cooperation and teamwork in learning, and
- c) Learning through problem solving.

Alavi states that collaborative or group learning involves interpersonal processes by which a small group of learners' work together cooperatively to complete a problem-solving task designed to promote learning. Thus, he said, the collaborative learning concept is based on the three premises of effective learning – active, cooperative, and problem solving. Alavi also said that in collaborative learning situations, through conversations, discussion, and debate, participants offer explanation, interpretations, and resolutions to

problems. This leads to active and social construction of knowledge and development and internalization of meaning and understanding. Furthermore, he added that group discussions reveal different views and enable a more comprehensive conception and understanding to emerge.

iv) There should be user support

Damodaran (1986) states that good user support will diminish the incidence of ease-of-use problems. Furthermore, she added that if user support is good, one would anticipate that there will be fewer ease-of-use problems and users will be able effectively to exploit the potential of the system to support their tasks. If user support is weak, skills and knowledge are less likely to develop and the user may make more limited use of the system or, in the extreme case, may conclude that it is too difficult to use, and cease using it.

Damodaran also pointed out that, the normal pattern of training users to a criterion level of skill and knowledge before they embark upon system operation is not likely to be successful with managers. A different method of providing support is required and the evidence suggests that the successful forms will be 'point of need' support methods which involve 'least effort' for the users. It should, of course, be noted that, user support in a distributed situation could be difficult to provide using conventional techniques (e.g. face-to-face teaching). The use of the Internet to provide this support is a major part of the investigation reported in this thesis.

v) Training should be adaptive to the learners

Mühlhäuser (1995) in his study on CAL (Computer Aided Authoring and Learning) said that adaption to the learner has to take into account two major aspects, the learner's individual knowledge or skill level and his

individual preferences. He added that the effect of such adaption will improve learner motivation and increased effectiveness of the learning process.

3.5 Summary

This section considers the relevance of the work that has been reviewed in Chapter 2 as well as that reviewed in this chapter, in the context of this thesis. The next paragraph summarises the situation. Subsequent paragraphs examine the appropriateness of the suggestions made by the various authors in our context.

The focus for the thesis is the provision of assistance on the effective use of IT for Civil Service Managers in Malaysia. These managers who are discretionary users of IT system need assistance when they have a problem. They may have many questions they want answered before they can make effective use of a system. For example, "How do I operate it to do 'x'? What does it mean when it says 'y'?" etc. There may also be a need to develop specific skills, for example, keyboard skills, before they become proficient. When using the system, they may require either an overview to explain the content, and/or a detailed explanation to solve a particular problem. They also need help at any time and at any place when they face problems. With regard to this, it is difficult to provide support to them in a conventional way since they often do not have the time to attend training courses. Moreover, the support structures most frequently used are quite likely to be created dynamically rather than being designed beforehand (e.g. when a new form is to be used for the first time).

Very little of the literature examined in Chapter 2 as well as this chapter is directly relevant to this situation. Many of the studies others have made are in a different context. For example, some (Scotti (1988), Donaldson (1989), Chrisman (1990) and Davis (1993)) discuss the effectiveness of training in a

conventional setting i.e. classroom-based learning. While useful for those who can participate, there can be many managers who cannot do so because of geographical difficulties. However, in this study we are looking at electronic-based collaborative learning settings and the focus is on exploring the feasibility of building a computer supported collaborative community of Malaysian Civil Service managers. This should provide point-of-need assistance. The investigation is to examine the idea that the supporting process as a whole can be distributed and to investigate the hypothesis that this environment will provide a useful support medium for managers. As a learning environment it must overcome the difficulties associated with distance and time. In this context, the study made by Forsyth (1996) has some relevancy in terms of the medium used i.e. the Internet. However, although there are similarities, Forsyth discusses the educational and administrative considerations of course delivery rather than its acceptance to users. By contrast Thomas (1992) focuses on conventional classroom training but looks at the application of Total Quality Management ideas to deliver Total Quality Training (TQT). He offers an analysis of training needs and from there outlines suggested courses of action. While the concept of TQT is potentially of interest, it is difficult to apply it when collaborative distance support is considered where the structure for co-ordination and control is more difficult to implement.

The study by Dugan (1998) touched on Web-based training. However, his study cannot be used in the context of this thesis since his focus is on the employees of the company as a whole. Also, the work reported by him does not assess the role of collaborative learning in a distributed environment. Reay (1995) concisely discussed training methods. He reports on group training and technology-based training, which has some relevance in this study. However, neither Reay nor Dugan cover the particular problem of technology-based distance support for managers.

Eason (1995) discussed human and organisational implications of information technology—particularly in relation to ease of use of IT in the workplace and providing point-of-need support. We have used his ideas in our system especially with regard to point-of-need support but needed to extend this to incorporate distance learning. Damodaran (1986) gives a good report on the concept of user support for managers, although the concept was not discussed in the collaborative support context. However, her discussion on 'point-of-need' support for managers was worthy of inclusion in this study

Alavi (1994) made a study on collaborative learning where she concentrates on the subject from a student standpoint. Her three attributes for providing effective learning have been adopted for use in this work and have, been extended so they are applicable to managers. In addition to that, she used desktop video-conferencing in her empirical study contrast to ours where the medium used is the Internet and the World Wide Web.

Finally, Mühlhäuser (1995) provides a good reference for this study. He examines co-operation among learners in a collaborative learning environment. One of the important facts he mentioned in collaborative distance support for managers is adaptation to learners and this is used as a starting point for this study.

Overall, as can be seen from the discussion above, the majority of the previous work has addressed situation, which, while they have some similarities, also have substantial differences. It has, therefore, been decided that an empirical approach, which involves the development of prototypes, which will be evaluated by the target subjects (the managers), would be most appropriate. In practical terms, the form of interactive development also has the advantage that the managers are encouraged to expect the system that can be delivered.

CHAPTER 4

RESEARCH DESIGN

4.1 Introduction

The previous chapters have explored the way in which training in IT skills for managers have been approached and the problems that have been identified. It has also examined the comments and proposals that have been made for improving the effectiveness of training using computing facilities and has described by way of example the approach adopted by the Malaysian Civil Service in training for IT skills.

Much of the work that has been examined concentrates on the training itself and, where measurements have been made, these also primarily relate to the assimilation of information about the particular computing skills involved (e.g. how proficient the trainee has become with a particular package). However, it is asserted that the primary purpose of training is to enable managers to be able to use computing facilities to perform their work more effectively. In addition to become proficient with those aspects of computing (applications, commands) that they will need to use to perform their work (plus those aspects which members of their staff need to use) requires the manager to:

- apply the techniques they have learned in the performance of their everyday work

- understand enough about what can, and cannot be done using computers to be able to recognise possible opportunities for further improvements and simplifications in the way they and their staff work which could be facilitated by the capabilities of the IT systems available to them.

The hypothesis, which is to be investigated, is that **an effective support system could be constructed which will assist the manager at point of need**. Such a support system must, therefore, be able to offer task-related help to the manager when there is a problem. Ideally such a system would:

- provide current information on the computer applications which are available for the manager to use (i.e. relevant facilities)
- be able to show examples of the use of these facilities for specific tasks which the manager may need to carry out
- be able to give context dependent assistance when the manager is unable to complete a task or is uncertain how a task might be completed.

4.2 Requirements for a Workplace Support System

Based on the above stated goals, the following is a list of the requirements for the Workplace Support System:

i) User Expandable Database of Information

The primary requirement of any such system is that the help or advice that is given is accurate and relevant to the actual situation. In concept what is required is a database containing explanatory text and examples of the

possible situations that might be encountered together with a way of detecting which situation the manager is actually in, in order to be able to present the appropriate assistance. This could be represented as a straightforward information retrieval problem. Unfortunately, in practice, there is no possibility of ever having a complete database and there is also a great deal of difficulty in deciding 'automatically' which situation the user is actually in (in order to determine which piece of advice should be given i.e. which data element to retrieve and present to the user). There are a very large number of possible tasks that the manager might be endeavouring to perform. Each of these is itself dynamic. That is, the facilities offered by the applications expand and change and the tasks which the managers need to accomplish change over time. In addition the way in which various tasks are carried out using the facilities changes (sometimes because new facilities have been provided which are more appropriate for the task in question but sometimes because that task has been re-evaluated and different existing facilities are to be used and sometimes simply to try out an alternative to see if it works better). This as previously stated means that it is impossible to have a complete set of answers to all possible questions. It is similarly impossible to unambiguously recognise the particular situation the manager is in when he makes his request for help. Obviously, if the manager knows what he wants and can express it in the terms, which are used in, the documentation then there is no difficulty in associating the request with the information which will satisfy that request. However, when, as is more normal, the manager is requesting help because he, or she, is uncertain how to proceed (e.g. because they are 'lost') then that person is very unlikely to be using the required terminology and may well be lost because they had taken a 'wrong turning' earlier in the interaction.

What is needed, therefore, is a way of **expanding the help database as new examples are discovered** and a way of exploring with the user what they are trying to achieve in order to enable them to 'match' their context to the possible contexts that are known by the system (or, of course, to

determine that this is a new context which will need material added to the database before effective help can be given).

ii) User Acceptance

The purpose of the research is to investigate some aspects of the feasibility of a suitable support system. However, unless the users are willing to use such a support system there would be no point at all in providing one. Thus, alongside designing a system which might provide the required facilities and producing a trial implementation, it is also necessary to determine whether the managers would be willing and able to use such a system if it were provided. As mentioned in earlier chapters, usability problems seem to be common for IT systems. In many cases a great deal of money and time has been spent in developing the system but it has not been used. In the context of the Malaysian Civil Service, it had also been noticed on occasions that the PC on the manager's desk was effectively an item of decoration. At first the manager had been eager to use the system but this eagerness had subsequently evaporated. What, then was the original motivation to use the equipment and what the demotivation? Coe, 1996 (p.63) said that motivation is a need, desire, or incentive that energises behaviour and directs it toward a goal. It is therefore necessary to ensure that the technical system actually supports the user in the conduct of the job. For a discretionary user acceptability criteria are critical because non-use is a relatively easy option; if the system does not positively help the user to do the job, it does not get used.

A lot of debate over the past several years revolve around the issue of whether IT is actually accepted by its intended users. Davis (1995), said that user acceptance has been viewed as the pivotal factor in determining the success or failure of any information system project. Many theoretical approaches have been proposed in understanding the psychology of user acceptance. Much of this work comes from the field of Management

Information System (MIS), where research seeks to predict how users in an organisation will react to new technologies. Davis, et al. (1989), proposed the Technology Acceptance Model (TAM) which states that user acceptance of any technology is determined by two factors: (i) perceived usefulness, and (ii) perceived ease of use. Perceived usefulness (U) is defined as the degree to which a person believes that use of the system will enhance his or her performance. Perceived ease of use (EOU), on the other hand, is defined as the degree to which a person believes that use of the system will be free from effort.

Hence in order for the support system to be useful, it should be designed to adapt to the users. In this context, adaptation to learners has to support the user's personal learning style, and to provide flexibility at the user interface.

iii) Bridge Distances

Another important requirement concerns location, that is the bridging of distances. Users of this support system are normally not located in the same place. Similarly, the trainers are not located with the managers. In order for the system to be effective, the managers should be offered technical support for communication to permit them to accomplish their task in a co-operative manner. A manager should be given the opportunity to communicate with other managers or ask questions to the trainers. Given this technical precondition, long distance support and learning becomes possible, so that managers or learners can have access to actual information at any time. That is, the system should be able to provide on-line delivery of individualised support and learning material to the user's desktop: point-of-need support and learning on demand.

iv) Feedback

It is important to build feedback into the system. Users depend on feedback to reassure them that they are performing correctly. As mentioned by Coe, 1996, the feedback component of the communication model is often overlooked. He further added that without feedback, communication has not taken place, and without communication, no learning can occur. This conclusion depends on how the feedback is interpreted. If someone receives a report then read it and stores that knowledge away, then learning is not taken place. However, if the person read the report, analyse it and talk about it, (this shows that he has demonstrated feedback, hence 'communication' has taken place) then the person has learned.

v) Platform Independence

The aim of the support system is to give help to users at wherever location they are. They will be accessing the system through a wide variety of computers. These computers might run on the same kind of operating system as the server (where the support system is residing) or might be using different operating system. For example, the support system might run on a server with a Unix operating system but a user might access the system through a PC using Windows. If this is the case, what is needed is a system, which is platform and machine independent. The system needs to be able to run on all major operating system and on any brand of computer – a Mac, a Unix box, a Windows machine or a network computer connected to a TV set. In this way, the system which not only be available to users at different geographical location but also to a user who travels from one place to another place who uses different brand of computers and different type of operating system. Hence the system is flexible and enables it to reach to a huge audience.

The above mentioned requirements itemises the high level design requirements for an effective workplace support system from the manager's point of view. A review of literature and research in this area of training reveals that there was a relatively small amount of available field data on the effectiveness of conventional training methods and even less on the requirements for workplace support. Thus, further information was required on how this group of people (managers) changes its use of IT facilities after training has been given. In addition information need to be gathered about the features required in a workplace support system and the likely acceptability of such a system. It was necessary, therefore, to consult the potential users to find out more about the way the effects of current training and the features they would like in a support system. The initial steps were:

- i) An investigation into the current methods used to train a suitable group of users (managers in the Malaysian Civil Service). The investigation would be intended to determine how the managers view current training procedures and what they might expect to have in order to provide greater support in the future
- ii) To show the managers a single prototype of a help system and ask them to comment on the system and suggest features that they felt would be useful.

The second of these objectives would also, it was hoped, encourage the managers to think about the possible benefits an online support might have.

The remainder of this chapter discusses the method that was used to conduct the investigation. The design of the first prototype support system, the detailed design of the questionnaire and the results obtained are described in chapter 5. The design of the revised support system produced as a result of these investigations is discussed in chapter 6.

4.3 Overview of the Method

The next step to consider is the methodology that is to be employed in this study. Galliers (1985) identified a list of eight major research strategies being used in the information science (IS) field. The list was updated by Galliers (1992) to be as follows: (1) Action research, (2) Simulation, (3) Phenomenological studies, (4) Forecasting, (5) Surveys, (6) Case studies, (7) Laboratory experiment, and (8) Field experiment.

Farhoomand (1992) conducted a survey to investigate the trend in MIS-related research strategies for the period 1977-1985. The majority of empirical studies found Farhoomand followed either case studies or surveys by experiments and field tests.

The case study approach is commonly used especially in the study of less understood issues such as business strategy. Case studies are most appropriate when the researcher is interested in the relation between context and the phenomenon of interest. The researcher has no control over the phenomenon under study, but can control the scope and time of the examination. The researcher may or may not have clearly defined independent and dependent variables.

The strength of the case study approach is that it enables the capture of reality in considerably greater detail than is possible with the survey approach. It is good at identifying new variables and possible relationships. As a result, the case study approach has been found to be very useful for theory building. On the other hand, its weaknesses include the fact that its application is usually restricted to a single organisation or event, and it is difficult to acquire similar data from a statistically meaningful number of similar

organisations. Hence the problems associated with making generalisations from individual case studies (Galliers, 1992). Therefore, its utility in theory testing is limited.

Survey research, on the other hand, involves examination of a phenomenon in a wide variety of natural settings. This examination is essentially a snapshot of practices, situations or views at a particular point in time, undertaken using questionnaires or (structured) interviews, from which inferences may be made (Galliers, 1992). The researcher has very clearly defined independent and dependent variables and a specific model of the expected relationships, which are tested against observations of the phenomenon.

4.4 The Chosen Research Design.

Choosing the best research design is a matter of appropriateness. Oppenheim, (1992), said that no single approach is always or necessarily superior, it all depends on what we need to find out and on the type of question to which we seek an answer.

Since the main aim of this research is to determine how the managers view current training procedures, the survey approach using questionnaires was thought to be more appropriate than the case study approach. Furthermore, they are in different levels and from different department.

There are three different ways in which the questionnaires can be administered: face-to-face interviews, by telephone or by mail.

Face-to-face interviews are best suited to the exploratory stages of research and the main advantage of this method is that the researcher can adapt the questions asked as necessary. The researcher can also pick up the non-verbal cues from the respondent. The main disadvantages of face-to-face

interviews are the geographical limitations they may impose on the surveys and the vast resources needed if such surveys are carried out nationally. There are, therefore, both times consuming and costly.

Telephone interviews are best suited for asking structured questions where responses need to be obtained quickly from a geographically spread sample. The main disadvantage of this method is that the respondent could terminate the interviews without warning or explanation by hanging up the phone.

The mailed questionnaire survey is best employed when a substantial amount of information is to be obtained from a geographically dispersed sample through structured questions, at minimal cost. However, the disadvantage of postal questionnaires is that the response is very poor. A response of 30% is considered as very, very lucky. Furthermore, if there are too many questions, which require effort on the part of the respondents, the non-response rate is very high.

In view of the research objectives, the face-to-face interview approach was chosen as the most appropriate data collection method. In addition to that, the group of users from which data was being collected, are high level managers, hence their numbers are very small. Furthermore, good results could be reasonably expected. However, there could be problems of fixing appointments, because this particular group of people is busy and very often on the move. Also, misleading answers could be given if the question were misunderstood or interpreted in a different context from that which the questioner had in mind.

To minimise those problems the researcher personally stayed with the respondents when they were answering the questionnaire (of course I tried my best not to be biased). Any doubts that the respondents might have regarding any questions were clarified on the spot. The administered interview

also gave the opportunity for researcher to motivate the respondents to give honest answers.

The face-to-face format was also appropriate to enable a demonstration of the prototype help system and was expected to facilitate the process of obtaining feedback and suggestions. The main concern here is the risk of not being accepted by the important individuals (i.e. Director of an organisation) who are being studied, especially on the issue of organisational performance and the success of IT utilisation. However, in this case the interview was needed only to obtain feedback on whether the 'Help System' is useful in giving support to the task in the workplace and to invite suggestions on how it might improved. No sensitive issues would be touched upon during the interview. Even if there were, the researcher would adapt the questions asked in order to avoid problems.

4.4.1 Questionnaire

The designed questionnaire consists of a set of specific questions aimed at assessing the effectiveness of the training given to the Malaysian Civil Service at the managerial level. The questionnaire also helped me to assess the impact of the potential problems that have been described in a previous chapter regarding training in general.

Reliability and validity are the two important aspects of any instrument to be used in any data collection process. In order to ensure the presence of these qualities in my research, I received advice and suggestions from my supervisor Dr. I. A. Newman and from Prof. Ken Eason of the HUSAT Research Centre, Department of Human Science, in designing the questionnaire. I had also sent the questions to seven officers in the Malaysian Public Service in order to obtain their comments on the questionnaires.

The questionnaire has two parts. Refer to Appendix A for details of the Questionnaire. Part 1 consists of four sections, which are as follows:

Section A - questions in this section cover the use of computers

Section B - questions in this section cover training, i.e. whether the participants had attended NCTC's IT training before and whether the training given matched with their work in the office and their expectations before attending the training

Section C - individual data on the participants, i.e. their job title, their age group and whether their formal education included a computing element

Section D - questions about their place of work (department).

Part 2 of the questionnaire, was aimed at assessing the effectiveness of the training given.

In the questionnaire the participants are required to tick one of the boxes provided and there are questions which required participants to give their comments or opinions in the space provided.

4.4.2 The Field Work

The initial investigation and trial of the Help System was conducted in Malaysia from 15th November to 20th December 1997. The objective of this fieldwork was to find out:

- i) the effectiveness of the IT training given by NCTC by determining the strength and weaknesses of the existing training

- ii) the possibilities of providing computer mediated assistance in the workplace as an additional training method.

Feedback from the investigation would be used as a source of information on users' requirements to further improve the 'Help System' as well as allowing identification of what is needed in the training given by NCTC.

In this fieldwork, interviewing was carried out on senior managers who were working in four different Malaysian Government Agencies. Two of the respondents were from the Public Service Department, ten respondents were from the Audit Department, another ten from the Perak State Secretariat Office, and seven were from the Kedah State Secretariat Office.

The location of the agencies is geographically dispersed. The Public Service Department and Audit Department are in Kuala Lumpur, while the Perak and Kedah Secretariat Offices are in the northern region of Malaysia. The Kedah Secretariat office is about 300 miles from Kuala Lumpur and the Perak State Secretariat Office is about 120 miles from Kuala Lumpur.

All respondents had attended the 'Electronic Government' module conducted between April and August 1997. In this module they had been taught about the Internet. Each agency had assigned an officer to help me in identifying respondents and making the appointments. I managed to interview on average about two respondents per day and each interview lasted between two and three hours.

CHAPTER 5

CURRENT TRAINING EXPERIENCE AND REQUIREMENT FOR FUTURE

5.1 Current Support Methods

As has been discussed in earlier chapters, the most common problems in IT training concerns user support. User support plays a vital role in the effectiveness of IT training. With the support, users would have some ideas how to apply whatever they have learned to the task they have in hand. The support given should make them think and view their jobs differently and tackle the task in a more efficient way. They may also be able to decide which facilities on the system are to be used for which task purposes. Support should also help the user feel more confident which should overcome any fear that they have of the new technology.

Following from this, the next thing we would ask is, how the support could be given? In terms of support for training, it can be done in several ways. They are as follows:

i) Human Support

It might be expected that human support would be the most effective since people prefer getting help from people. Also, people understand problems better than manuals do. This kind of support could be provided by either the training provider or in-house technical specialists of the organisation where the user is working. This kind of support is equivalent to roadside

rescue services for motorists. As Eason (1989) mentioned these services are often provided in the form of a telephone 'hot-line' – a permanently manned service whereby any user can discuss problems with a technical expert. In theory these services should provide a very flexible form of support but in practice these services can be very frustrating. Usually the technical specialists or the official support staffs are not always there when the user requires help. Telephone help lines become busy. Also it can be difficult for the user to explain the problem. In practice the user often gets the help from a member of the user's immediate work group. Damodaran (1986) called this person a 'local expert'. However, Eason stated that the disadvantages with this support are that their knowledge may not be very reliable and they could lead their colleagues into bad habits and false beliefs.

ii) Manuals

Usually some references and documentation are provided to a user during training. In principle users can always fall back upon these materials if they run into difficulties. The problem with this is that if the user is not familiar with the material they contain, it can be a very time consuming, and intellectually challenging task, to search the manual to find the single piece of information they need in order to proceed. Furthermore, manuals, even if they are well designed, are under-utilised. As Eason (1989) noted, most users focus on the task in hand and proceed by trial-and-error, using the manual only as a last resort.

iii) On-line Help

Many systems now include some kind of on-line support for users. For example help buttons that give more information about current options, informative error messages when the user is behaving inappropriately, 'pull down' menus which at any time will list the facilities available and demonstration routines and examples to show how facilities could be used.

Eason (1989) said that these facilities could provide a rich and easily accessible learning environment for users but they are often the Cinderella of the system design process, left until last, neglected and starved of resources. As a result when they do exist they are often not very good.

5.2 Requirement for Future

What have been outlined in the above section is some of the methods for supporting managers. However, as has been noted, each has some weaknesses. In this study what will be explored is that to introduce a 'Help System' which can be accessed through Internet. This is a support system, which will suggest to users a solution when they run into difficulties. In addition to that, this system will also provide information on whatever subjects they would like to know especially on materials related to the training that they had just attended. The beauty of this system is that it will also record what the user actually does when working on the computer and accept whatever feedback the user sends regarding the system and 'help' needed by the user. Data recorded through monitoring and feedback obtained from users will be then used by the developer to update and improve the system. By doing this, the system is 'growing' and can be described as a 'live' system, which will continuously update and improve through the feedback sent by users. Hence, the system should give better functionality in terms of a supporting tool for the users. Since the help provided in the system is partially based on the feedback from the user, the system should be able to provide assistance that will relate to the needs of the user. Thus the system should be beneficial to the user.

To test the validity of this proposal it would be necessary to have a suitable group of users who had both a need and responsibility with computer systems as part of their job. Managers in the Malaysian Civil Service meet these criteria. An initial system was developed to investigate whether the

managers might be interested in such a system. The initial investigation was carried out and the detail is explained in the following section.

5.3 The Questionnaire

The questionnaire has two parts. Refer to Appendix A for details of the Questionnaire. Part 1 consists of four sections. Each section is based on 'goal' that was aimed to meet. They are as follows:

- Section A -** Questions in this section concern on usage of computers.
- Section B -** Questions in this section captured data on the training itself i.e. whether the participants had attended NCTC's IT training before and whether the training given match with their work in the office and their expectation before attending the training.
- Section C -** This section captured individual data of the participants' i.e. their job title, their age group and whether their formal education included a computing element.
- Section D -** This section captured data about their place of work (department).

Part 2 of the questionnaire, was aimed at assessing the effectiveness of the given training.

The questionnaire was primarily designed to make it easy for the participants to give answers. Mostly the participants were asked to just to tick

one of the boxes provided. However, there were few questions, which required participants to give their comments or opinions in the space provided.

The following sub-section explains briefly the purpose and objective of each question.

5.3.1 Brief Explanation: Usage of Computers.

This section consists of 6 questions. The aim is to find out regularity of usage, their problems and where do the officers get help in doing their office work.

Question 1. Do you use computers in your Everyday work?

This question concerns with whether the respondents use a computer in handling their everyday work. It is used to separate 'users' from those who attended the NCTC's training just to seek knowledge.

Question 2. If you answered Yes to Q1, how often do you use the computer?

It is important to know how often the officer uses their computer. More frequent use of their computers will be more familiar with the operation of their computer system. Usually these are the group that are actively involved during training and want to know a lot of things.

Question 3. If you answered Yes to Q1, where is the computer situated?

Accessibility is generally recognised to be important to non-computer-oriented users and in practice is a function of the availability of a computer or

terminals. If the person is serious in using a computer, then the computer should be situated not too far from them, i.e. on their desk.

Question 4. Do you have any problem when using the computer?

The aim is to find out, what kind of problems they usually have and where do they get the support. This is being asked in the following questions.

Question 5. If you answered Yes to Q4, please indicate the most common sources of problems: -

This question tells us whether the user's problems relate to hardware or software or both.

Question 6. If you answered Yes to Q4, where do you get help?

This question concerns on where the users get the support. It is important to know whether the user gets support from in-house technical specialists, their local expert, manuals, external or their training provider.

5.3.2 Brief Explanation: Training

This section consists of 6 questions. The main aim is to find out whether the officer had attended a general IT training course before and their evaluation of that training.

Question 1. Have you attended any computer course before (locally or overseas)?

If 'Yes', what was the subject?

It is important to know whether the respondent has attended a computer course before so that we can know whether they have some knowledge about computers.

Question 2. Have you attended NCTC's IT training course before?

If the respondents have attended NCTC's IT training before, then they would be able to compare with the current training.

Question 3. If you answered Yes to Q2, when was the last NCTC's IT training you had attended?

The evaluation would be better if the gap between the last NCTC's IT training and the current training is small.

Question 4. If you answered Yes to Q2, when was the last NCTC's IT training you had attended?

It is extremely important to know whether the training given fulfils the expectation of the trainees. It gives some impact on the effectiveness of the training.

Question 5. Have you since found there were any aspects you needed to know that were not covered in the training?

This question is trying to find out what are the weak points in NCTC's training from trainee's perspective.

Question 6. Does the training given match with the work you are doing?

It is very important to know whether the training given matches with the way the respondent's office works because that will help verify the hypothesis that a good match between training and the operation of their office improves the effectiveness of the training.

5.3.3 Brief Explanation: Individual Data

This section consists of 7 questions. The aim is to determine their knowledge of computers.

Question 1. Your job title

This question is just to make sure that the respondents are from managerial level, which was needed in this study. It was also being used to send the summary of the results to respondents.

Question 2. How long have you been in this department?

This question gives some ideas on the respondent's familiarity with the computer system of their department. The longer the officers serve with the department, the more familiar they might be expected to be with computer systems in the department.

Question 3. What is your age group?

Usually a very senior officer in the department will be responsible for key tasks since they are more experienced and will be the decision-maker in the department.

Question 4. Did your formal education include a computing element?

This question is just to know their background, whether they have some computer knowledge or not.

Question 5. If you answered YES to Q4, which one of the following best describes the formal computing element?

The aim is same as question 4.

Question 6. Which publications, with educational computing interest, do you subscribe to or have reasonable access to?

This question is just trying to know whether respondents have some interest or are knowledgeable in information technology.

5.3.4 Brief Explanation: Department Data

This section has 6 questions. The aim is to find out whether the department puts high emphasis on information technology.

Question 1. Department name and address:

This question is used to send the summary of the results.

Question 2. Is there a computer system in your department?

This question is to find out whether the department puts high emphasis on information technology.

Question 3. If you answered Yes to Q2, then, is the computer system run on PC or Mini or Mainframe?

This question is amplified to Question 2. The study was conducted in 1997 and generally speaking, for the Malaysian Government Department the 'bigger' the computer system gives a picture that the department put high emphasis on IT. They will then have more IT peoples and thus users have better support. They were also being given better training priority from NCTC.

Question 4. How many technical people in your department?

Usually when a department has more technical people then user support will be better.

Question 5. Is there a training unit in your department?

Same as question 4, if there is a training unit in the department, then the user support will be better.

Question 6. Please estimate the budget for IT training for this year?

The bigger the budget for training, the better the support the users might expect.

5.3.5 Brief Explanation: Part II – After Training.

This section consists of 15 questions. Most of the questions were aimed at evaluating the effectiveness of the training method used by NCTC.

Question 1. Is the way in which training given appropriate for your task?

This question is extremely important to know whether the training given matches with the perceived task of the officer.

Question 2. Was any of the information in the module particularly relevant to your situation?

As above, this question is trying to get information whether the training given was relevant to the work of the officer.

Question 3. Were the problems and task data used in the training appropriate for your situation?

Same as above but this question is more specific in the sense that it is trying to ascertain whether the task data and problems given in the training match with the work of the officer.

Question 4. Were any of the materials presented during the training particularly difficult for you to understand?

This question is trying to find out the effectiveness of the given training materials.

Question 5. Does the training given match with the work you are doing?

A straight forward question, trying to ascertain whether the training given matches with the work of the officer.

Question 6. If the training did not fully match with your work, please rank the following as the reason why.

It is essential to know what are the reasons if the training did not fully match with the work of the officer, i.e. whether the subject taught was not relevant, the presentation was too technical, examples used not relevant and so on.

Question 7. What was the best feature of the training?

This question is trying to find the strong point of IT training given by NCTC.

Question 8. What was the worst feature of the training?

This question is trying to find the weak point of IT training given by NCTC.

Question 9. Overall, how would you rate the training in term of its relevancy to your job?

This question is trying to find out whether the training given matched with the task of the officer.

Question 10. Do you think that to be effective, training must be completely integrated directly and clearly to the attainment of organisational goals?

Trying to get the opinion of the trainees that in order for training to be effective, it must be integrated directly and clearly to the attainment of the

organisational goals. This will result in improved productivity of the organisation.

Question 11. After attended NCTC's IT Training, do you feel that you have developed new ideas and new methods of tackling your tasks?

This question is trying to evaluate the effectiveness of the training given by NCTC.

Question 12. After attended the training, do you feel that the training has helped to reduce the problems of 'ease-of-use' of computer systems in your department?

This question tells us whether the training given satisfied the needs of the officer. If the training satisfied the need of the officer, it should also reduce the problem of 'ease-of-use' for the trainees.

Question 13. Has the training given motivated you to go for IT?

Indirectly this question tells us whether the given training was good and had satisfied the need of the trainees.

Question 14. Do you feel there should be any follow-up for the training?

This question is very important to know whether the trainees feel that there should be some kind of support be given to trainees after the training.

Question 15. Will you recommend the NCTC's IT training to other people?

It is important to know how the respondents assess the NCTC's training.

5.4 The Help System

The main objective of this system as mentioned in earlier section is to provide both a monitoring and a help function. What is needed from this system is that it will record the users computer based activity and simultaneously allow us to identify what is needed in the training as well. The system is also intended to provide on line context sensitive help to the users.

5.4.1 Initial Help System

The fieldwork trip included an initial investigation, to help me to assess the effectiveness of the materials in the first version of the Help System. The data collected from this trip assisted me to improve the design of the interface to the system. It also allowed me to improve the content (the help materials themselves) for the enhanced Help System. The enhanced Help System would then be used to investigate the possibilities of providing computer-mediated assistance in the workplace as an additional training support method.

The Help System was demonstrated to each individual respondent, and they were allowed to try it for themselves for as long as they liked (on average each respondents tried it themselves for about 30 minutes). They were then asked to comment on the contents and layout of the system. There were cases where the respondents needed additional time to look through the system before they could give comments and there were times where the system was down due to technical problems (communication lines or server was down). In this case, since the system can be accessed using the Internet,

they could use the system at any other time they liked. The user was given time to try the system before being contacted for their reply. The feedback was very useful and it assisted me to improve the system and in designing the enhanced Help System.

5.5 Experimental Results

Two results were collected. One from the Questionnaire distributed to the respondents and the other one through interviewing the respondents and getting their feedback from the initial Help System they had tried. The following sections describe both results.

5.5.1 Questionnaire Results

The main issues in this study are the relationships between training, task match, ease-of-use, and user support. It was postulated that training would be more effective if it matches with the task, and is followed by support for the user. The support given should make the system easier to use and assist the user to appreciate what can be done with it.

It is sufficient to say at this stage that we assess the effectiveness of NCTC's IT Training with task match, ease-of-use and user support. The questions in the questionnaire were therefore focused on these topics. If we look at question 3 from Part II of the questionnaire,

Were the problems and task data used in the training appropriate for your situation?

78 % of respondents answered YES.

This is supported by the answer to question 5,

Does the training given match with the work you are doing?

73% of respondents answered 'Partly Match'. This implies that there is nothing wrong with the training.

However from question 6 of Part II,

If the training did not fully match with your work, please rank the following as the reason why?

gives the reason 'subject taught totally not relevant to my job' as the highest score. This result appears to be a contradiction to the results for question 3 and 5. During the experimental study, the researcher did explain to all the respondents that, 'totally not relevant' means that the subjects taught not at all match with the task at their workplace, whereas 'partly match' means that there are some relevancy. There is however, reason to believe that, these contradictory results are due to the following problems:

- i) The respondents might have misunderstood the question and be interpreting it differently from what was intended. For example, question 1 of Part II – Is the way in which training given appropriate for your task? Most respondents answered 'appropriate' or 'very appropriate'. When I asked why, they said that from the training, they had learned how to communicate with other officers through e-mail, which is very useful to them. Clearly through my observation, e-mail is only their communication medium and not their main task.
- ii) There is an element of bias. Through my experience working with NCTC, most participants never give 'the best' or 'the worst' rating to any course.
- iii) There is a possibility that, because of some subjects or materials in the course are relevant to them, then the whole course is being rated as 'good'.
- iv) It may be because of good presentation given by the lecturer or of goodwill towards the NCTC.

Rating for other questions, suggest that respondents perceive no weakness in the training given by NCTC. However, this does not imply that we can conclude at this point that there is no scope for improvement in NCTC's training. For example, it may just be that the respondents have currently not experienced better training.

For 'user support', the majority of the respondents, about 86% (Part II question 14) agreed that there should be a follow-up for the training. This suggests to us that, there is a strong belief that for training to be effective it must be followed-up by user support. Perhaps Question 14 ought to have been followed by a question asking about what follow-up should be provided.

5.5.2 Result on the Help System

The same respondents were asked to assess the layout and the contents of the Help System. Because of time constraints, all of them were given about 30 minutes to try it for themselves. All of them were satisfied and said that the system was good and beneficial to them. The subjects were observed during the 30 minutes trial and it did not appear if the subjects had encountered any ease-of-use problems. However, this may be an overstatement of the quality of the system. It could be because subjects are already familiar with the browser (Netscape and Internet Explorer) or it could be due to the duration of the trial, which was too short.

Listed below are some of the comments given by respondents, which should be taken to improve the Help System.

Comments on Layout:

1. There should be a means of previewing pages that might be visited (e.g. clicking and holding down the left mouse button on icon button on

the screen that could cause a description of the target page to be presented).

2. Should make hypertext link to some of the key words on the pages.
3. Navigational buttons (e.g. Home, Internet, and WWW) should be placed on the left of the page.
4. Too much use of dark colors.
5. Should have a search engine.
6. Some of the pictures are not clear.
7. It's good to use Frames on some of the pages.

Comments on the Contents:

Most of the respondents said that the contents are good but would like to add more information.

5.6 Enhanced Help System

The idea behind this Help System is to provide the user with a personal training support system, which enables him or her to learn according to his or her prior knowledge, individual abilities and preferences and adapted to his or her motivational state, needs and learning rate. To realize this, the system should be able to provide with 'point of need support' that is, help and advice on a particular issue at the time when the user was aware that he/she needed help on that issue (the aim is to give support for managers who have relatively unstructured tasks).

The system should also be easy-to-use and involve 'least effort' from the users. As has been pointed out by Demodaran (1986), managers are discretionary users, if they find the system difficult to use, they will tend not to use it.

Besides what has been said above, the aim of the Help System is also to help designer (trainers) with the recording of behavioural process data and analyzing it to provide a diagnosis of the state of the learning process. This is because the materials delivered by the system are the results of the diagnosis and feedback from the user. The system will be continuously updated and improved. In this way the system is said to be 'live' and 'growing'.

To achieve what has been said above, the Enhanced Help System should have the following:

- i) In addition to the existing static search mechanism (using indexes and catalogs), it should provide a search engine. This will make the user easier to look for any information they want.
- ii) A monitoring mechanism that would be able to analyze the traffic flows and measures the effectiveness of the materials in the system as a support for training.
- iii) Feedback from user.

CHAPTER 6

DESIGN OF THE SUPPORT SYSTEM

6.1 Introduction

As described in Chapter 4, a support system would need a database of information about computing topics and their application to specific tasks, which need to be accomplished by the managers using the system. In the first prototype of the Help System, which was described in Chapter 5, the information that was held was related specifically to the use of the Internet and there was no information about how this could be applied to the particular problems encountered by the managers. Nevertheless there was a general acceptance from the managers who tried it that even such a limited system would be useful and would be used. This chapter, therefore, concentrates on exploring the issues in the design of a suitable help system. It concludes by proposing a specific design outline in the form of principles which need to be tested in a working prototype to confirm that the sort of support system which has been envisaged could be implemented in practice and would be both usable and useful. Appropriate methods for testing and evaluating the prototype are also discussed as an integral part of the design process. The following chapters explain how the system was implemented, present the results that were gathered from the experiment and review the design ideas in the light of these results. This approach is based on the assumption that effective design is an iterative process.

The next section of this chapter considers some general design guidelines and the overall design issues for a complete system. Subsequent sections contain an outline design for the prototype and a statement of the assessment criteria.

Although managers in the Malaysian Civil Service were chosen as a suitable group to consider as a specific exemplar, the work reported here is not intended to be restricted to this context. However, it is hoped and expected that the results collected from the work will be applicable to this specific context. Where specific decisions or assumptions need to be made to facilitate design or implementation, then these will be compatible with the conditions experienced by managers in the Malaysian Civil Service unless explicitly stated otherwise.

6.2 General Design Guidelines

In developing the prototype system, it was important to take account and fully understand the needs of the user. Ideally, taking a human computer interaction standpoint, users should be involved at each stage of the design process to help understand and ensure that user requirements have been met. This is not always easy, and when designing for the WWW practically impossible. There are potentially too many users with too many different requirements. However, for the Help System (as has been described in Chapter 5), an initial version was demonstrated to each potential user (managers in the Malaysian Public Service). Their feedback and comments on the contents and layout of the system has been used as a guide in the design of the final system. Additionally the following design principles have been followed:

- * **Keep it simple**

Avoid overwhelming the reader. Pages that contain massive amounts of text are typically not read.

- * **Think usability**

Ensure the design is easy to learn and easy to use.

- * **Include a graphic or two**

Graphics are a great way to provide interest and style to the page.

- * **Use the user's natural conceptual model**

It is important to present only the information that is needed by the user and to provide this in a logical fashion.

- * **Reduce cognitive load**

This concerns designing so that users do not have to remember large amount of details. This can be achieved by using techniques such as selecting from a menu rather than remembering command names, using names for objects rather than numbers and using names and symbols that are meaningful to the user.

- * **Be consistent across the system**

The same command should have the same effect in the same situation. For example, if 'Top' is set up to go back to the top of the page in some pages it should do this in all pages, and not suddenly take the user to just the top of a paragraph, or the top of a contents list. Inconsistency will simply confuse the reader.

6.3 Design Issues

6.3.1 Setting up the Support System.

To appreciate how a suitable help system can be used to increase the effectiveness of user support, it is important to understand how the Help System can be provided on existing hardware. If we refer back to Chapter 4, bridge the distance and feedback are among the requirements for an effective workplace support system. In view of these requirements, the workplace support system, in order to be effective, should be capable of being accessed by users dispersed geographically, and be able to provide feedback to those users. There are two kinds of electronic communication: synchronous and asynchronous. Mason (1998) stated that in synchronous communication, all participants are 'on-line' simultaneously interacting at the same time, A synchronous event typically lasts for about an hour. In asynchronous communication, participants interact over a protracted period of time – days or even weeks – reacting to each other in their own time. In this study, what have been focussed is on asynchronous communication because it overcomes most of the problems experienced by face-to-face meetings. The following discussion first considers the advantages and disadvantages of different ways in which the support service might be provided. The chosen method is then discussed and elaborated.

The possibilities of setting up the support system are as follows:

- i) The Help System could be provided as a web site somewhere centrally and existing web browsers could be used as the means of providing interaction support.
- ii) The Help System could be provided as an application on each machine with its database loaded into the machine.

iii) A special system could be built which links all of the PC's together with one or more central databases – this would allow each PC to access any of the material held on the total system but every PC would have its own copy of the most commonly used material.

iv) A new operating system could be designed which integrates with the Help System – this would run all of the applications.

These possibilities are based on the assumption that most of the potential users would have PCs on their desks which would be used for preparing documents, filling in existing templates, sending messages and preparing reports (including work statistics). These PCs are likely to be connected to the Internet (however, this connection will be lost on occasions). The next sub-section discusses the four possibilities in greater detail.

I) Possibility P1 – Central Web based Help System.

Here, the Help System is provided as a web site and placed on a central server. Users (wherever their location) can use their web browser to link to the server (delivery site) to access the Help System (refer to Figure 6.3.1(1)). This set-up gives flexibility to the user in the sense that they can access the system wherever they are and at any time provided they have an Internet connection. They can access the system during or after working hours, at their home and even, potentially during meetings. This means that the system can be delivered at point-of-need, which is a necessary criterion for an effective user support system. Furthermore, the ability of the system to be accessed at any time convenient to users undoubtedly improves motivation. Users can also use the system according to their preferences and can adapt to their motivational state and need.

In addition to the above, there are other advantages when the Help System is provided as a web site and uses the Internet. Since it uses the communication technology of the Internet, users at geographically different locations can be linked together, thus allowing human networks to be established which play a crucial information role in the system. The link between users at different locations allows interpersonal interactions in a co-operative context and achieves optimal

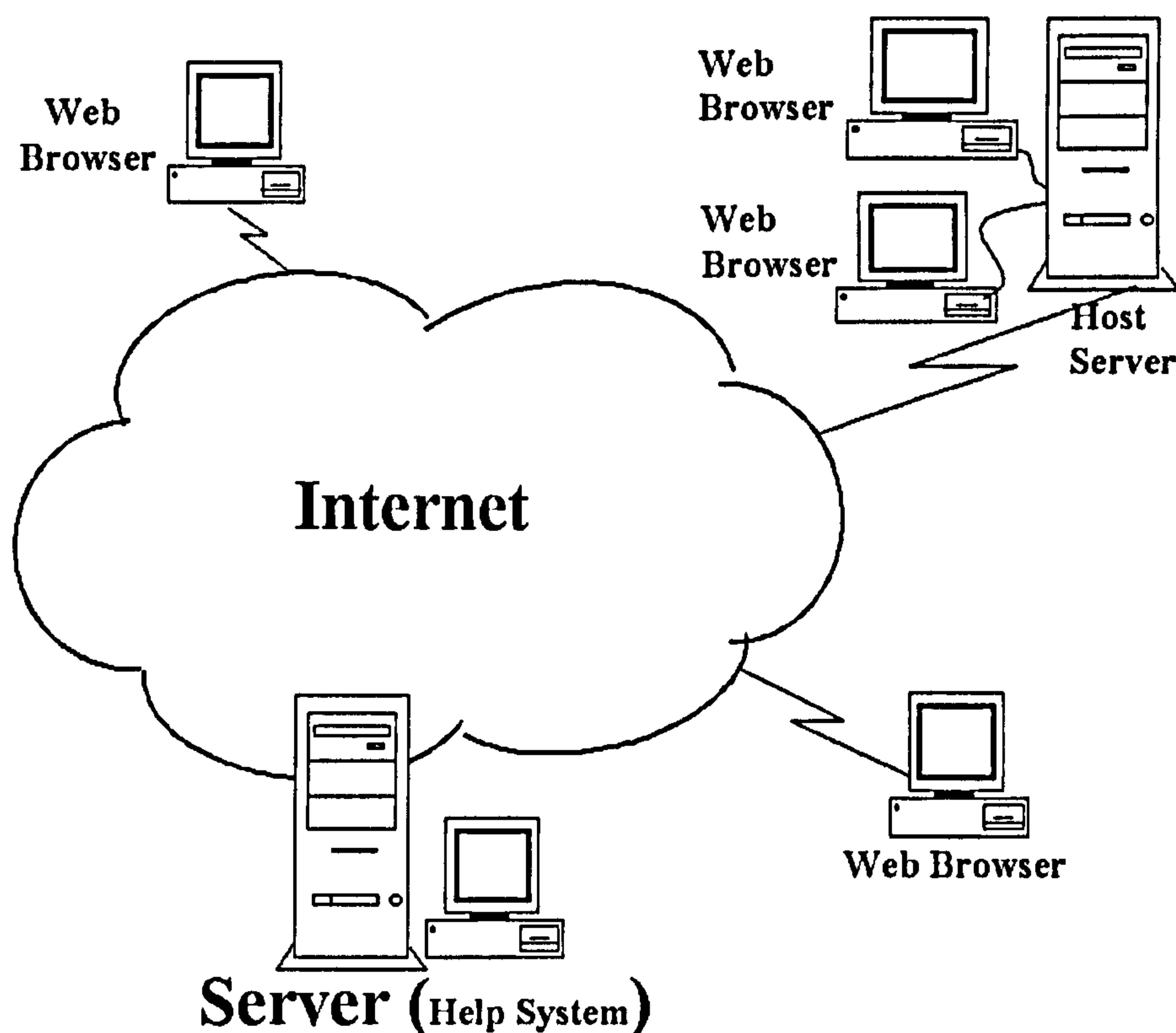


Figure 6.3.1(1): Help System is placed in central server.

effectiveness from the co-operative learning. It permits teamwork and learning within a group of people, which is more exciting and effective. It can be argued that learning is best accomplished in this set-up because it engages

several users in constructing knowledge through acquiring, generating, analyzing, manipulating, and structuring information from the Help System database and other linked information resources. Furthermore, the managers can use creative strategies like brainstorming to solve problems at hand. They can break the 'problem task' into pieces to be tackled separately then integrate the individually solved parts and update the knowledge gained in these parts. Several studies have pointed out the positive motivational and effective cognitive aspects involved in group-oriented learning processes (Alavi, 1994; Pinsonneault & Kraemer, 1990).

Another advantage of this approach is that, since the materials of the system originate from a central source, quality is controllable and there is only one version of the content.

Although the **P1** approach shows many advantages, there are some limitations. First, the facility of the Internet is dependent on the type of browser and enquiry structures available to users. The presentation pages on the Internet might not be very users friendly if the user is accessing on a slow modem, with a different browser and from the opposite side of the country or hemisphere.

Second, making the Help System available on the Internet means that there is a fear of exposing the server system to computer hacking. Although a modern web server is not in itself, a security risk, the publicity associated with the help site may make the server a more probable target for hackers. It is also possible for hackers to disrupt the service by changing messages to or from the Help System while they are in transit on the Internet. Some security measures should be put in place. The first line of defence is to enforce an adequate password-protection mechanism on each and every machine. Most breaks-in are the results of users choosing poor password. Other method could be using encryption technique and for serious security, we need a firewall. Although both risks mentioned above are small, the perception that

they exist may put people off from providing or accessing the service. The focus of this study at this point is not on this issue, hence it will not be discussed further.

Third is the problem created when the server and communication line is down, and in this situation users will not be able to access the Help System. Co-operative learning, on-line communication and solving problems through brainstorming will not be possible in this situation. If such lines were frequently down or out of commission for a long time then the system would not fulfil its function as a user support and information resource. In such a scenario users would refrain from using it.

Other problems are the limitations of computer power (both the central server and user's own computer), ability of the operating system to cope and the Internet connect costs through either a WAN or connection to a commercial server such as CompuServe.

II) Possibility P2 – The Help System residing in each individual machine of the user

The main problem with the first set-up is breakdown of connectivity when the server or communication line is down. One of the possibilities of eliminating this problem is by not using the network. Therefore, in this second set-up, the Help System and its database are loaded into each PC of the user as an application system. In this set-up, the user still has the flexibility of accessing the Help System as mentioned in the first set-up, i.e. they can access the system at wherever location they are and at any time they like (of course their PC/notebook loaded with the Help System needs to be with them wherever they go).

Although problems of loss of server/communication line have been avoided, this approach has its limitations. The biggest disadvantage in this set-up is that there is no interactivity either among the users or between a user and the developers. Hence, users will not get feedback and co-operation and teamwork in learning will not be established. Users will now depend completely on the contents of the Help System and its database at the time when it was first loaded into the PC (of course the system can be updated but, if this is left to individual users, it is unlikely to happen). As a result of this, users cannot be linked to external resources (since it is not connected to the Internet network) and users will not be able to exchange information through the system or be able to receive the latest materials or contents of the system.

Even though interactivity (using PCs) cannot be accomplished in this set-up, users can still revert to the traditional phone call to other users or to the developer whenever they wish to discuss or explore certain information in the Help System. Moreover, this may take time (persons might not be at the place they were called to) and is ineffective, defeating the purpose of the system, which is to provide point of need support. Furthermore, if the support needed is critical and requires lengthy explanation, using a telephone call might not produce an effective answer.

In the experimental study on collaborative learning conducted by Thomas & Carswell (2000), students expressed the view that email was more 'immediate' than the telephone. Email were guaranteed to receive a response within a short period of time whereas with the telephone it was not guaranteed to make contact with the tutor at the time wanted and, as a result, would not get a response to immediate needs.

Another disadvantage with this set-up is that it will be difficult to update the Help System and its database if it is placed in the user's PC and is not connected to the Internet network. It is impractical for the developer to go to

each individual user and update with the latest copies of the system and its database. There are many users and they are geographically dispersed.

The Help System is being designed in such a way that it will continuously keep a history of the interaction capturing tasks performed by the users and keywords searched by users, which are not in the database. Although, the system can accomplish this function automatically, the information gathered cannot easily be shared with other users. Thus, it is preferable to have the Help System in a server.

Another limitation is that, it will be difficult, with this approach, to monitor the effectiveness of the Help System since the users are at dispersed location, hence without in an interconnecting network and very unlikely that collaborative learning have taken place.

Possibility P2 seems does not meet some of the requirements in this study, however it is presented here to give total idea to the reader of the possibilities. Furthermore, if the Help System is to be implemented in Malaysia, some head of Department in Malaysian Civil Service might like to have it in this way (for a short duration).

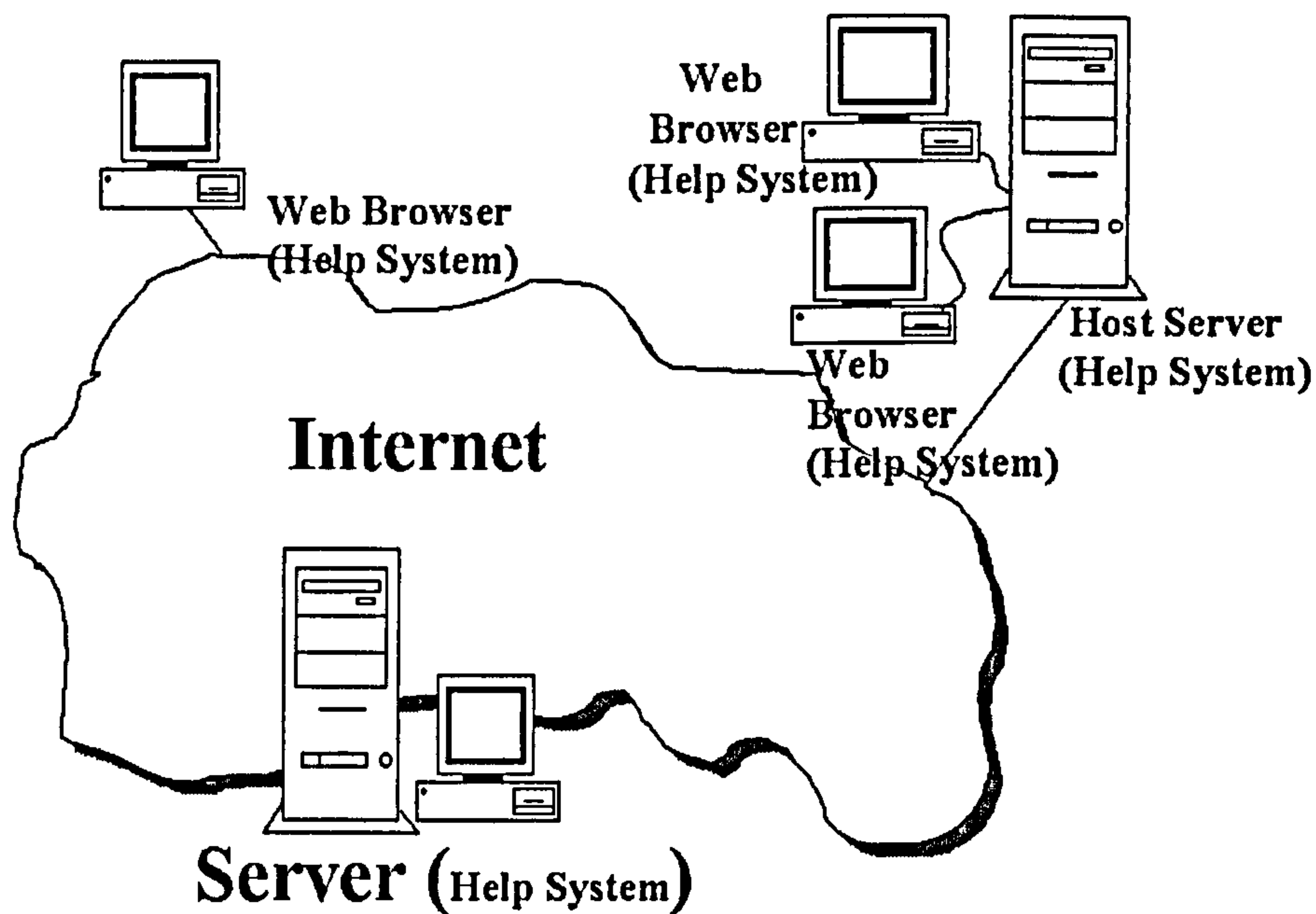
III) Possibility P3 – Central databases plus a copy of the Help System in each individual PC of users.

The Help System is placed in the server of the Intranet network of organisations. However, sometimes the communication link or the server could be down. Hence, to make sure that users can still use the Help System in this situation, a copy of the Help System can also be placed in each individual PC of the user, as an application system. Obviously, if a user's computer is not working, then he/she will still not be able to access the Help System. However, if it is merely a server or communication failure, the

information that is currently in the system can be used and information about using of the system can be recorded. This set-up allows users to use the Help System wherever they are and at whatever time they wish.

In this set-up the Help System is placed in one or more central databases which are linked to the Internet so that users can access it from anywhere. In addition, each user's PC will be loaded with a copy of the most commonly used materials of the Help System so that when the server or the communication line is down, the system can still be used (Figure 6.3.1(2)).

This set-up is the best of the three discussed so far because it is linked to the Internet network, and therefore interactivity between users and developer site can be established. Similar to the first approach (P1), this set-up allows collaborative learning whereby each user can improve their mental models through on-line discussions and information sharing while working on a problem task. In addition to this, since this system is connected to the Internet, users can get a feedback from the developer's site or other users. The main advantage that this set-up has over the first approach is that there will be no situation in which the users cannot be connected to the Help System. If the Internet network is down, then users will always be able to access the Help System which resides in their PCs. Hence continuous support is always available to users.



**Figure 6.3.1(2): Help System placed in a few servers
(Developer server and Intranet server)
plus in each individual PCs of users.**

IV) Possibility P4 – A new operating system could be design to integrate with the Help System.

The three approaches that have been mentioned so far have one common limitation. Although they can record information about how the help system is used (e.g. what requests have been made), they cannot record which other applications have been run or how they have been used. It is also not possible to determine when they pause and for how long. This extra information would help us to know what users are trying to do and where they get stuck. This idea is good but is very difficult to achieve. In order to

implement it, a special operating system that integrates with the Help System would need to be developed. This is very difficult to do, expensive and needs more time.

6.3.2 The Chosen Set-up

In the prototype system, approach **P1** was chosen. It is placed in a server (**avarice.lboro.ac.uk**) and linked to the Internet. It can be accessed by Internet users using the URL address;

<http://avarice.lboro.ac.uk/~comh1/netpg1F.html>.

Although this set-up has limitations, as mentioned in the above section, it is adequate enough to be used as a vehicle for investigating the facilities to be provided in a point of need support system. Furthermore, it could be extended to offer the capabilities suggested in **P3** relatively straightforwardly if it proved successful.

6.3.3 Information in the Database

As mentioned in Chapter 4, we need a database of information. With so many support calls covering different topics, the most important issue here is knowing where to start. There is a tendency to build large, all-encompassing applications that address the most complex problems. However, what is required for this study is a demonstration that a system, which contains some information and the capability to add more, would be useful and usable.

In most organisations, there are two types of support needed. One is information system support, which focuses on system-related problems that

affect the availability and performance of production systems, applications, and corporate networks. These problems require a high degree of expertise to solve.

The other kind of support (which is the focus of this study) is a support that addresses user problems that affect individual performance and productivity. In this case the difficult issue is not the complexity of the problems but the sheer volume of calls and the need to provide information which is relevant to the person requesting support. Many of the queries are not actual problems but requests for guidance and direction on how to use a particular application or how to perform a specific task. The queries are usually simple and often repetitive, for example how to copy files, how to attach a document to e-mail, how to create a table using Word and so on. In addition to that, the user usually wants to know instantly the meaning of any words that have crossed their mind and will require technical terms to be explained when they are encountered (e.g. 'What is Internet', 'What are superhighways'). They will often hesitate to ask technical people or their colleagues about these problems for fear of looking foolish. In other words, they need ready access to product knowledge.

The ultimate objective for a support system for managers would be to provide a comprehensive and evolving database that provides assistance on all of the topics that the managers may require assistance. However, what needs to be demonstrated in the context of the present research is that a useful computer based support system can be provided. It starts with a relatively small database and has the capability of growing by adding information both as it becomes available as, and when, it is requested. Unless it can be guaranteed that a 'stable' state has been reached where no new problems ever occur, it is obviously impossible for any support system to contain the information, which would solve all of the problems that might, encountered. Furthermore, even for 'known' problems (i.e. ones for which a solution exists in the system) 'completeness' cannot be reached until all of the

ways in which users (managers) might perceive and express their problems are also encapsulated within the system.

In order to demonstrate the principles so that the ideas could be tested, the initial contents of the prototype system were chosen to be:

- a database containing information about the Internet
- examples of the usage of specific features in a commonly used word-processing package.

The internet information had been used as the basis of the help system which had already been demonstrated to managers in the Malaysian Civil Service and which they had already said that they found useful. Also, since the Internet would be used as one of the underlying technologies to implement the system and thereby provide communications and information updating facilities, as discussed earlier, it is reasonable to suppose that information about the Internet would be needed by managers as part of the support system.

The second component was included to demonstrate the concept of providing support for packages, which the managers used on their machines. Word-processing was chosen since it is one of the most common uses of computer systems by managers and the Microsoft Word package was selected as being suitably representative.

In both cases the key issues are to investigate:

- the usefulness of the existing information
- the effectiveness of the retrieval mechanisms in finding existing information
- the ability of the system to identify a failure to find useful information and to notify an appropriate person who may be able to assist

- the ability of the system to update the information in the system as a by-product of passing a reply back to the original enquirer.

6.3.4 Design Issues – Dynamic and Learning System

The next main issue to be addressed is on the systems dynamic and learning capabilities.

The founding ethos of the Internet was a spirit of co-operation and coexistence, where share and share alike was expected behaviour (Horton, 1996, p.4). If anyone had a particular skill, a special knowledge, or an area of interest that others could share, they may want to provide this knowledge in a Web page or related resource. The Web is then a great forum for personal expression and sharing ideas and topics of interest with others around the world. This is what has been designed for the Help System - a system that supports users as well as providing a platform for users to share knowledge.

Most Web sites today are just pages of text that provide static information. Where there are multiple pages or a single site they are usually organised hierarchically or as a simple network. As an example, a user can click on a topic on the main page, and the system will link the user to a page that describes the topic in detail. This would represent a two level hierarchy. If there is a 'home' button in the detail pages then this is a network. However in these cases the system does not provide an opportunity for the user to interact and give their ideas. Interactivity in this context is not only enabling visitors to branch off to areas that interest them or to explore topics in greater levels of detail, and to jump to related topics but it is more than that. It means that the system should enable users to search databases, interact with developers through feedback pages and also enabling users to interact with

each other. In a user support system, interaction is necessary because it builds partnerships between the users and provides a means of knowledge transfer. If the developer also uses the system (e.g. during testing) this helps build a partnership in which users can contribute to the development and assists the developer to understand their needs, expectations and cognitive processes. As stated by Coe (1996, p.177), building user partnerships is the bridge between human factors theory and human factors application in technical communication. He further added that, it is impossible to create user-centred information without having an ongoing, dynamic relationship with users. Hence, to be effective, the system should be interactive and dynamic.

In the case of the Help System, besides allowing a user to give feedback, it is also monitoring what the user does. For example, it tracks down the pages which the user goes, and thus what information the user accesses and which pages the user regularly visits and also the information, such as search terms, questions and answers to questions which the user keys in. That is, the Help System captures information about the site's visitors and updates its database accordingly. This information is useful and the data collected is then used to update the database. Through this it would be able to demonstrate knowledge growth.

When users are provided with facilities to interact with each other and be able to give their own ideas, this should motivate them. Users should feel that the system is theirs. These feelings of ownership should keep them coming back to use the system. This is the strategy - encourage and motivate users to use the system as regularly as possible. The system greatly depends on the frequency of usage as well as the number of users to speed up its knowledge growth. This process of learning (collecting information from users and at the same time updating the database) goes on and on and this would transform the system into a 'living' entity. It is similar to us as a human being whereby we learn as we grow up by constantly reviewing everything that is happening to us and around us and also through information we acquire from

other fellow human being. The only difference is that in human beings the person himself pick up the information and transforms it into knowledge but in the Help System users provide the information and they actually make the system learn.

Figure 6.3.4(1), illustrates the process flow for updating the database. As an example (Figure 6.3.4(1)-a), when a user requests information through the browser, the request is sent to the server which then communicates through appropriate interface to search the required information in the database. For systems which have learning capabilities, the interaction (request) provides information (e.g. user identity, the request itself) which is then stored in the database.

In Figure 6.3.4(1)-b, the server searches the information for request1 in its database (DB1). If the required information is in the database, it will then be displayed to user through the browser. If the required information is not in the database (DB1), the information about the request is then added to DB1 to create DB2 (Figure 6.3.4(1)-c).

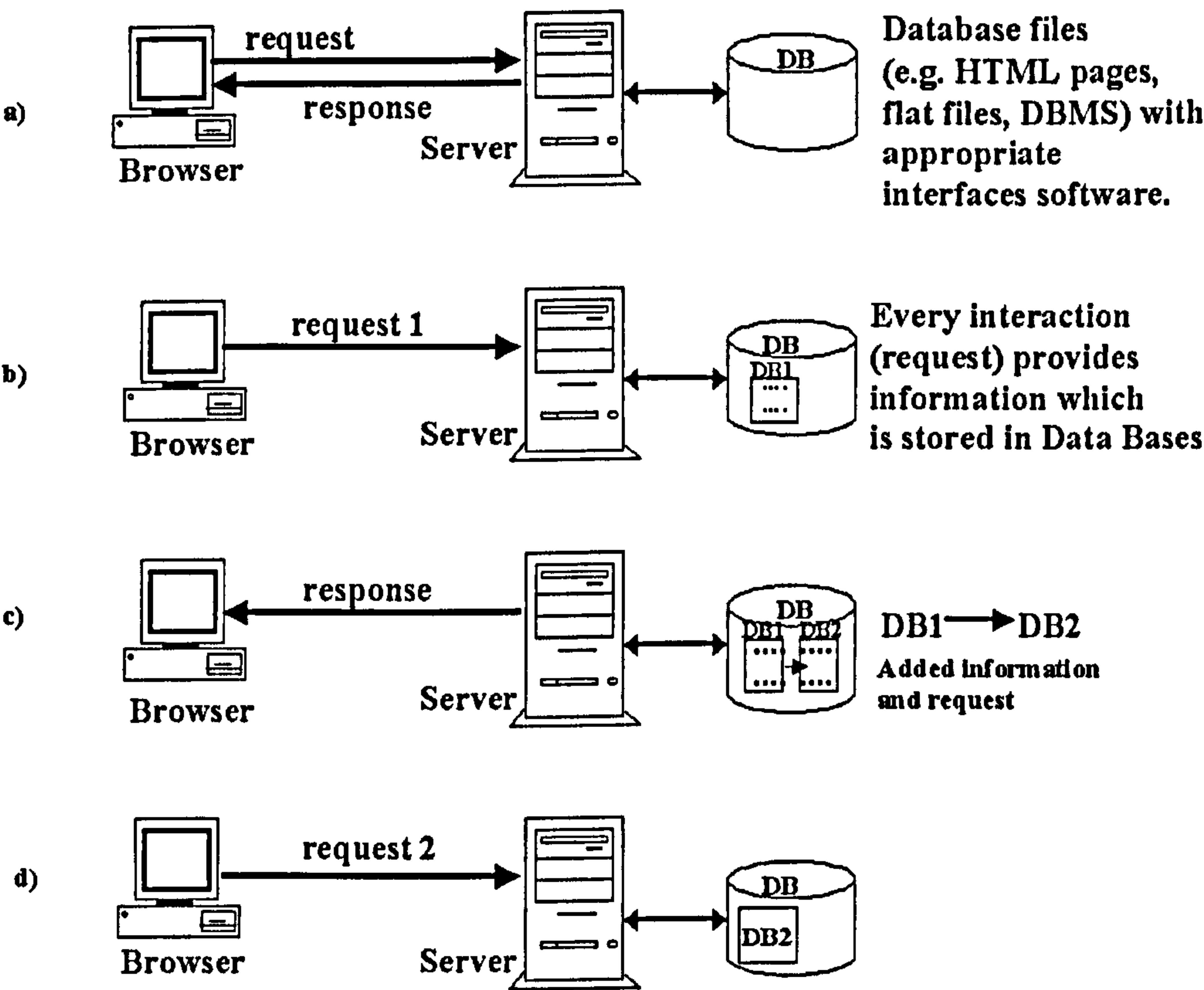


Figure 6.3.4(1): Process Flow for Updating Database.

If a user requests something, which the system does not apparently contain, then the response in a non-learning system might be - 'No information available'. However in a learning system, the response might be - 'No information currently available, but your question will be included in the "unanswered question section". If we receive an answer we will e-mail you (if we have your e-mail) and it will be entered into the system'. However, there should be a time limit on responding to queries that could not be answered immediately.

Several cases can be considered now. For example if another user asks for the same information, it is possible to tell them there have been previous queries. Also, if another user has information, which might answer the question, this can be added to the system and forwarded to the requester.

Figure 6.3.4(1)-d, shows another request (i.e. request 2) and the requester now, can view the response (if available) in the updated database DB2.

In addition to this, in the learning system, it is possible for a manager or other users to look and to see which items of information (pages) have been accessed and which haven't and also to see who has been using the system. There is an ethical issue here since the system allows a user to see at whatever other users is doing. Technically, this is a direct opposition to usability. However, if a person is genuinely want to learn and get help from others, why should be shy or reluctance to let people to look at what information we access or what question we had 'publish'. After all they are all managers.

This information can be used to provide alternative structures for people to view the information. It should also be possible for some or all of the users to choose not to receive updated information from the database until or unless it has been validated to their satisfaction.

To achieve such services that have been described above, we need some means by which the server can interface to the database and other application programs. Technically we cannot alone use HTML, since it has no facilities to directly query a database. Two methods of accomplishing this will briefly be discussed below. The first is by using CGI (Common Gateway Interface) scripts. Through CGI this capability exists. The second is using an 'embedded' language within the page (e.g. JavaScript or Java).

Utilising CGI scripts a request or feedback from the user can be sent from within HTML, and processed by the HTTP server, to query or update the database for specific information.

The process is described in the following five steps (refer to Figure 6.3.4(2)).

Step 1: A user, accessing the Help System (through a browser), sends a request to the server as a URL (using HTTP). This URL constitutes a request to execute a CGI program. The HTTP message, which accompanies the URL, will contain parameters, which are processed by the CGI program.

Step 2: The server receives the request from the browser, processes the URL, as a request to execute a CGI program. The HTTP server initiates the CGI program's execution by calling it and passing it the parameters that were received from the browser.

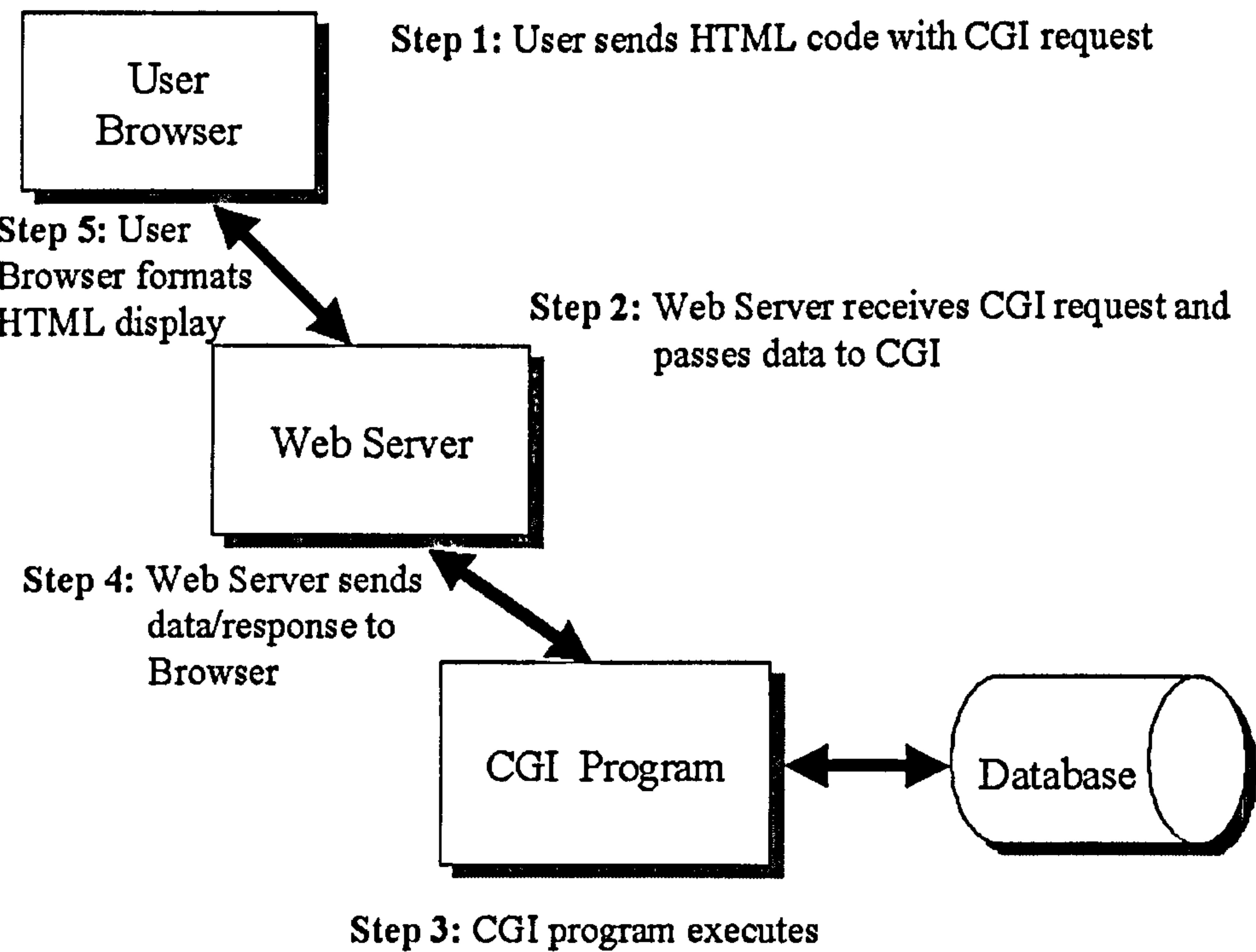


Figure 6.3.4(2): CGI Process Flow.

Step 3: The CGI program executes. In its execution, it may:

Access the database to construct the reply.

Updates the database to contain information about the request.

Step 4: The HTTP server receives a result set from the CGI program and sends the data (response) back to the browser, normally as an HTML 'page' using HTTP.

Step 5: The browser receives the HTML sent to it from the server and formats and displays the data received.

The alternative, utilising programs embedded in the page has a number of similarities but also some differences. The browser still sends a URL with parameters but in this case the URL identifies a page rather than a CGI script in the server. The return page either contains the 'program' actually as part of the text of the page (JavaScript) or contains a reference (URL) to a further Internet object, which actually contains the program (JAVA).

6.3.5 Design Issues - Searching the databases

There are many different techniques behind making a site searchable. All of them require a search engine. Search engines are a tool, which can be used to help enquirers to find relevant information on a site. Any search system has a number of components. A typical set could be:

- 1) A 'collector' which identifies the page on a site – this could be a hand maintained file containing a list of URLs but is more usually a link follower (web-crawler) with rules about what links it should follow to stay 'on-site'.

2) An 'indexer' which produces an index which 'maps' from key words or key phrases to pages (URLs) on the site, this might, for instance, read all the identified pages and extract key words or phrases from the pages using some predefined algorithm.

3) A 'search system' with which the browser interacts – this normally uses one page to collect a search expression from the user then uses the index to find a list of pages which might satisfy the enquiry and displays the list (or section of it) as another page for the user to choose from. The displayed list can be either a list of possible hits that satisfy the enquiry or a list of possible questions for which answers exist.

Searching using a search system of this type can provide fast searches, but has the drawback that all users do not necessarily use a particular word to mean the same thing. Thus, there can be several pages, which are potentially appropriate to a particular search item, which are not all of the same sort. For example 'report' can be a noise (e.g. the noise of a gunshot) as well as a document and 'sheet' would be bed sheet, paper sheet, metal sheet or even a rope on a yacht. In this case, it is desirable to cut down the alternatives i.e. to help the user to refine or clarify the query. One way of doing this is to offer the user a clue of possible 'meanings' for the word. For example, The UK Global Environmental Network for Information Exchange (GENIE) system (Figure 6.3.5(1)) does this by letting possible 'concepts' or terms. Another search engine Ask Jeeves does this by listing questions for which answers are available. This latter approach will be used in the search system for this project. The reason for choosing this approach is because learning is based around getting answers to questions.

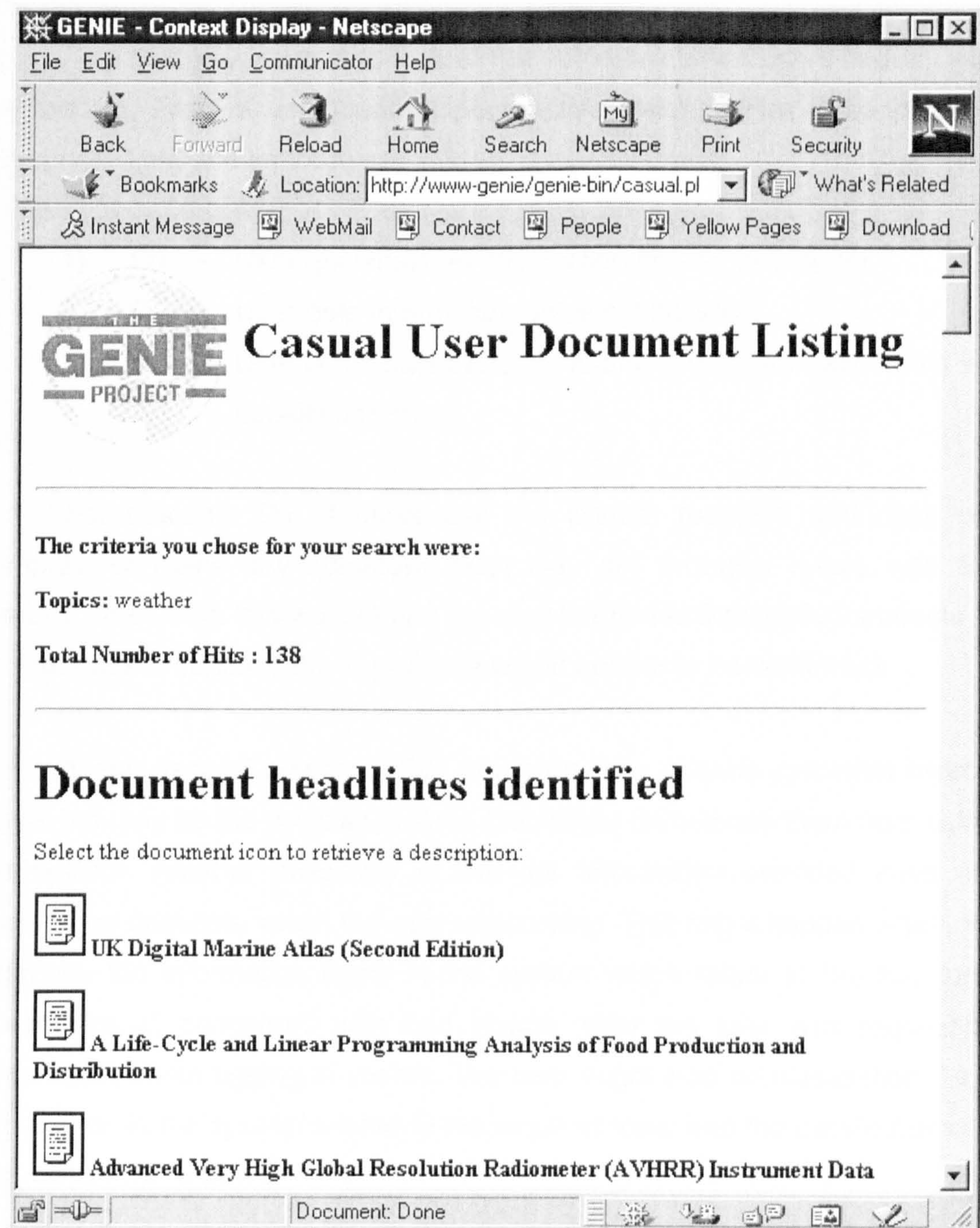


Figure 6.3.5(1): List of document titles indexed by the Topic phrase: 'weather'.

6.3.6 Design Issues – Outcome from users interaction

The next key issue is to look at the outcomes when users interact with the system. From a user centred perspective there will be three possible outcomes. They are as follows:

- 1) **O1** - User get whatever information he/she looking for.
- 2) **O2** - User gets information but is not satisfied.
- 3) **O3** - User is not successful in obtaining the information (and is usually unhappy).

For outcome **O1**, if users use the system regularly and does not complain or make any comment, then they are probably happy with the system. To confirm this we can ask the user to provide feedback/comments. If no feedback is supplied the hypothesis would appear to be confirmed.

In the second outcome (**O2**), the user may actually get what he/she wants but may be the process is slow. This might demotivate them from using the system. Another possibility is that the information provided does not answer the question, which the user was asking. This might happen when, for example, the information items in the system which relate to the key term 'sheet' are all concerned with bed sheets while the user was requesting information about rigging in yachts. The user might also be dissatisfied if the information in the system related to the required topic was too detailed or was not sufficiently detailed.

In the second case it is not self-evident within the system that the user has not received a satisfactory answer. It is important, therefore to give the user the opportunity to identify this situation to the system and to explain what the problem is perceived to be. This can be achieved using a 'comment' or 'feedback' capability within the system.

In the third outcome (O3), the user did not receive any information. In this situation, the system could not match the query by the user with information in the database. This fact will be recorded in the database. The user will be asked if they have further information (as feedback). This will also be recorded in the database. Subsequent users can ask about unanswered questions and may then provide answers.

6.3.7 Design Issues – Adding Information

The next question to ask as a design issue is 'If a user gives a feedback which contains new information, then where should the information be placed in the existing database structure?'

There are two aspects of this question;

- 1) How, if at all, can the information be found from a search?
- 2) How, if at all, can the information be found as a result of browsing (following the hierarchy)?

In the first case (search), if new information is the answer to a question, either one which has not yet been answered or one which already has one or more answers, then a search which identifies the question will now provide access to the new information.

However, if the new information was not provided as an answer to an existing question then it is necessary to ask what question or questions is this information an answer to. This is the equivalent of asking for concepts, which the new information relates to in the GENIE approach. The user providing the new information must be asked if they wish to supply appropriate question when they provide the information.

In the second case (browse), there are three possibilities. The first is that the new information is about a completely new topic, one, which is not covered at all by the existing browse structure. In this case a new 'root' for the browse tree needs to be introduced which has two entries. One is leading to the original browse tree and the other to the new information.

The second possibility is that the new information 'belongs' to a sub-node within the existing tree. In this case it is only necessary to add an entry in the sub-node which leads to the new information.

The third possibility is that the new information is a supplement to an existing information item. In this case the tree is being extended by an additional level.

These possibilities will be illustrated in the context of the Internet information system described in Chapter 5. To recap, the structure of the system is as shown in Figure 6.3.7(1) and it consists of information on Internet.

Assuming that a user gives feedback, which contains new information such as, 'how to create a table using Microsoft Word'. This is a completely new subject area. Since it is a new subject area, then a new root is created which has two link entries. One to the original browse tree and the other to the new information. This is shown in figure 6.3.7(2).

If the new information provided by the user is related to the Internet but it is a new topic such as, 'security on the Internet' then a new sub-node is created within the existing structure that has a link to a new page (contains information about 'security on the Internet'). This is shown in figure 6.3.7(3).

If a user provides new information, for example 'What is Hypertext Markup Language (HTML)' and the current database has information about

‘What is hypertext’. Clearly these questions are about the same topic. The difference is that HTML is a language used to create pages and links on the Web. On the other hand, hypertext is text that uses HTML code that contains links to other pages on the Web. In these circumstances, it might be decided that these two pages should branch out from the same parent (node) as illustrated in figure 6.3.7(4).

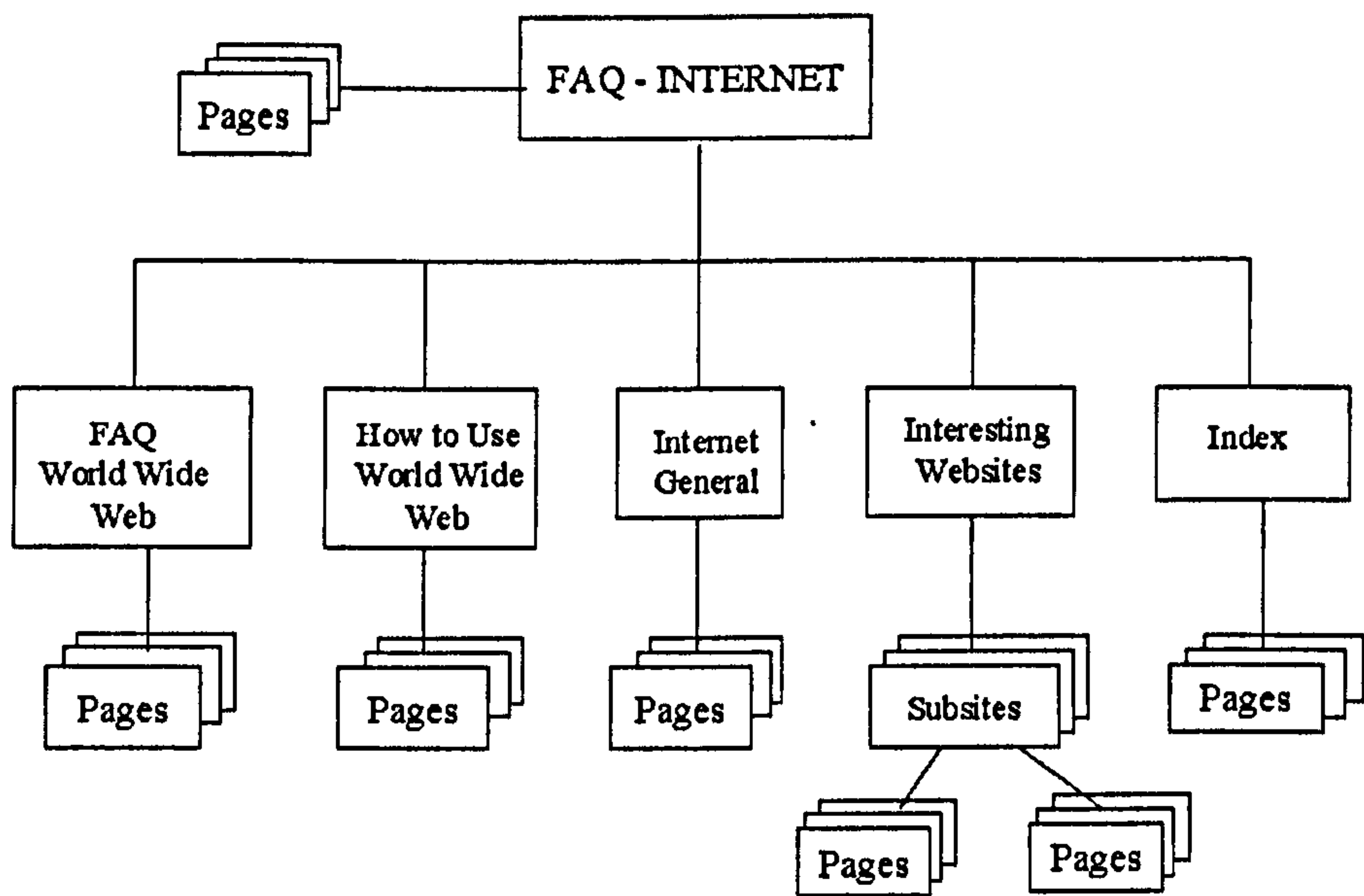


Figure 6.3.7(1) – Existing structure for Internet Information System.

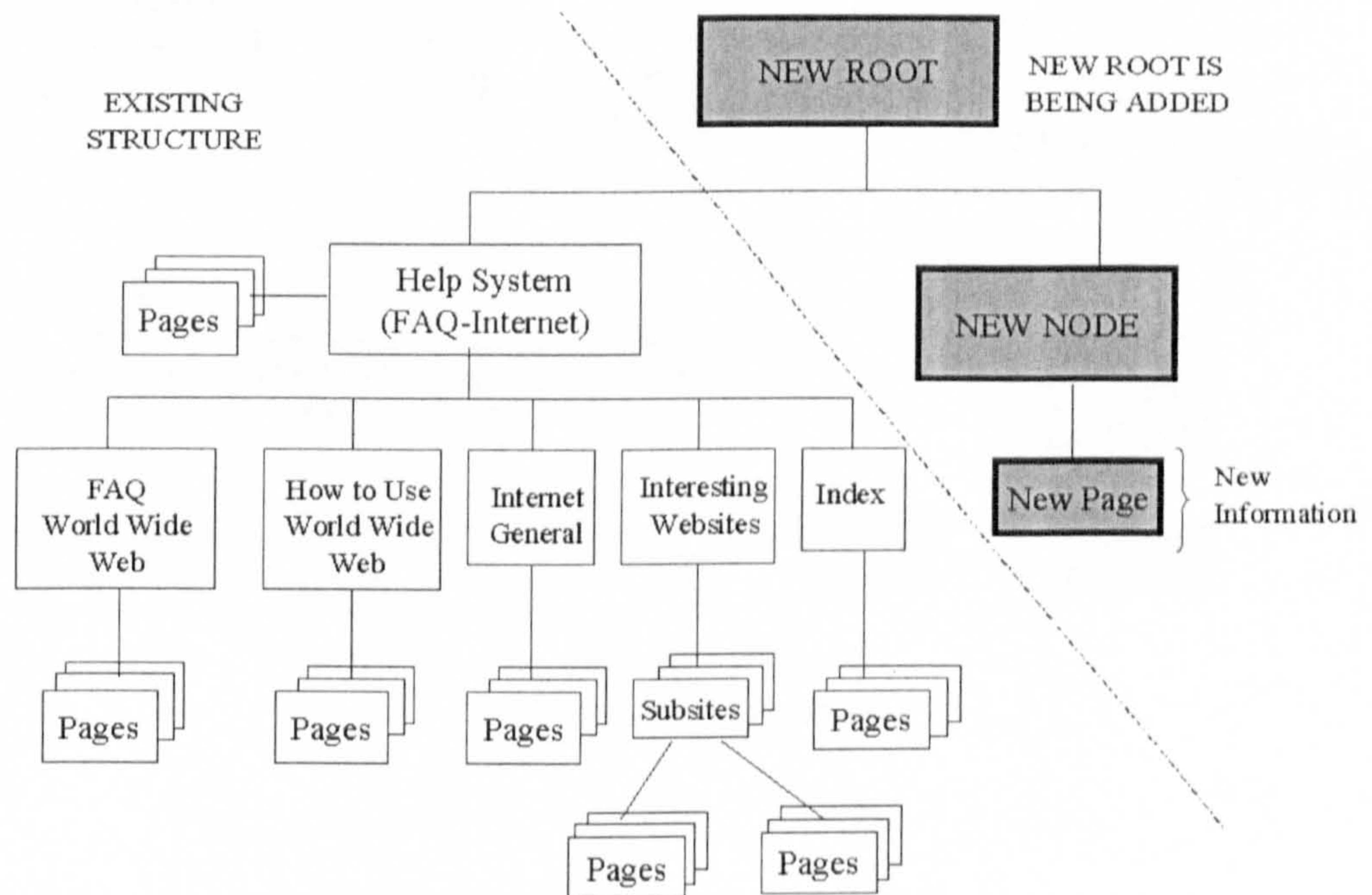


Figure 6.3.7(2): New root is added to accommodate new subject area.

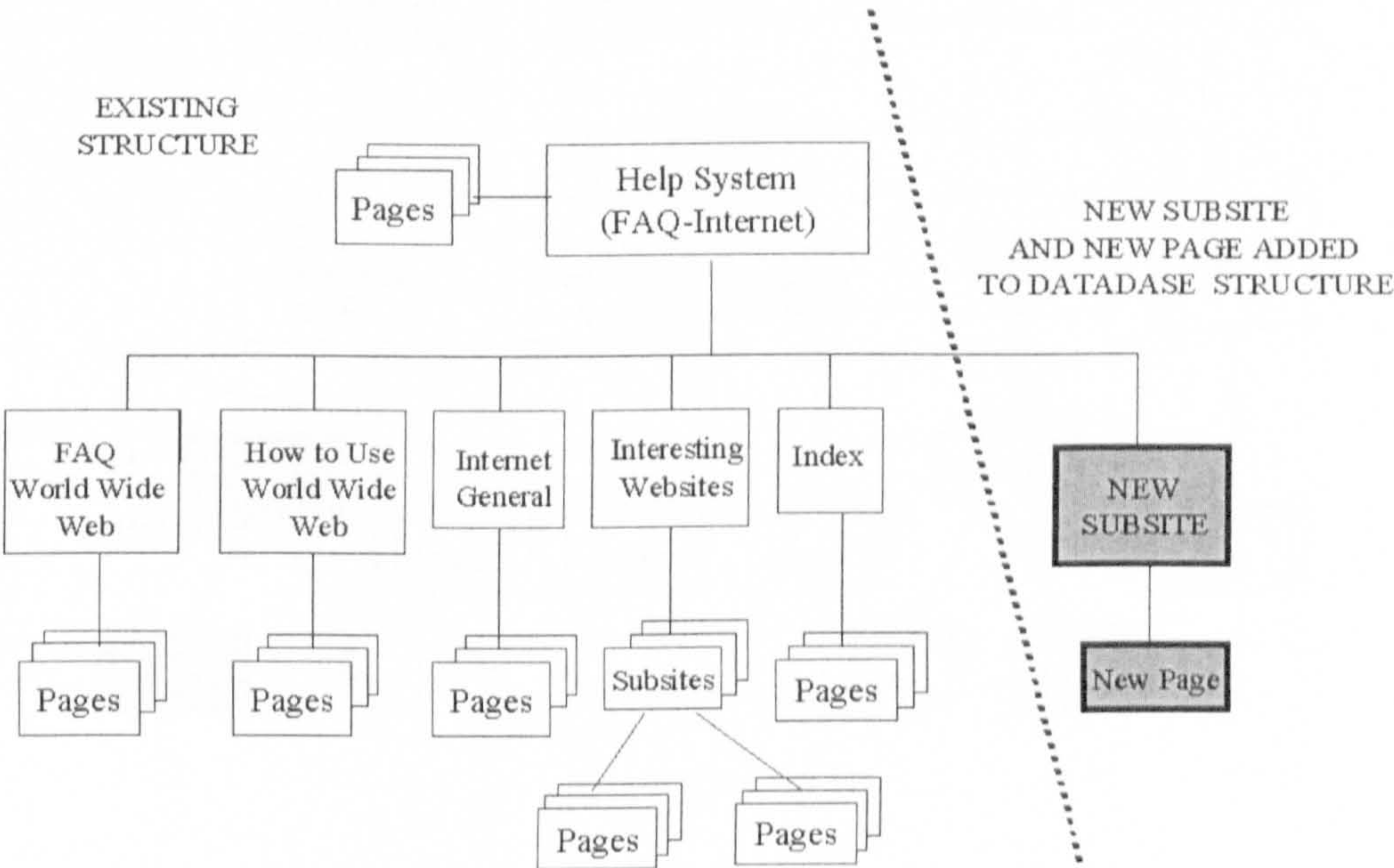


Figure 6.3.7(3): A new subsite with a new page added to database.

CHAPTER 7

IMPLEMENTATION OF THE SUPPORT SYSTEM

7.1 Introduction

This chapter describes the implementation of a support system based on the initial Help System described in Chapter 5, the feedback received from the users and the design issues considered in Chapter 6.

As discussed previously, this implementation was intended to investigate the possibility of providing a user managed help system where the information in the system is provided and updated by users based on their usage. The World Wide Web is an appropriate environment in which to perform this investigation.

The next subsection discusses the general approach taken in the implementation for the wide variation in browsers that users could potentially use to access such system. The following subsection describes the implementation of an improved version of the original Help System incorporating the additional facilities requested by the users during the trial. This version includes search facilities implemented using Java Applets and feedback obtained via e-mail. The final subsection of this chapter describes a reimplementing using CGI scripts, which demonstrate the systems capability of monitoring users' activities. This subsection also contains the results of user evaluation of this version. Chapter 8 describes an extended implementation of the cgi-based system and a further user evaluation.

7.2 Constraints

There is wide variety of users' computers that could potentially access a web-based support system. Each and every one of them can read HTML, but they all do it in a slightly different way – according to what is allowed in their particular browser. For example, some computers can only display text: letters and numbers, a few symbols, but no graphics or colour of any kind.

In addition, the way users connect to the Internet may affect the way their computer can view Web pages. Thus, there is a big difference between the user who connects to the Web with a slow computer, through a slow modem, and the user who has a direct, high speed connection, and a computer that can make the most of it. An image, which the second type of users can load instantaneously, could take an unacceptable time to be loaded by the first type of user.

Many browsers let the user decide how to view certain elements on a Web page. The user might be able to change the text and background colours, the text formatting, or evens whether or not to show graphics.

Therefore, in developing the system which could be used by any one on the web, it is important to realise that each person who looks at the page may see it in a different way, according to the kind of computer system they have, the browser they have chosen, the graphics capacity they have, the speed of their modem and connection to the Web and the settings they have chosen for their browser. The developer has limited control over how the page actually looks once it reaches the person who is seeing the system's page through a browser. The primary concern is that the page is understandable by any computer, and appearance is a secondary issue. However, in the context of this research what is important is to show that this web-based is acceptable to users as a workplace support system and have the required capabilities

and requirements as described in Chapter 4. Thus for this implementation it will be assumed that all users will be accessing the system using a reasonably fast Internet connection and a modern browser (e.g. Internet Explorer version 4.0 or Netscape Navigator version 4.4). It is also assumed that they will not change their browser settings to any extent.

These assumption are made because:

- a) the managers in the Malaysian Civil Service will all have suitable systems with this type of browser and will be warned about changing browser settings.
- b) the current implementation is a test of the ideas. As was discussed in Chapter 6, if the idea appears to be successful then the users would have a copy of the majority of the information they accessed in their own machine.

7.3 The improved version of the Help System

In the initial investigation, respondents had pointed out some points to be improved of the Help System. They are as follows: -

- 1) Need to have a Search Engine,
- 2) Provide a feedback facility,
- 3) Use Frames on some of the pages,
- 4) Other improvements required
 - make some of the key-words on pages hyperlinks,
 - navigational buttons should be placed on the left of the page,
 - reduce the use of dark colours,
 - make the pictures clear.

7.3.1 Adding the Search Engine

The earlier version of the Help System was designed without having a search engine in the main site. The user had to work their way down a list of topics to get to what they wanted. This posed two problems to the user. First, the user has to go through the list and read one by one to arrive at the topic that he/she wants. This may cause difficulties when the list is long and the topic that the user is looking for is at the bottom of the list or when there are several levels which need to be followed before the topic is found. Second, in some cases the list does not provide topics, which exactly match with the word or phrase that the user had in mind. In this case, the user might only guess that the word he/she is looking for might be related to the word or string in the list. For example, let's say the site contains a page or pages about dogs, but the user wishes to find information about a particular sort of dog (e.g. poodle). As a result, someone conducting a search for pages about poodles would not find the word poodle in the list.

Adding a search engine to the system should make it easier for visitors to locate what they need. The implementation described here uses a Java Applet.

When implementing the search facility using Java Applets, an area to run the applet has to be specified within an HTML document (because an applet must run from within an HTML document). An example of the code is as follows (Figure 7.3.1(1)): -

```
<HTML>

<HEAD>
<TITLE> .....</TITLE>
</HEAD>

<BODY>
<P><font size=4><b>Keyword Search</b></font><br>
    <APPLET CODE="InfoSearch.class" WIDTH=410
              HEIGHT=35></APPLET>

<br>
</BODY>

</HTML>
```

Figure 7.3.1(1) Specify an Area to run the Applet.

In the above code, the **<APPLET....>** and **</APPLET>** tags mark the start and end of code that handles the applet. **CODE="InfoSearch.class"** tells the browser which file to fetch and run and in this case, **InfoSearch** is the program that both provides a database which maps words to URLs and searches that database. **WIDTH=410 HEIGHT=35** defines the size (in pixels) of the area in which to run the applet. Figure 7.3.1(2) on the following page helps to illustrate this.

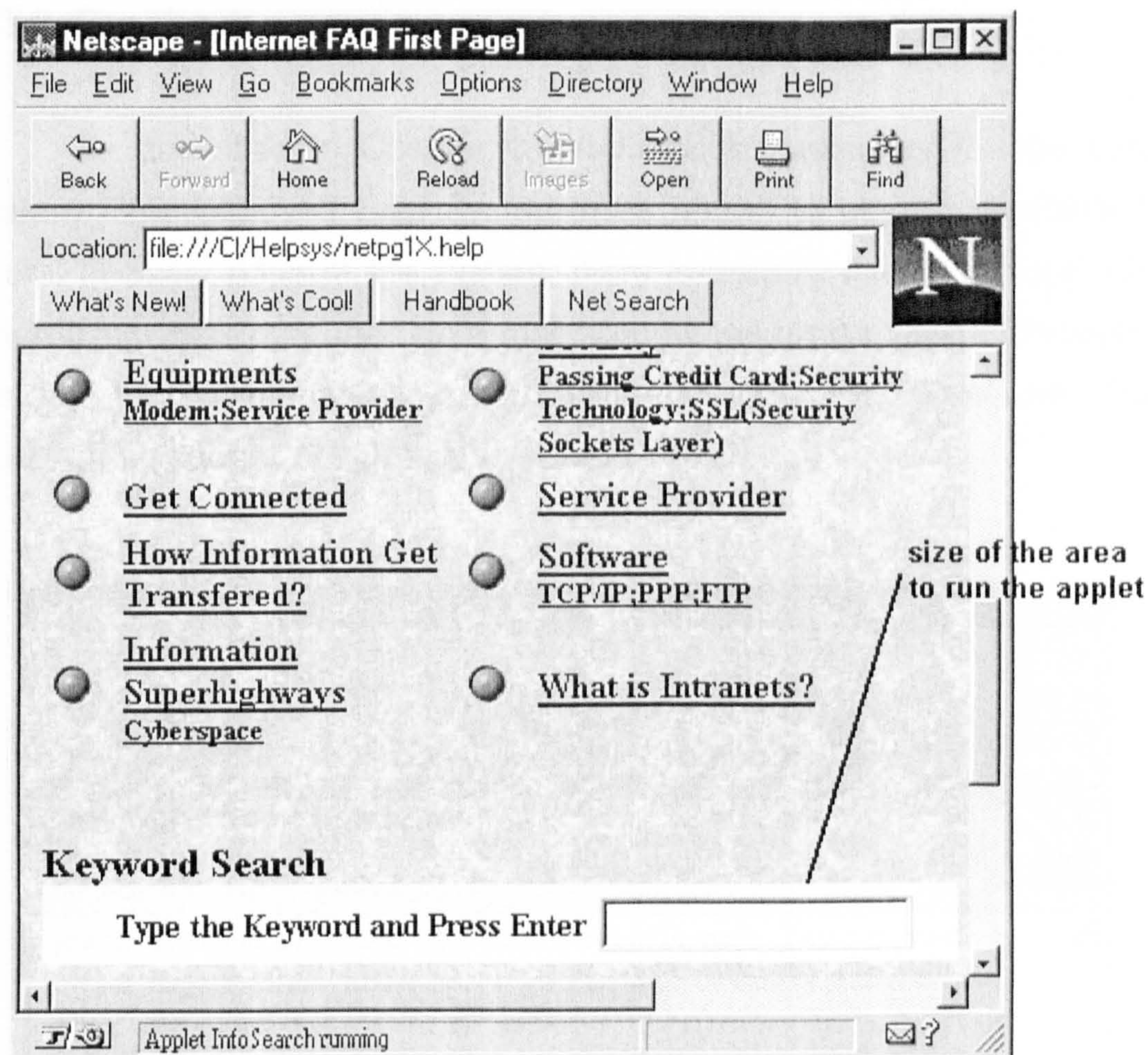


Figure 7.3.1(2) An area to run applet is created.

The next element in this search system is the search program itself. The program is called **InfoSearch** and is coded in Java. This program stores an array where each element contains a word or a phrase and a URL of a page relating to that word or phrase. When the user types a word or phrase, it is then compared with the words/phrases that are stored in the array. If it matches then it will fetch and display the page of the respective URL in the browser. If there is not an exact match, then it will display a page that contains a list of words or phrases that might be related to the words that the users has in mind. The full program of InfoSearch is shown in appendix D.

7.3.2 Feedback

As described in Chapter 6, feedback is necessary for the support system. This improved Help System uses **e-mail** to get the feedback from users. In every page of the system, there is a small 'comment icon' which, when users click on it then an e-mail window will be displayed. Through this the user can write whatever comments he/she has to the developer. Figure 7.3.2(1) and figure 7.3.2(2) help to illustrate this.

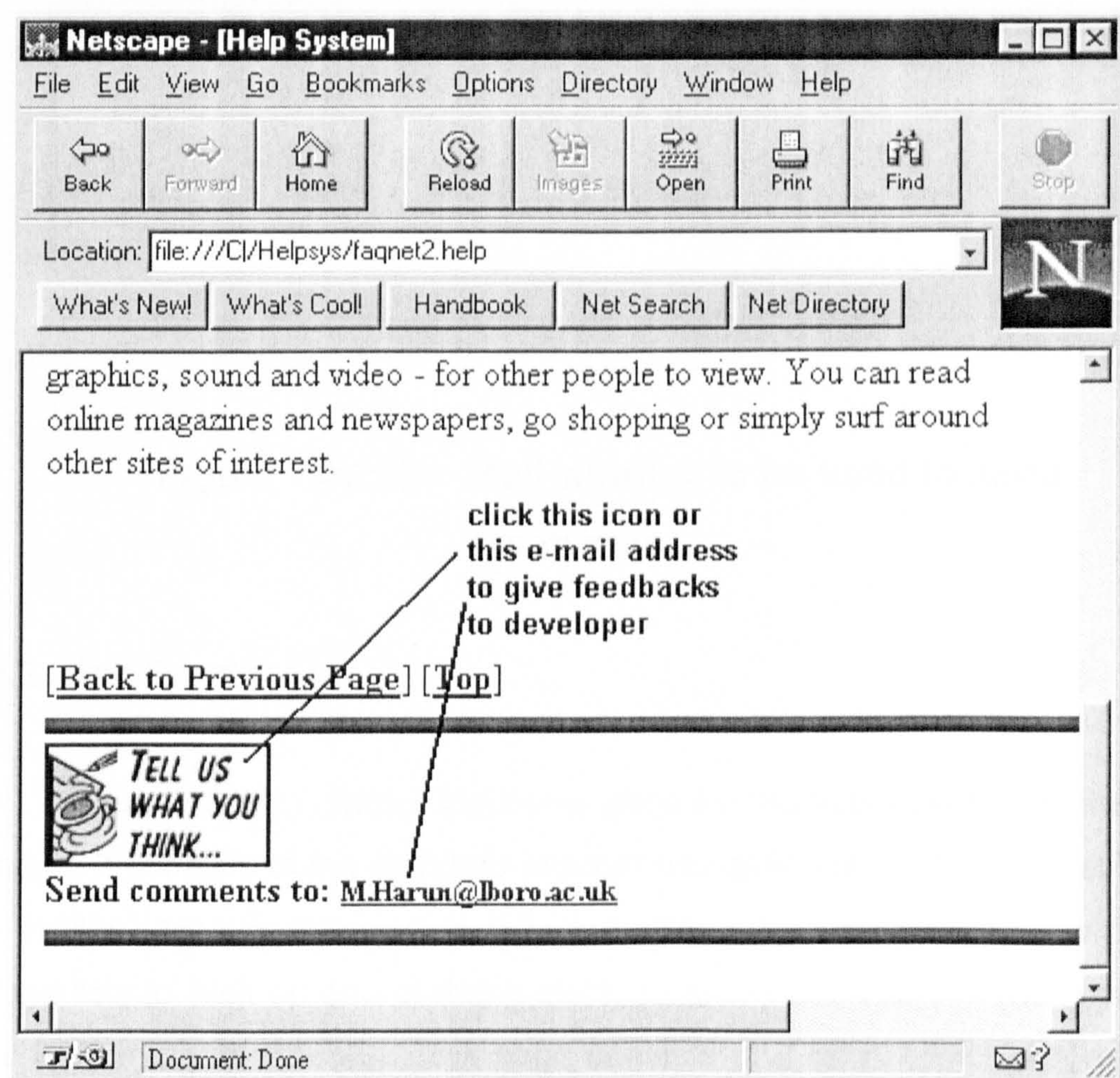


Figure 7.3.2(1) User can use the icon or e-mail address to send feedback.

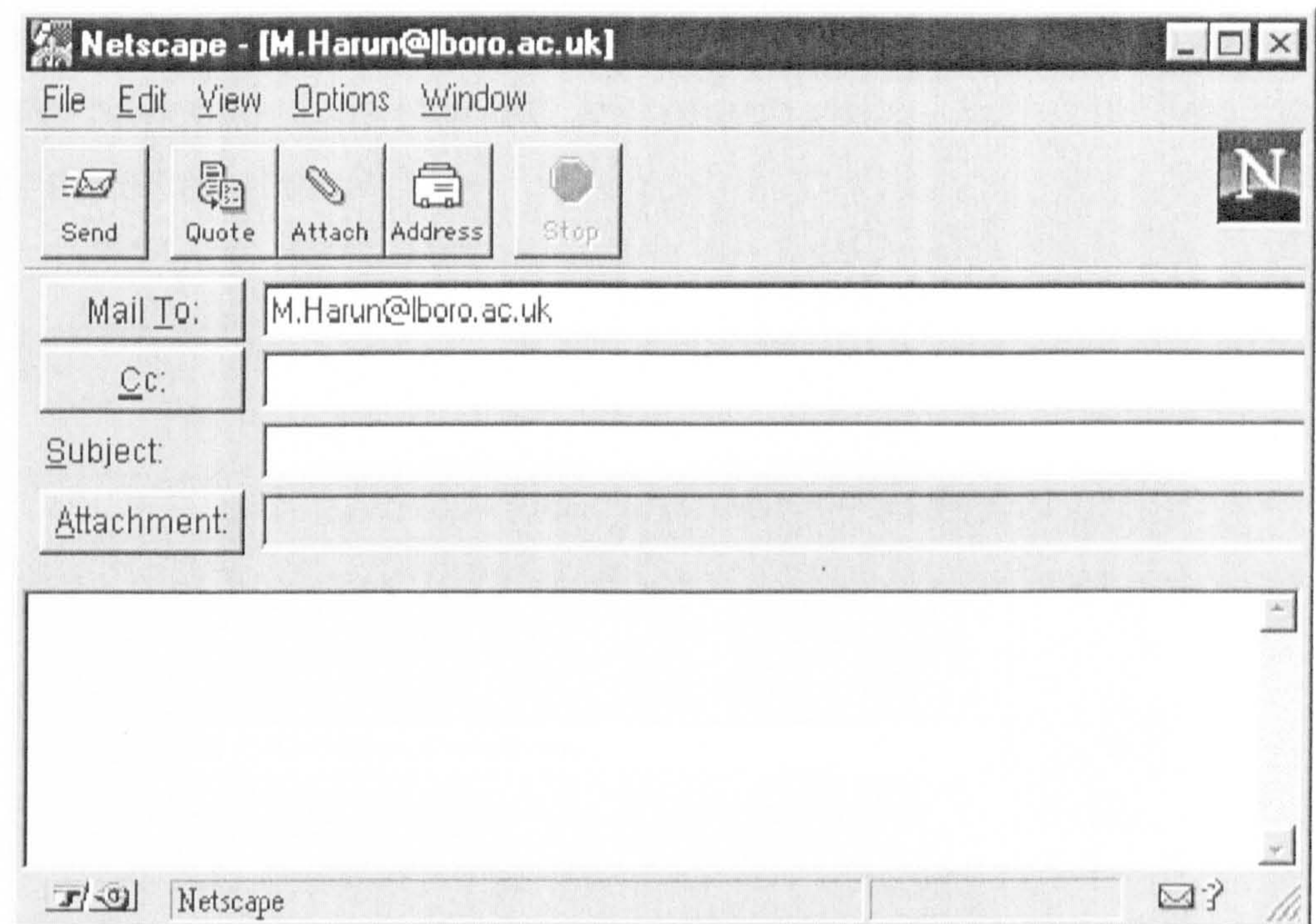


Figure 7.3.2(2) Mail window to be used to send comments.

7.3.3 Use Frame

Figure 7.3.3(1), shows the home page for the initial version of the Help System. It consists of the standard Internet navigation at the top and topics for the subject area in the centre. When a user wants to access information, he/she has to click on one of these topics to arrive at a page in the next level as shown in figure 7.3.3(2). This page consists of a list of topics whereby the user can then choose and get to the information (page or pages) that he/she wants. From here, if user wants to get back to the home page (to look for other information, which is on different subject) he/she then has to use the Back button in the Browser navigation bar. Many of the respondents commented during the initial investigation that this is not 'user friendly'. What

they had suggested is to put a small frame with a list of contents (subjects) on one side and a larger frame next to it (a list of topics for the subject). In this way, the navigation aids stay put, and remain visible, no matter how the user scrolls the other windows.

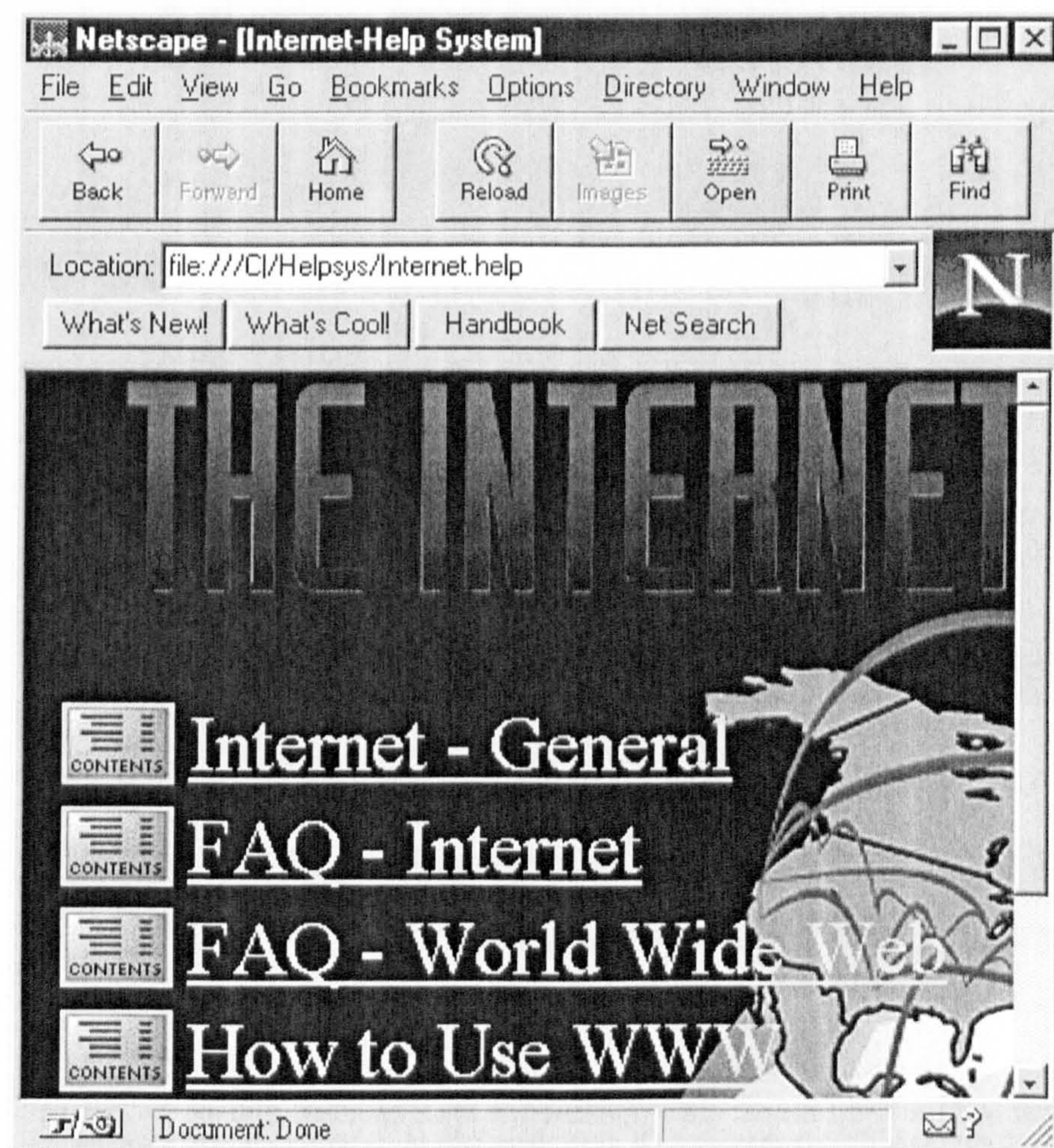


Figure 7.3.3(1) Initial version of the Help System.

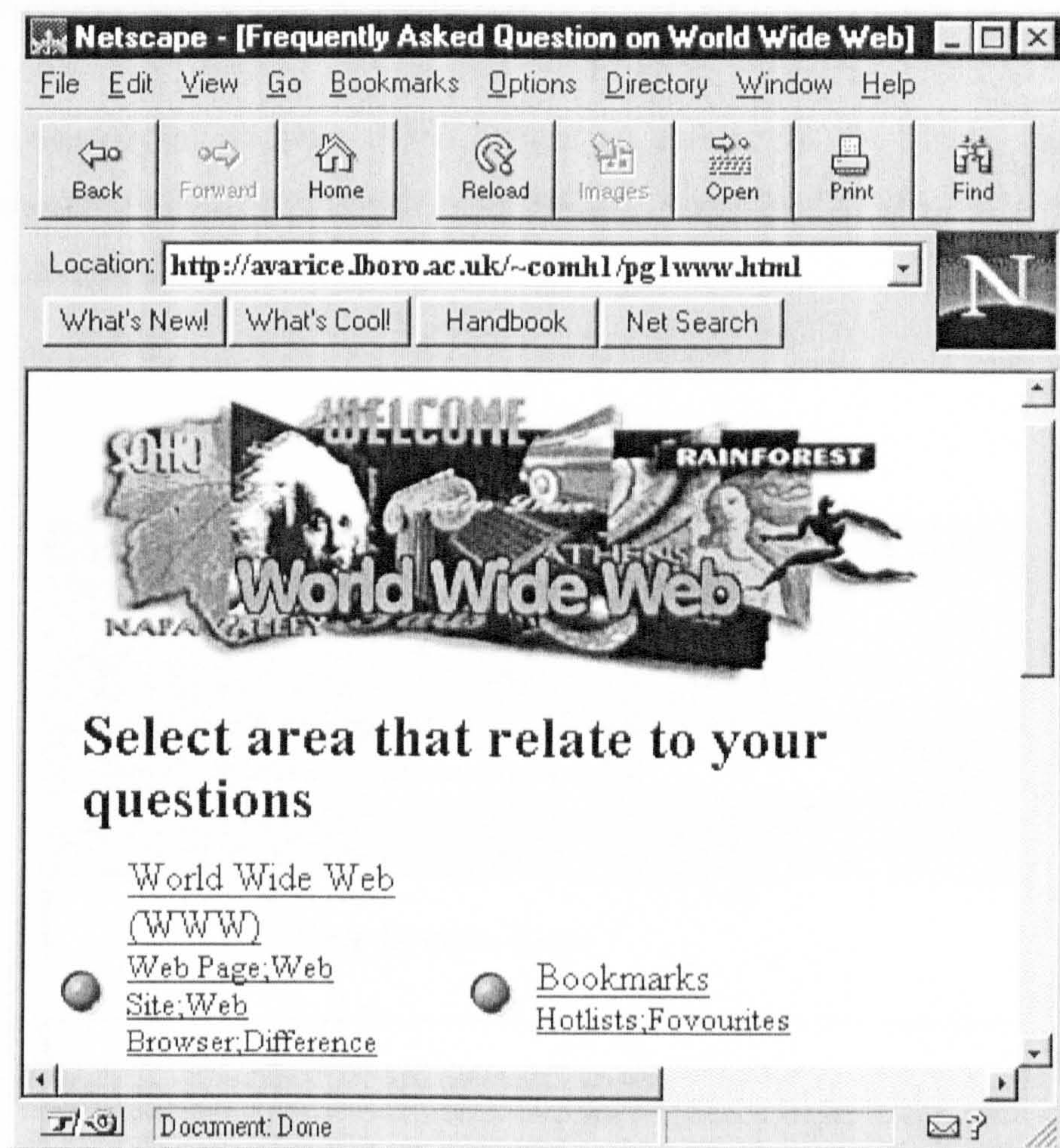


Figure 7.3.3(2) Example of a page in second level of initial version of the Help System.

In response to users' suggestions, the opening document (Home Page) was redesigned to use frames. In this study we have assumed that all users will have access to a browser that supports frames. However, in a practical implementation, we recognise that not all users have browsers capable of using frames. In this case we would provide a "no frames" version of any screens as appropriate. The layout is as shown in figure 7.3.3(3). As seen in figure 7.3.3(3), the page consists of three frames. The top row displays the

Help System's logo. The second row is divided into two columns: the first is a frame of navigation buttons, while the second displays topics of subjects for users to select in order to access the information required. Thus, as required, when a user clicks on one of the topics on the small left frame, documents appear dynamically in the larger right frame. The table of contents on the left frame is always visible to users.

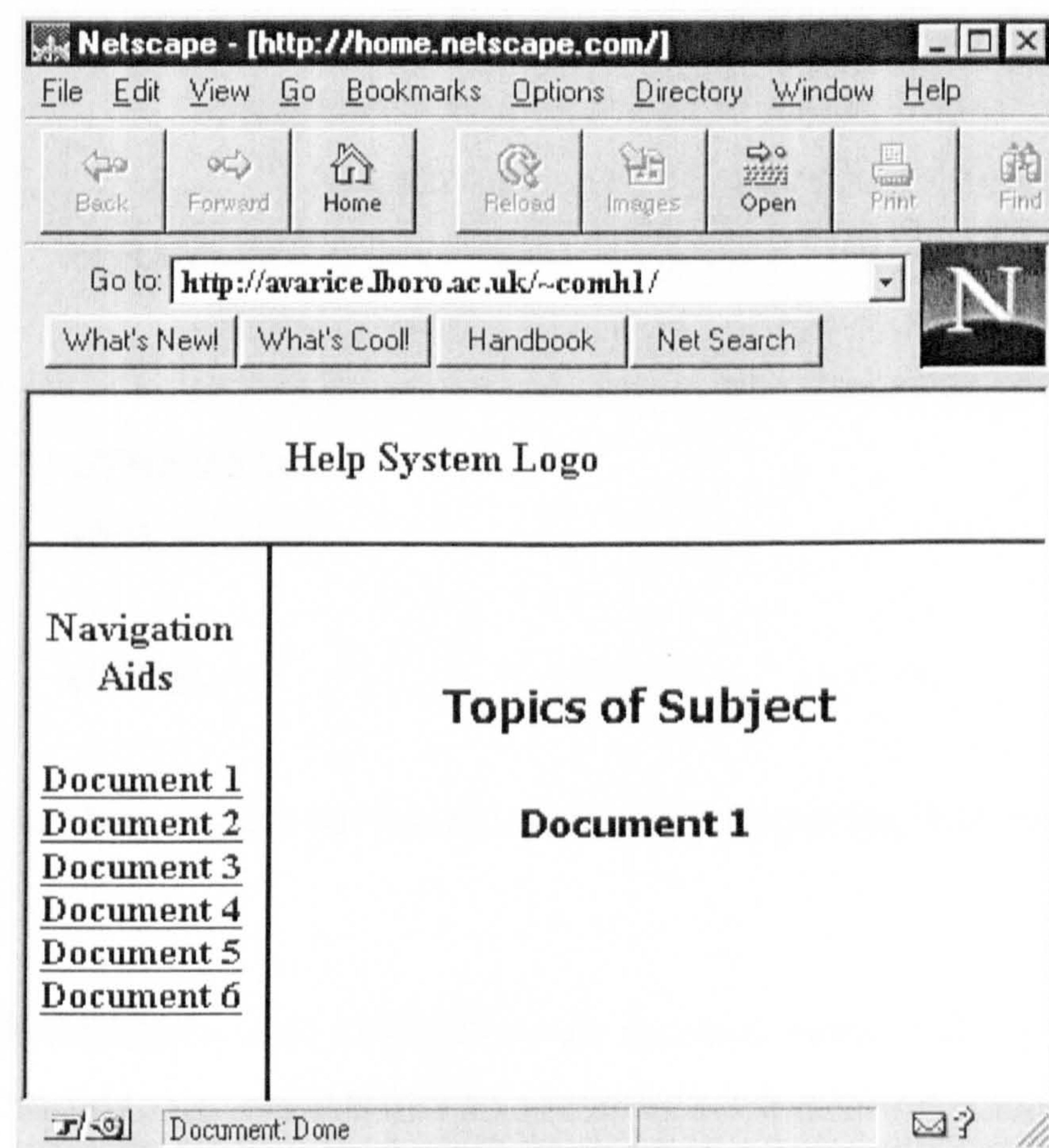


Figure 7.3.3(3) Layout of the Improved Version of the Help System.

The above document was created using the following HTML code:

1. <HTML>
2. <HEAD>
3. <TITLE>Help System Home Page Using Frame</TITLE>
4. </HEAD>
5. <FRAMESET ROWS="77,*"><!-- Split screen into 2 rows-->
6. <FRAME NAME="top" SRC="HSlogo.html"
 MARGINWIDTH="5" MARGINHEIGHT="5">
7. <FRAMESET COLS="140,*"><!-- Split 2nd row into 2 columns-->
8. <FRAME NAME="navaids" SRC="navaids.html">
9. <FRAME NAME="display" SRC="mainlist.html">
10. </FRAMESET>
11. </FRAMESET>
12. </HTML>

(Note: The number on the left is for easy reference. It is not an HTML code).

<FRAMESET> and <FRAME> are the two basic building blocks for frames. The first tag, <FRAMESET>, establishes the frame and the second tag <FRAME> specifies which HTML document appears in a cell. The key to getting frames to be able to reference one another is to name the frames when they were created, as follows:

<FRAME NAME="display" SRC="mainlist.html">

With the frames named, the **TARGET** attribute of an **<HREF>** tag can be used to cause the indicated URL to appear in the named frame, as in the following example:

link text

When user clicks on the **link text** in the navigation aids window on the left of Help System, the browser goes to the URL **Internet.html** in the frame called **display** in the same window.

Line 5 - **<FRAMESET ROW="77, *">**)

- frame was established, and the page was divided into two rows using the Rows attribute. The top row height is 77 pixels and the second parameter coded as " * ", means that the rest of the space available in the page is set to the second row.

Line 6 - **<FRAME NAME="top" SRC="Hslogo.html"**

MARGINWIDTH="5" MARGINHEIGHT="5">

- the name of the top frame is "**top**" and the document that appears in this frame is **Hslogo.html** file with horizontal and vertical margin of 5 pixels.

Line 7 - **<FRAMESET COLS="140, *">**

- the second row was divided into two columns. The first column has a width of 140 pixels. The rest of the available space is set for the second column (*).

Line 8 - **<FRAME NAME="navaids" SRC="navaids.html">**

- the first column in the second row is given the name "**navaids**" and the document that appears in this column is **navaids.html** file. As

explained earlier, the frame is given a name so that it can be made a target by other windows.

Line 9 - **<FRAME NAME="display" SRC="mainlist.html">**

- the second column is given the name "display" and the document that appears in this column is mainlist.html file. Again, as in line 8, the frame is given a name so that it can be made a target by other windows.

7.3.4 Other Improvements

The three improvements described above are the major improvements recommended by respondents. However, there were also other things that respondents commented on which were considered as minor improvements.

- i) Make some of the key words on pages hyperlinks (clickable text). This is implemented by creating a link to the key words, as follows;

clickable text

In implementing the link, some points have been noted and followed, such as:

- a) keep hyperlinks short. If the hyperlink is part of a longer sentence, keep only the key words within the link definition
 - b) avoid the use of "Click here" as hyperlink. Only the key words that already exist in the text were used to identify the link.
- ii) Navigational buttons should be placed on the left of the page. The navigation aids frame is on the left of the page.

- iii) Reduce dark colours.

The improved Help System is implemented without using too many dark colours.

- iv) Make the pictures clear.

This has been done.

7.4 Drawbacks

Version 2 of the Help System was designed and implemented in an effort to satisfy user requirements. Unfortunately, nothing is perfect and it has some drawbacks. These drawbacks are concerned with the use of a Java applet for the search engine and e-mail to get feedback from users. The drawbacks encountered are as follows:

- i) **Speed.** With all the hype surrounding Java, there is a tendency to view Java as a “one-stop solution” to all active content on the Web. This is not the case, and Java is slow. When testing with a Pentium II PC with a processor speed of 166MHz, it took about one minute to download the Help System. However, with a Pentium III PC and processor speed of 300MHz, it is all right, almost instantaneously being downloaded.
- ii) **E-mail feedback.** In this version of the Help System, the feedback goes to the developer and the information obtained has to be processed and updated manually. However, the Help System requirements described in Chapter 6 indicate that what is needed is a system that has the capability of updating the information automatically without intervention.

7.5 Towards A Dynamic, Learning and User-Driven Help System (Step 2 - Version 3)

Interactivity is by far the most important aspect of the development of the version 3 Help System. Interaction among users - the human beings, not just pre-programmed scripts - is what is required. Version 2 of the Help System does not have this capability. Although users can send their feedback using the e-mail hypertext link provided in this version, the interaction is only with the developer. This is not the most effective feedback mechanism. What is needed is that the feedback should be read by other users, and they should be given the opportunity to give their opinions or ideas. They should be allowed to put what they need and what they know into the content of the Help System. It is similar to training (mentioned in Chapter 2) in which Donaldson and Rae stressed the important of 'identification of training needs' as a key ingredient in making a training program effective. Following from this the contents of the Help System would be matched with the needs of the user. In other words, the system would be user driven and thus be a more effective support system.

Version 3 of the Help System has better control of the process. By using CGI programming, interactivity can be built into the system more easily. This should eventually allow users to interact among themselves, compose and send feedback to let other users read and give their opinions. Although the interactive capability could in principle be achieved using Java programs, however it is only at the expense of performance as has been noted in the 'keyword search' and as is also the case with some of the animation in version 2 of the Help System, which also are programmed in Java. It was noted that the relevant pages took some time to load and this could make users reluctant to use the system.

The key aspect introduced in version 3 is a monitoring capability. This is an interesting feature whereby the Help System can record all 'activity' within the system. Besides recording any feedback (text entry) given by a user as required, it can record the IP address from which the browser is being used, the login name of the user on that machine (if known), which information (pages) the user had accessed and which button (including 'Home' button) the user has pressed. This information is potentially very valuable and the beauty of this system is that it will allow other users to access this information. Any users who login into the system could inspect the logging information such as who have accessed the system, e.g. which pages a particular user has accessed, which users have accessed a particular page, which pages have been accessed and what feedback has there been in the system. By having this information any user can interact with other users that have the same interest, and exchange ideas and knowledge, thus the system provides users a platform for collaborative learning. The privacy issues raised here have been discussed earlier.

7.5.1 Implementing Version 3 of the Help System

As already noted above, the main purpose of version 3 of the system was to carry out a preliminary investigation of the use of CGI scripts to manage and record the progression of users around the Help site and to record the feedback provided by the users. Version 3 was to be used to confirm that this was technically practical and that the system produced was acceptable to users. The expectation was that, if version 3 did prove practical and acceptable, then the information that was being collected would be used in version 4 to demonstrate the possibilities of dynamically generating pages to enhance the interactivity of the site.

The starting points for this version were the pages that had been designed for version 2 and a CGI-script that had previously been developed to

assist students investigating the creation and management of web sites. The intention was to use the existing pages as a basis for the new system and, initially, to make only the essential changes needed to permit monitoring and recording to take place.

To do this all of the files making up the version 2 web site were copied from the directory in which they resided (`~comh1/public_html`) to a new sub-directory of this directory called "1". In addition the cgi-script, a program written in 'C', was also copied to this new directory and named "`mh1.cgi`".

The script was designed to be called by the Web server on the host (by requesting the URL "<http://cos.lboro.ac.uk/~comh1/1/mh1.cgi>"). Once called, it would write a record to the log file (named `<program name>.log` i.e. "`mh1.cgi.log`") and would generate and return the next page. The log record contained information about the circumstances of the call (the time and date, the IP address of the machine making the request, the login name of the user on the machine, if known) and the input provided by the user (as text in INPUT areas, as button pushes, or as 'selects'). The next page could either be static (taken from a file) or could be wholly created on request (e.g. by processing the contents of the log file). The idea behind the script was that every page on the site would be 'generated' as and when needed since this permitted greater flexibility. Thus every page in the system would need to call the server using the same basic URL but with different 'parameters' (depending what the user had selected or written on the page before submitting it). The cgi-script expected the parameters to appear as input on the standard input channel (which required every page in the system to 'call' the script using the 'METHOD' "POST" in a FORM tag on the page - this is discussed in more detail below).

The cgi-script contained features, which assisted user specified navigation within the site and the incorporation of information gathered at run-time in the page. These are discussed in the next two paragraphs.

Navigation was accomplished using a file "<program name>.inf" (i.e. **mh1.cgi.inf** as in Figure 7.5.1(1)) which contained a series of records (one per line). The first record simply contains the name of the page, which is to be used when the system starts up (i.e. when the cgi-script is invoked with no input). All the remaining records consist of triples containing **<page name>**, **<submit button name>**, **<target file name>** separated by tabs (e.g.

page1 Internet+Jargon intgen3.html). This required each existing page to be enhanced by adding a "FORM" section containing a hidden input field with a unique page name and, by convention, having one or more "submit" buttons with the NAME="Go_To" and a VALUE which was unique to that page.

(e.g. <INPUT TYPE="submit" NAME="Go_To" VALUE="Internet General">).

The .inf file had to contain the values of the first two elements in the triples in http encoded form. Thus, every space was replaced by the symbol '+' and various other symbols (e.g. '+', '(', ')', '%') had to be replaced by three symbols: a '%' followed by two hexadecimal digits giving the ASCII value of the replaced character). In practice, the monitoring facility incorporated in the script made this easy by recording the value of the fields received from the page in the appropriate form in the log file from where they could be copied to the inf file (the cgi scripts produced a page containing an error message if it was unable to identify a new page to 'go to').


```
HelpSystem.html
Log          LOGIN          netpg1F.html
Log          netpg1F.html
page0        Internet-General intgenX.html
page0        FAQ-Internet    netpg1X.html
page0        FAQ-WWW         pg1www1.html
page0        How-WWW         howtoX.html
page0        Interesting+Sites IntWebX.html
page0        Index           indexX.html
page0        Accessed+Pages   accessedpgs.html
page0        Who+the+Users    whoaccess.html
page0        Show+Feedback    wfeedback.html
----
----
page1        Internet+Jargon   intgen3.html
page1        History          intgen2.html
----
----
page2        Modem            faqnet13.html
page2        Security         faqnet18.html
* page2      Software        faqnet5.html
----
----
* page6      Where+do+I+get+software+from%3F faqnet5.html
page6        Alta+Vista       faqwww14.html
----
----
page121      Home             intgenX.html
page122      Submit+Feedback  intgenX.html
----
page5237     Home             IntWebX.html
page5238     Submit+Feedback  IntWebX.html
```

Figure 7.5.1(1) Part of the mh1.cgi.inf file
(the full listing is given in Appendix E).

(Note: the line which marked with ' * ' and written in bold

- The information page, **faqnet5.html** is being called from two different pages, page 2 (netpg1X.html) and page 6 (indexX.html). This problem will be explained in the next paragraph).

The ability to produce dynamic pages was assisted by three 'server side' pseudo html tags. These were:

<!--#incl <file name> --> which substituted the contents of the named file for the tag

<!--#exec <program name> <parameters> --> which ran the named program and substituted its output for the tag

<!--#my <operation name> --> which processed the current input record (and/or the log file) as directed by the operation name and substituted the result for the tag.

The two operations, which were used in this version of the Help System, were:

'U' which finds the name which the user has logged in with (used primarily to supply a hidden input field 'username' on the page, and thus on the log records)

'P' which extracts the name of the page that has just been used in the current log record (this is needed, in conjunction with another file <program name>.inf1 containing one record per page on the site with two fields separated by a colon (<file name>:<page name>), to allow the 'BACK' function to be executed properly as is discussed later).

To work with the cgi-script the copied files were changed to incorporate a FORM section which included: the 'hidden' input field with NAME="PageName" and VALUE= <unique page name>; an area for feedback and at least one 'submit' button. These features are discussed in more detail below.

When making the changes, the majority of the pages could be viewed as being simply 'information' and these mostly only needed two submit

buttons since the user would either submit feedback (using a button labelled 'Submit Feedback') or return to a starting page (using a button labelled 'Home'). However, some information pages could be reached by more than one route and these needed a 'Home' button which was intended to take the user back to the 'calling' page rather than to a fixed page. This requirement is discussed later.

In addition to the 'information pages', there are 'navigation' pages designed to assist the user to select a suitable page to go to. These contained a number of buttons, all of which had different 'VALUES' (which appeared as the name of the button when the page was displayed). In addition, some contained a 'search' text box with a 'submit' button to allow the user to input a suitable term and search for the pages that might contain relevant information. Two variants of this type of hierarchical index page can be distinguished in the original static system. The first is the single navigation sub-page used as the left hand section of the full 'page' throughout the site (the full page is generated using FRAMES and consists of three elements). The second group consists of the six hierarchical index sub-pages, which are displayed in the right hand frame when one of the navigation sub-page buttons is 'pressed'.

In this version of the system the search element was not implemented since, as noted before, the primary purpose of the version was to test navigation rather than to produce pages dynamically (which is what is required for the search system, and also for answering questions and displaying information derived from the log file).

The following section describes the changes that were made to the HTML pages in version 2 to incorporate the requirements described above.

7.5.2 Changes made in the HTML pages

The main changes that have been made to HTML pages concern the replacement of html hyperlink tags () with SUBMIT buttons in a Form. As has been mentioned in the section above, forms are used to capture users' input using a variety of different *input fields* (e.g. text, submit), which are then sent to the server for processing by the CGI program. The output is then constructed with information provided on the form, and returned to user's browser by the CGI program.

The pages that are affected by changes are the following:

- i) The navigational aids page (navaids.html)
 - this is the static left frame.
- ii) The five 'index' pages (in the right frame) that lead to information on
 - Internet in general (intgenX.html)
 - Frequently Asked Question (FAQ)
about Internet (netpg1X.html)
 - Frequently Asked Question (FAQ)
about World Wide Web (pg1wwwX.html)
 - How to solve certain problems (howtoX.html)
 - Interesting Web sites (IntWebX.html)
- iii) An index to the system (indexX.html).
- iv) Other pages (the information page).

Figure 7.5.2(1) shows the layout of the screen when viewed through the browser indicating the navigational aids subsection and the 'target' subsection (where the index and information pages are placed).

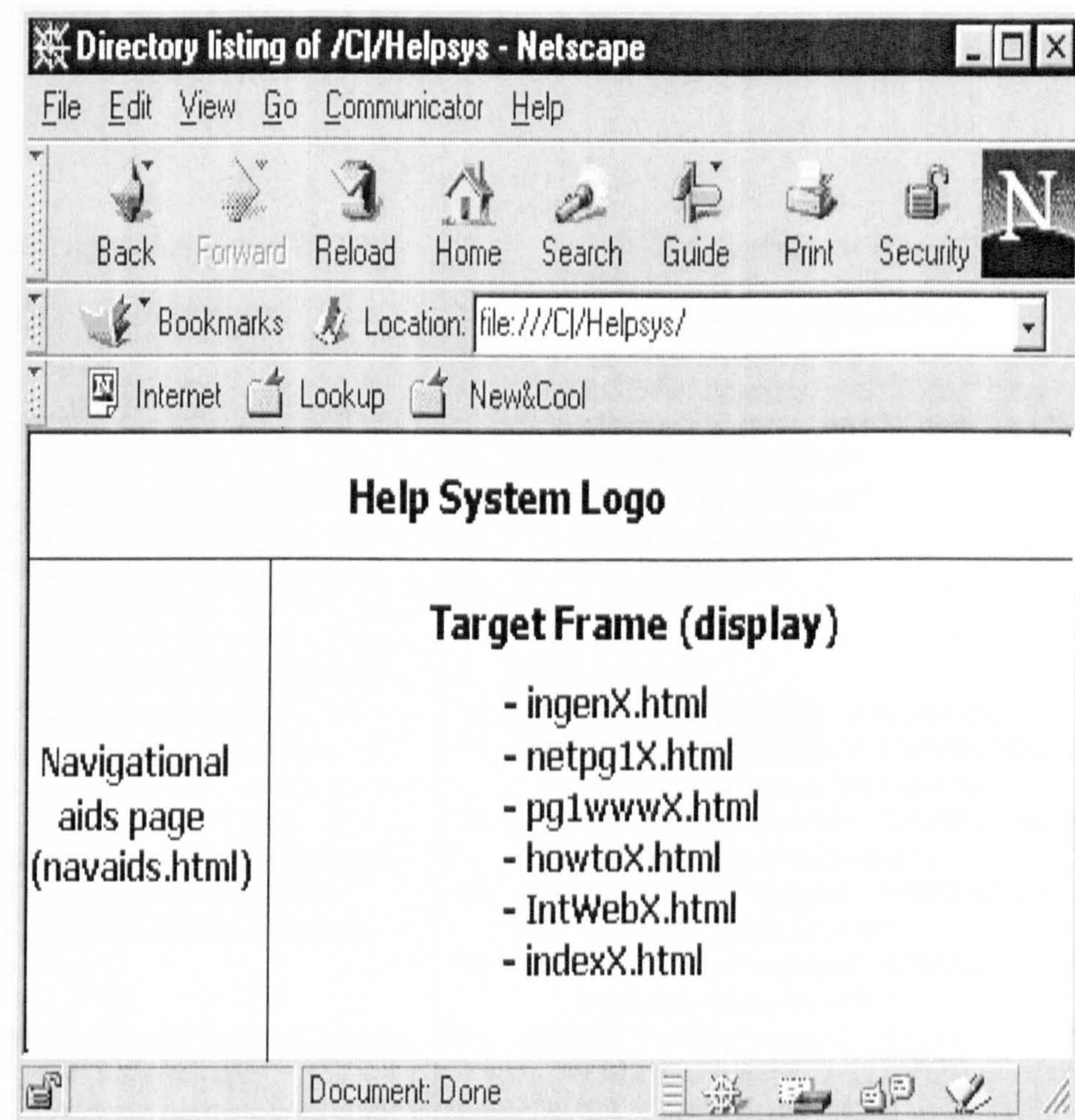


Figure 7.5.2(1) Shows where the navigational aids and target pages are placed.

i) Navigational Aids page - nav aids.html

Extracts from the original and modified pages for nav aids.html are shown below. Figure 7.5.2(2) is the original page and Figure 7.5.2(3) is the modified page.

```
<HTML>
<HEAD>
  <TITLE>Navigational Aids</TITLE>
</HEAD>
<BODY BGCOLOR="#0000ff">
  -----
  -----
  <TABLE>
  <TR><TD>
    <a target="display" href="intgenX.help">
    <font color="ffffff" size=3><b>
    Internet - General</b></font></a><br>
  </TD></TR>
  <TR><TD>
    <a target="display" href="intgenX.help">
    <font color="ffffff" size=3><b>
    FAQ - Internet</b></font></a><br>
  </TD></TR>
  <TR><TD>
    <a target="display" href="intgenX.help">
    <font color="ffffff" size=3><b>FAQ -
    World Wide Web</b></font></a><br>
  </TD></TR>
  <TR><TD>
    <a target="display" href="intgenX.help">
    <font color="ffffff" size=3><b>How to Use WWW</b></font></a><br>
  </TD></TR>
  <TR><TD>
    <a target="display" href="intgenX.help">
    <font color="ffffff" size=3><b>Interesting
    Web Sites</b></font></a><br>
  </TD></TR>
  <TR><TD>
    <a target="display" href="intgenX.help">
    <font color="ffffff" size=3><b>Index</b></font></a><br>
  </TD></TR>
  </TABLE>
</BODY>
</HTML>
```

Figure 7.5.2(2) Original Nav aids.html

```
1. <HTML>
2. <HEAD>
3.   <TITLE>Navigational Aids</TITLE>
4. </HEAD>
5. <BODY BGCOLOR="#DAA520">
6. <FORM METHOD="POST"
   TARGET="display" ACTION="http:
   //cos.lboro.ac.uk/~comh1/1/mh1.cgi">
7. <INPUT TYPE="hidden"
   NAME="PageName"
   VALUE="page0">
8. <TABLE BORDER>
   -----
   -----
9. <TR>
10. <TD><font color="ffffff" size=1><b>
11. <INPUT TYPE="submit" NAME="Go_To"
   VALUE="Intenet-General">
12. <INPUT TYPE="submit" NAME="Go_To"
   VALUE="FAQ-Internet">
13. <INPUT TYPE="submit" NAME="Go_To"
   VALUE="FAQ-WWW">
14. <INPUT TYPE="submit" NAME="Go_To"
   VALUE="How-WWW">
15. <INPUT TYPE="submit" NAME="Go_To"
   VALUE="Interesting Sites">
16. <INPUT TYPE="submit" NAME="Go_To"
   VALUE="Index"></b></font>
17. </TD>
18. </TR>
19. </TABLE>
20. </FORM>
21. </BODY>
22. </HTML>
```

Figure 7.5.2(3) Modified nav aids.html. (Note: 1. The changed code is written in bold. 2. The number on the left is for easy reference).

The <FORM> Tag - line 6:

**<FORM METHOD="POST" TARGET="display"
ACTION="http://cos.lboro.ac.uk/~comh1/1/mh1.cgi">**

Each HTML form has three main components: the *form header*, one or more named *input fields*, and one or more *action buttons*. The form header and the <FORM> tag are actually one and the same. The <FORM> tag takes three attributes - ACTION, TARGET and METHOD. The ACTION attribute is required in every <FORM> tag.

ACTION Action is set equal to the URL of the processing script (CGI script) so that the browser knows where to send the form data once it is entered. Without it, the browser would have no idea where the form data should go. Hence for the ACTION statement in line 6:

ACTION="http://cos.lboro.ac.uk/~comh1/1/mh1.cgi">,

the protocol is **http**, the server is **cos.lboro.ac.uk**, the directory path is **~comh1/1/** and **mh1.cgi** is the script program that is to be executed to control the transfer of information.

TARGET Since FRAMES are used to display pages in this system, the TARGET attribute directs the composed data to be loaded into the place where we want it to appear. In this case the composed response is loaded into frame named "**display**", which is the right hand frame (see Figure 7.5.2(1)).

METHOD METHOD specifies the HTTP method to use when passing the data to the script. It can be set to values of GET or POST. In this case, the POST method is used (as required by the CGI script) which sends the form data to the server in a separate HTTP transaction (in the GET method, the browser appends the form data to the end of the URL of the

processing script which can cause problems if a significant amount of feedback is provided by the user).

The <INPUT> Tag - line 11 to line 16:

```
<INPUT TYPE="submit" NAME="Go_To"
      VALUE="topic_of_subject">
```

The <FORM> tag, by itself doesn't do anything, it is the INPUT tags which make it interactive. The INPUT tags (as used in line 11 to 17) all have three attributes namely TYPE, NAME and VALUE. In this case the TYPE field that is used is "submit". This creates a submit button on the displayed page.

The VALUE entry in line 11 to 17 shows the topic or subject, which indicates the information to be shown to the user if they click on the button. As an example, if the TYPE="submit" and VALUE="Internet-General", the submit button created is as follows;

Internet-General

The NAME attribute assigns a name to the button. If no NAME attribute is present, no data is returned to the server regarding which submit button has been 'pressed'. However if both NAME and VALUE attribute are present, a sub-record consisting of the values of the NAME attribute, an equals symbol and the value of the VALUE attribute will be sent to the server (e.g. in the above example Go_To=Internet-General is sent to the server by the browser).

How does the server access the required information page?. In this system it is accomplished with the following mechanism.

As has been said earlier, navigation was accomplished using mh1.cgi.inf file. The records consist of triples containing <page name>,

<name of the submit button> and <name of the target file>. Hence, to access the information page, what is needed are the <page name> and the <submit button name>, whereby <page name> is the name of the calling page and <submit button name> is the name of button which the user pressed (as far as the user is concerned, it is the topic of information required).

When the submit button is 'pressed', the Form data which are to be processed are sent to the server by the browser. In the case of `navaids.html` code in Figure 7.5.2(3), the data sent come from the following INPUT tags.

- i) The "hidden" INPUT tag in line 7 - a sub-record consisting of the value of the NAME attribute, an equals symbol and the value of the VALUE attribute (In this case, `PageName=page0`).
- ii) The data from the appropriate INPUT tag (one of the 'submit' INPUT fields in line 11 to 16) depending on which submit button had been pressed by the user. Thus, if the "Internet-General" submit button had been pressed, then the data value in the NAME attribute equals the data value of VALUE attribute in INPUT tag of line 11 (e.g `Go_To=Internet-General`) is involved.

When the server receives the Form data from the browser, it then initiates the CGI program's execution and passing these received data values as input to the program. The CGI program then appends an entry to the log file (`mh1cgi.log`) which contained these values. An extract from the log file is shown below (Figure 7.5.2(4)).


```

| 378343 6 unknown 158.125.108.20 27 PageName=log&User_Name=Adam
| 378343 35 unknown 158.125.108.20 37 PageName=page0&Go_To=Internet-General
| 378343 42 unknown 158.125.108.20 28 PageName=page0&Go_To=FAQ-WWW
| 378343 52 unknown 158.125.108.20 28 PageName=page0&Go_To=How-WWW
| 378344 0 unknown 158.125.108.20 26 PageName=page0&Go_To=Index
| 378344 7 unknown 158.125.108.20 33 PageName=page0&Go_To=FAQ-Internet
      -----
      -----
| 378346 9 unknown 158.125.108.20 56
      PageName=page3&Go_To=Home+Page&keyword=&feedbacks=++++++
| 378346 20 unknown 158.125.108.20 55
      PageName=page327&Go_To=Home+Home=page3&feedbacks=++++++

```

Figure 7.5.2(4) Extract from mh1.cgi.log file.

Notice that in line 2 (shown in bold), PageName=page0 and Go_To=Internet-General is written in the log file. By convention, log entries are terminated with a new line and fields are separated by spaces. The first six fields of each entry are 'metadata' generated from information which is available to the cgi program. The 'I' indicates input from a browser, the next two numbers represent a time (the first in minutes since midnight on 1st January, 1999 and the other in seconds). The next two are the login name of the user using the browser (if known) and the IP address of the machine running the browser. The sixth field is the number of characters in the input.

After writing to the log file, the log file is closed then opened again and read. The cgi program finds the 'value' part of the Go_To field in the entry it wrote to the log file and checks that entry to see if it contains another field whose 'NAME' part is the same as this value (the effect if this happened is discussed below). If it does not (this is expected to be the normal case) then the cgi program takes the value of the two fields 'PageName' and 'Go_To' and tries to match them with a line in the mh1.cgi.inf file (refer to Figure 7.5.1(1)) which contains the same two values. If a match is found then the remainder of the matching line in mh1.cgi.inf is the name of a file, which contains the 'next page'. The cgi program reads the named file and processes it looking for the pseudo html tags (<!--#incl, <!--#exec or <!--#my) discussed earlier and

whenever one of them is found, the tag is substituted as described above. If no match is found in the cgi file then the 'startup' file is used (first line in mh1.cgi.inf). The result of processing the file is sent to the browser to be displayed as the next page.

The "hidden" type <INPUT> tag - line 7:

**<INPUT TYPE="hidden" NAME="PageName"
VALUE="page0">**

The input element from this "hidden" INPUT tag is transparent to the user. The data value from this INPUT tag (e.g. PageName=page0) is used in combination with data from the INPUT tag in line 11 to 16 to access the information page required by the user. This has been explained in the section above.

ii) The index pages - intgenX.html

The changed code for intgenX.html is as follows (written in bold). As can be seen the changes for the page are similar to those made for the navigational aids page discussed above.

```

1.    <HTML>
2.    <HEAD>
3.        <TITLE>Internet In General</TITLE>
4.    </HEAD>
5.    <BODY BACKGROUND="burong.jpg" LINK="#0000FF"
6.    ALINK="#FF0000" VLINK="#0000FF">
7.    <FORM METHOD="POST" TARGET="display"
8.        ACTION="http://cos.lboro.ac.uk/~comh1/1/mh1.cgi">
9.    <INPUT TYPE="hidden" NAME="PageName" VALUE="page0">
10.    <TABLE><!-------Table of the body----->
11.        -----
12.        -----
13.    <TR>
14.        <TD width=50%><font size=1>
15.            <INPUT TYPE="submit" NAME="Go_To"
16.            VALUE="Intenet-Basics"><br>
17.            <INPUT TYPE="submit" NAME="Go_To"
18.            VALUE="History"><br>
19.            <INPUT TYPE="submit" NAME="Go_To"
20.            VALUE="Internet Jargon"><br></font>
21.        </TD>
22.    </TR>
23.    </TABLE><!-------End of Table of the body ----->
24.        -----
25.        -----
26.    <TEXTAREA NAME="feedbacks" ROWS="4" COLS="50"
27.        WRAP=VIRTUAL>
28.    </TEXTAREA></font>
29.        -----
30.        -----
31.    <INPUT TYPE="submit" NAME="Go_To"
32.        VALUE="Submit Feedback">
33.        -----
34.        -----
35.    </FORM>
36.    </BODY>
37.    </HTML>

```

Figure 7.5.2(5) Modified intgenX.html

The explanation is also similar to the above (i.e. for navaid.html). The difference here is that this page has TEXTAREA tag (line 17). This is to give the user a larger space to provide feedback. This tag has four attributes. The NAME attribute gives name to the text area. This name identifies the data

when it is sent to the server. In this case the name is 'feedbacks'. The ROWS attribute identifies the height of the text area in rows. The COLS attribute is set the width of the text area in characters. The WRAP attribute enables automatic wrapping of text within the multiline text window. By putting this attribute, users, when typing their input, do not have to remember to hit Enter near the end of each line. The line doesn't scroll off the edge of the window. Finally the end tag (`</TEXTAREA>` - line 18) is required to complete the text area since it is possible to include 'default' text in the area. If such default text is included then it will be returned as if the user had input it unless the user changes it.

Note that the 'submit button' (the INPUT tag on line 19) is similar to those in the navigational aids page with the name Go_To field being used to indicate to the CGI script which page to go to next as discussed above. Note also that the same button Value (Submit Feedback) is used on all the pages. It is only when the value on the Go_To button is combined with the value of the (hidden) Page Name input field (which is also returned to the server) that an appropriate 'next page' can be selected (using the file '.inf').

Submit Feedback

In this version of the system, the feedback is simply put in the log and can be inspected from there.

The explanation for other target pages, i.e. netpg1X.html, pg1wwwX.html, howtoX.html, IntWebX.html and indexX.html are the same. That is they have the same structure and include the same tags (Form METHOD, ACTION, TARGET, INPUT type and TEXTAREA).

iii) The information page

The codes for all of the information pages have a similar pattern. Page faqnet5.html is shown here as an example. The code is as follows (the amended code is written in bold).

```

1.    <HTML>
2.    <HEAD>
3.        <TITLE>Help System</TITLE>
4.    </HEAD>
5.    <BODY BGCOLOR="#FFFFFF">
        -----
        -----
6.    <P><b><font size=+2>Where do I get software from?</font></b><br>
        -----
        -----
        -----
6.    <FORM METHOD="POST" TARGET="display"
        ACTION="http://cos.lboro.ac.uk/~comh1/1/mh1.cgi">
7.    <INPUT TYPE="hidden" NAME="PageName"
        VALUE="page225">
8.    <INPUT TYPE="submit" NAME="Go_To" VALUE="Back">
9.    <INPUT TYPE="hidden" NAME="Back"
        VALUE="<!--#my P -->">
        -----
        -----
10.   <TEXTAREA NAME="feedbacks" ROWS="4" COLS="50"
        WRAP=VIRTUAL>
11.   </TEXTAREA></font>
        -----
        -----
12.   <INPUT TYPE="submit" NAME="Go_To"
        VALUE="Submit Feedback">
        -----
        -----
13.   </FORM>
14.   </BODY>
15.   </HTML>

```

Figure 7.5.2(6) Modified page faqnet5.html.

This code is similar to the two listings given above (Figure 7.5.2(3) and 7.5.2(5)). The additional differences in this case are in lines 8 and 9.

```
Line 8. <INPUT TYPE="submit" NAME="Go_To" VALUE="Back">
Line 9. <INPUT TYPE="hidden" NAME="Back"
        VALUE="<!--#my P -->">
```

In line 8, a "Back" button is created (the 'Home' button is used for this purpose in the 'real' pages, however, 'Back' has been used in this example (to avoid confusion)) which is intended to enable the user to return back to the index page from which this page was called. In most cases there is only one page from which a particular information page can be called. For these cases, the mechanism described earlier, which uses the value of the Page Name and the Go_To button and the mapping contained in the file `mh1.cgi.inf` (see Figure 7.5.1(1)) is sufficient. However, this mechanism does not work where the same page can be called from two (or more) different index pages (see Figure 7.5.2(7)).

The problem mentioned above is due to a many to one relationship.

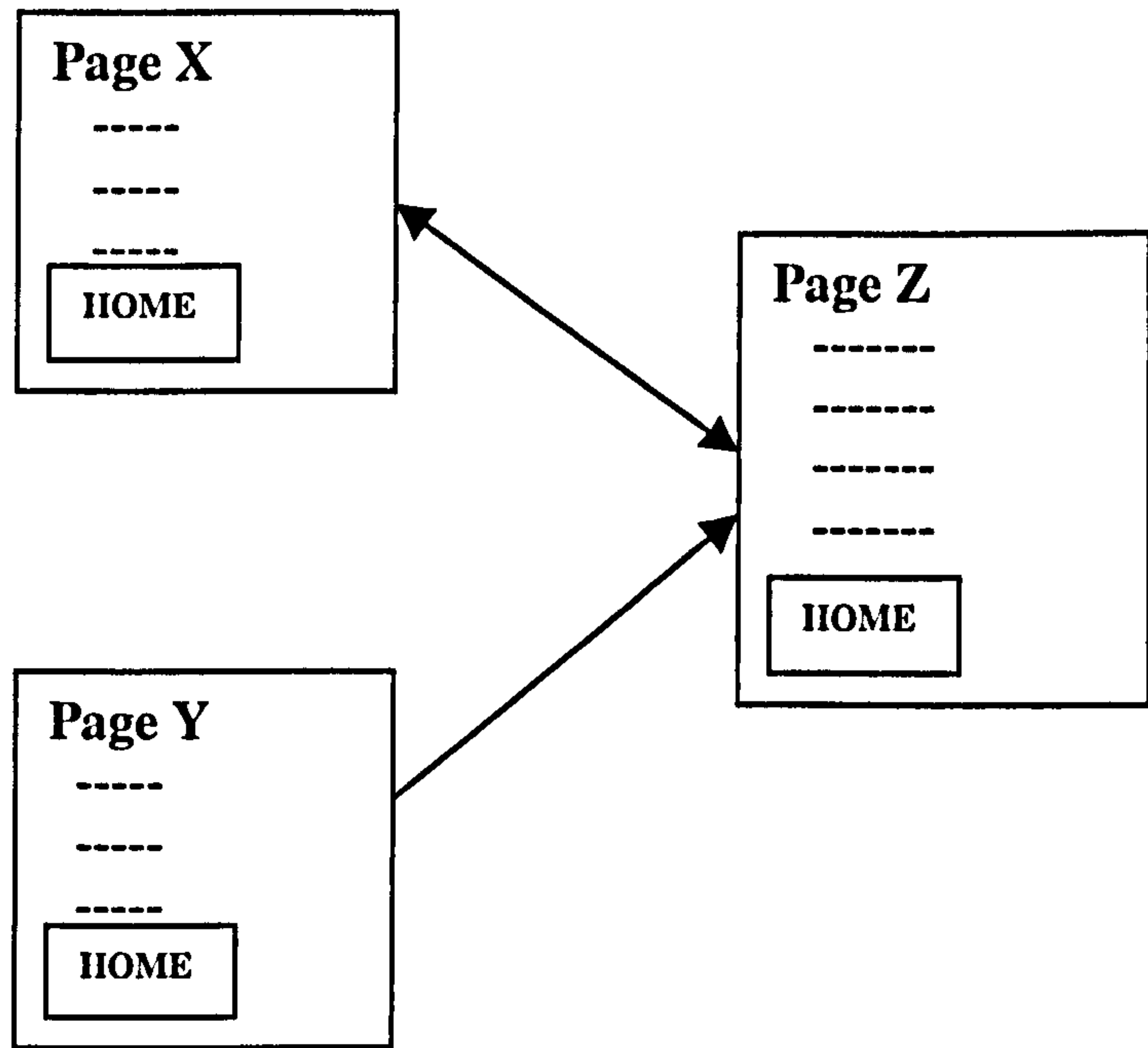


Figure 7.5.2(7) Many to one relationship

If for example, the Inf entry for Page Z is;

pagez BACK X

(where **X** is the filename Page X) then even if the user reached Page Z from Page Y rather than Page X, pressing the back button (HOME) would mean that they went to Page X, i.e. there is no flexibility in the Go_To mechanism using the .Inf file.

One of the ways to solve this problem is replicating each 'target' information file and giving them unique names. However, this is not a good solution since it takes a lot of disk space and will give maintenance problems i.e. if the information in one page is changed then the replicated page must be changed accordingly.

In the case of the Help System it was decided to resolve the problem by putting a "hidden" input tag in the respective pages since this will not take additional disk space and would be easier to maintain.

To implement this, a 'back' function was needed which will take the user to the right index page.

If the button is as follows,

1. <INPUT TYPE="Submit" NAME="Go_To" VALUE="Home">

then the hidden field is

2. <INPUT TYPE="hidden" NAME="Home"

VALUE="<!--#my P-->">

Note that the entry in the VALUE of INPUT tag of line2 is in pseudo html tags. The value is computed by the operation **P** which extracts the name of the page that has been used.

When the cgi-script is called a log file is generated as seen in Figure 7.5.2(4). In normal circumstances the value of the PageName and Go_To is used and maps with .inf file to generate the 'next page'. However, in this circumstance, the entry to the log file is as below - the value of Go_To is

```
I 378346 20 unknown 158.125.108.20 55
```

```
PageName=page327&Go_To=Home&Home=page3&feedbacks=++++++
```

```
-----
```

```
-----
```

equal to the next entry field (which is equal to "Home"). This is the value used by the cgi program to decide which page to go to next (it is done by mapping with the record in the mh1.cgi.inf1 file (Figure 7.5.2(8))- by searching for the page name, the second field in each entry, and when a match is found, using the file name which precedes it).

```
HelpSystem.html:log
IntWebX.html:page5
Accessedpgs.html:acceddedpgs
```

```
-----
```

```
-----
```

```
faqnet1.html:page221
faqnet10.html:page2210
faqnet11.html:page2211
```

```
-----
```

```
-----
```

```
netpg1X.html:page2
pg1wwwX.html:page3
```

```
-----
```

```
-----
```

```
wsite8.html:page528
wsite9.html:page529
```

Figure 7.5.2(8) Extract from mh1.cgi.inf1 file

7.6 Evaluation of Version 3 of the Help System

To evaluate the version 3 of the Help System, a user test was carried out. Eight postgraduate students from various departments (Business, Social Sciences, Engineering, Humanities, Chemistry and Computer Science department) in Loughborough University volunteered to participate in the evaluation study. Seven of them have working experience (worked with Malaysian Civil Service) and have held managerial positions before undertaking their Ph.D. studies. Only one of them was studying with the Computer Science Department, however, all of them have used the World Wide Web in their everyday work, i.e. looking for information and journals that are relevant to their thesis.

During the experiments, three questions were asked to the participants. They were as follows:

- 1) What do you think of the system in term of 'ease-of-use' and user friendliness?
- 2) With all the capabilities you have seen, does the Help System have the potential to be used as a support system for managers?
- 3) Overall, do you think, the system has the characteristic as a support mechanism for collaborative learning.

Besides the above main questions, participants were also being asked informally in term of its interactivity, monitoring capability, its value as a user-driven system, the system's layout, index and keyword search.

The aim of this experiment was to establish the effectiveness of the system as a support system and the participants have been reminded that subjects and materials in the system are only a prototype, which can be changed to suit the needs of the user. What they were asked to do was to

provide feedback on their perception of the usefulness of the system as an implementation of this idea. Comments were particularly sought on the effectiveness of the system in its current form and on improvements that might be needed.

7.6.1 Experimental procedure

In carrying out the experiment, the most desirable situation would be to test it at the users' 'home' site. Most of the users had their home site on campus, however two had machines at home (off-campus) which they would have liked to use. When the system was tested at the two remote sites, it could not be accessed. It was later found out that the 'ACTION' clause in the FORM

```
(<FORM METHOD="POST" TARGET="display"  
ACTION="http://cos/~comh1/1/mh1.cgi" >)
```

tag on the pages had not been constructed to enable off site access (the URL referred to the server as "cos" instead of using the full name "cos.lboro.ac.uk").

It was also found that tests at a user's office were more problematic than had been anticipated. They have older model PCs (e.g. Intel 486, which run unreasonably slowly). Furthermore, it was required, as part of the evaluation process, to show the users that their input was being recorded. A second machine (or, at least, a second connection) was therefore needed (one for the web pages and one for displaying the log file).

It was therefore decided to carry out the experiment at the Computer Science Laboratory using Pentium III PC with processor speed of 300MHz and a Sun workstation. One experiment was, however, carried out in a user's office where the right equipment was available.

The experiment was carried out one by one (i.e. they were not tested simultaneously). Each user was first told about the Help System and what the session would be about. Each user had been asked to focus on the intended main aspects and capability of the system, which were as follows:

- i) ease-of-use
- ii) user friendliness
- iii) capability for user support
- iv) interactivity
- v) monitoring capability
- vi) learning capability
- vii) value as a user-driven system
- viii) others – e.g. layout and graphics.

After explaining the main concept of the system, the user was then asked to go through the system by themselves. Any question posed by the user during the session, were noted and answered orally at that point. When 'going through the system' session was finished, they were then shown the monitoring capability of the system. They were shown that whatever activity they had done during the session (i.e. their name, which topics they clicked, which pages they went and feedback that they give) were captured and stored in the database. At the same time, their opinion was requested as to the usefulness of this data. For each user, the experiment took about 2 hours.

The following section discusses the feedback and comments given by the participants.

7.6.2 Feedback and Comments

a) Ease of use

All the eight users said that the system is very easy to use and user friendly. They felt that it was very easy to access the information and navigate around the various screens. What they had to do was just to use the mouse and click to the respective topic buttons to go to the information page. To go back to the main page, they only needed to click the home button. One of the user said that 'even a novice could quickly learn to navigate the system'. He also said that the 'home' and 'top' link is very useful.

Another user said that the system is not particularly technical and should appeal to both the beginners and more experienced users.

b) As a support system for managers

All users agreed that this system has the potential to be a support system. This is because of its easy to use, interactive and user-driven. They had seen that their feedback had been captured automatically, meaning that this allowed them to change information and ideas among themselves. One of the users mentioned that 'the crucial aspect of the site is that it allows users to submit questions and answers which act as a two-way communication environment among users'.

Another user said that, 'After exploring the Help System, I discovered that the system could be beneficial to managers and researchers as it act as supporting tool. The system also could be seen to incorporate a 'reasoning

approach' which has a close association with artificial intelligence which all queries by user could be kept in the provider database and monitored.'

c) Learning Capability

One of the users said that, 'The system monitoring capability will provide valuable feedback information and essential requirements for the learners. This will ensure the 'learning nature' of the system so as to be flexible and responsive to demands'.

d) Collaborative Learning

Most users had indicated that the Help system potentially provided collaborative learning among users. This is because of its interactive nature, which allowed users to communicate, send feedback, questions and answers. One of the users said that, 'The system provides collaborative learning to users. I am very interested to communicate with my peers and I found it very interesting to give feedback and received information regarding the areas that need urgent solutions to the problems.

e) Other Comments

The other comments given by the participants are as follows;

- the alphabetical index is good since it complements the hyperlink approach.
- the keyword search is very supportive and a good feature for people who may be in a hurry and want answers quickly.
- there's not too much Java in the system, as Java can take ages to load, especially on an old computer and can end up just annoying people.
- the system would have to consider other languages, since not all managers understood English.

- it would be good to add highlighting of the current topic in the left one that corresponds to the frame displayed on the right.

7.6.3 Concluding Remarks on Version 3

The experiment was carried out with a very small sample, nevertheless it is sufficient to show that the Help System using CGI scripts does work, and is acceptable to the users. It also demonstrates that navigational information can be collected satisfactorily. The comments of the users suggest that the Help System has the potential to be a useful support system.

CHAPTER 8

VERSION 4 OF THE HELP SYSTEM

8.1 Introduction

Version 3 of the Help System has successfully shown that the usage of the site can be monitored. With this monitoring capability, it can be known who used the system, what information had been accessed, what feedback had been given and what choices users made on each page of the site while they were there. In addition to this, the system recorded the IP address of the computer from which each user accessed the system. However, on this version of the system, all this detailed data are stored in the log file (mh1.cgi.log). They are not delivered on any of the pages of the system. Yet these detailed data would be most useful and beneficial if they were known to users since this would create opportunities for interactivity and collaborative learning among themselves. Version 4 of the Help System extends the facilities and capabilities of the system. This version will allow users to see those detailed users' information.

One of the important aspects mentioned earlier, which the Help System needed to show is the ability to change through feedback from its user community. That is the system should evolve - the system grows by initially establishing a simple system, and then providing mechanisms for user involvement and feedback from which to 'extend' the system (the content and potentially, display formats). Version 4 is intended to demonstrate that users

can provide information in the system, ask questions, answer unanswered questions in the system and possibly structure information within the system. As part of these ideas, version 4 must have 'learning' capabilities. For example, when a user decides that a word or phrase could be a key to finding a page, he/she can then submit the keyword or phrase as an indexing term to that page. The system will then learn from this feedback and the indexing will be updated automatically. The newly indexed page can then be accessed from the search system using this word.

8.2 Implementing Version 4 of the Help System

Version 4 was implemented as an extension to version 3. However, in order to allow comparisons to be made, version 3 was left fully operational in the directory " ~comh1/public_html/1 " and all of the files were copied to a newly created directory " ~comh1/public_html/2 ". This directory then contained all of the page templates (HTML files), the picture files (gif and jpg) and the navigational files (.inf and .inf1). In addition, a new version of the cgi-script was created which would support keyword search and full incorporation of input from users.

8.3 Design of the site for Version 4

Similar to version 3, the script is to be called by the Web server on the host (by requesting the URL "http://cos.lboro.ac.uk/~comh1/2/mhi.cgi"). As in earlier versions, once it was called, it writes a record to the log file (mh1.cgi.log) then generates and returns the next page. The content of the log file is similar to what has been described earlier, i.e it contains information about the circumstances of the call and the input provided by the user. The page returned to users can either be static (taken from a file) or can be largely

or even wholly created on request (e.g. by processing the contents of the log file). As in version 3, every page in the system would need to call the server using the basic URL stated above but with different 'parameters', which appear as input on the standard input channel (using the 'METHOD' "POST" in a FORM tag on the page). However, in this version, there are additional facilities provided to users to call the information page, that is by using keyword search. This is to give flexibility and make it easier for users to locate what they need. In addition to the above, this is to show another alternative of providing a search facility (using cgi-scripts) that contrast to the earlier version, which was implemented using Java Applets. The mechanism of this searching will be explained later.

Navigation, as in version 3, was accomplished using the file `mh1.cgi.inf` (an extract of it is shown in, Figure 8.3(1)). As described earlier, this file contained a series of records. The first record, which is to be used when the system starts up, contains the name of the file containing the initial page and all the remaining records consist of triples containing <page name>, <submit button name> and <target file name> separated by tabs. The record set up of this file, required a "FORM" section to be added to each existing page which contain a hidden input field with a unique page name and having one or more "submit" buttons with the NAME "Go_To" and a VALUE which was unique to that page as shown in Figure 8.3(2) below. Each attribute in the FORM and INPUT tags has been explained in detail in this Chapter 7. The only difference was a change in the ACTION parameter in the FORM HTML tag which now references the script in directory 2 (as shown in Figure 8.3(2)).

HelpSystem.html		
Log	LOGIN	netpg1F.html
log		Netpg1F.html
page0	Internet-General	intgenX.html
page0	FAQ-Internet	netpg1X.html
page0	FAQ-WWW	pg1www1.html
page0	How-WWW	howtoX.html
page0	Interesting+Sites	IntWebX.html
page0	Index	indexX.html
page0	Accessed+Pages	accessedpgs.html
page0	Who+the+Users	whoaccess.html
page0	Show+Feedback	wfeedback.ht
----	-----	-----
----	-----	-----
page1	Internet+Jargon	intgen3.html
page1	History	intgen2.html
----	---	----
----	---	----
page2	Modem	faqnet13.html
page2	Security	faqnet18.html
* page2	Software	faqnet5.html
----	---	----
----	---	----
* page6	Where+do+I+get+software+from%3F	faqnet5.html
page6	Alta+Vista	faqwww14.html
----	---	----
----	---	----
page121	Home	intgenX.html
page122	Submit+Feedback	intgenX.html
----	---	----
page5237	Home	IntWebX.html
page5238	Submit+Feedback	IntWebX.html

Figure 8.3(1) Part of the mh1.cgi.inf file

```

<HTML>
<HEAD>
<TITLE>Internet In General</TITLE>
</HEAD>
<BODY BACKGROUND="burong.jpg"
      LINK="#0000FF" ALINK="#FF0000" VLINK="#0000FF">
<FORM METHOD="POST" TARGET="display"
      ACTION="http://cos.lboro.ac.u/~comh1/2/mh1.cgi">
<INPUT TYPE="hidden" NAME="PageName" VALUE="page1">
      -----
      -----
<INPUT TYPE="submit" NAME="Go_To" VALUE="Internet-Basics"><br>
<INPUT TYPE="submit" NAME="Go_To" VALUE="History"><br>
<INPUT TYPE="submit" NAME="Go_To" VALUE="Internet Jargon"><br>
      -----
      -----
</FORM>
</BODY>
</HTML>

```

Figure 8.3(2) Adding a FORM section in the page.

Similar to version 3, the dynamic pages in version 4 were “assisted” by the same ‘server side’ html tags described earlier in this chapter i.e. `<!--#incl<file name> -->`, `<!--#exec<program name><parameters> -->` and `<!--#my <operation name> -->` where the operation names used were U (which finds the name that the user has logged in with) and P (which extracts the name of the page that has just been used in the current log record). In addition, a number of new “my” pseudo html tags have been introduced. Two new operations ('F' and 'm') have been added which extract information from the current user input and perform appropriate processing. One operation ('D') displays today's date while others process the log file as a whole ('I', 'A') or a single record within the log file ('t', 'f'). Finally the 'S' (search) operation takes its input from the current record, the log and the navigational files (.inf and .inf1) in order to produce a search results page. Each of these operations is discussed in more detail below.

F - extracts the 'type' of a submission (question, comment, feedback, indexing) from the current input from a page and displays it (used in the Answers page);

m - places the minutes and seconds values which appear in the current log record into the name of the response field on the 'Answers' page, so that responses can be correlated with the questions (comments, feedback) they are a response to;

D - displays the current date in dd:mm:yy format for inclusion as a default in the two 'date' fields in the 'advancedfeatures' page;

I - processes the complete log file looking for records which meet the criteria that were specified in the 'advancedfeatures' page and extracts, formats and displays the information from the records which do match the criteria (used in the 'Logdisplay' page);

A - processes the log to find feedback which is labelled with a 'date/time' (in the form: minutes:seconds) which matches with an initial user input and reformats it to fit on the responses part of the 'Answers' page;

t - processes a single log record which contains user supplied information to extract and display the type of the information (question, comment, feedback) - used in the 'Answers' page;

f - processes a single log record containing user supplied information to extract that information and display it (from the feedback field) - used in the 'Answers' page;

S - implements the search facility and displays the results in tabular format. In the current version, the search processes the navigational files (mh1.cgi.inf , mh1.cgi.inf1) and the log, using input taken from the search field of the current record. The .inf file is processed to construct a tree of words, which occur in the middle fields of the records in the file, and the log is processed to form a tree of words used in the 'feedback' fields on information pages when a 'Submit Indexing' button was pressed. In both cases each word in the tree gives access to the character position of the start of the record(s) from which the word was extracted in the navigational file or the logfile respectively. These trees are use to see whether the word supplied by the user as the search request occurred as either a word in the navigational file information or as a word in an indexing entry by users or both. The search extracts the addresses of each of the selected records (if there are any) and displays each one as a button which, when selected, causes the indexed page to be displayed. This structure could readily be amended to provide a stem searching facility (find all of the words which start with a particular sequence of characters and then use a selection of these words to find relevant indexing phrases). It could also be amended so that the title of the target page could be used as the label on the button instead of the information drawn from the log file or the navigational file.

8.4 New Pages

As has been mentioned earlier, version 4 gives flexibility to users. It gives additional interactive features and has a knowledge acquisition capability. By this we mean that when a user response to another person question, the response is save in the database and is searchable for future reference or questions. To provide all this functionality, five new pages have been added. They are as follows: -

- i) **advancedfeatures.html** - this is a page which allows users to display (using Logdisplay explained below) records from the log file. It enables users to define conditions, which determine which records are displayed and permits the user to select the information that is to be displayed.
- ii) **Logdisplay** - this defines the template in which the log records are displayed as specified in the 'advancedfeatures.html' page.
- iii) **Answers** - this page allows users to view and provide follow-up responses to the feedback, comment and questions that have been submitted. This page is called from the Logdisplay page.
- iv) **Thanks** - an appreciation page to users when they have submitted a response (feedback, comment, question or indexing).
- v) **searchresults.html** - to display the results of a search.

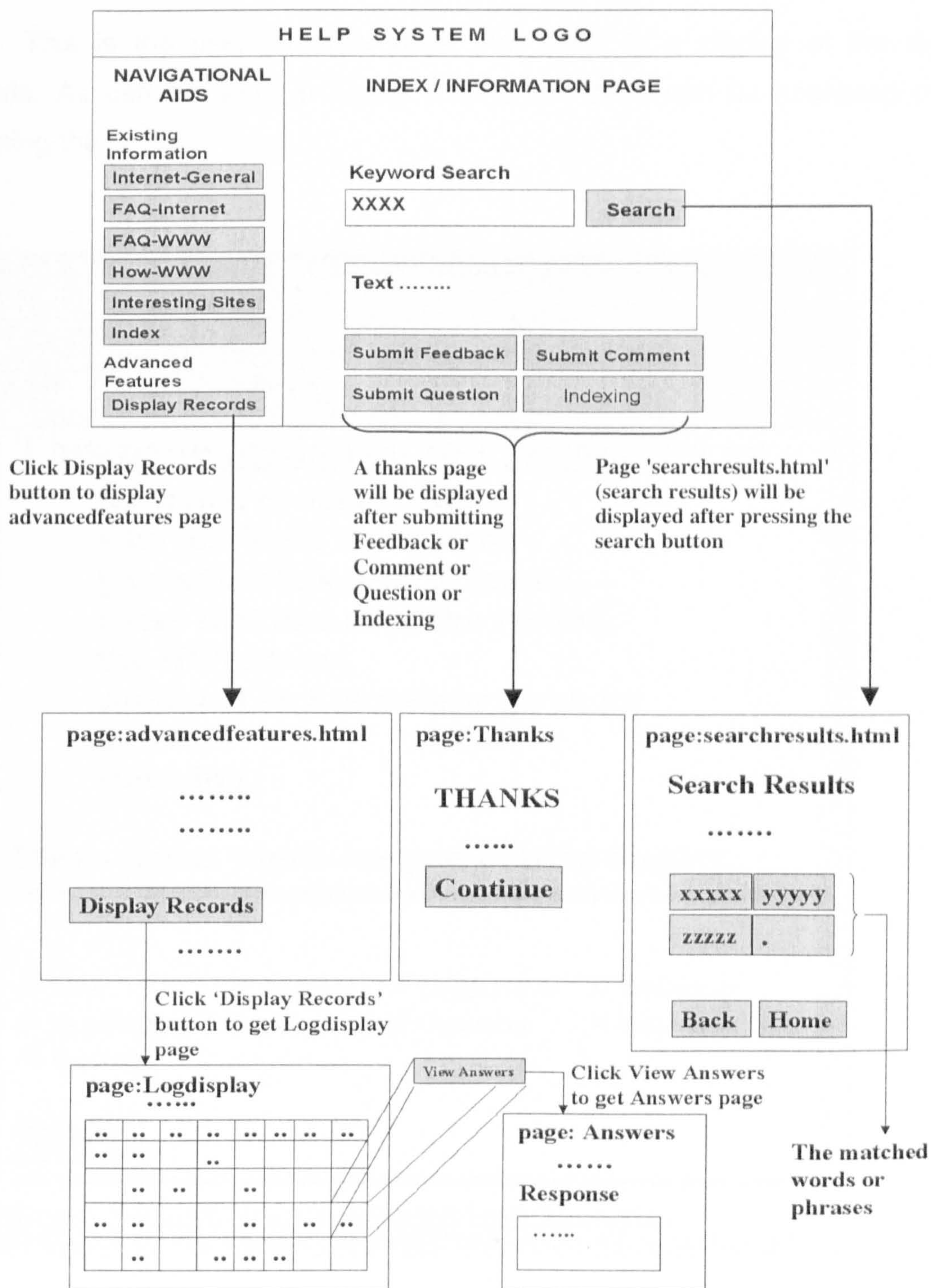


Figure 8.4(1) Shows from where the pages can be accessed.

The next paragraph explains each of the pages in more detail.

i) **Advanced features page - advancedfeatures.html**

This is the user interface page that leads to a display of the log records. As can be seen in Figure 8.4(1), this page can be accessed by selecting the

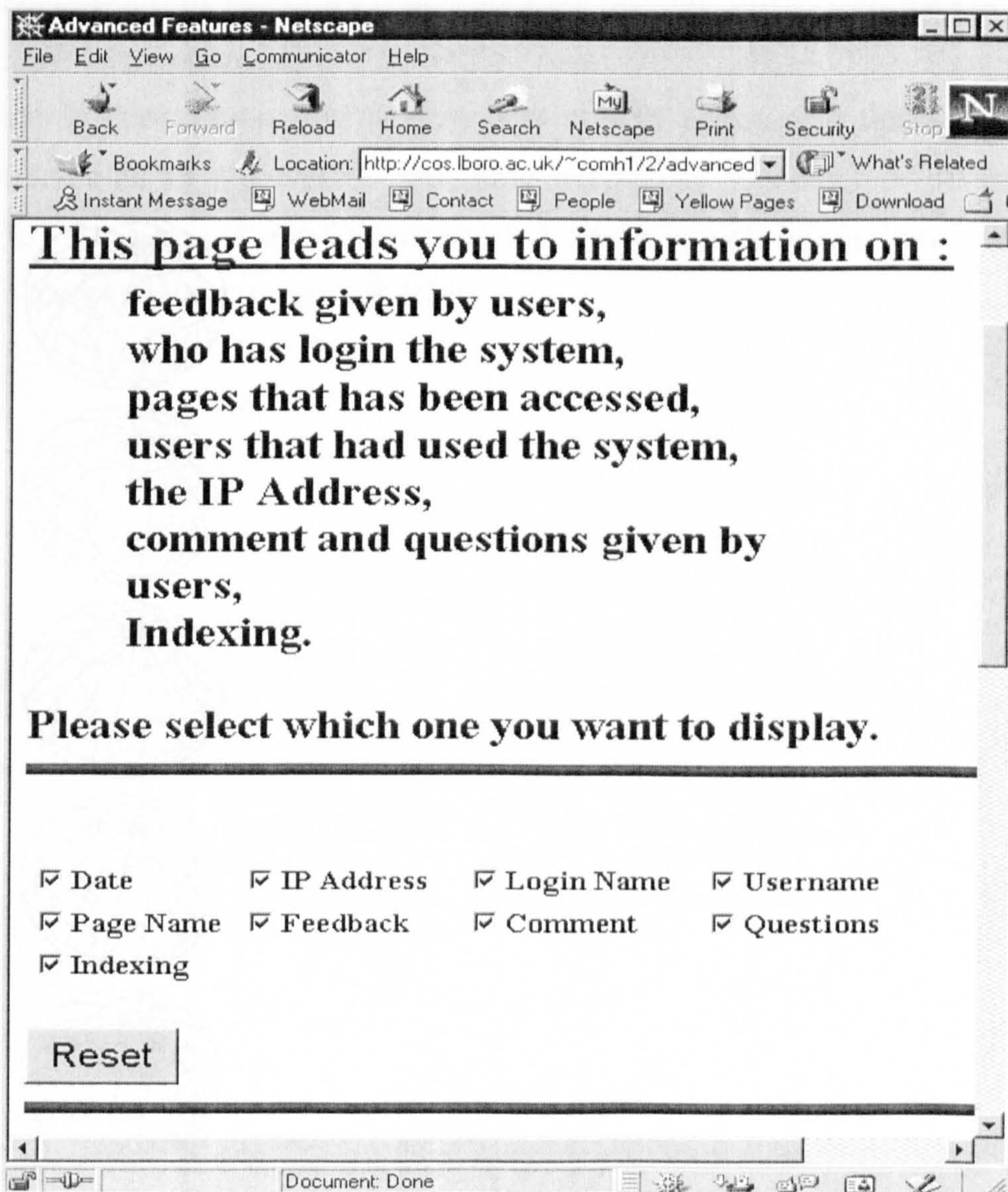


Figure 8.4(2) Top part of the 'advancedfeatures' page.

'Display Records' button of the advanced features in the navigational aids frame.

Basically the page itself is divided into three parts. The top part consists of several check boxes, which provide users with the choice of what information they want to display from the log records. This is shown in Figure 8.4(2). Users can select as many choices as they want. This allows them to structure information according to their need (which should help show that the system is user-driven and flexible and should encourage users to suggest other aspects of the display that they would like to select or control). The `<INPUT>` tag that is use to produce the above check box option is shown in the following extract (Figure 8.4(3)).

```
<HTML>
<HEAD>
  <TITLE>Help System</TITLE>
</HEAD>
  -----
  -----
  <TABLE>
    <TR><TD width=23%><font color="000000" size=2>
      <INPUT TYPE="checkbox" CHECKED NAME="Date">
        <b>Date</b></TD>
      <TD width=17%><font color="000000" size=2>
        <INPUT TYPE="checkbox" CHECKED NAME="IPad">
          <b>IP Address</b></TD>
      <TD width=30%><font color="000000" size=2>
        <INPUT TYPE="checkbox" CHECKED NAME="Login">
          <b>Login Name</b></TD>
      <TD width=30%><font color="000000" size=2>
        <INPUT TYPE="checkbox" CHECKED NAME="UserN">
          <b>Username</b></TD>
    </TR>
    <TR><TD width=23%><font color="000000" size=2>
      <INPUT TYPE="checkbox" CHECKED NAME="PageN">
        <b>Page Name</b></TD>
      <TD width=17%><font color="000000" size=2>
        <INPUT TYPE="checkbox" CHECKED NAME="Feedb">
          <b>Feedback</b></TD>
      <TD width=30%><font color="000000" size=2>
        <INPUT TYPE="checkbox" CHECKED NAME="Comm">
          <b>Comment</b></TD>
      <TD width=30%><font color="000000" size=2>
        <INPUT TYPE="checkbox" CHECKED NAME="Quest">
          <b>Questions</b></TD>
    </TR>
    <TR><TD width=23%><font color="000000" size=2>
      <INPUT TYPE="checkbox" CHECKED NAME="Index">
        <b>Indexing</b></TD>
      <TD></TD><TD></TD><TD></TD>
    </TR>
  </TABLE>
  -----
  -----
</BODY>
</HTML>
```

Figure 8.4(3) Extract of file advancedfeatures.html .

Each check box option is created by its own <INPUT> tag and must have its own unique NAME. If the multiple check box options have the same NAME, the script has no way to determine which choices the user actually made. The optional CHECKED attribute preselects the check box when the form is rendered on the browser screen as shown in Figure 8.4(2).

The middle part of the advanced features page allow users to specify conditions for the log records to be displayed. Here, the users can set the duration of interest (date from and date to), specify any specific user or any specific page name. If the 'Username' and the 'Page Name' has been left blank, then records for all users and pages that had been visited within the set date will be displayed. If the date fields are left blank then the start date is taken as referring to the first record in the log and the end date refers to the latest record in the log. Figure 8.4(4) shows the extract code for the middle part of the page. Figure 8.4(5) shows how the middle part of the page looks when displayed by the browser.

```

Line1  <HTML>
Line2    <HEAD><TITLE>Help System</TITLE></HEAD>
        -----
Line3  <FORM METHOD="POST" TARGET="display"
        ACTION="http://cos.lboro.ac.uk/~comh1/2/mh1.cgi">
Line4  <INPUT TYPE="hidden" NAME="PageName"
        VALUE="advancedfeatures">
Line5  <INPUT TYPE="hidden" NAME="User_Name"
        VALUE="<!--#my U -->">
        -----
Line6  <TABLE ALIGN=LEFT BORDER=2 CELLPADDING=4
        CELLSPACING=4 WIDTH=80% COLS=2>
Line7  <TR VALIGN=MIDDLE>
Line8  <TD><B>Date From (dd:mm:yy):</B>
Line9  <INPUT TYPE="text" NAME="DateF" MAXLENGTH="8"
        VALUE="<!--#my D -->">
Line10 <TD><B>Date To (dd:mm:yy):</B>
Line11 <INPUT TYPE="text" NAME="DateT" MAXLENGTH="8"
        VALUE="<!--#my D -->"><TR VALIGN=MIDDLE>
Line12 <TD><B>Username (in system):</B>
Line13 <INPUT TYPE="text" NAME="Uname" MAXLENGTH="24"
        VALUE="<!--#my U -->">
Line14 <TD><B>Page name:</B>
Line15 <INPUT TYPE="text" NAME="PName" MAXLENGTH="24"
        VALUE="<!--#my P -->">
Line16 </TABLE>
        -----
Line17 </FORM>
Line18 </BODY>
Line19 </HTML>

```

Figure 8.4(4) Code for the middle part of advanced features page.

Notice that in the Figure 8.4(4), above, the VALUE attributes in Line9, Line11, Line13 and Line15 use pseudo html tags. The 'my D' tags in Line9 and Line11 extract the current date and enters it as a default value in the input text area of the 'Date From' and 'Date To' as seen in Figure 8.4(5). The 'my U' tag in Line13 finds the name which the user has logged in with and 'my P' tag in Line15 extract the name of the page that has been used in the last log

record. These values are then used as defaults in the input text area of the 'Username' and 'Page Name' when the 'advanced features' page is displayed. Note that the 'Date From' date is interpreted as 00.00 (hours and minutes), where as the 'Date To' date is interpreted as 23.59 (hours and minutes) searching through the log file. (Note: Figure 8.4 (5) and Figure 8.4 (2) are from the same page. The whole page cannot be fitted as one piece on this page)

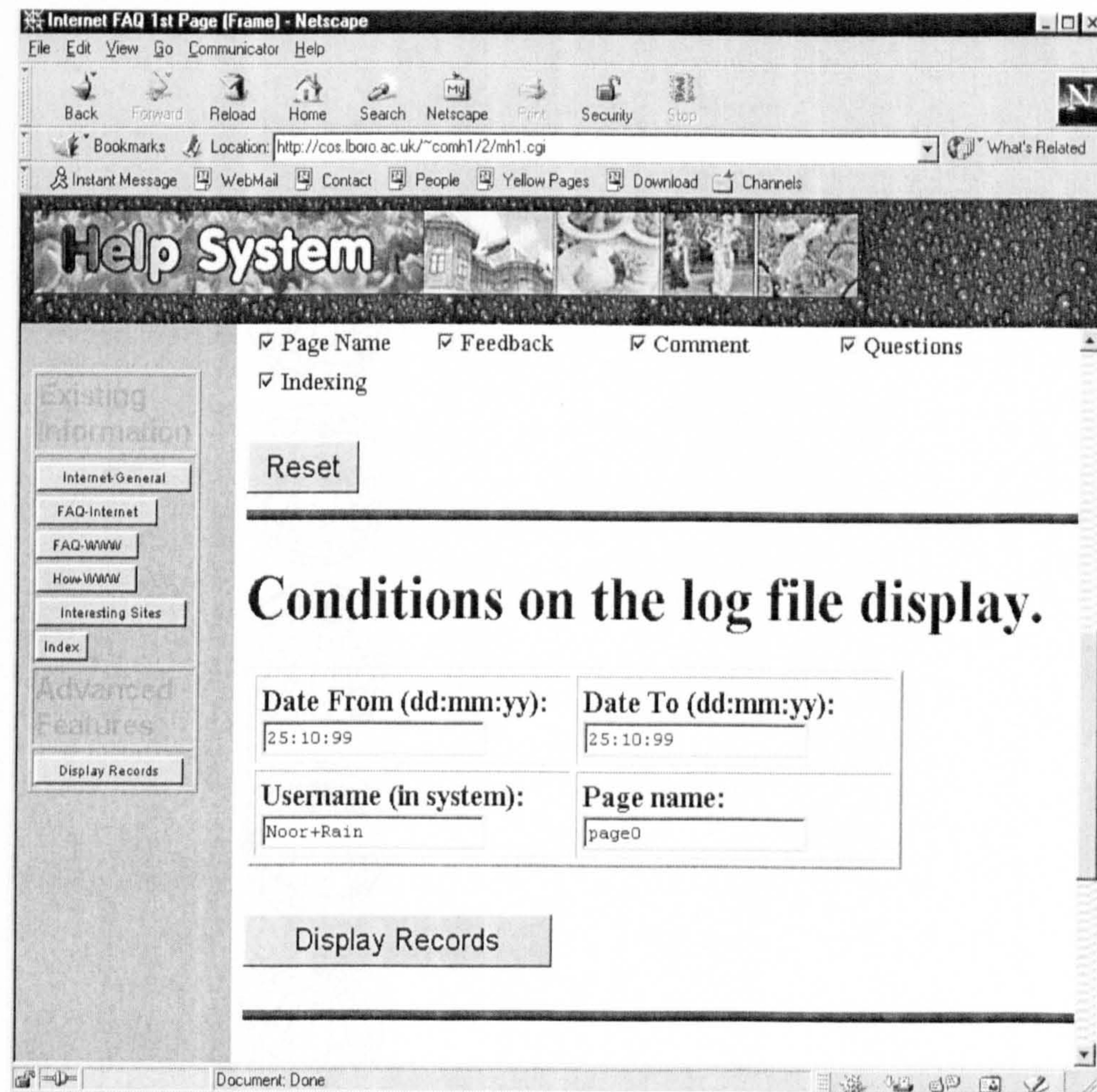


Figure 8.4(5) The middle part of the advanced features page.

The bottom part of the advanced features page contains a text area for users to submit any feedback and questions they may have about the page or the system. This is similar to other pages, which have been described in Chapter 7.

The bottom part of the advanced features page contains a text area for users to submit any feedback and questions they may have about the page or the system. This is similar to other pages, which have been described in Chapter 7.

ii) Logdisplay

Under the conditions table (Figure 8.4(5)), a 'Display Records' button is provided for the users to view information in the log file. As can be seen in Figure 8.4(1), when clicking the 'Display Records' button a Logdisplay page is delivered to the browser. The information items that can be displayed if the users so choose are the IP address on which the user ran the browser, the user name registered as running the browser (if known), the name of the user as entered on the login page, the names of the pages that have been accessed, feedback, comment, question which had been given by users and word or phrases for page indexing. Figure 8.4(6) and Figure 8.4(7) show the code and the page respectively.

As an example, Figure 8.4(7) shows that, on the 20th October, 1999, at 18 hours and 15 minutes, a user, JOADAM (name of the user as entered on the login page) login into the system. Two minutes later (at 18:17) he went to 'advancedfeatures' page. There was no input from the user since there are no data under the column 'Input Type' and 'Input'.


```

<HTML>
<HEAD>
    <TITLE>Test</TITLE>
</HEAD>
<BODY BACKGROUND="burong.jpg">
<H1>Log Display</H1>
Test page for my I for <!--#my U --> <P>
<FORM METHOD="POST"
    ACTION="http://cos.lboro.ac.uk/~comh1/2/mh1.cgi">
<INPUT TYPE="hidden" NAME="PageName" VALUE="tt7">
<INPUT TYPE="submit" NAME="Go_To" VALUE="Home">

<P>
<!--#my I -->
<P>

<TEXTAREA ROWS=7 COLS=60 NAME="feedback" WRAP=VIRTUAL>
Space for writing comments on the content of the page,
feedback on the system,
Questions about the page or the system or for providing
indexing terms which you might use to reach the page
with a search
</TEXTAREA>

<br clear=all>
<br clear=all>
<TABLE ALIGN=CENTER BORDER=2 CELLPADDING=4
    CELLSPACING=4 WIDTH=60% COLS=2>
    <TR VALIGN=MIDDLE>
        <TD>
            <INPUT TYPE="submit" NAME="Submit"
                VALUE="Submit Comment">
        <TD>
            <INPUT TYPE="submit" NAME="Submit"
                VALUE="Submit Feedback">
    <TR VALIGN=MIDDLE>
        <TD>
            <INPUT TYPE="submit" NAME="Submit"
                VALUE="Submit Question">
        <TD>
            <INPUT TYPE="submit" NAME="Submit"
                VALUE="Submit Indexing">
    </TABLE>
</FORM>
</BODY>
</HTML>

```

Figure 8.4(6) Code for the Logdisplay page.

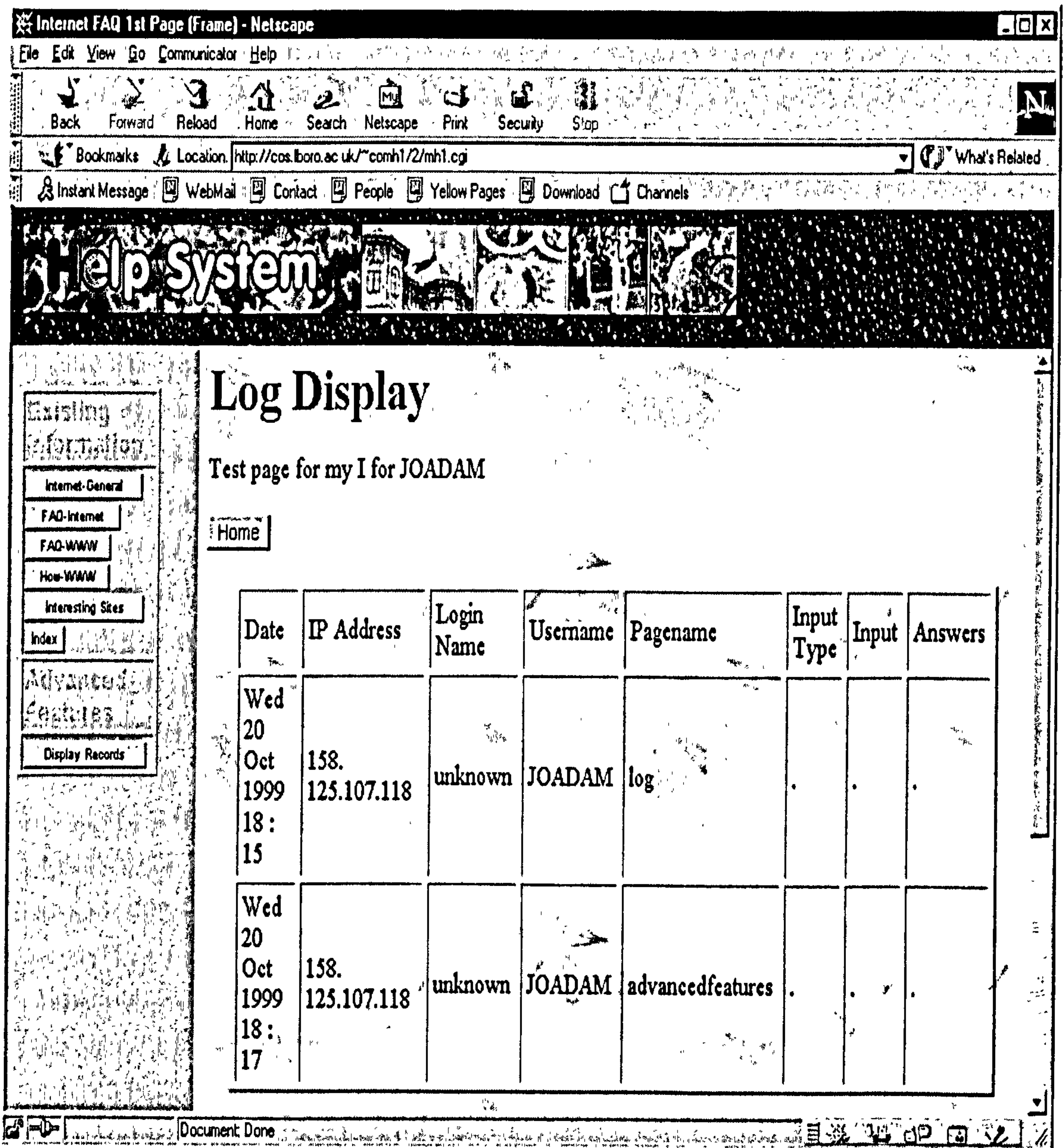
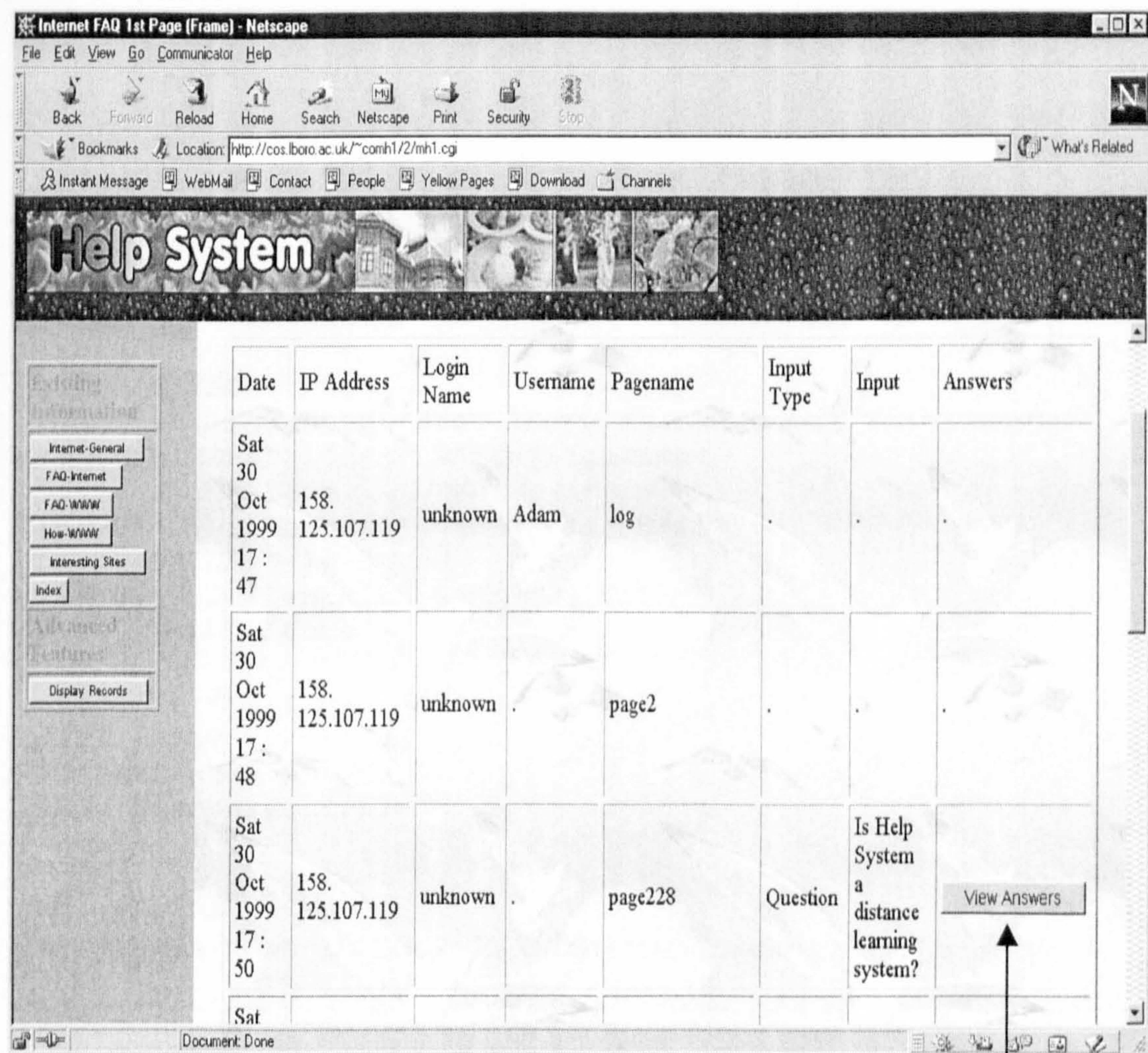


Figure 8.4(7) Logdisplay page.

iii) Answers

When a user provides feedback or comment or submits a question to the system (using the text area at the bottom of the information or index pages), a 'View Answers' button is created (Figure 8.4(8)) adjacent to the user's input under the 'Answers' field of the Logdisplay table. Figure 8.4(8), shows the question 'Is Help System a distance learning system?' was submitted by a user. As shown in Figure 8.4(1), when the 'View Answers' button is pressed, an 'Answers' page is displayed. This page is provided for the user to make a follow up on the submitted feedback, comment or question. The user can view the feedback, comment or question given by other users and in addition to this, he/she could also respond to the input. This is like a virtual classroom and gives choices to users when to participate. This is very useful to managers who are very busy class of people in an organisation. It gives opportunities for a manager to communicate at the time and pace of his own choosing rather than at the discretion of others. This also can reduce travel by replacing some face-to-face meetings and providing a continuous link without the financial and human costs of travel. Furthermore, this provides the ability for users to join groups (discussions) more freely i.e., it provide opportunities for communicating and joining groups without the intrusion of sex, race, physical appearance, or other irrelevant characteristics. Another important aspects by having this kind of communication is that it potentially increases group resources by permitting users as well as 'trainers' or 'experts' to provide information

Figure 8.4(9) shows the code for this page. Figure 8.4(10a) and Figure 8.4(10b) shows the page as displayed on the screen.



the created button

Figure 8.4(8) 'View Answers' button is created when users submitted a feedback, comment or question.


```

<HTML>
  <HEAD>
    <TITLE>Test</TITLE>
  </HEAD>

  <BODY BACKGROUND="burong.jpg">
    <H1>Answers to Question, Comment or Feedback</H1>
    <B>Page for viewing the follow up to a question
      or comment or to feedback<BR>
      You can also provide your response if you wish </B>
    <P>

    <FORM METHOD="POST"
      ACTION="http://cos.lboro.ac.uk/~comh1/2/mh1.cgi">
    <INPUT TYPE="hidden" NAME="PageName"
      VALUE="8">
    <INPUT TYPE="hidden" NAME="User_Name"
      VALUE="<!--#my U -->">
    <INPUT TYPE="submit" NAME="Go_To"
      VALUE="Home">

    <h3> <!--#my t --> </h3>
    <B><!--#my f --></B>
    <BR><HR><BR>
    <h3> Responses </h3>
    <!--#my A -->

    <P><HR><P>
    <TEXTAREA ROWS=10 COLS=72 NAME="feedback<!--#my m -->"
      WRAP=VIRTUAL>
    Space for writing your response
    </TEXTAREA>

    <TABLE ALIGN=CENTER BORDER=2 CELLPADDING=4
      CELLS=1><TR VALIGN=MIDDLE><TD>
    <INPUT TYPE="submit" NAME="Submit"
      VALUE="Submit Response">
    </TABLE>

  </FORM>
</BODY>
</HTML>

```

Figure 8.4(9) Code for the 'Answers' page.

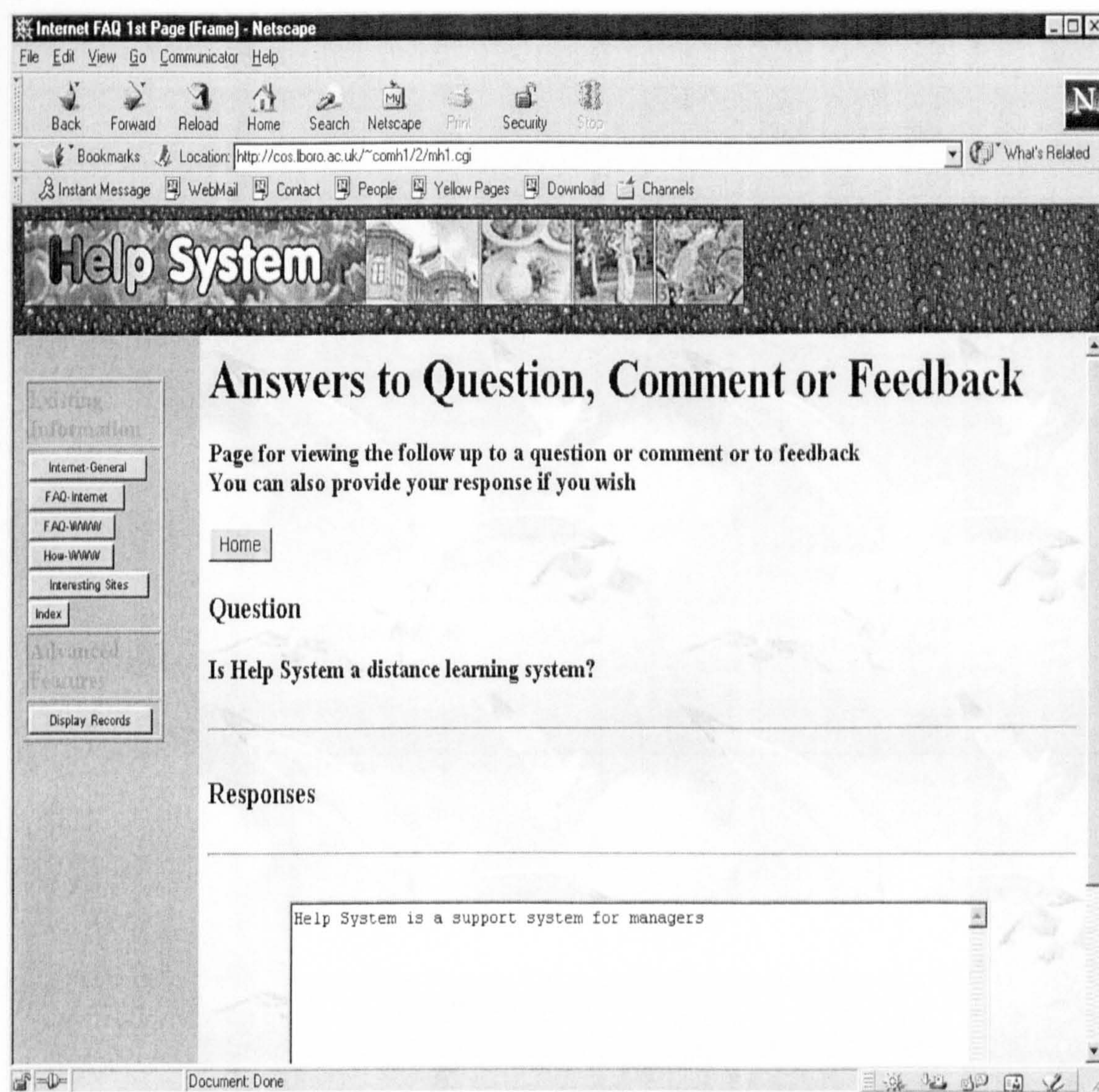


Figure 8.4(10a) First half of the 'Answers' page.

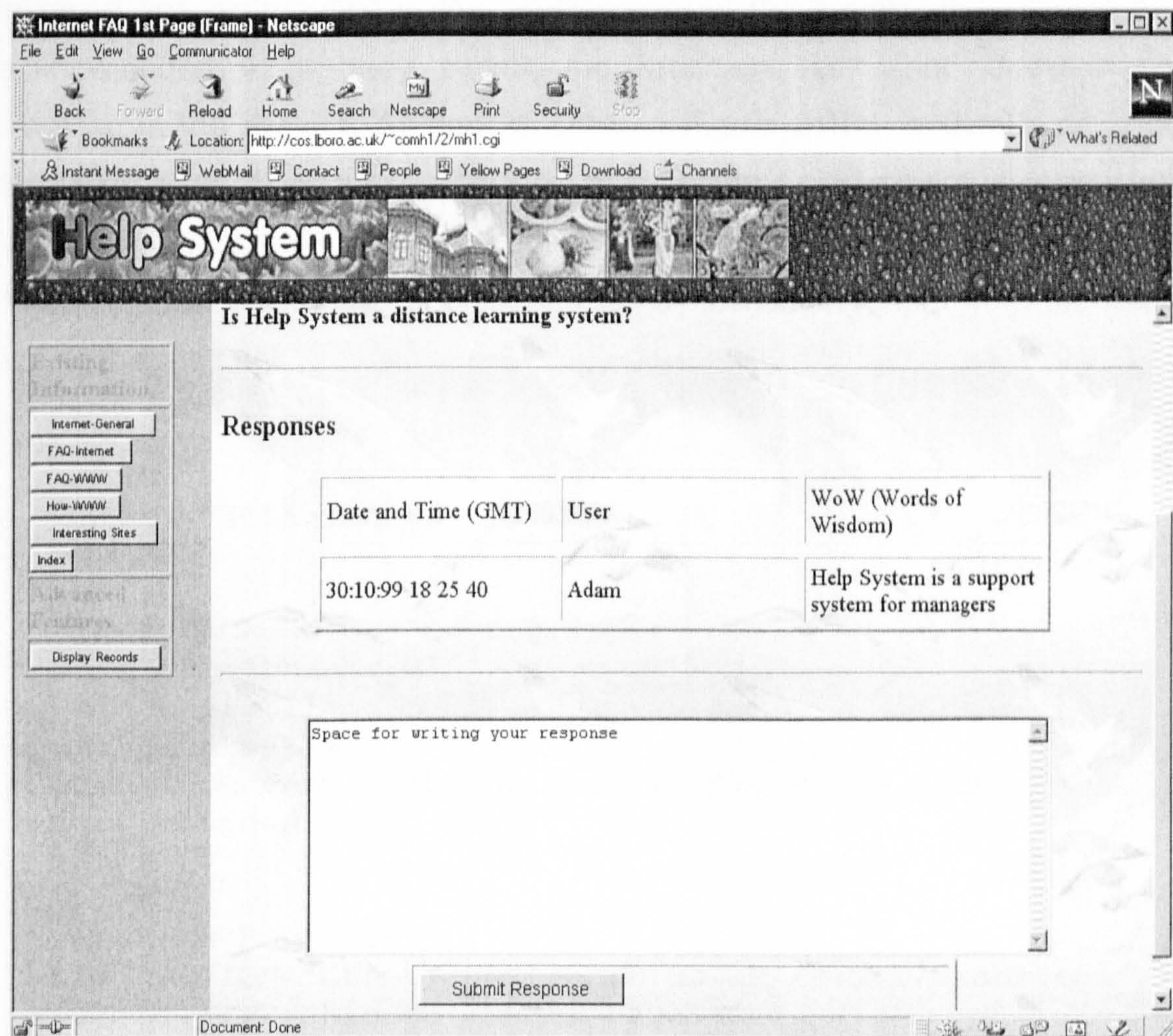


Figure 8.4(10b) Second half of the 'Answers' page where users can submit their response to feedback, comment or question.

iv) Thanks

To provide better interaction and make users feel that they are also involved and contributing in the development of the system, they should be acknowledged when they submit the feedback, comment, question or indexing in the system. As can be seen in Figure 8.4(1), a thanks page is displayed when they have submitted their feedback, comment, question or indexing. Figure 8.4(11) is the code of the page and Figure 8.4(12) is the 'Thanks' page. Alternative approaches to acknowledging input from the user are discussed later.

```
<HTML>
<HEAD><TITLE>Thanks</TITLE>
</HEAD>

<BODY BACKGROUND="burong.jpg">

<br clear=all>
<br clear=all>
Thank you very much for the <!--#my F --> that
you provided
<P>

<FORM METHOD="POST"
      ACTION="http://cos.lboro.ac.uk/~comh1/2/mh1.cgi">
<INPUT TYPE="hidden" NAME="PageName"
      VALUE="<!--#my Q -->">
<INPUT TYPE="hidden" NAME="User_Name"
      VALUE="<!--#my U -->">
<INPUT TYPE="submit" NAME="Go_To"
      VALUE="Continue">
<INPUT TYPE="hidden" NAME="Continue"
      VALUE="<!--#my P -->">
</FORM>

</BODY>
</HTML>
```

Figure 8.4(11) Code for the 'Thanks' page.

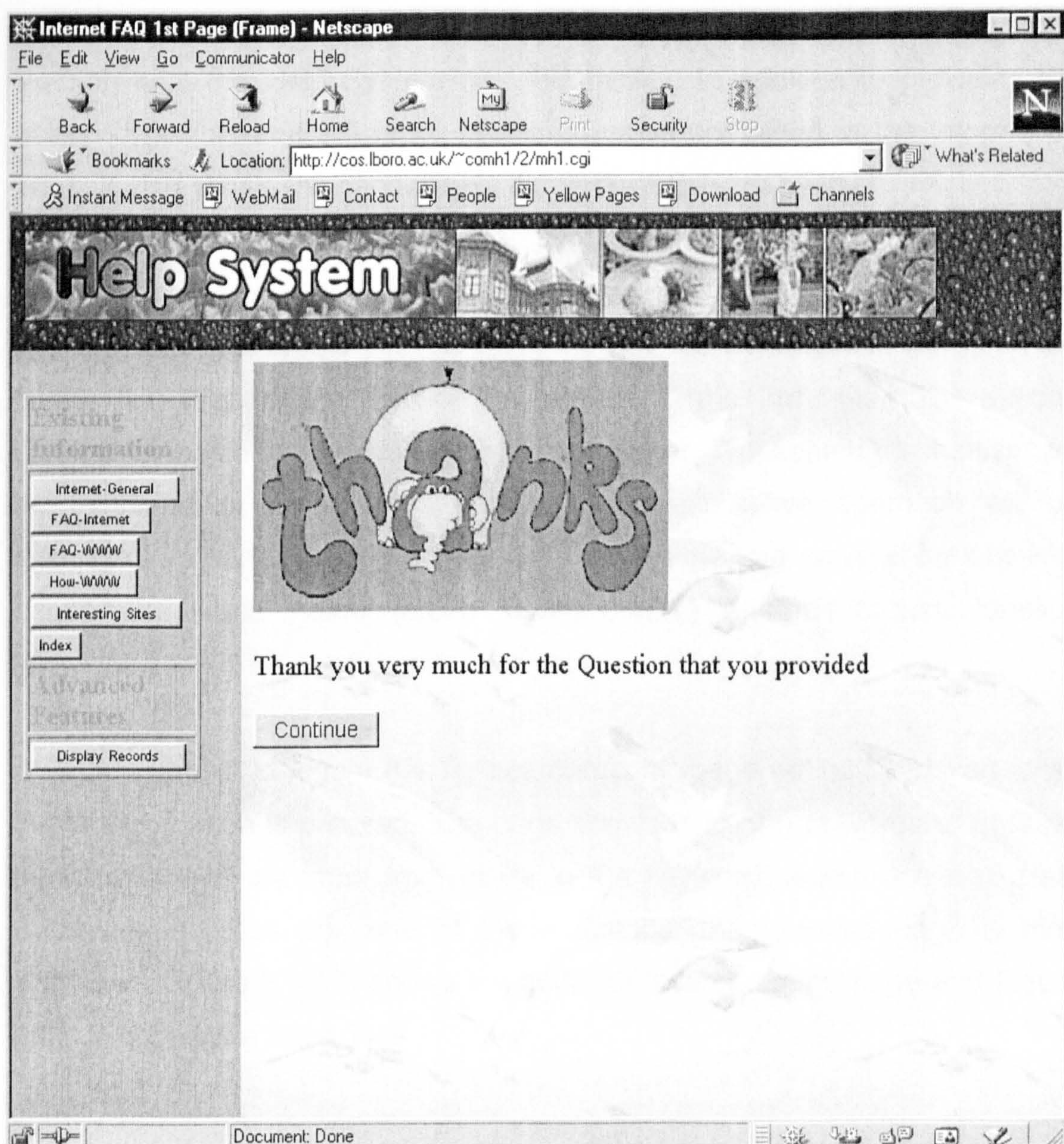


Figure 8.4(12) 'Thanks' page will be displayed after submitting feedback, comment, question or indexing.

v) The 'searchresults.html' page

Providing a search facility in a web database application system is almost a necessity. This is especially true for a large web-based system. Version 4 of the Help System has this facility. In addition to providing the ability to flexibly and efficiently find information contained in the information page, it also shows the capability of the system to learn by itself.

It should be noted that, currently, the results of the search appear in two sections. The first is derived using the .inf file by matching words on the button text (the middle field of the records in the .inf file). The second consists of indexing phrases supplied by the user. The search mechanism will be explained in more detail later, and an alternative approach will be discussed. In particular, the problem of showing the user several buttons with exactly the same 'name' (as in Figure 8.4(14) with the buttons labelled Hypermedia) will be considered.

As shown in Figure 8.4(1), 'searchresults' page will be displayed when the search button is pressed. The page shows button(s) of words or phrases that match with the input from users in the keyword search text box area. When users press any one of these buttons, the required page is then displayed. Figure 8.4(13) shows the code for 'searchresults' page and Figure 8.4(14) shows the page itself.

```
<HTML>
  <HEAD>
    <TITLE>Test</TITLE>
  </HEAD>

  <BODY BACKGROUND="burong.jpg">
    <H1>Search Results</H1>
    Search Possibilities.<br>
    First section are taken from the index pages
    for the system.<br>
    Second section from the index terms supplied
    by users as the system runs.
    <br clear=all>

    <P>
    <FORM METHOD="POST"
      ACTION="http://cos.lboro.ac.uk/~comh1/2/mh1.cgi">
    <INPUT TYPE="hidden" NAME="PageName"
      VALUE="tt5">
    <INPUT TYPE="hidden" NAME="User_Name"
      VALUE="<!--#my U -->">
    <h2 ALIGN="CENTER">Headers for Pages which may
      meet your need </h2>
    <!--#my S -->
    <INPUT TYPE="submit" NAME="Go_To" VALUE="Back">
    <INPUT TYPE="submit" NAME="Go_To" VALUE="Home">
    <INPUT TYPE="hidden" NAME="Back"
      VALUE="<!--#my P -->">
    </FORM>

  </BODY>
</HTML>
```

Figure 8.4(13) The code for 'searchresults.html' page.

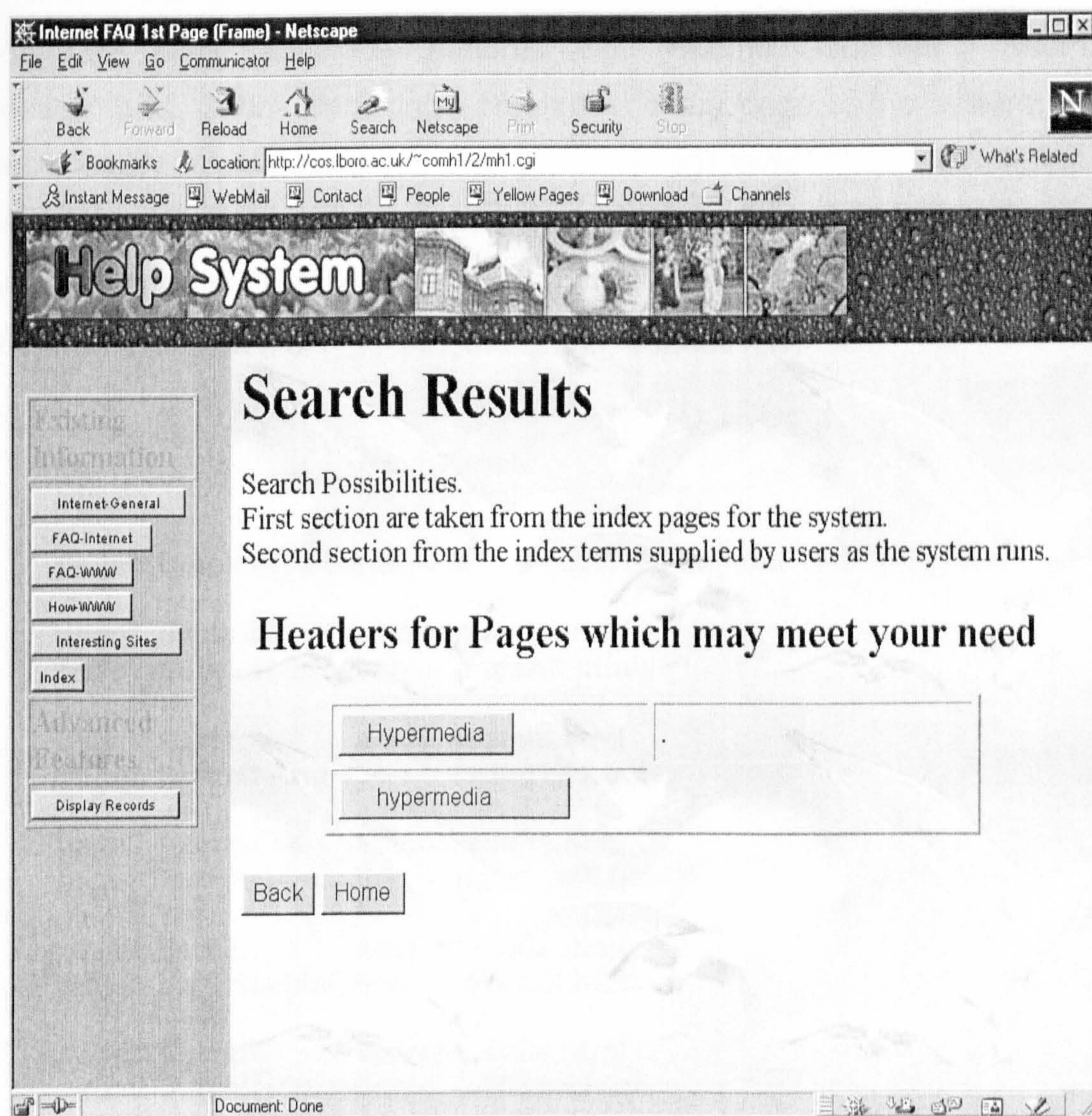


Figure 8.4(14) Search results displayed by the 'searchresults.html' page.

Note that, 'hypermedia' button at the bottom of the table is an index term submitted by users.

8.5 Changes to Navigational Files

The changes that had been made to **.inf** and **.inf1** were just to incorporate some additional buttons (e.g. "Submit Comment", "Submit Question" and "Submit Indexing") created in every page of the system, the search facility (in **intgenX.html**, **netpg1X.html**, **pg1wwwX.html**, **howtoX.html**, **IntWebX.html** and **indexX.html**) and the addition of an interface page for advanced features. The changes that have been made to **.inf** and **.inf1** files are shown in Figure 8.5(1) and Figure 8.5(2) respectively.

```

HelpSystem.html
log      LOGIN      netpg1F.html
log
-----
page0 Display+Records    advancedfeatures.html
-----
page1 Search            searchresults.html
page1 Submit+Question    intgenX.html
-----
page2 Search            searchresults.html
page2 Submit+Question    netpg1X.html
-----
page3 Search            searchresults.html
page3 Submit+Question    pg1wwwX.html
-----
page4 Search            searchresults.html
page4 Submit+Question    howtoX.html
-----
page5 Search            searchresults.html
page5 Submit+Question    IntWebX.html
-----
page6 Search            searchresults.html
page6 Submit+Question    indexX.html
-----
advancedfeatures    Submit+Feedback    advancedfeatures.html
advancedfeatures    Submit+Question    advancedfeatures.html
-----
page123    Submit+Comment    intgenX.html
page123    Submit+Question    intgenX.html
page123    Submit+Indexing    intgenX.html
-----

```

Figure 8.5(1) Extract of mh1.cgi.inf file which shows changes that have been made (written in bold).

```

HelpSystem.html:log
IntWebX.html:page5
-----
-----
advancedfeatures.html:advancedfeatures
-----
-----
wsite8.html:page528
wsite9.html:page529

```

Figure 8.5(2) Extract of mh1.cgi.inf1 which shows changes that have been made (written in bold).

8.6 Changes made in the HTML pages

The main changes that have been made to HTML pages in this version are as follows:

i) The Navigational Aids page - nav aids.html

In the navigational aids page, an advanced features button is added. This allows users to display records in the log file. That is, each users can look at who uses the system, which pages have been accessed, and what feedback, comments, question and indexing users have submitted within a specified period (see Figure 8.4(8)). The code for the amended navigational aids page is as shown in Figure 8.6(1) below and the resulting page displayed on the screen is shown in Figure 8.6(2):

```

<HTML>
<HEAD>
<TITLE>Navagational Aids (Internet)</TITLE>
</HEAD>
<BODY BGCOLOR="#DAA520">
<FORM METHOD="POST" TARGET="display"

```

```

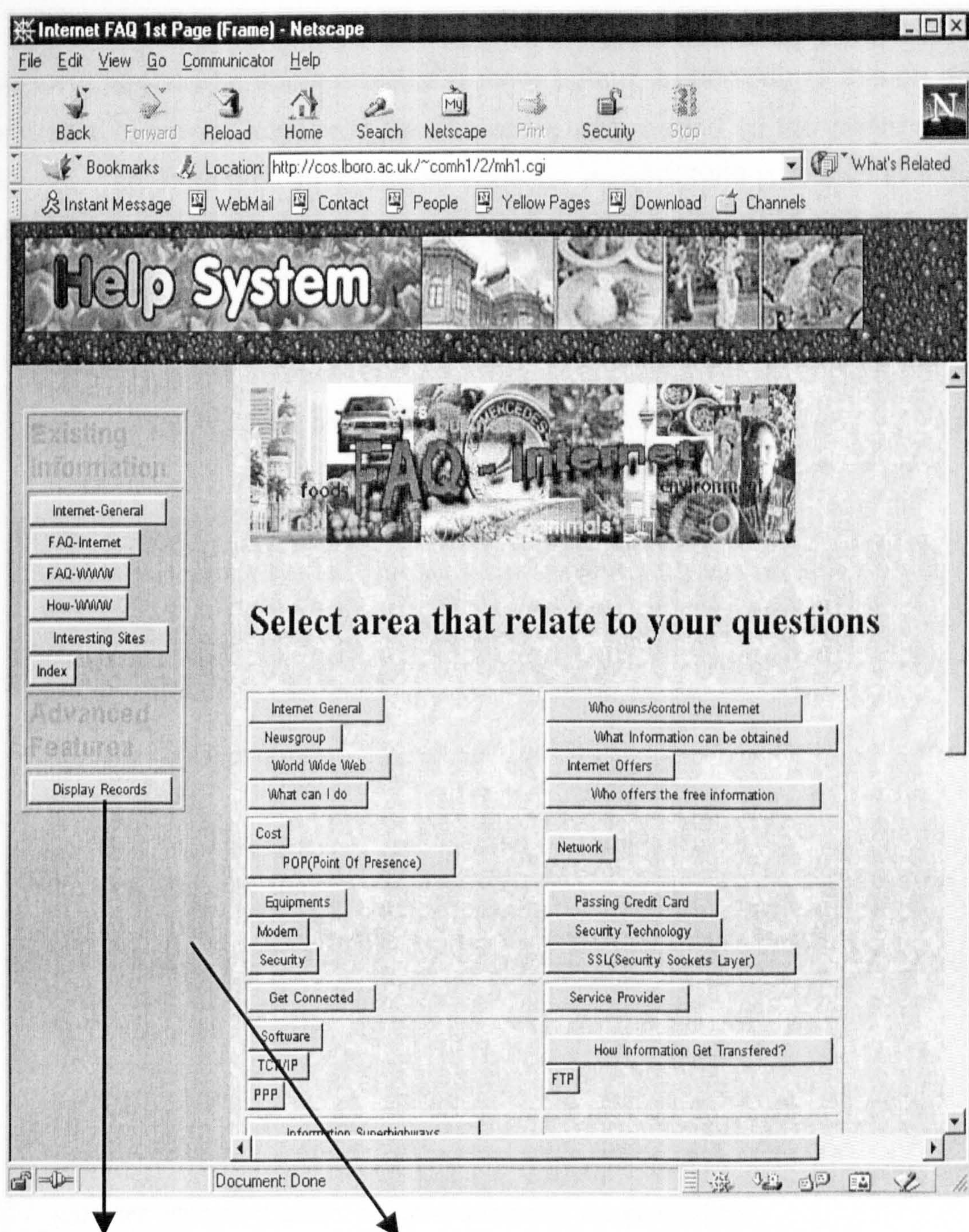
        ACTION="http://cos.lboro.ac.uk/~comh1/2/mh1.cgi">
<INPUT TYPE="hidden" NAME="PageName" VALUE="page0">

<TABLE BORDER>
<TR>
<TD><font face="Arial,VAGRounded BT,Times New Roman"
        color="00ff00" size=3>
<b>Existing Information</b></font><br></TD>
</TR>
<TR>
<TD><font color="ffffff" size=1>
<b><INPUT TYPE="submit" NAME="Go_To"
        STYLE="background:#0000ff" VALUE="Internet-General"></b></font>
<font color="ffffff" size=1>
<b><INPUT TYPE="submit" NAME="Go_To"
        STYLE="background:#0000ff" VALUE="FAQ-Internet"></b></font>
<font color="ffffff" size=1>
<b><INPUT TYPE="submit" NAME="Go_To"
        STYLE="background:#0000ff" VALUE="FAQ-WWW"></b></font>
<font color="ffffff" size=1>
<b><INPUT TYPE="submit" NAME="Go_To"
        STYLE="background:#0000ff" VALUE="How-WWW"></b></font>

<font color="ffffff" size=1>
<b><INPUT TYPE="submit" NAME="Go_To"
        STYLE="background:#0000ff" VALUE="Interesting Sites"></b></font>
<font color="ffffff" size=1>
<b><INPUT TYPE="submit" NAME="Go_To"
        STYLE="background:#0000ff" VALUE="Index"></b></font>
</TD>
</TR>
<TR>
<TD><font face="Arial,VAGRounded BT,Times New Roman"
        color="00ff00" size=3>
<b>Advanced Features</b></font><br></TD>
</TR>
<TR>
<TD><font color="ffffff" size=1>
<b><INPUT TYPE="submit" NAME="Go_To"
        STYLE="background:#0000ff"
        VALUE="Display Records"></b></font>
</TD>
</TR>
</TABLE>
</FORM>
</BODY>
</HTML>

```

Figure 8.6(1) The changed code for nav aids.html (written in bold).



Newly added
button

navigational aids frame

Figure 8.6(2) Newly added button for navigational aids frame.

ii) The index pages - e.g. intgenX.html

The changes that have been made were to add an additional INPUT tag for users to ask questions and a reset button. In addition to this an area for users to key-in keywords for searching was added to the page. As an example, an extract of the changed code for intgenX.html is shown in Figure 8.6(3) (written in bold) and the resulting page is shown in Figure 8.6(4).

```
<HTML>
<HEAD>
  <TITLE>Internet In General</TITLE>
</HEAD>
<BODY BACKGROUND="burong.jpg" LINK="#0000FF"
      ALINK="#FF0000" VLINK="#0000FF">
  <FORM METHOD="POST" TARGET="display"
ACTION="http://cos.lboro.ac.uk/~comh1/2/mh1.cgi">
<INPUT TYPE="hidden" NAME="PageName" VALUE="page1">
<TABLE><!--Table of the body-->
-----
-----
  <TR>
    <TD width=50%><font size=1>
      <INPUT TYPE="submit" NAME="Go_To"
        VALUE="Internet-Basics"><br>
      <INPUT TYPE="submit" NAME="Go_To"
        VALUE="History"><br>
      <INPUT TYPE="submit" NAME="Go_To"
        VALUE="Internet Jargon"><br></font>
    </TD>
  </TR>
</TABLE><!--End of Table of the body-->
-----
-----
<!--Search by Keyword-->
<font color="000000" size=5><b>Keyword Search</b>
  </font><br>
<INPUT TYPE="text" NAME="search" size="30">
<font size="2">
<INPUT TYPE="submit" NAME="Go_To"
  VALUE="Search"></font><br>
<!--End of Keyword Search-->
-----
-----
```



```

<font color="0000ff" size=+1><b>You can give feedback
      or ask question in the following textbox area.
</font></b>

<br>
<br clear=all>
<TABLE>
<TR>
  <TD><font size=1>
    <TEXTAREA NAME="feedback" ROWS="5" COLS="50"
      WRAP=VIRTUAL>
    </TEXTAREA></font>
  </TD>
</TR>
<TR>
  <TD><font size="2">
    <INPUT TYPE="submit" NAME="Submit"
      VALUE="Submit Feedback">
    <INPUT TYPE="submit" NAME="Submit"
      VALUE="Submit Question">
    <INPUT TYPE="Reset" NAME="Reset"
      VALUE="Reset Button"></font>
  </TD>
</TR>
</TABLE>
  -----
  -----
</FORM>
</BODY>
</HTML>

```

Figure 8.6(3) Extract of the changed code for intgenX.html (written in bold).

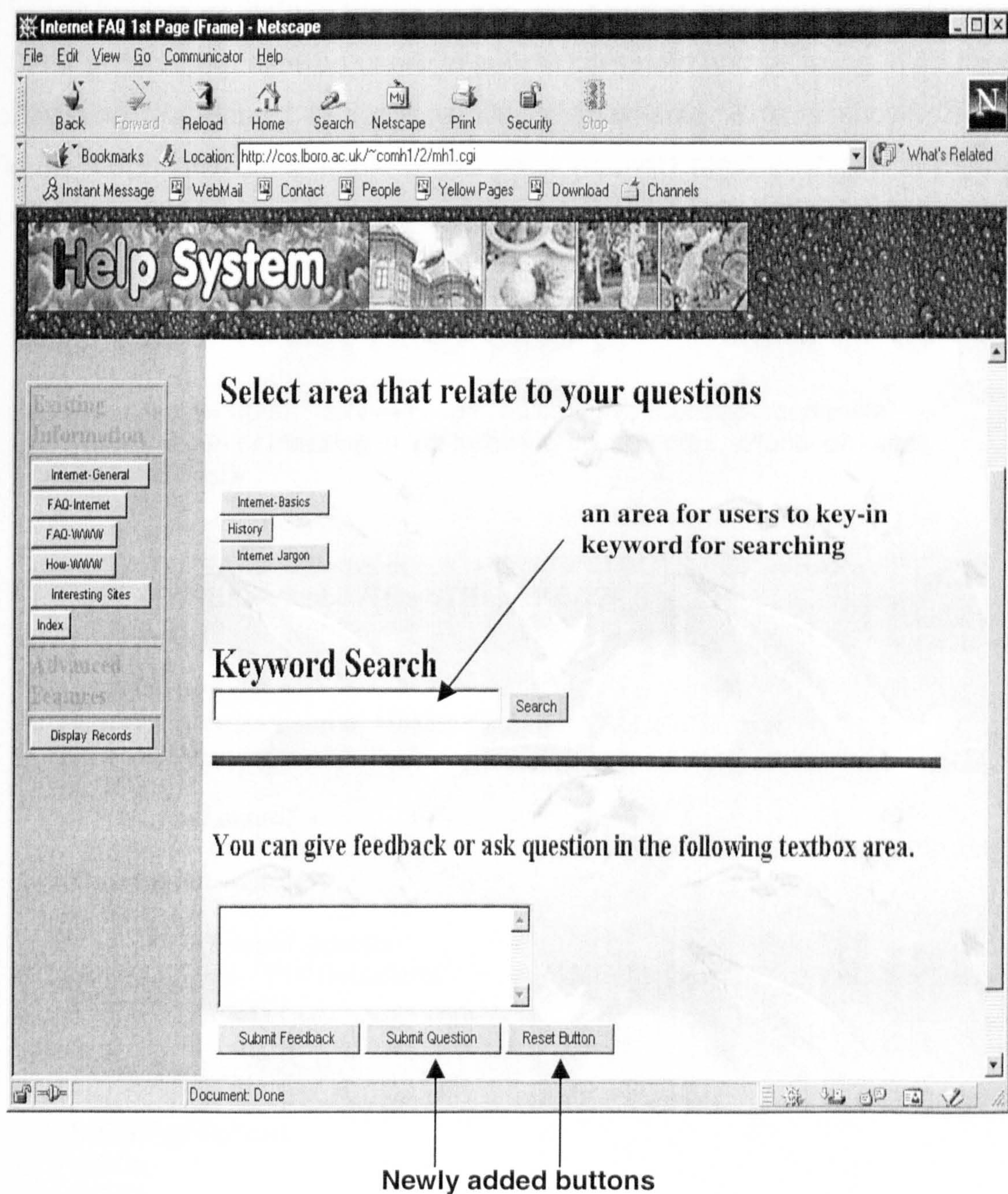


Figure 8.6(4) The resulting page for the changed code in `intgenX.html` .

iii) Information page

Three more INPUT tags and one reset button have been added in the FORM section that allowed users to submit comment and indexing in addition to existing "Feedback" button near the textbox area. This is shown in the Figure 8.6(5) and an example of the page (faqnet1.html) is shown in Figure 8.6(6).

```
<HTML>
----
----
<font color="0000ff" size=+1><b>You can give feedback, comment,
ask question or indexing in the following textbox area. </font></b><br>
<br clear=all>
<TABLE>
<TR><TD>
<TEXTAREA NAME="feedback" ROWS="4" COLS="50" WRAP=VIRTUAL>
</TEXTAREA></font></TD></TR></TABLE>
<TABLE>
<TR>
<TD><font size=2>
<INPUT TYPE="submit" NAME="Submit" VALUE="Submit
Feedback"></font>
</TD>
<TD><font size=2>
<INPUT TYPE="submit" NAME="Submit" VALUE="Submit
Comment"></font>
</TD>
<TD><font size=2>
<INPUT TYPE="submit" NAME="Submit" VALUE="Submit
Question"></font>
</TD>
<TD><font size=2>
<INPUT TYPE="submit" NAME="Submit" VALUE="Submit
Indexing"></font>
</TD>
</TR>
</TABLE>
</FORM>
</BODY>
</HTML>
```

Figure 8.6(5) Changes made in the Information Page (written in bold).

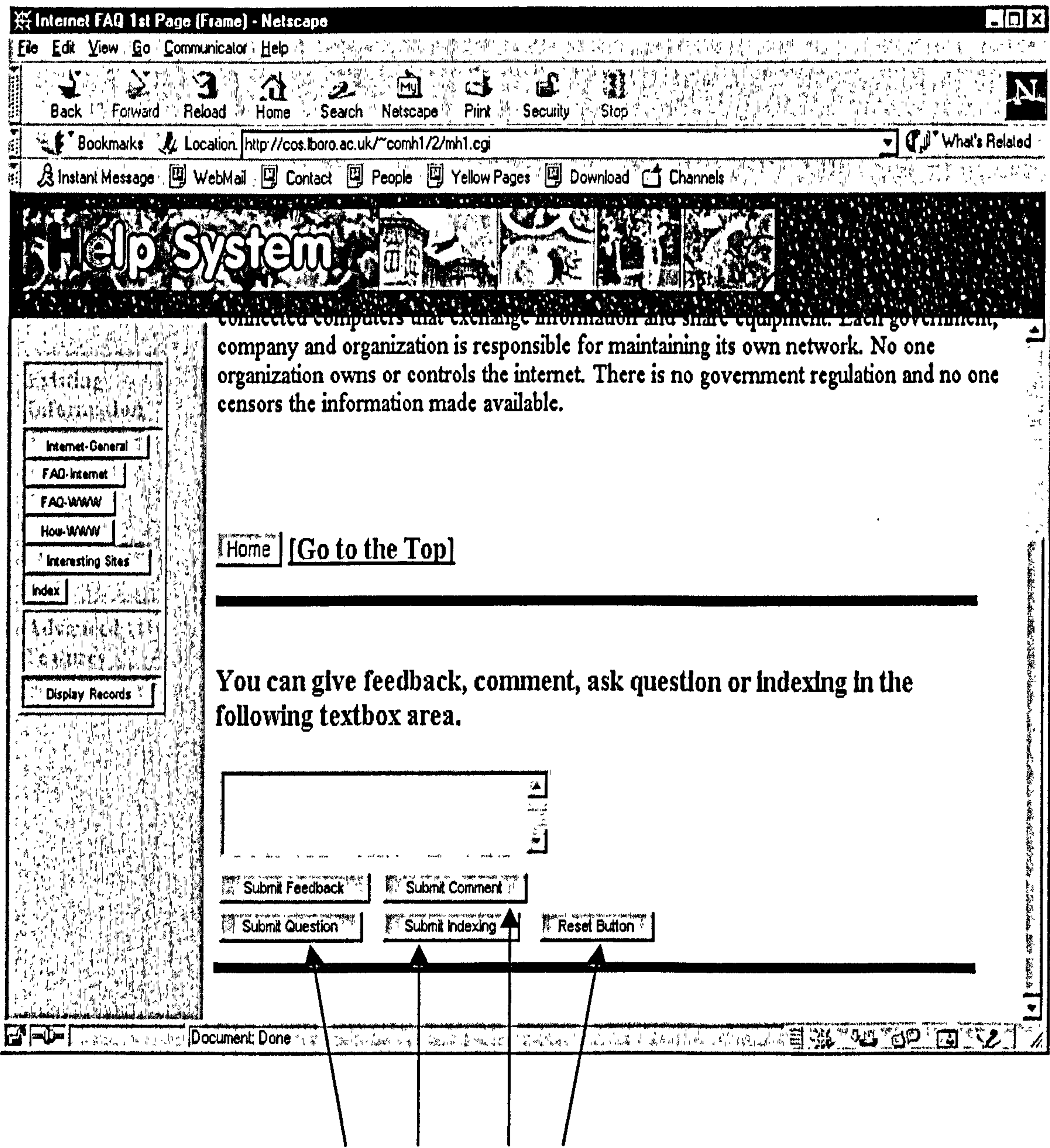


Figure 8.6(6) Three input buttons and a reset button have been added to the information page.

8.7 The Search Engine

One of the facilities provided in this version is to provide a keyword search. The searching capability in this version is different from the one that had been built in version 2, which has been explained previously. In version 2, the searching mechanism used a Java Applet and it was found that using Java programming downgrades the performance of the whole system (it takes time to transfer the applet to the user's machine) as well as being more difficult to expand with user input. Thus the alternative is to use cgi-program and the revised facility is provided in all the 'index' pages in this version (e.g. intgenX.html, netpg1X.html, pg1wwwX.html, howtoX.html, IntWebX.html and indexX.htm).

To implement this, INPUT tags as shown below are added to every page code of the 'index' pages;

```
<INPUT TYPE="text" NAME="search" size="30">  
<INPUT TYPE="submit" NAME="Go_To" VALUE="Search">
```

This provides an area of size 30 characters on the page for users to key-in a keyword or phrases to be searched and a "Search" submit button as shown in Figure 8.7(1) below. This is only a prototype. In the actual implementation, if required, it can be extended to unrestricted length.

When users press the "Search" submit button, the input word, or phrase, to be searched for is sent to the server and this word is then compared first with all the <submit button name> of the records in mh1.cgi.inf file, then with all the words in the 'indexing words and phrases' submitted by users (via the feedback section using the submit indexing buttons). If there is a match (either as a single word or as a word in a phrase), then the matching

word or phrase and the name of the file is then incorporated into the 'searchresults.html' file, which is then delivered to the browser. The user is presented with this expanded page which offers a selection of buttons with the phrases (or word) used in the original buttons or as a supplied index phrase.

Figure 8.7(1) shows a 'Modem' word was typed in the textbox area, which is to be searched. The result of the search is displayed as in Figure 8.7(2).

Note that, at present, if the same phrase appears several times in the .inf file then several buttons will be created on the search results page if, but only if, they have different pages as targets. However, if the same word or phrase is supplied by the user no equivalent check is performed. The next chapter explores some alternative approaches to providing search facilities.

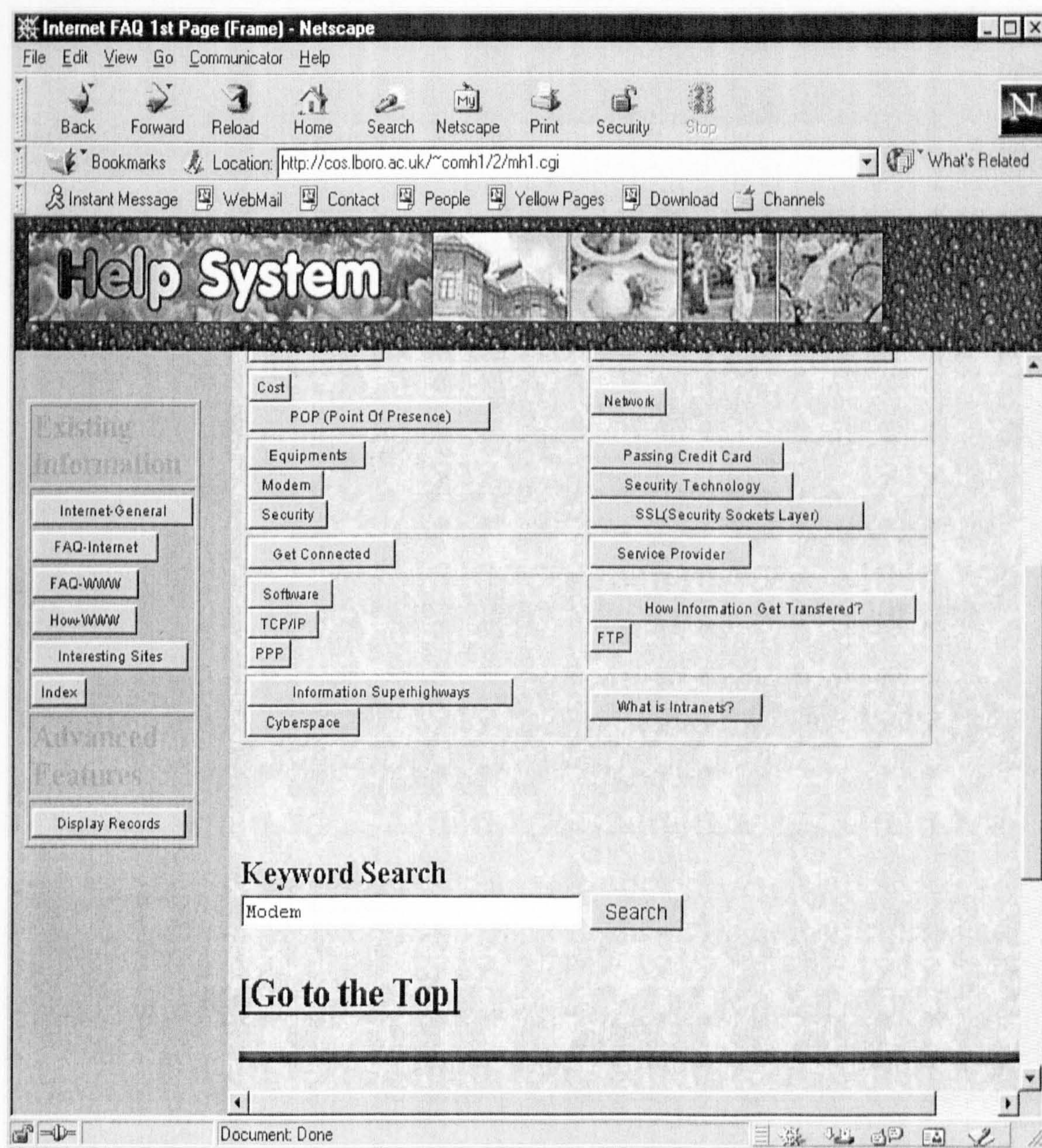


Figure 8.7(1) Searching the word 'Modem'.

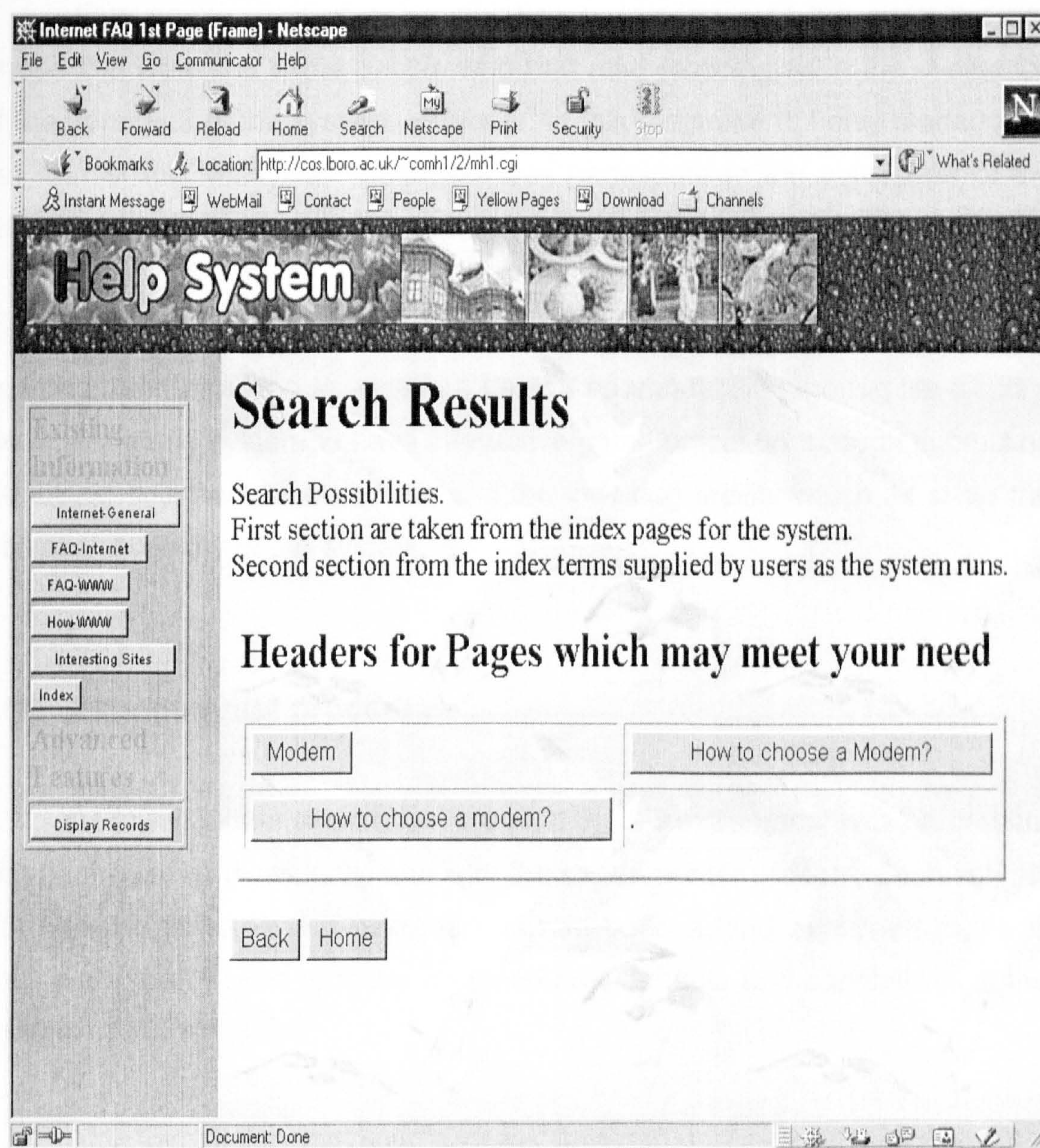


Figure 8.7(2) Result of searching the word 'Modem'.

8.8 Evaluation of Version 4 of the Help System

Five people carried out evaluation of version 4 of the Help System. These five were the same people who had also participated in the evaluation of the version 3 of the system. However, in this experiment, I only managed to get four of the Malaysian managers that participate in the evaluation of the version 3. The other three were not in this country during the experiment.

The aim of this user test was to get their feedback on the new features that had been provided in version 4 i.e. the search facility, the log file display, the ability of the system to have interactive communication through submitting feedback, comment or questions and the indexing facility which all show the learning capability of the system.

8.8.1 Experimental procedure

As in the earlier experiment (version 3), this experiment was carried out with each subject individually and with the experimenter present. Each subject first had the features and facilities that had been added explained to them. They were then asked to focus on these new aspects and capabilities of the system.

After explaining the new features and capabilities of the system, the participant was then asked to go through and try the new facilities on their own. All questions asked by the participants during the session, were noted and answered orally at that point. The experiment took about 2 hours for each of the participants.

8.8.2 Feedback and Comments

All the five participants gave positive feedback and agreed that the Help System (with some adjustment in the contents) has tremendous potential to be used as a support system for managers. The following is the feedback given by the participants:

Participant 1:

I like the idea of being able to make keyword searches that can narrow down the pages to be viewed. This is a good feature to aid busy management who often don't have time for haphazard browsing in the same way as casual users do.

The advanced features are better as you can now see where you've been. The ability to view all the questions that have been asked is similar to newsgroup, and newsgroups have a proven track record in this area. So, the idea is a good one and will undoubtedly aid group learning capabilities. The ability to just add feedback is not found in user groups as a separate area, so this is a bonus.

Overall, the prototype system is good one and I can see that its use across a wide community will be a major benefit to co-operate and co-ordinated group learning and dissemination of information generally.

Participant 2:

I had tested your Help System, it looks fantastic! The additional features that you have added into the system are very good, as now I can see the log records. To me, this system is very interesting because it allows users to provide feedback, comments and questions. I feel that these facilities are very good since it encourages group learning and interaction among users.

Your idea of allowing users to create the index is superb since this shows that the system is user-driven and learns by itself. Frankly,

this is a very good system and I admire it. As you explained to me before, I agree 100% that this system can be implemented as a support system for managers. It has all the ingredients - easy to use, group learning, user driven and learning capabilities.

Participant 3:

I managed to interact with the advanced features of your 'IT support system for managers' that you have developed. I find that the features enabled me to get feedback on the usage of the system either from my own activities or other users as well. This will provide useful information for learning activities.

Furthermore, the features enabled input from me to be incorporated into the system such that as a user I can contribute towards the development of the system. This indicates the learning capability of the system, which I think, will ensure the 'dynamic or organic characteristic' of the system. I think this is essential to future development of any system of this type.

Participant 4:

I am grateful to be given an opportunity to try your system and like to give some comments on this matter.

Firstly, I found out that your system have a monitoring capabilities and friendly with user. There is a collaborative interaction between each user.

Secondly, your system have learning capabilities in such a way that I can communicate with another user and suggest or comments on the topics. Furthermore, I found that indexing of keywords look very simple and easier to understand.

Participant 5:

I noticed there are a lot of improvements on the Help System from the one I have seen previously. By improving the advanced capabilities e.g. learning, monitoring, indexing etc., make the system complete and appealing for managers. I personally would like to congratulate you on your effort in producing this intelligent help system.

It appears clear from the feedback given above that, the system is workable. All of them agreed that 'the advanced features' is very useful since it allows self-guided and learning within group of people. During the experiment all the participants had mentioned orally that the system is very easy to use and it is a user-centred learning support system since they can join the 'virtual classroom' at any time they like. They were also impressed with the learning capability of the system that they were shown, particularly with the automatic updating of indexing.

However, during the oral evaluation, users did point out some areas of the system, which require further attention. They commented that the 'keyword searching' was a bit slow and in addition to this they pointed out that in the Logdisplay page, a more descriptive name of the page (they have visited) should be displayed instead of 'page1, page2, page3, etc.....', since as they pointed out they did not know what that implied until the experimenter explained it. These problems will be discussed in the next chapter.

One of the limitations of this experiment was that the evaluation uses only five people. From this five, only four are managers from Malaysian Civil Service that took part in the evaluation of version three. It would be better to have a much larger scale of Malaysian Civil Service managers participated in the experiments.

CHAPTER 9

RESULTS AND DISCUSSION

9.1 Results and Discussion

As mentioned by Damodaran (1986, p. 81), the most popular forms of support as far as the managers were concerned were other people and for this support they usually locate a nearby and accessible fellow user (local expert). However, in the case of managers who required 'point of need support', this is sometimes impractical because the support is not accessible at all times. Hence, in many instances, they struggled on or gave up.

Although human support is accepted to be the best, it was the contention of this thesis that with the recent developments in computer hardware, software and communication technologies, a sophisticated in-system support could be developed which could in time come to rival human support. However, as mentioned by Damodaran (1986, p. 81), given the qualities users seek in a support mechanism (accessibility, ease-of-use, flexibility, an ability to relate quickly to the user's problem) it seemed likely that human support would provide very stern competition to in-system support aids. Furthermore, a major characteristic of human support systems is that they change, develop and grow with new knowledge being added through experience. This is not a common characteristic of most computer-based systems. Thus most users have no real conception of how a computer-based

system might be constructed to provide effective support. This meant that users could not be asked what their requirements for such system would be.

It was therefore decided that it would be necessary to use a series of prototype (exemplar) systems to investigate possible approaches. This was based on the approach advocated by Schön (1983) in which a 'problem' is solved by investigating the solution space as an integral part of the collection of requirements.

One requirement, which was clear, was that the system would need to be accessible and available whenever it was needed. It was also clear that the system would need to include the knowledge and experience of its users who could be widely dispersed (and would be, in the case of Civil Service Managers in Malaysia). This identified a requirement for the solution to be based on a network of linked computers where regularly used information was replicated at the places it was used (for speed and availability) but where information supplied at one site could be made accessible to users at other places.

The technical problems of providing a suitable infrastructure had been researched and shown to be feasible by other researchers. What was required from this research was a demonstration that a system could be produced, which would be acceptable to its users and would provide effective support. It was, therefore, decided to use the World Wide Web as a basis for implementing prototypes since most potential users already use the Web and have a browser on their machine. A Web based system can permit users to enter new information of their own and also provides adequate facilities for formatting and presenting information to users. Given this starting point it was necessary to investigate two interrelated questions:

- i) What format should be used for effective information delivery?

- ii) How could individuals be enabled to provide information to the system?

The major criterion, which was to be used to assess the result, would be user acceptability.

To carry out experiments, a suitable body of knowledge was required. This needed to be understandable and relevant to the experimental audience and preferably, also needed to be dynamic. Since the starting point for the project was training managers in the effective use of IT, the Internet and the Web were chosen as appropriate subjects. They were particularly useful as they enabled the system produced to be assessed by other people as well as the target group of managers with different backgrounds.

In all, four experimental systems were produced. The first two were used to establish the acceptability of a 'static' information retrieval framework. The overall design was based on the design of the search engines which have become popular on the Web with both on an index structure (introduced in version 1) and a search facility (introduced in version 2). However, unlike many existing search engines, it was assumed from the outset that there could be several overlapping hierarchical structures since it was anticipated that users would have different backgrounds and different ways of thinking about the information based on those backgrounds.

Users were encouraged to look at both of these prototypes and to make comments or suggestions. One major point that was identified was a requirement to ensure acceptable speed of response even in the prototypes. However, as was hoped, the users all felt that this type of structure would meet their information needs.

The other two prototypes explored the requirements for and acceptability of dynamic information capture and presentation within the basic

framework provided by the first two experiments. One point to note here is that, subjects participated in the evaluation of version 3 and 4 are all managers in the Malaysian Civil Service (except one). They are from different background of knowledge and experiences. They are here doing Ph.D.

9.2 Improvements on the Help System

Although version 4 of the Help System had proved to be workable and acceptable, both the experimenter and the users noted some possibilities for improvement. The most obvious of these observations was that the search mechanism took a long time to generate the 'results' page. The existing search mechanism recreates an index each time it is called by processing the various information sources (.log, .inf, .inf1). This was originally considered to be acceptable for a prototype. Note that, a proprietary search engine was not used because if it was used then the Help System would not be able to monitor what the users activities. However, the experiments demonstrated that an alternative mechanism was needed which would use a stored version of the index, which was then updated by processing the log.

Several, other more fundamental improvements for the search mechanism were also noted:

If a user wants to look at certain information in the system by using the keyword search facility, the user can only key-in a single (atomic) word (it is not possible to enter a phrase of several words and obtain a response) and must enter a word which actually occurs:

As an example, in the first case, if a user wants to find information about the 'World Wide Web' what he/she has to do is to key-in only one of the words (e.g. 'World'). In the current implementation if the user does key-in a

phrase 'World Wide Web', the phrase is not matched since the index contains only single words and he/she will not get any information returned.

In the second case, if a user would like to find information about 'Networks', and keys in the word 'Networks', then, only those phrases, which contain the word 'Networks' are found. If there are also several entries for the word 'Network' then they will not be returned.

Both 'problems' occur because the search tree constructed by the indexing process stores complete words and the matching process treats the user input as a single word and tries to find an exact match.

An alternative search mechanism could process the user input to split it into its component words and search for each of the words. Having found matching phrases there are several alternative approaches that could then be adopted:

- a) all of the phrases could be displayed (a logical 'or' operator);
- b) phrases would only be displayed if all of the words occurred in them (a logical 'and' operator);
- c) phrases would only be displayed if all of the words occurred in the same order;
- d) all phrases where two or more words occurred would be displayed;
- e) some combination could be used e.g. display c) first, then d) and finally a) (eliminating duplicates).

Further experimental research would be needed to investigate the acceptability of the various possibilities.

One way to approach the second problem is by having a stem search mechanism. In this mechanism, what is required for the user is to key-in a few letters (strictly 'symbols') of the required search word and the system will match it against the contents of the search tree. All the words, which start with the given letters, are then displayed to the user who can then select the relevant ones. For example, if a user is interested in finding information about 'Networks', then what he/she needs to key-in is just the first few letters of the word e.g. 'Net'. All words that start with the letters 'Net', (case insensitive) e.g. 'Netscape', 'Network', 'networks' and so on, will be displayed. The user can then select word(s) from the list and submit the selection to get a list of the indexing phrases containing one of the selected words.

Although the users can already add indexing terms, it would be possible to construct the index using other existing terms or phrases as well as or instead of the 'buttons' information contained in the navigational file (.inf). As an example, the page titles could be indexed as well as the buttons. Note that, if required, the complete contents of pages could be indexed.

Currently, the words or phrases on the buttons are not very informative in the result page for the search. Although, exact duplicates (two buttons with the same phrase and the same target page) are removed automatically it is possible to have several buttons with the same name, which go to different target pages. This problem could be overcome by using page titles instead of button labels on the search results page. This should provide a better cognitive impact on users.

Another improvement is to create a new form that deals with only questions, answers, feedback and comments. This grouping of information could improve flexibility and interactivity for the users. If a user is interested in

only looking at questions and feedback and would like to participate in the 'virtual classroom', he/she can just click this 'new button'.

Another potential improvement is for the system to be able to show times and dates of sessions for named users only. In this way a user would be able to know when he/she last logged into the system, and could check whether another user has had the opportunity to reply to a comment or question.

Another improvement worth mentioning here is that the system should be able to allow more than one username to be specified in the query on the 'advancedfeatures' page. This gives flexibility and more choice for users to display the log records. At the moment the choice is between one specified user and 'all' users displayed in the Logdisplay page within the specified date and time.

9.3 Suggestions for Future Research

The experiments reported here focus on the issues on interactivity, ease-of-use, dynamic feedback mechanisms and a learning system. Clearly, there is a need to investigate in more depth the suitability of the materials in this Help System i.e. how to match the contents with the tasks of managers in the workplace. One way to approach this is to utilise verbal protocols, asking subjects to describe what they are thinking as they use the computers. Protocols could be implemented by video tape recordings.

Another aspects for further research is the information page itself. Currently, the information given in solving certain task is static. For example the page on information on 'how to create tables in Word' which gives only a 'how to do' steps for users to follow. It would possibly be better to provide an

animated page with voice over. The existing system would support the investigation of these issues.

Finally, the focus on perception of the system could be extended to include making the Help System more enjoyable to use. Ease of use does not imply, necessarily, that a system is also enjoyable or that individuals will be motivated to use it. An important question researchers need to deal with is how to best measure users' levels of enjoyment and motivation. Techniques that promote enjoyment with computer systems may help reduce anxiety and promote healthier attitudes toward computer use. This issue offers an interesting and potentially fruitful line of research for those who are inclined to pursue them.

9.4 Review of Achievements

The starting point for the work described in this thesis was a requirement for Malaysian Civil Service Managers to make more effective use of the IT resources available to them. Conventional training, while useful, had not proved as beneficial as had been hoped since the managers were discretionary users faced with an evolving situation (changes in working practice as well as changes in technology). This meant that they could not practice what they had been taught on a regular basis. Also the subjects which managers would need help on had not necessarily been covered in the training. Therefore, It was hypothesized that their needs might be more appropriately met by providing a computer supported collaborative community system for them.

The two primary issues that needed to be considered were acceptability of such a system to the managers and the technological feasibility of producing such system. With regards to the latter consideration, it

was recognized that an ideal system should always be available to managers at their point of need. It was also recognized that the information in the system would be provided from many sources and would need continual updating. An ideal situation would combine the benefits of a stand-alone system—i.e. desktop or lap top that would be available even if the network failed—with an Internet based distributed system that would publish requests and receive answers. However, it was decided to focus on the Internet aspects of the system since this is the medium used to provide support for collaboration that was the main focus for this work.

The system that was proposed combined a user driven system with a 'Help' site that could be browsed or searched to find both background information's about IT related matters and authoritative solutions to common problems. It was assumed that the 'Help' part of the site would be maintained and managed by IT support staff (since this was not currently part of any manager's duty) who would also provide the background information about IT for the site.

The initial step was to confirm the acceptability of the idea with managers. This was achieved by means of a questionnaire and a demonstration static help site. Subsequent investigation focussed on the way in which managers might use such a system to ask questions and obtain answers, and on the technical facilities which would be needed to support this type of dynamic interaction.

The support system operates on the principle of collaborative learning. For example, a manager who encounters a problem describes it in the Help System and other managers in the community can offer their advice based on their own experience. The collaborative environment provides manager-to-manager interaction and, in addition to getting support to solve a particular problem, it could also encourage the exchange of ideas and learning experiences.

The system that has been developed does demonstrate that facilities can be provided to allow managers to ask questions and receive responses. It has also been demonstrated that they can add their own indexing terms and thus add personalized structure to the site. It also demonstrates that the information required to manage the Help Site can be collected and made available to the IT support staff who will manage it. For example, the managers can make comments and provide feedback on individual pages and the usefulness of the pages in terms of number of visits can be monitored.

The initial response from the people who tested the final prototype, several of whom had had experiences as managers, was positive. However, there are two areas associated with usability where work is still needed to make the system fully effective. These two are considered in more detail below.

First, there is the question of potential misuse of the system by managers. As an example, they could ask unnecessary questions or add fallacious answers to questions, either through a misunderstanding or maliciously. They may put erroneous answers in by accident misunderstanding the question or thinking they know the answer when they don't. The fact that the origin of every question and answer in terms of IP address and username is known means that anyone who regularly abused the site could be "named and shamed" and ultimately could be barred from access. Alternative approaches are possible. For example, a brief set of rules of participation and a moderator is required. The responsibility of the moderator is to make sure the participants follow the rules and also to filter the input. In addition to this the moderator should have the ability to send a private e-mail to an offender to draw attention to their behavior.

Second, is the question of appropriate user interface design based on the design principles discussed in chapter 4 (e.g. user-acceptance). One of the key issues in any online system is the usability of the system and thus of

the human computer interface. This was not made a primary consideration in prototype 4, that was mainly examining the requirements for, and feasibility of, particular functionality (e.g. user indexing, searching, user comments, feedback and questions). This thesis has only concentrated on showing how to put together a workable solution to a given problem and has deliberately not considered screen interface design in an HCI context. Interface design is not the subject of this study and, as such, is outside the scope of this thesis. Nevertheless, as has been noted several times in the thesis, it is essential for the system to be accepted by its users, the managers. Even though some representative managers have agreed, in principle, that the idea is good, it will still be necessary to ensure that the system that is released is acceptable. It will, therefore, be important to ensure that the released system has a good human computer interface.

In order to illustrate the work that is needed, two examples where the HCI needs to be improved are given below.

Example 1

The advanced features page (shown in Chapter 8 as Figure 8.4(2)) could trivially be improved by displaying the choice buttons alongside the descriptive text rather than beneath the menu as they are currently shown (Figure 9.4(1)).

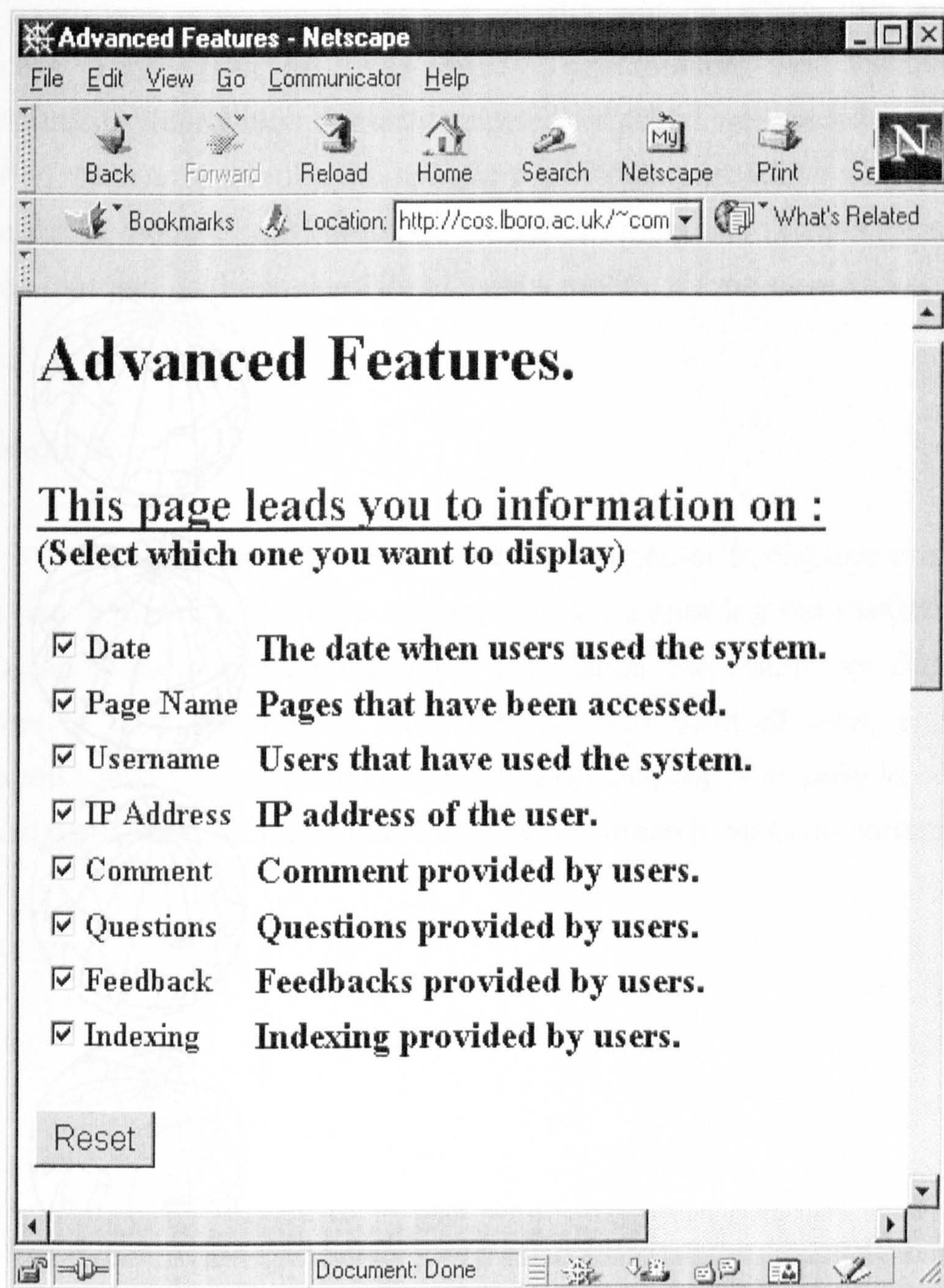


Figure 9.4(1) The improved 'advancedfeatures' page.

However, this simple change while it is a significant improvement may itself be insufficient. The whole question of the way in which the 'advanced features' might best be used needs consideration. For instance, this multipurpose information extraction screen might be replaced with a screen offering retrieval layered to the specific of particular individuals or groups. For example, a request could be made for the ten most used pages, or all these pages that had not been used for at least a month, for maintenance purposes.

Example 2.

The Logdisplay page, Figure 8.6 (7), in chapter 8, displays a record of who has logged into the Help system. The table showing the statistics is not arranged in the most readable way. For instance, the column for **Date** is too narrow to read comfortably and, from an HCI point of view, should be widened. Also the sub-heading beneath **Log Display** is actually in error and should be deleted. In the Figure 9.4(2) below, these have been corrected.

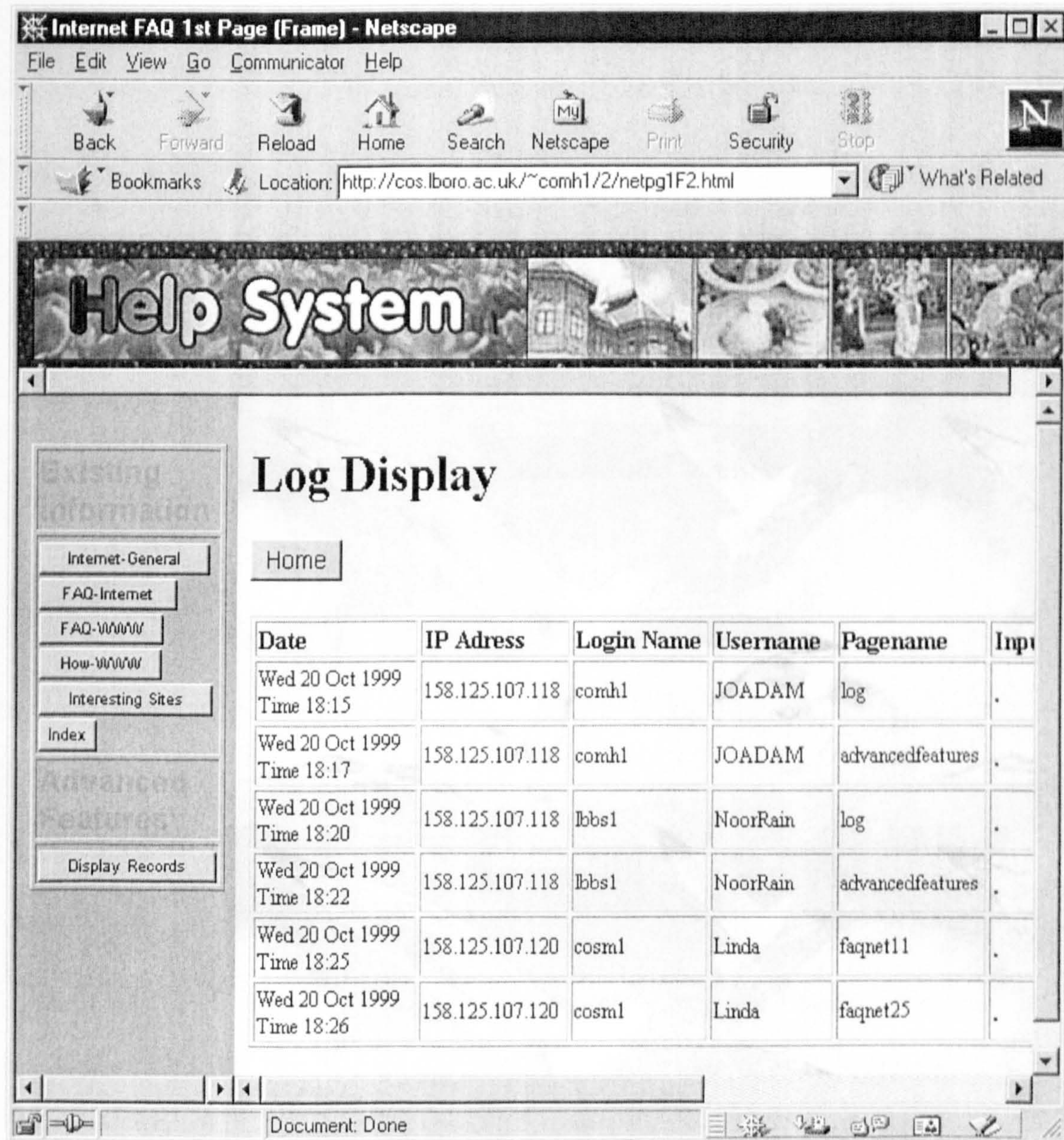


Figure 9.4(2) The improved Logdisplay page.

CHAPTER 10

CONCLUSION

10.1 Conclusion

The purpose of this study was to explore ways in which training for managers in IT skills and technique for making effective use of IT, might be improved by the use of IT technology.

The study was carried out in an environment in which it is widely acknowledged that information technology (IT) is very important and has revolutionised organisational life. Although IT technology has come into the workplace, in many organisations expensive IT equipment seems to be making very little contribution to the goals of the enterprise and has apparently not been used effectively. Previous research, which has focussed in this area, has argued that this problem is due to the inadequate knowledge and skills of potential users in the organisations. There has been a widespread assumption that what was needed was training programmes, which would improve users knowledge and skill so that they can use the machines in a better way to improve productivity. However, it has also been argued that while training programmes have their place in providing support, they were not, and could not be, the universal solution. This was particularly true for managers, who are discretionary users and tend to give low priority to the development of knowledge about a computer system and rarely attend

training courses. Furthermore, the existing training programmes mostly are not learner-centred. It was suggested that for managers, what is required is to provide 'point of need support' that is, help and advice on a particular issue at the time when the user was aware that he/she needed help on that issue. It is generally agreed that this support is most effective when it is supplied by fellow human beings. However, in conditions where support has to be 'point of need' and users are discretionary, this is generally impractical.

It was therefore postulated that what was required was a computer based support system which could provide instantaneous, advice. Such a system would also need to be truly interactive, which means that not only must the user knowledge change as a result of interacting with the system, but the system must also change as a result of that interaction. Most existing computer-based systems are not truly interactive since their information content does not appear to change as a result of what users are doing; nor does the system give them feedback on how they are using it. An effective support system should be able to offer a 'learning' capability based on the experiences of its users. In addition, the system should be able to meet the following key requirements:

- i) have a user expandable database of information
- ii) be acceptable to users – useful and easy to use
- iii) would bridge distances - can be accessed by users at geographically dispersed location
- iv) provide users with a feedback mechanism
- v) be platform independent - a system that could be run on any type of computer as well as on any operating system.

In this study, a prototype system (Help System) with these capabilities has been designed and evaluated. It was a web-based system, which runs on the Internet. Since it runs on the Internet, it could be accessed by users at

geographically dispersed location. As far as users are concerned it was also platform independent since suitable browsers run on most types of computer and operating system. These capabilities also make it a system that could provide support to managers at point-of-need.

In addition to the above, the Help System is truly interactive which provides users with a feedback mechanism. By having these capabilities, the Help System is a dynamic and 'two-way' computer based system. It is not an old style computer based system, which is 'one-way' where the computer is in control of the user's progress. The Help System is a 'two-way' system where either the computer or the user is in control of the learning process. For example, in indexing the information page, the Help System provides an existing index as well as giving the opportunity to the users to provide index terms themselves. Not only this, the Help System allows users to suggest questions or invites them to give a short text answer and the system allows them to compare their answer with other peoples suggestions - leaving the user to draw their own conclusions (without forcing them into the straitjacket of multiple-choice, or worrying about how the computer will parse an open response). This capability meets the first requirement specified in Chapter 4 where a user-expandable database of information is required. It also shows that a Help System can be user driven and has learning capability.

One of the main issues in this study is how confident that users will react by inputting questions. Do they need incentives to actively use the Help System. From personal experience in conducting training for managers in the Malaysian Public Service, that they will attend the training if there is an incentive for them (i.e. promotion). However, if the very top managers can be convinced to use the system, then the middle and lower managers will follow. Furthermore, managers that do not use the system will feel ashamed if their clique talked and discussed about it.

In this study, what was important was to show that the system could meet the requirements and have the capabilities mentioned above, and also that it would be acceptable to users. The Help System has been tested by users at each stage of its development. As was discussed in Chapter 7 and Chapter 8, the Help System generally received a favourable response from users. All the users had agreed that the concepts of the Help System were acceptable and commented on its ease-of-use and that on its potential as a support system for managers.

The Help System was designed to be evolved. It has the potential to be improved further. In this context, on larger scale trials, there is a plan for the Help System to be implemented in Public Service Department (PSD) of Malaysia with some modification to the contents that will make it applicable to the local environment. The existing information on the Internet will be retained and updated. Some information regarding Malaysian Public Service will be added to the system.

BIBLIOGRAPHY

Alavi, M. (1994), Computer-Mediated Collaborative Learning: An Empirical Evaluation. MIS Quarterly/June, pp. 159 - 173.

Alavi, M., Bradley, C. V., Joseph, S. V. (1995), Using IT to Reengineer Business Education: An Exploratory Investigation of Collaborative Telelearning. MIS Quarterly, September, pp. 293-312.

Armstrong, J. (1992), Knowledge-based systems for Users. Journal of Information Systems Management, Vol. 9, Issue 1, pp. 28-38.

Arnold, S. E., Arnold, E. S. (1999), Search Engines: Lost and Found in Cyberspace. Arnold Information Technology (AIT), pp. 37-53.

Ause, W., Arpajian, S., Ivens, K. (1997), How to use The World Wide Web. Ziff-Davis Press, USA.

Bainbridge, L., Ruiz Quintanilla, S.A. (1989), Developing Skills with Information Technology. John Wiley & Sons Ltd, England.

Baker, S., Marshall, E. (1989), Simulators for Training and the Evaluation of Operator Performance, in: Bainbridge, L., Ruiz Quintanilla, S.A., Developing Skills with Information Technology. John Wiley & Sons Ltd, England, pp. 293-314.

Barfield, L. (1993), The User Interface, Concepts and Design. Addison-Wesley Publishing Company Inc. United Kingdom.

Barnatt, C. (1995), Cyber Business: Mindsets for a Wired Age. John Wiley & Sons Ltd, England.

Bergeron, F., Rivard, S., De Serre, L. (1990), Investigating the Support Role of the Information Centre. MIS Quarterly, September, Vol. 14, No. 3, pp. 247 - 260.

Bjørn-Anderson, N., Eason, K. D. and Robey, D. (1986), Managing Computer Impact. Ablex Publishing Corporation, Norwood, New Jersey.

Booth, P. (1992), An Introduction to Human-Computer Interaction. Lawrence Erlbaum Associates Ltd, U.K.

- Borgman, C. L. (1986), The User's Mental Model of an Information Retrieval System: An Experiment on a Prototype Online Catalog. *International Journal of Man-Machine Studies* (24:1), January, pp. 47 - 64.
- Bostrom, R. P., Olfman, L., Sein, M. K. (1990), The importance of learning style in end-user training. *MIS Quarterly*, March, Vol. 14 Issue 1, pp. 101 - 119.
- Bostrom, R. P., Olfman, L. (1993), Learning Styles and End-User Training: A First Step. *MIS Quarterly*, March, pp. 118-119.
- Brande, L. (1993), Flexible and Distance Learning. John Wiley & Sons Ltd, Chichester, West Sussex, England.
- Brown, G., Atkins, M. (1991), Effective Teaching in Higher Education. Methuen & Co. Ltd., UK.
- Carey, J. M., Mizzi, P.J, Lindstrom, L. C. (1996), Pull-down versus traditional menu types: an empirical comparison. *Behaviour & Information Technology*, Vol.15. no. 2, 84 - 95.
- Carroll, J. M., Rosson, M. B. (1995), Managing Evaluation Goals for Training. *Communication of the ACM*, Vol. 40 - 48.
- Castro, E. (1996), HTML: For the World Wide Web. Peachpit Press, USA.
- CERI (1986), New Information Technologies: A Challenge for Education. OECD, France.
- Chacon, F. (1999), Distance Education in Latin America: growth and maturity, Routledge, London.
- Chang, P. L., Shen, P. D. (1997), A Conceptual Framework for Managing End-User Computing by the Total Quality Management Strategy. *Total Quality Management*, February, Vol. 8, Issue 1, pp. 91 - 103.
- Charron, R. (1998), Training and the Push for Change. *The Journal of Object-Oriented Programming*, Vol. 11, No. 6, pp. 15-18, 38.
- Cheney, P. H., Mann, R. I., and Amoroso, D. L. (1986), Organizational Factors Affecting the Success of End-User Computing. *Journal of MIS* (13:3), Summer, pp. 65-80, as quoted in Davis, S.A., Bostrom, R.P. (1993), Training End Users: An Experimental Investigation of the Roles of the Computer Interface and Training Methods. *MIS Quarterly*, March, 61-78.
- Chrisman, C., Beccue, B. (1990), Training For Users as a Management Issue. *Journal of Information Systems Management*, Summer, Vol. 7, Issue 3, pp. 56-62.

Clegg, C., Warr, P., Green, T., Monk, A., Kemp, N., Allison, G., and Lansdale, M. (1988), *People and Computers: How to evaluate Your Company's New Technology*, Ellis Horwood Limited, England.

Clothier, P. (1998), *Adapting to Learners*. IT Training, January, pp. 43-45.

Coe, M. (1996), *Human Factors for Technical Communicators*. John Wiley & Sons, Inc. New York, USA.

Cruickshank, D. R., Bainer, D.L., Metcalf, K. K. (1995), *The Act of Teaching*. Mc Graw - Hill, Inc. U.S.A.

Dale, L. G., Ronald, L.T. (1995), *Task, Technology Fit and Individual Performance*, MIS Quarterly, June, Vol. 19, No. 2, pp. 213 - 236.

Damodaran, L. (1986), *User Support*. In Bjørn-Anderson, N., Eason, K. D. and Robey, D. *Managing Computer Impact*. Ablex Publishing Corporation, Norwood, NJ.

Damodaran, L. (1996), *User involvement in the systems design process - a practical guide for users*, Behaviour & Information Technology, Vol. 15, No. 6, 363 - 377.

Davis, F. D. (1989), *Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology*. MIS Quarterly, September, pp. 319 - 339.

Davis, S.A., Bostrom, R.P. (1993), *Training End Users: An Experimental Investigation of the Roles of the Computer Interface and Training Methods*. MIS Quarterly, March, 61-78.

Deitel, H.M., Deitel, P.J. (1997), *Java How To Program*. Prentice Hall, Inc. New Jersey, USA.

Dillon, A., Morris, M. G. (1996), *User Acceptance of Information Technology: Theories and Models*. Annual Review of Information Science and Technology, Volume 31. Information Today, Inc., NJ. Pp 3-24.

Donaldson, L., Scannell, E. (1986), *Human Resource Development: The New Trainer's Guide*, Second Edition. Addison-Wesley Publishing Company, Inc. , USA.

Dugan, S. (1998), *Internet Fuels Training Market*. InfoWorld, Vol. 20 Issue 36, p. 77.

Eason, K., (1989), Meeting the Information Technology Learning Needs Of Professional Office Workers, in: Bainbridge, L., Ruiz Quintanilla, S.A. Developing Skills with Information Technology. John Wiley & Sons Ltd, England. Pp. 227-240.

Eason, K., (1995), Information Technology and Organisational Change. Taylor & Francis Ltd., London, U.K.

Eden, H., Eisenberg, M., Fischer, G., and Repenning, A. (1996), Making Learning a Part of Life. Communications of the ACM, April, Vol. 39, No. 4, pp. 40-42.

Farhoomand, F., Hrycyk, G. P. (1985) The Feasibility of Computes in the Small Business Environment. American Journal of Small Business, IX, pp. 15 - 22.

Faulkner, C. (1998), The Essence of Human-Computer Interaction. Prentice Hall, London.

Forsyth, I. (1996), Teaching and Learning Materials and the Internet. Kogan Page Limited, London.

Forsyth, I., Jolliffe, A., Stevens, D. (1995), Preparing a Course: Practical Strategies for Teachers, Lecturers and Trainers. Kogan Page Limited, London.

Galliers, R. D. (1992), Integrating Information System Into Business - Research at Warwick Business School, International Journal of Information Management, pp. 160 - 163.

Grosser, K. (1991), Human Networks in Organizational Information Processing. Annual Review of Information Science and Technology (ARIST), Volume 26. Learned Information, Inc. N.J., USA.

Guzdial, M., Kolodner, J., Hmelo, C., Narayanan, H., Carlson, D., Rappin, N., Hubscher, R., Turns, J., Newstetter, W. (1996), Computer Support for Learning through Complex Problem Solving. Communications of the ACM, April, Vol. 39, No. 4. pp. 43-45.

Harry, K., (1999), Higher Education through Open and Distance Learning. Routledge, London.

Heid, J. (1997), HTML & Web Publishing Secrets®. IDG Books Worldwide, Inc. USA.

Heslop, B. D. , Holzgang, D. A. (1998), HTML Publishing on the Internet, 2nd Edition. Coriolis Group, Inc. USA.

Heverly, R. A. (1998), Training helps employees overcome 'Technophobia'. Capital District Business Review, Juky, Vol. 25 Issue 14, pp. 25 - 28.

Hobuss, J.J. (1998), Building Access Web Sites. Prentice Hall PTR, New Jersey, USA.

Horton, W., Taylor, L., Ignacio, A., Hoft, N. L. (1996), The Web Page Design Cookbook. John Wiley & Sons, Inc., USA.

Howitt, D., Cramer, D. (1997), An Introduction to Statistics in Psychology: A Complete Guide for Students. Prentice Hall/Harvester Wheatsheaf, London.

Huang, A. H. (1998), Empowering End Users Through Online Training. Journal of Information Systems Management, Spring, Vol. 15, Issue 2, pp. 83-86.

Kappelman, L. A., Guynes, C.S. (1995), End-User Training and Empowerment. Journal of Systems Management, September/October, pp.36-41. Ablex Publishing Corporation, NJ.

Kerr, E. B. , Hiltz, S.R. (1982), Computer-Mediated Communication Systems, Status and Evaluation. Academic Press Limited, London.

King, J. K. (1996), Where Are the Payoffs from Computerization? Technology, Learning, and Organizational Change. *Computerization and Controversy*, pp. 239-258.

Kirk, C. (1998), Internet and Web: Answers!, Certified Tech Support. Osborne McGraw-Hill, USA.
Kogan Page Limited, London.

Ladd, E., O'Donnell, J. (1996), Platinum Edition Using HTML 3.2, Java 1.1, and CGI. QUE[®] Corporation, USA.

Larmont, N. (1996), A virtual coach. IT Training, August, pp. 27-28.

Lawson, P.A. (1995), A Joint Bid to the University's Strategic Fund. Memo to Distance/Co-operative Learning Working Party.

Lee, S. M., Kim, Y. R. (1995), An Empirical Study of the Relationships among End-User Information System acceptance, Training, and Effectiveness. Journal of Management Information Systems, Fall, Vol. 12, Issue 2, pp. 189 - 201.

Leplat, J. (1989), Simulation and Simulators in Training: Some Comments, in: Bainbridge, L., Ruiz Quintanilla, S.A., Developing Skills with Information Technology. John Wiley & Sons Ltd, England, pp. 277-291.

Levin, R. (1998), Train at the speed of change. Information week. June 8, Issue 685.

Little, B. (1996), Designing Interactive Training. IT Training, August, pp. 25-28.

Little, B. (1998), Training issues: Lifelong Learning. IT Training, January, pp. 16-21.

Macaulay, L., (1995), Human-Computer Interaction for Software Designers. International Thomson Computer Press, London, U.K.

MAMPU (1997), Towards a Vision for a New Electronic Government In Malaysia. Percetakan Nasional malaysia Berhad, Kuala Lumpur, Malaysia.

Maran, R., Mohan, N. (1995), Internet and World Wide Web Simplified. IDG Books Worldwide, Inc., USA.

Martinco, M. J., Hendry, J. W., Zmud, R. W. (1996), An attributional explanation of individual resistance to the introduction of information technologies in the workplace. Behaviour & Information Technology, Vol 15, No. 5, pp. 313-330.

Mason, R. (1994), Using Communications Media in Open and Flexible Learning. Kogan Page Limited, London.

Mason, R., Bacsich, P. (1998), Embedding computer conferencing into university teaching. Computers and Education, 30 (3-4), 249-258.

Mason, R. and Kaye, A. (Eds.), (1989), Mindweave: Communication, Computers and Distance Education. Pergamon Press, Oxford.

McBride, P. K. (1997), Java Made Simple. Made Simple, An Imprint of Butterworth-Heinemann, Oxford.

Medyckyj-scott, D., Cuthbertson, M., Newman, I. A. (1996), Discovering Environmental Data: Metadatabases, Network information resource tools and the GENIE system. *Int. J. Geographical Information Systems*, Vol. 10, No. 1, pp. 65-84.

Martin, M. (1998), More Top Officers Using Internet at Work. The Star Online, August 9.

Moreira, C. F. (1998), The Distance Learning Dilemma. The Star Online, August 9.

Mühlhäuser, M. (1995), Cooperative Computer-Aided Authoring and Learning. Kluwer Academic Publishers, London.

Murphy, I. (1999), Recipe for CBT success. IT Training, February, pp.24-25.

Müsseler, J., Meinecke, C., Döbler, J. (1996), Complexity of user interfaces: Can it be reduced by a mode key?. Behaviour & Information Technology, Vol. 15, No. 5, pp. 291-300.

Nahvi, M. (1999), Dynamics of Student-Computer Interaction in a Simulation Environment: Reflections on Curricular Issues, at <http://www.elee.calpoly.edu/~mnahvi> .

Nelson, R.R. (1991), Educational Needs as Perceived by IS and End-User personnel: A survey of knowledge and skill Requirements. MIS Quarterly, December, Vol. 15 Issue 4, pp 503 - 522.

Nelson, R. R., Whitenet, E. M., Philcox, H. H. (1995), The Assessment of End-User Training Needs. Communication of the ACM, Vol. 38, No. 7. 27-36.

Newman, I. A., Sethi, J. (1985), Some Observations on User Interface Design and User Performance. In: Grundy, A. F., Proceedings of the Fourth British National Conference on Databases. Cambridge University Press, Cambridge, pp. 199 - 213.

Norman, D. A., Spohrer, J.C. (1996), Learner-Centered Education. Communications of the ACM, April, Vol. 39, No. 4, pp. 24-27.

Norros, L. (1989), Simulation in Industrial Work Training, In: Bainbridge, L., Ruiz Quintanilla, S.A., Developing Skills with Information Technology. John Wiley & Sons Ltd, England, pp. 315 - 327.

Oppenheim, A. N. (1992), Questionnaire Design, Interviewing and Attitude Measurement, Printer Publishers, London, p. 12.

Pappas, M. (1998), New Tricks: Applying Traditional Strategies to New Resources. Technology Connection, May/June, Vol. 5, Issue 3, pp. 10-14.

Pfaffenberger, B. (1997), Publish It on the Web!, 2nd Edition. Academic Press Limited, London.

Pinsonneault, A. , Kraemer, K.L. "The Effects of Electronic Meeting on Group Process and Outcomes: An Assessment of the Empirical Research," European Journal of Operational Research (46:2), May 1990, pp. 143-161.

Pont, T. (1991), *Developing Effective Training Skills*. McGraw-Hill Book Company (UK) Limited, England.

Preece, J., (1993), *A Guide to Usability: Human Factors in Computing*. Addison-Wesley Publishing Company, England.

Rae, L., (1997), *How to Measure Training Effectiveness*, Third Edition. Gower Publishing Limited, England.

Ravden, S. J., Johnson, G. I. (1989), *Evaluating Usability of Human-Computer Interfaces: A Practical Method*. Ellis Horwood Limited, England.

Reay, D. G. (1995), *Selecting Training Methods*. Kogan Page Ltd, London, U.K.

Richardson, L.S. (1998), *Creating Value with a Training Program*. *Employee Benefits Journal*, September, Vol. 23 Issue 3, pp. 6 - 8.

Rivard, S., Huff, S. L. (1988), *Factors of Success for End-User Computing*. *Communication of the ACM* (31:5), May, pp. 552 - 561, as quoted in Davis, S.A., Bostrom, R.P. (1993), *Training End Users: An Experimental Investigation of the Roles of the Computer Interface and Training Methods*. *MIS Quarterly*, March, 61-78.

Ruble, T. L., Stout, D. E. (1993), *Learning style and end-user training: An unwanted leap of faith*. *MIS Quarterly*, March, Vol. 17, Issue 1, pp. 115 - 118.

Ruiz Quintanilla, S. A. (1989), *Intelligent Tutorial Systems (ITS) in Training*. In Bainbridge, L., Ruiz Quintanilla, S.A. *Developing Skills with Information Technology*. John Wiley & Sons Ltd, England, pp. 329-338.

Schön, D. A. (1983), *The Reflective Practitioner: How Professionals Think in Action*. Maurice Temple Smith Ltd., London.

Scotti, F. (1988), *Computer Literacy for The Local Public Administration: Design, Implementation and Diffusion*. *Information Technology for Organizational Systems*. Elsevier Science Publisher B. V. , North-Holland, pp. 1112 - 1116.

Sein, M. K., Bostrom, R.P., and Olfman, L. (1987), *Training End Users to Compute: Cognitive, Motivational, and Social Issues*. August, *INFOR* (25:3), pp. 236-255, as quoted in Davis, S.A., Bostrom, R.P. (1993), *Training End Users: An Experimental Investigation of the Roles of the Computer Interface and Training Methods*. *MIS Quarterly*, March, 61-78.

Sein, M. K. and Bostrom, R. P. (1989), Individual Differences and Training of Novice Users. *Human Computer Interaction* (4:3), pp. 197 - 229.

Sekaran, U. (1992), *Research Methods for Business: A Skill-Building Approach*, Second Edition. John Wiley & Sons, Inc. USA.

Shackel, B., (1991), Usability - context, framework, definition, design and evaluation, in: Shackel, B. and Richardson, S. (Eds), *Human factors for informatics usability*, Cambridge University Press, Cambridge.

Shepherd, A. (1989), Training Issues in Information Technology Tasks. In: Bainbridge, L., Ruiz Quintanilla, S.A. *Developing Skills with Information Technology*. John Wiley & Sons Ltd, England, pp. 193-201.

Shepherd, A., Hinde, C.J. (1989), Mimicking the Training Expert: A Basis for Automating Training Needs Analysis, in: Bainbridge, L., Ruiz Quintanilla, S.A. *Developing Skills with Information Technology*. John Wiley & Sons Ltd, England, pp. 153-175.

Silverman, D. (1993), *Interpreting Qualitative Data: Methods for Analysing Talk, Text and Interaction*. Sage, London.

Smith, D. (1998), Computerizing Computer Science. *Communications of the ACM*, September, Vol. 41, No. 9, pp. 21-23.

Smith, P.A., Newman, I.A., Parks, L.M. (1997), *Virtual hierarchies and virtual networks: some lessons from hypermedia usability research applied to the World Wide Web*. Academic Press Limited, U.K.

Sole, S. (1998), Memo to Managers: Learn the Right Stuff - or Burn. *NZ Business*, August, Vol. 12, Issue 7, pp. 48 - 52.

Soloway, E., Pryor, A. (1996), The Next Generation in Human-Computer Interaction. *Communications of the ACM*, April, Vol. 39, No. 4. Pp. 16-18.

Somekh, B. (1997), *Using Information Technology Effectively in Teaching and Learning*. Routledge, London.

Spoll, J. M., Scanlon, T., Schroeder, T., Snyder, C., DeAngelo, T. (1999), *Web Site Usability: A Designer's Guide*. Morgan Kaufmann Publishers, Inc., San Francisco, California.

Stack, J. (1998), The Training Myth. Inc., Vol. 20 Issue 11, pp. 41-42.

Stewart, T. (1986), Task Fit, Ease-of-Use, and Computer Facilities. In Bjørn-Anderson, N., Eason, K. D. and Robey, D. *Managing Computer Impact*. Ablex Publishing Corporation, Norwood, NJ.

Stout, R. (1997), *Web Site Stats: Tracking Hits and Analising Traffic*. Osborne/McGraw-Hill, USA.

Suomi, R. (1996), One size fits all - or does it?. *Behaviour & Information Technology*, Vol. 15, No. 5, pp. 301-312.

Taylor, S., Todd, P. (1995) *Assessing IT Usage: The Role of IT Prior Experince*. *MIS Quarterly*, Vol. 19, No. 4, pp. 561 - 568.

Thomas, B. (1992), *Total Quality Training (The Quality Culture and Quality Trainer)*. London: McGraw-Hill Book Company.

Thomas, P. and Carswell, L. (2000), *Learning through Collaboration in a Distributed Education Environment*. *Journal of International Forum of Educational Technology and Society*, (in publication).

Ttooulis, B. (1996), *Making Training Count*. *IT Training*, April, pp. 51 & 52.

Vainio-Larsson, A. (1991), *As We May Learn: Training With Multimedia*. Elsevier Science Publishers B.V., North-Holland.

Wohl, A. D. (1998), *Users Want Computers That Take Care of Themselves*. *VARBusiness*, June, Vol. 14 Issue 12, pp. 171 - 172.

Woolf, B. P. (1996), *Intelligent Multimedia Tutoring Systems*. *Communications of the ACM*, April, Vol. 39, No. 4, pp. 30-31.

Yaacob, R. A. (1994), *Application of Information Technology in Libraries and Information Centres and Impact on Management, Users and the IT Industry*. In *Proceedings of the International Conference On Information Technology*. MNCC & MSORSM, Malaysia..

Zmud, R. W. and Lind, M. R. (1985), *Linking Mechanisms Supporting End-User Computing*, *Proceedings of the 12th Annual Conference of ACM SIGCPR/SIGBDP*, Association for Computing Machinery, New York, NY, pp. 74-80, as quoted in Davis, S.A., Bostrom, R.P. (1993), *Training End Users: An Experimental Investigation of the Roles of the Computer Interface and Training Methods*. *MIS Quarterly*, March, 61-78.

APPENDIX A

Questionnaire

**Computer Supported
IT Training for Managers**

QUESTIONNAIRE

1997

**UNIVERSITY OF LOUGHBOROUGH
UNITED KINGDOM**

INTRODUCTION

Information Technology (IT) is playing a key role in the operations and management of the Malaysian Public Service Departments. IT is significantly affecting the productivity and services of Malaysian civil servants.

National Computer Training Centre (NCTC) - PLKN INTAN, was set up for the purpose of giving training in the field of information technology to civil servants. It was set up to develop the effectiveness of government departments by developing the skills of the people who work within those organisations through the use of the technology.

This questionnaire has been designed to assist in the collection of research data, which will help in understanding and improving the impact of IT training in the Malaysian Public Service. Most of the questions require you to tick appropriate response boxes and in some cases you will be asked to answer briefly. Each answer should be based on your perspective and personal involvement, as being a participant in NCTC's IT training.

The data collected in the survey will be treated on a confidential basis.

Please return the completed survey using self-addressed envelope enclosed to:

Ketua PLKN
Pusat Latihan Komputer Negara, INTAN
Jalan Elmu
59700 Kuala Lumpur.
(attn:Dr. Raja Malik bin Raja Mohamed / En. Mazlan Harun).

Specific questions regarding the contents of the questionnaire should be addressed to En. Mazlan Harun at 03-7579155/03-2535059.

Your assistance in completing the questionnaire is very much appreciated.

PART I

A Usage of Computers

1. Do you use computers in your everyday work?

☐ Yes ☐ No

2. If you answered Yes to Q1, how often do you use the computer ?

☐ Several times a day

☐ Once a day

☐ Once a week

☐ Once a month

☐ Intensively in bursts

3. If you answered Yes to Q1, where is the computer situated?

☐ On your desk

☐ In a separate room

☐ At a place which is five minutes walk away

☐ In a separate building

4. Do you have any problems when using the computer?

☐ Yes ☐ No

5. If you answered Yes to Q4, please indicate the most common sources of problems: -

(please rank them according to the following -

most common	next most common					least common
1	2	3	4	5	6)

- | | |
|--|--|
| <input type="checkbox"/> Use of hardware
e.g. keyboard skills | <input type="checkbox"/> Inputting data |
| <input type="checkbox"/> Reliability | <input type="checkbox"/> Using new software |
| <input type="checkbox"/> Accessing information | <input type="checkbox"/> Finding out how
to do things |

☐ Other (please specify)

6. If you answered Yes to Q4, where do you get help ?

- ☐ From technical people in the office
- ☐ From other users
- ☐ Solve it by myself
- ☐ Manuals
- ☐ Help Desk outside the Department
- ☐ Other (Please specify)

B Training

1. Have you attended any computer course before (locally or overseas) ?

☐ Yes ☐ No

If Yes, what was the subject

2. Have you attended NCTC's IT training course before ?

☐ Yes ☐ No

3. If you answered Yes to Q2, when was the last NCTC's IT training you attended ?

- ☐ One month ago
- ☐ Between one and six months ago
- ☐ Between six months and one year
- ☐ More than one year ago

4. If you answered Yes to Q2, what was your expectation before attending the IT training ?

5. If you answered Yes to Q2, have you since found there were any aspects you needed to know that were not covered in the training?

☐

Yes

☐

No

If Yes, please specify

6. If you answered Yes to Q2, does the training given match with the work you are doing?

☐

Not at all

☐

Partly match

☐

Totally match

C Individual Data

1. Your job title

2. How long have you been in this department?

--	--

 years

3. What is your age group?

<input type="checkbox"/>	21 ~ 30	<input type="checkbox"/>	41 ~ 50
<input type="checkbox"/>	31 ~ 40	<input type="checkbox"/>	51+

4. Did your formal education include a computing element?

<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
--------------------------	-----	--------------------------	----

5. If you answered YES to Q4 which one of the following best describes the formal computing element?

- ☐ The study of computer science as a degree;
- ☐ The study of computer science as a joint degree ;
- ☐ An introduction to computing as part of a degree in another subject;
- ☐ Other (please specify)

6. Which publications, with educational computing interests, do you subscribe to or have reasonable access to ?

7. Do you want a summary of questionnaire results ?

☐ Yes ☐ No

If Yes, state your name, please

D Department Data.

1. Department name and address :

2. Is there a computer system in your department?

☐ Yes ☐ No

3. If you answered Yes to Q2, then , is the computer system run on PC or Mini or Mainframe ?

☐ PC ☐ Mini ☐ Mainframe

4. How many technical people in your department?

system analysts

programmers

5. Is there a training unit in your department?

☐ Yes ☐ No

6. Please estimate the budget for IT training for this year?

☐ Less than RM10,000.00

☐ Between RM10,000.00 to RM100,000.00

☐ Greater than RM100,000.00

Terima kasih atas kerjasama anda
Thank you for your co-operation

PART II

This part should be answered to those who have attended the training courses covered by this research.

A After Training.

1. Is the way in which training given appropriate for your task?

very
appropriate

1

2

3

4

not very
appropriate

5

2. Was any of the information in the module particularly relevant to your situation?

☐

Yes

☐

No

If yes, can you indicate which module and what information?

Module:

Information:

3. Were the problems and task data used in the training appropriate for your situation?

☐

Yes

☐

No

If no, please suggest a problem or task area that would have been more appropriate?

4. Were any of the materials presented during the training particularly difficult for you to understand?

☐

Yes

☐

No

If yes, can you please indicate which modules and which materials?

5. Does the training given match with the work you are doing?

☐

Not at all

☐

Partly match

☐

Totally match

6. If the training did not fully match your work, please rank the following as the reason why.

(Rank :

most
appropriate
reason

1

next most
appropriate
reason

2

3

4

.....

☐

Subjects taught not relevant

☐

The presentation was too technical

☐

Examples used not relevant

☐

Training too fast

☐

Other (please specify)

7. What was the best feature of the training?

8. What was the worst feature of the training?

9. Overall, how would you rate the training in term of its relevancy to your job?

very
relevant

1

2

3

4

not very
relevant

5

10. Do you think that to be effective, training must be completely integrated directly and clearly to the attainment of organisational goals ?

strongly
agree

1

2

3

4

strongly
disagree

5

11. After attended NCTC's IT Training, do you feel that you have developed new ideas and methods of tackling your tasks?

☐

Yes

☐

No

12. After attended the training, do you feel that the training has helped to reduce the problems of 'ease-of-use' of computer systems in your department?

For you : ☐ Yes ☐ No

13. Has the training given motivated you to go for IT?

☐ Yes ☐ No

14. Do you feel there should be any follow-up for the training ?

☐ Yes ☐ No

15. Will you recommend the NCTC's IT training to other people?

☐ Yes ☐ No

Terima kasih atas kerjasama anda
Thank you for your co-operation

Appendix B

Questionnaire Responses

FREQUENCY COUNTS

PART I

A Usage of Computers

1. Do you use computers in your everyday work?

28	97%	Yes	1	3%	No
----	-----	-----	---	----	----

2. If you answered Yes to Q1, how often do you use the computer?

Several times a day	20	69%
Once a day	-	-
Once a week	-	-
Once a month	1	3%
Intensively in bursts	7	24%

3. If you answered Yes to Q1, where is the computer situated?

On your desk	27	93%
In a separate room	1	3%
At a place which is five minutes walk away	-	
In a separate building	-	

4. Do you have any problems when using the computer?

Yes	20	69%	No	9	31%
-----	----	-----	----	---	-----

5. If you answered yes to Q4, please indicate the most common sources of problems:-

please rank them according to the following –

most common	next most common					least common
1	2	3	4	5	6	

	1	2	3	4	5	6
Use of hardware e.g. keyboard skills	3	3	1	-	1	4
Reliability	-	2	-	4	-	1
Accessing information	1	4	6	2	1	1
Inputting data	-	3	3	3	3	-
Using new software	9	3	5	1	-	1
Finding out how to do things	6	10	1	-	2	-
Other (please specify) -----	-	-	-	-	-	-

6. If you answered Yes to Q4, where do you get help?

From technical people in the office	16
From other users	15
Solve it by myself	4
Manuals	8
Help Desk outside the Department	1
Other (please specify) -----	1

Note: Each respondent tick one or more.

B Training

1. Have you attended any computer course before (locally or overseas)?

29	100%
----	------

 Yes

0	0%
---	----

 No

If Yes, what was the subject?

Lotus Notes, Lotus 123,
Auditing Computer Software (packages),
Introduction to Computing,
Microsoft Office (Word, Power Point, Excel),
Windows 95,
WordPerfect,
Dbase, SAS,
System Analysis & Design,

2. Have you attended NCTC’s IT training course before?

16	55%
----	-----

 Yes

13	45%
----	-----

 No

3. If you answered Yes to Q2, when was the last NCTC's IT training you attended? (before the most recent one).

One month ago	1	6%
Between one and six months ago	5	31%
Between six months and one year	3	19%
More than one year ago	7	44%

4. If you answered Yes to Q2, what was your expectation before attending the IT training?

To gain knowledge and share experiences on IT,
 To get familiar with MIS,
 To learn how to use computer and retrieve information,
 Learn specific software (Corel Draw and PageMaker),
 To learn Dbase, Lotus and MS-Office,
 Awareness and skilful,
 Competent in handling computer,
 Learn how to use computer in daily work,
 Learn some new things,
 To be able to manage my work more effectively and efficiently.

5. If you answered Yes to Q2, have you since found there were any aspects you needed to know that were not covered in the training?

6	38%
---	-----

 Yes

10	62%
----	-----

 No

If Yes , please specify

Security, Computer Auditing,
 Multimedia Application,
 Subjects covered were not too detail.

6. If you answered Yes to Q2, does the training given match with the work you are doing?

Not at all	1	6%
Partly match	11	69%
Totally match	5	31%

C. Individual Data

1. Your job title.

Auditor, Head of IT training division,
Executive Officer, Assistant to State Secretary,
Assistant State Financial Officer, Assistant Director
for State Economy, Director for State Development,
Deputy Secretary for State Planning Unit,
Director for State Economy Planning Unit,
Assistant State Secretary for Development.

2. How long have you been in this department?

1	2	3	4	5	6	7	8	9	>=10 (Years)
4	4	3	2	3	1	1	1	1	8

1 respondent didn't give answer

3. What is your age group?

21 - 30	2	7%
31 - 40	11	38%
41 - 50	15	52%
More than 50	1	3%

4. Did your formal education include a computing element?

13	45%
----	-----

 Yes

16	55%
----	-----

 No

5. If you answered YES to Q4 which one of the following best describes the formal computing element?

The study of computer science as a degree	2	15%
The study of computer science as a joint degree	-	-
An introduction to computing as part of a degree in another subject	11	85%
Other (please specify) -----	-	-

6. Which publications, with educational computing interests, do you subscribe to or have reasonable access to?

**Intech (STAR), Computimes (NST),
PC Magazine, Software & Trouble shooting,
Into IT, PC Week Asia.**

7. Do you want a summary of questionnaire results?

12	41%
----	-----

 Yes

17	59%
----	-----

 No

D Department Data

- 1. Department name and address;
 - a) Public Service Department.
 - b) Audit Department.
 - c) Perak State Secretariat Office.
 - d) Kedah State Secretariat Office.

2. Is there a computer system in your department?

29	100%	Yes	0	0%	No
-----------	-------------	-----	----------	-----------	----

3. If you answered Yes to Q2, then, is the computer system run on PC or Mini or Mainframe?

PC	18	62%
Mini	7	24%
Mainframe	4	14%

4. How many technical people in your department?

	0	1	2	3	4	5	>5
System Analyst	2	7	2	1	1	4	2
Programmers	4	2	-	2	4	2	2

Note: Many respondents were not sure of the total number of system analysts and programmers in their department.

5. Is there a training unit in your department?

21	72%	Yes	8	28%	No
----	-----	-----	---	-----	----

6. Please estimate the budget for IT training for this year?

No budget	2	7%
Less than RM10,000.00	2	7%
Between RM10,000.00 to RM100,000.00	8	27%
Greater than RM100,000.00	15	52%

2 (7%) respondents didn't give answer

PART II

This part should be answered to those who have attended the training courses covered by this research.

A After Training

1. Is the way in which training given appropriate for your task?

very appropriate				not very appropriate
1	2	3	4	5
7	14	5	-	-
24%	48%	18%	-	-

3 (10%) respondents didn't give answer

2. Was any of the information in the module particularly relevant to your situation?

24	83%
----	-----

 Yes

1	3%
---	----

 No

4 (14%) respondents didn't give answer

If yes, can you indicate which module and what information?

Module : **Multimedia Super Corridor (MSC),
Electronic Government,
MS-Office,
IT for Managers.**

Information : **Internet, E-mail,
Video Conferencing,
MSC functions and Infrastructure,
Computer Auditing,
Contract Evaluation,
Word, Excel.**

3. Were the problems and task data used in the training appropriate for your situation?

23	78%
----	-----

 Yes

3	11%
---	-----

 No

3 (11%) respondents didn't give answer

If no, please suggest a problem or task area that would have been more appropriate?

**Office administration,
Data base creation,
Course contents should relevant to my daily work**

- service matters
- salary
- personnel system

4. Were any of the materials presented during the training particularly difficult for you to understand?

6	21%	Yes	20	69%	No
3 (10%) respondents didn't give answer					

If yes, can you please indicate which modules and which materials?

Strategic Planning,
Data Processing Module,
Words, Excel,
Internet and Homepage,
MSC – Function & Infrastructure.

5. Does the training given match with the work you are doing?

Not at all	0	0%
Partly match	21	73%
Totally match	5	17%

3 (10%) respondents didn't give answer

6. If the training did not fully match your work, please rank the following as the reason why?

most appropriate reason 1	next most appropriate reason 2	3	4		
		1	2	3	4	5 6 ...
Subject taught not totally relevant to my job		7	-	2	2	- 1
The presentation was too technical		-	2	4	2	- 1
Examples used not relevant		2	1	5	2	- -
Training too fast		3	1	1	1	- -
Other (please specify)						
1. Course given, covered only basic knowledge of computer.		1				
2. Transitional Stage.		1				

7. What was the best feature of the training?

Internet, E-mail, IRC Chatting,
 Video-Conferencing,
 Confidence in IT usage,
 Link files,
 One PC per person with internet facilities & teleconferencing,
 Hands-on, Case study,
 Lecture on Multimedia Super Corridor,
 Simulation type of training,

8. What was the worst feature of the training?

Stretched day and night,
LCD equipment, not of expected quality,
Inability to demonstrate mail-merge feature,
Time – very short,
Not enough facilitators – 90 participants with only 15
facilitators.
Subjects quite complicated.

9. Overall, how would you rate the training in term of its relevancy to your job?

very relevant				not very relevant
1	2	3	4	5
10	11	5	-	-
34%	38%	18%	-	-

3 (10%) respondents didn't give answer.

10. Do you think that to be effective, training must be completely integrated directly and clearly to the attainment of organisational goals?

strongly agree				strongly disagree
1	2	3	4	5
23	2	-	1	-
80%	7%		3%	

3 (10%) respondents didn't give answer

11. After attended NCTC's IT Training, do you feel that you have developed new ideas and methods of tackling your tasks?

24	83%	Yes	1	3%	No
----	-----	-----	---	----	----

4 (14%) respondents didn't give answer

12. After attended the training, do you feel that the training has helped to reduce the problems of 'ease-of-use' of computer systems in your department?

For you	25	86%	Yes	0	0%	No
---------	----	-----	-----	---	----	----

4 (14%) respondents didn't give answer

13. Has the training given motivated you to go for IT?

25	86%	Yes	0	0%	No
----	-----	-----	---	----	----

4 (14%) respondents didn't give answer

14. Do you feel there should be any follow-up for the training?

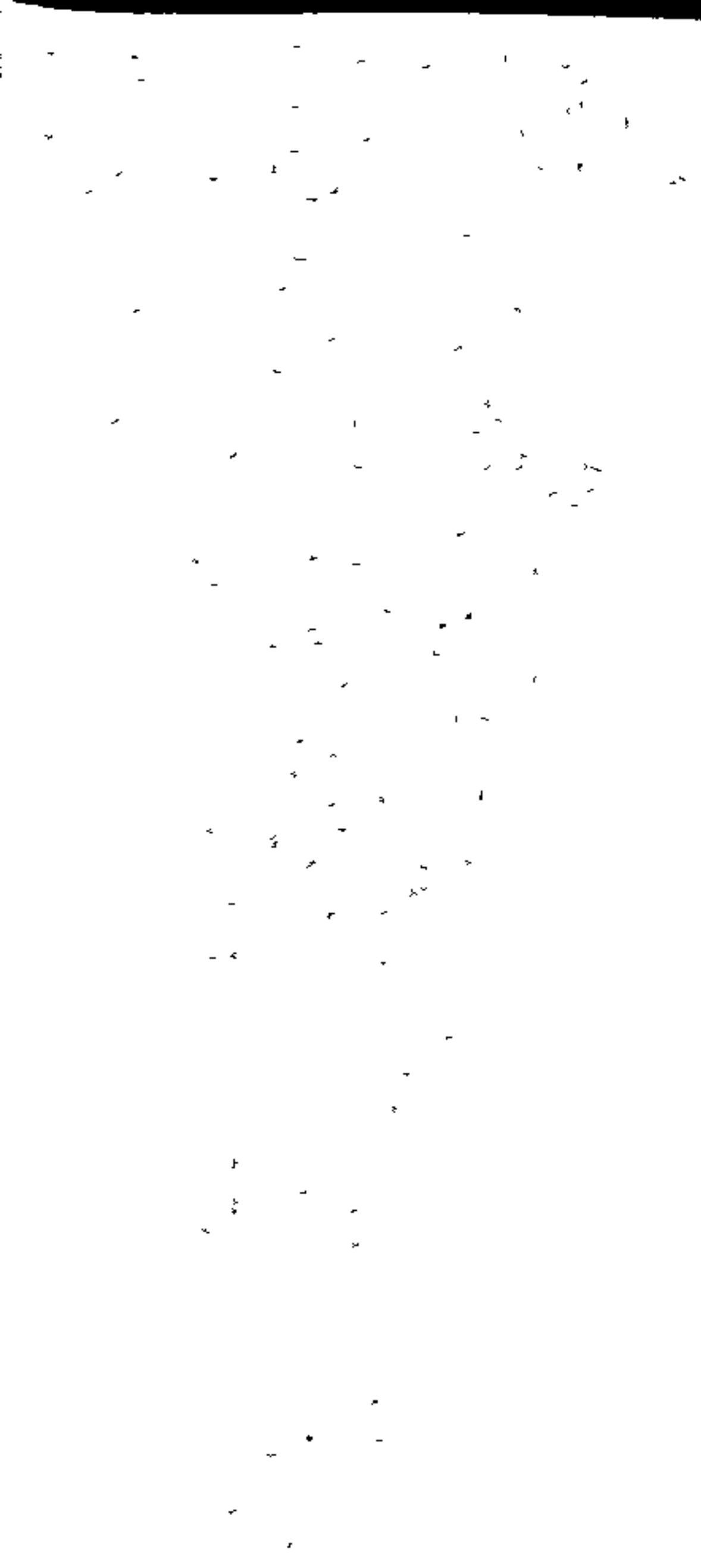
25	86%	Yes	0	0%	No
----	-----	-----	---	----	----

4 (14%) respondents didn't give answer

15. Will you recommend the NCTC's IT training to other people?

25	86%	Yes	0	0%	No
----	-----	-----	---	----	----

4 (14%) respondents didn't give answer



Appendix C

**Background on Internet, World Wide
Web and other related topics**

BACKGROUND

This appendix aims to introduce the background to the Internet, World Wide Web and other related topics of which an understanding was necessary to complete the Help System successfully.

1.0 The Internet

The Internet is a world wide informal agglomeration of connected computers, linked by high bandwidth/capacity lines that stretch across countries and under oceans.

The Internet was started in the 1960s as an experiment by the U.S. Department of Defence, as a means to communicate with its contractors and researcher at academic institution. A protocol was established – TCP/IT (Transmission Control Protocol/Internet Protocol) which defined the way computers on the network could talk to each other. A protocol is a set of rules governing the procedures for exchanging information. The Internet's Transmission Control Protocol (TCP) and the Internet Protocol (IP) enable world wide connectivity between browsers and servers thereby designing a decentralised system in which any computer on the network can talk to any other. Messages can also be re-routed as needed, depending on which lines are available.

2.0 Early Internet Services

The Internet's facility for speeding communication through e-mail (electronic mail) and newsgroups quickly caught on, leading to new methods for sharing and retrieving information, for example:

- * **Telnet** – lets remote users log onto Internet computers as guests and run programs on them from their own machine.
- * **FTP** (File Transfer Protocol) – allows users to download files from remote computers.
- * **Gopher** – provides hierarchical menus for finding information.

- * **WAIS** (Wide Area Information Service) – provides a search engine for finding what users need anywhere in the world.

3.0 The World Wide Web

In 1991, a group of scientists at CERN, European Physics Laboratory developed a new system for accessing information on the Internet, which was called the World Wide Web (WWW) – a collection of all browsers, files, and browser-accessible services available through the Internet. The browser provides the capability to view Web documents and access Web-based services and applications.

In order to publish a document on the Web, it must be made available to a Web server (A server is a computer attached to a network which is the main repository for data and program files used by other computers attached to the network). Web servers retrieve Web documents in response to browser request and forward the documents to the requesting browsers via the Internet.

The Web makes use of hypertext to link any Web document to any other document anywhere in the world (provided there is a suitable connection). It does this by making use of a URL, (Universal Resource Locator) which is the standard method for naming and finding files on the WWW. A URL is the notation used to specify the addresses of an Internet file or service. An example of a URL is:

<http://ww.jaring.my/bharian>

A URL always contains a protocol identifier such as:

- * http (hypertext transfer protocol),
- * ftp (file transfer protocol) or

- * · file (used to transfer files from a local hard disk to a browser).

In writing a URL, the protocol identifier is followed by `://` and then the host name of the computer to which the link is required. In addition, the URL can specify the path and file name of a file to be accessed by adding single forward slashes (`/`) between elements of the full path name. For example:

<http://www.jaring.my/comh1/netpg1.html>

would open the HTML file named `netpg1.html` from directory `comh1` from the computer `jaring.my`.

These URLs are used to hyperlink the user from one document location to another which could either be on the same page of the same document or to another file on another server in another part of the world. The process normally takes only a matter of seconds for the file to download to the user's browser.

The Web can be interactive – unlike material printed in a book Web publications can respond to input by the user. The response can be as simple as returning an answer to a request for information or as complex as monitoring users' choices and controlling what they see based on their past preferences and actions. Web pages can also include full colour text and graphics, plus sound, animation and video, all in a hyperlink environment.

The web is the first service on the Internet to seize the attention of the public, publishers and businesses as it allows pages to be designed. The Web presents an exciting opportunity through the use of hyperlinks, graphic design and interactivity to create fluid and friendly interfaces to help visitors find, scan, and enjoy the material published. A hyperlink can theoretically be set for any page in the Web, this means a reader can potentially land on any page in a Web 'site' (a specific collection of documents in a particular location on a

particular server). It is therefore important that site designers help visitors understand how to get the information they're looking for within the site or to provide links to external sites for further information.

4.0 TCP/IP and HTTP (Hypertext Transfer Protocol)

The Web uses the Internet as a communications medium and must therefore follow the Internet communications protocol – that is TCP/IP, which enables world-wide communication between servers and browsers.

In addition to using TCP/IP Protocols for communication across the Internet, the Web uses the Hypertext Transfer Protocol (its own Protocol) for exchanges between browsers and servers. This uses a request/response model of communication. The protocol specifies how to access and transfer files over the Web.

5.0 Hypertext Mark-up Language (HTML)

HTML is the basic format for all Web pages, it marks the structure, (not design), of documents with tags. HTML springs from an international standard for electronic exchange known as SGML (Standard Generalised Marked Language), a system widely used in government and educational organisations.

HTML are pure ASCII (American Standard Code for Information Interchange) text and can be read by practically any browser. The HTML codes or 'tags' are embedded in these text files between angle brackets. The scheme relies on the reader having the special software required (a browser) designed to retrieve and display HTML files. Its strengths, and limitations, determine what you can and can't do with the Web.

There are three types of tags:

Structural tags :

- label parts of a document, headings, paragraphs, lists etc.

Style tags :

- tell the browser exactly how to present the labelled text.

Programming tags :

- tell the browser to perform some action, to fetch a graphic or run a program.

Each HTML document has two sections :

Head :

- present the browser with general information about the file.

Delineated by `<HEAD>` and `</HEAD>` tags, and

Body :

- includes information that will be displayed in the browser window.

Delineated by `<BODY>` and `</BODY>` tags.

Some browsers also require an `<HTML>` tag at the top of the file and a `</HTML>` tag at the end to let the browser know to interpret the file as an HTML file and not as plain text:

An example of a typical HTML listing :

```
<HTML>
<HEAD>
<TITLE>This is the page title</TITLE>
```



```
<HEAD>
<BODY>
<H1 align=center>This is a centred heading</H1>
<P>This is the first paragraph</P>
</BODY>
<HTML>
```

5.0 HTML editing tools

There are many ways to create HTML documents. We can use any text editor such as WordPad on Windows, SimpleText on the Macintosh, or vi in Unix systems. The HTML code produced with these simple programs is no different from the HTML produced by more complex HTML editors. Many word processing and page layout programs for example, Microsoft Word 7, have the ability to save files as HTML documents. The most popular tools are HTML editors, essentially word processors specially designed for HTML formatting. Some editors allow HTML tags to be selected from menus while others such as Microsoft's FrontPage offer WYSIWYG interfaces which let you drag images into place and add styles to text with menu commands. The HTML codes are easily viewed via a view source menu option and the HTML can be manipulated directly if fine tuning is required. Some editors also have scripting tools which permit interactivity to be added by choosing actions from simple dialogue boxes.

6.0 Browsers

The most commonly used browsers are Netscape Navigator and Microsoft Internet. Over 300 other browsers do exist, for example, Mosaic and

Lynx. According to latest statistics floating around the Net, Netscape Navigator (most often referred to simply as Netscape) is used by over 70% of the Web browsing public.

In addition to the browser there may also be helper applications or 'plug-ins' which are launched by the browser to display files the browser can't read itself. The browser software interprets the HTML codes and lays out the document on screen accordingly. Default specifications are programmed into the browser and can be changed only by user. Most browsers actually use similar settings for things like typeface, for example 12-point Times for the basic text font and 12-point Courier for the alternate font. Though users can change these defaults using a browser's Preference Settings, many users leave the settings alone. Pages may also appear different depending on the platform they're viewed on. For example, the resolution of the user's monitor can make graphics and type appear larger or smaller. Some visitors to a site may use browsers that can't display graphics and others will browse with the graphics switched off to speed downloading. This means, although a significant portion of users will see the designed pages as the designer intended, another segment may not. Therefore, successful Web design includes the art of creating pages that can be viewed successfully under a number of different conditions.

7.0 Java and JavaScript

Java is a platform independent programming language. Unlike traditional programming languages that require separate versions of a program to be compiled for each type of machine it is to run on, Java programs can be compiled just once to run on a Java Virtual Machine (a software base that acts as a Java specific processor). The ability to run, just like HTML, on any computer, has meant programmers have migrated to it as it is suited to creating applications that are to be distributed over the Web.

Java has advantages over conventional programming languages for web design. Conventional programs are not designed to execute over the Web and the programmer would have to write functions to perform the most basic operations. Conventional programs can also generate very large executables which on a standalone machine may not be a problem but with communication over the Web, where bandwidth is limited, this becomes an issue. Security is also a potential problem in that over the Internet a conventional program could possibly perform potentially fatal operations on their machine, for example wiping out the hard disk. There is also the problem that there are many different computers attached to the Internet and many different operating systems in use. Java solves these problems. Its platform independent nature makes it a suitable language for the Web.

Non-programmers may also make use of Java in their Web pages. 'Applets', small programs that run on the user's hard disk from within the browser, are freely available over the Web. Java programs that can be executed by a web browser are called Applets rather than applications because they cannot be run outside of the browser window. Web pages written in HTML can reference Java Applets using the `<APPLET>` tag. An applet is fetched from a server in a similar way to an image.

JavaScript is a scripting language that has been designed for the Web. While HTML is good for creating static Web pages, JavaScript provides the capability to design pages that dynamically respond to user inputs. While Java is an excellent language for creating components that can be embedded into a Web page, the output display is confined to a limited area of the browser window. JavaScript, however, allows the programmer to develop scripts that can access all aspects of the browser display.

To summarise, the difference between Java and JavaScript is that Java Script is unseparated in the page and can manipulate information within

the page as displayed by the browser. Java applets are fetched from a server in a semi-compiled form which is then interpreted by the browser. Java interactions with the user are confined to a special interface area. The applet can however, communicate over the internet back to the server from which it came which JavaScript program cannot do. Both enable the design of pages with element of interactivity for the user.

Appendix D

Search Engine

Search Engine for the Version 2 of the Help System.

File name: InfoSearch.java

```
import java.awt.*;
import java.net.*;
import java.applet.Applet;

public class InfoSearch extends Applet
{
    Site siteList[];
    int last;

    public void init()
    {
        TextField keyword;
        Font f;
        Label textLabel;
        last = 3;        //      10;
        siteList = new Site[4]; //      new Site[11];
        siteList[0] = new Site ("Internet",

"http://avarice.lut.ac.uk/~comh1/faqnet1.html");
        siteList[1] = new Site ("What will it cost",

"http://avarice.lut.ac.uk/~comh1/faqnet4.html");
        siteList[2] = new Site ("What is a URL",

"http://avarice.lut.ac.uk/~comh1/faqnet9.html");
        siteList[last] = new Site ("Unmatch",

"http://avarice.lut.ac.uk/~comh1/unmatch.html");

        //      siteList[last] = new Site ("What is a network",
        //
"http://avarice.lut.ac.uk/~comh1/faqnet7.html");
        //      siteList[3] = new Site ("Service Provider",
        //
"file://diskc/co/comh1/faqnet14.help");
        //      siteList[4] = new Site ("What is a URL",
        //
"file://diskc/co/comh1/faqwww9.help");
        //      siteList[5] = new Site ("How do I get connected",
        //
"file://diskc/co/comh1/faqnet3.help");
        //      siteList[6] = new Site ("How to create a bookmark",
        //
"file://diskc/co/comh1/faqwww17.help");
        //      siteList[7] = new Site ("What is YAHOO",
        //
"file://diskc/co/comh1/faqwww11.help");
        //      siteList[8] = new Site ("How to change Start Page",
```

```

        //
        "file:/diskc/co/comh1/how5.help");
        //      siteList[9] = new Site ("Crashing",
        //
        "file:/diskc/co/comh1/how6.help");
        //      siteList[last] = new Site ("Johan",
        //
        "file:/diskc/co/comh1/faqnet5.help");

        f = new Font("SanSerif", Font.BOLD,12);
        textLabel = new Label("Type the Keyword and Press
Enter");

        textLabel.setFont(f);
        add(textLabel);
        keyword = new TextField(30);
        add(keyword);
    }

    public boolean action(Event e, Object arg)
    {
        String title;
        String userinput;
        URL location;

        for (int i=0; i<siteList.length; i++)
        {
            location = siteList[i].getLocation();
            userinput = arg.toString();
            userinput = userinput.trim();
            if (title.equalsIgnoreCase(userinput))
            {
                gotoSite(location);
            }
            else if (i == last)
            {
                location = siteList[last];
                gotoSite (location);
                return true;
            }
        }
        return false;
    }

    public void gotoSite(URL loc)
    {
        getAppletContext().showDocument(loc);
    }
}

class Site
{
    private String title;
    private URL location;

```

```
public Site(String siteTitle, String siteLocation)
{
    title = siteTitle;

    try
    {
        location = new URL(siteLocation);
    }
    catch(MalformedURLException e)
    {
        System.err.println("Invalid URL: " +
siteLocation);
    }
}

public URL getLocation() { return location; }
}
```


Appendix E

Navigational File .inf and .inf1

Navigational File

File name: mh1.chi.inf

HelpSystem.html

log LOGIN netpg1F.html
log netpg1F.html
page0 Internet-General intgenX.html
page0 FAQ-Internet netpg1X.html
page0 FAQ-WWW pg1wwwX.html
page0 How-WWW howtoX.html
page0 Other Information unmatch.html
page0 Interesting+Sites IntWebX.html
page0 Index indexX.html
page0 Display+Records advancedfeatures.html
page0 Accessed+Pages accessedpgs.html
page0 Who+the+Users whoaccess.html
page0 Show+Feedback wfeedback.html
page0 Add+Information addinfo.html
page0 Ask+Questions askques.html
page0 Answer+Questions answerques.html
page1 Internet-Basics intgen1.html
page1 History intgen2.html
page1 Internet+Jargon intgen3.html
page1 Search searchresults.html
page1 Submit+Feedback intgenX.html
page1 Submit+Question intgenX.html
page2 Internet+General faqnet1.html
page2 Newsgroup faqnet2.html
page2 World+Wide+Web faqwww1.html
page2 What+can+I+do faqnet6.html
page2 Who+owns%2Fcontrol+the+Internet faqnet8.html
page2 What+Information+can+be+obtained faqnet12.html
page2 Internet+Offers faqnet11.html
page2 Who+offers+the+free+information faqnet11.html
page2 Cost faqnet4.html
page2 POP+%28Point+Of+Presence%29 faqnet4.html
page2 Network faqnet7.html
page2 Equipments faqnet13.html
page2 Modem faqnet13.html
page2 Security faqnet18.html
page2 Passing+Credit+Card faqnet18.html
page2 Security+Technology faqnet19.html
page2 SSL%28Security+Sockets+Layer%29 faqnet20.html
page2 Get+Connected faqnet3.html
page2 Service+Provider faqnet14.html
page2 Software faqnet5.html

page2 TCP%2FIP faqnet5.html
 page2 PPP faqnet5.html
 page2 How+Information+Get+Transferred%3F faqnet17.html
 page2 FTP faqnet5.html
 page2 Information+Superhighways faqnet9.html
 page2 Cyberspace faqnet9.html
 page2 What+is+Intranets%3F faqnet21.html
 page2 Search searchresults.html
 page2 Submit+Feedback netpg1X.html
 page2 Submit+Question netpg1X.html
 page3 World+Wide+Web+%28WWW%29 faqwww1.html
 page3 Web+Page faqwww2.html
 page3 Web+Site faqwww2.html
 page3 Web+Browser faqwww3.html
 page3 Difference+between+WWW+and+Internet faqwww13.html
 page3 Web+Page+Creation faqwww15.html
 page3 Bookmarks faqwww8.html
 page3 Hotlists faqwww8.html
 page3 Favourites faqwww8.html
 page3 Bring+Up+Bookmarks faqwww16.html
 page3 Create+a+Bookmarks faqwww17.html
 page3 Home+Page faqwww7.html
 page3 Hypertext faqwww6.html
 page3 Hypermedia faqwww6.html
 page3 Netscape+Navigator faqwww4.html
 page3 NSCA+Mosaic faqwww5.html
 page3 URL%28Uniform+Resources+Location%29 faqwww9.html
 page3 Virtual+World faqwww10.html
 page3 3D-browser faqwww10.html
 page3 Virtual+Reality+Modelling+Language+%28VRML%29 faqwww10.html
 page3 WebSpace faqwww10.html
 page3 WebFX faqwww10.html
 page3 Search+Engine faqwww14.html
 page3 YAHOO faqwww11.html
 page3 LYCOS faqwww12.html
 page3 Search searchresults.html
 page3 Submit+Feedback pg1wwwX.html
 page3 Submit+Question pg1wwwX.html
 page4 How+Browser+Work%3F how1.html
 page4 How+to+chat+with+IRC%3F how3.html
 page4 How+to+read+a+Web+Address%3F how2.html
 page4 How+to+change+my+default+Start+Page%3F how5.html
 page4 How+to+choose+a+Modem%3F how4.html
 page4 How+to+prevent+crashing%3F how6.html
 page4 Search seachresults.html
 page4 Submit+Feedback howtoX.html
 page4 Submit+Question howtoX.html

page5 Animals wsite1.html
 page5 Astronomy wsite3.html
 page5 Art wsite2.html
 page5 Biology wsite4.html
 page5 Bizarre wsite5.html
 page5 Books+and+Language wsite6.html
 page5 Business%3ACompanies wsite7A.html
 page5 Business%3AShopping wsite7C.html
 page5 Business%3AFinance wsite7B.html
 page5 Cars wsite8.html
 page5 Chemistry wsite9.html
 page5 Computers%3AResources wsite10B.html
 page5 Computers%3APictures wsite10A.html
 page5 Computers%3ASounds wsite10C.html
 page5 Dance+and+Dance+Music wsite11.html
 page5 Education wsite12.html
 page5 Environment+and+Weather wsite13.html
 page5 Games wsite15.html
 page5 Food+and+Drink wsite14.html
 page5 Geography wsite16.html
 page5 Government+and+Information+on+the+World wsite17.html
 page5 Healthwsite18.html
 page5 History wsite19.html
 page5 HTML%28Hypertext+Markup+Language%29 wsite20.html
 page5 Humor wsite21.html
 page5 Internet%3APrograms wsite22A.html
 page5 Internet%3AResources wsite22B.html
 page5 Macintosh wsite23.html
 page5 Movies wsite25.html
 page5 Magazines wsite24.html
 page5 Museums wsite26.html
 page5 Music wsite27.html
 page5 News wsite28.html
 page5 Organisation wsite29.html
 page5 Philosophy wsite30.html
 page5 Physics wsite31.html
 page5 Poetrywsite32.html
 page5 Religion wsite33.html
 page5 Search+Tools wsite34.html
 page5 Sportswsite35.html
 page5 Travel wsite37.html
 page5 Theater wsite36.html
 page5 Windows wsite38.html
 page5 Search searchresults.html
 page5 Submit+Feedback IntWebX.html
 page5 Submit+Question IntWebX.html
 page6 Alta+Vista faqwww14.html

page6 Anchor+name how2.html
 page6 AOL+NetFind faqwww14.html
 page6 Attach+file+to+E-mail+%28using+Explorer%29 attachE.html
 page6 Attach+file+to+E-mail+%28using+Netscape%29 attachN.html
 page6 Create+Chart+%28using+Word%29 createchart.html
 page6 Create+Table+%28using+Word%29 createtable.html
 page6 Difference+between+WWW+and+Internet faqwww13.html
 page6 directories faqwww14.html
 page6 Equipment+needed+%28to+access+Internet%29 faqnet13.html
 page6 Excite+Search faqwww14.html
 page6 Favourites faqwww8.html
 page6 History intgen2.html
 page6 Home+Page faqwww7.html
 page6 HotBot faqwww14.html
 page6 Hotlists faqwww8.html
 page6 How+browser+work%3F how1.html
 page6 How+do+I+change+my+default+start+page%3F how5.html
 page6 How+do+I+chat+with+IRC+%28Internet+Relay+Chat%29%3F
 how3.html
 page6 How+to+choose+a+modem%3F how4.html
 page6 How+to+prevent+system+crash%3F how6.html
 page6 How+to+read+a+web+address%3F how2.html
 page6 Hypermedia faqwww6.html
 page6 Hypertext faqwww6.html
 page6 Hypertext+Markup+Language+%28HTML%29 faqwww6.html
 page6 Hypertext+Transfer+Protocol how2.html
 page6 Info+Seek faqwww14.html
 page6 What+is+Internet%3F faqnet1.html
 page6 Internet-basics intgen1.html
 page6 Internet+Jargon intgen3.html
 page6 Network faqnet7.html
 page6 How+do+I+get+connected%3F faqnet3.html
 page6 Cyberspace faqnet3.html
 page6 What+can+I+do+once+I+get+connected%3F faqnet6.html
 page6 FAQ+%28Frequently+Asked+Question%29 faqnet6.html
 page6 Usenet faqnet6.html
 page6 What+does+the+Internet+offer%3F faqnet11.html
 page6 Electronic+Mail faqnet11.html
 page6 Online+Shopping faqnet11.html
 page6 What+is+a+network%3F faqnet7.html
 page6 What+is+Cyberspace%3F faqnet10.html
 page6 Information+Superhighways faqnet10.html
 page6 What%27s+in+it+for+me%3F faqnet2.html
 page6 Usenet+newsgroup faqnet2.html
 page6 World+Wide+Web faqnet2.html
 page6 What+will+it+cost%3F faqnet4.html
 page6 Access+provider faqnet4.html

page6 POP+%28Point+Of+Presence%29 faqnet4.html
 page6 Where+do+I+get+software+from%3F faqnet5.html
 page6 Fetch faqnet5.html
 page6 FTP faqnet5.html
 page6 Mac+TCP faqnet5.html
 page6 PPP+%28Point+to+Point+Protocol%29 faqnet5.html
 page6 TCP%2FIP faqnet5.html
 page6 Trumpet+Winsor faqnet5.html
 page6 Web+Browsing faqnet5.html
 page6 Win+FTP faqnet5.html
 page6 What+information+can+be+obtained%3F faqnet12.html
 page6 Who+owns%2Fcontrol+the+Internet%3F faqnet8.html
 page6 LYCOS faqwww12.html
 page6 Modem faqnet13.html
 page6 NCSA+Mosaic faqwww5.html
 page6 Netscape+Navigator faqwww4.html
 page6 network faqnet1.html
 page6 Newsgroup faqnet2.html
 page6 Open+Text faqwww14.html
 page6 Search+Engine faqwww14.html
 page6 Security+Technology faqnet18.html
 page6 SLIP%2FPPP+account how1.html
 page6 Uniform+Resource+Locators+%28URL%29 faqwww9.html
 page6 Virtual+Reality+Modelling+Language+%28VRML%29 faqwww10.html
 page6 Virtual+Worlds faqwww10.html
 page6 Web+Address how2.html
 page6 Web+Browser faqwww3.html
 page6 WebCrawler faqwww14.html
 page6 WebFX faqwww10.html
 page6 Web+Page faqwww2.html
 page6 Web+Site faqwww2.html
 page6 WebSpace faqwww10.html
 page6 What+are+Bookmarks%2C+Hotlists%2C+Favourites%3F
 faqwww8.html
 page6 Difference+between+WWW+and+Internet faqwww13.html
 page6 Yahoo faqwww11.html
 page6 Search searchresults.html
 page6 Submit+Feedback indexX.html
 page6 Submit+Question indexX.html
 advancedfeatures Submit+Feedback advancedfeatures.html
 advancedfeatures Submit+Question advancedfeatures.html
 Answersresponse Submit+Response Answers
 createchart Home unmatched.html
 createchart Submit+Feedback unmatched.html
 createchart Submit+Comment unmatched.html
 createchart Submit+Question unmatched.html
 createchart Submit+Indexing unmatched.html

Navigational File

File name: mh1.cgi.inf1

HelpSystem.html:log

IntWebX.html:page5

accessedpgs.html:accessedpgs

addinfo.html:addinfo

advancedfeatures.html:advancedfeatures

Answers:Answers

searchresults.html:searchresults

answerques.html:newques

answerques2.html:ansques

askques.html:askques

createchart.html:createchart

createtable.html:createtable

faqnet1.html:page221

faqnet10.html:page2210

faqnet11.html:page2211

faqnet12.html:page2212

faqnet13.html:page2213

faqnet14.html:page2214

faqnet15.html:page2215

faqnet16.html:page2216

faqnet17.html:page2217

faqnet18.html:page2218

faqnet19.html:page2219

faqnet2.html:page222

faqnet20.html:page2220

faqnet21.html:page2221

faqnet3.html:page223

faqnet4.html:page224

faqnet5.html:page225

faqnet6.html:page226

faqnet7.html:page227

faqnet8.html:page228

faqnet9.html:page229

faqwww1.html:page321

faqwww10.html:page3210

faqwww11.html:page3211

faqwww12.html:page3212

faqwww13.html:page3213

faqwww14.html:page3214

faqwww15.html:page3215

faqwww16.html:page3216

faqwww17.html:page3217
faqwww2.html:page322
faqwww3.html:page323
faqwww4.html:page324
faqwww5.html:page325
faqwww6.html:page326
faqwww7.html:page327
faqwww8.html:page328
faqwww9.html:page329
how1.html:page421
how2.html:page422
how3.html:page423
how4.html:page424
how5.html:page425
how6.html:page426
howtoX.html:page4
indexX.html:page6
intgen1.html:page121
intgen2.html:page122
intgen3.html:page123
intgenX.html:page1
navaids.bu.html:page0
navaids.html:page0
netpg1X.html:page2
pg1wwwX.html:page3
unmatch.html:unmatchpg
attachN.html:unmatchpg21
attachE.html:unmatchpg22
unmatch3.html:unmatchpg23
unmatch4.html:unmatchpg24
unmatch5.html:unmatchpg25
unmatch7.html:unmatchpg25
wfeedback.html:wfeedback
whoaccess.html:whoaccess
wsite1.html:page521
wsite10A.html:page5210A
wsite10B.html:page5210B
wsite10C.html:page5210C
wsite11.html:page5211
wsite12.html:page5212
wsite13.html:page5213
wsite14.html:page5214
wsite15.html:page5215
wsite16.html:page5216
wsite17.html:page5217
wsite18.html:page5218
wsite19.html:page5219

wsite2.html:page522
wsite20.html:page5220
wsite21.html:page5221
wsite22A.html:page5222A
wsite22B.html:page5222B
wsite23.html:page5223
wsite24.html:page5224
wsite25.html:page5225
wsite26.html:page5226
wsite27.html:page5227
wsite28.html:page5228
wsite29.html:page5229
wsite3.html:page523
wsite30.html:page5230
wsite31.html:page5231
wsite32.html:page5232
wsite33.html:page5233
wsite34.html:page5234
wsite35.html:page5235
wsite36.html:page5236
wsite37.html:page5237
wsite38.html:page5238
wsite4.html:page524
wsite5.html:page525
wsite6.html:page526
wsite7A.html:page527A
wsite7B.html:page527B
wsite7C.html:page527C
wsite8.html:page528
wsite9.html:page529

Appendix F

Extract of Logfile

Logfile

Extract from mh1.cgi.log file

```
I 383928 48 ian 158.125.102.131 0
I 383933 26 ian 158.125.102.131 0
I 383933 33 ian 158.125.102.131 27 PageName=log&User_Name=fred
I 383933 41 ian 158.125.102.131 39
    PageName=log&User_Name=fred&Go_To=LOGIN
I 383937 9 ian 158.125.102.131 39
    PageName=log&User_Name=fred&Go_To=LOGIN
I 383937 30 ian 158.125.102.131 60
    PageName=page2&Go_To=What+can+I+do&keyword=&feedbacks=+
+++++
I 383943 48 ian 158.125.102.131 60
    PageName=page2&Go_To=What+can+I+do&keyword=&feedbacks=+
+++++
I 383947 46 ian 158.125.102.131 60
    PageName=page2&Go_To=What+can+I+do&keyword=&feedbacks=+
+++++
I 383954 3 ian 158.125.102.131 38
    PageName=log&User_Name=jim&Go_To=LOGIN
I 383955 26 ian 158.125.102.131 38
    PageName=log&User_Name=jim&Go_To=LOGIN
I 383955 52 ian 158.125.102.131 63
    PageName=page2&keyword=&feedbacks=++++++&Submit=Submit+Q
uestion
I 383958 2 ian 158.125.102.131 53
    PageName=page2&keyword=&Go_To=Search&feedbacks=++++++
I 384041 9 ian 158.125.102.131 0
I 384041 17 unknown 158.125.107.119 26
    PageName=log&User_Name=mat
I 384041 20 ian 158.125.102.131 40
    PageName=log&User_Name=Claud&Go_To=LOGIN
I 384041 31 ian 158.125.102.131 60
    PageName=page2&Go_To=What+can+I+do&keyword=&feedbacks=+
+++++
I 384041 37 ian 158.125.102.131 66
    PageName=page226&Home=page2&feedbacks=++++++&Submit=Su
bmit+Comment
I 384045 33 ian 158.125.102.131 63
    PageName=page2&keyword=&feedbacks=++++++&Submit=Submit+F
eedback
I 384050 16 ian 158.125.102.131 0
```

I 384050 26 ian 158.125.102.131 38
 PageName=log&User_Name=Joe&Go_To=LOGIN

I 384050 41 ian 158.125.102.131 60
 PageName=page2&Go_To=What+can+I+do&keyword=&feedbacks=+
 ++++++

I 384050 48 ian 158.125.102.131 66
 PageName=page226&Home=page2&feedbacks=++++++&Submit=Su
 bmit+Comment

I 384050 54 ian 158.125.102.131 61
 PageName=Thanks&User_Name=Joe&Go_To=Continue&Continue=p
 age226

I 384051 8 ian 158.125.102.131 56
 PageName=page226&Go_To=Home&Home=Thanks&feedbacks=+++
 +++

I 384052 13 ian 158.125.102.131 68
 PageName=page226&Home=Thanks&feedbacks=++++++&Submit=Su
 bmit+Question

I 384052 20 ian 158.125.102.131 61
 PageName=Thanks&User_Name=Joe&Go_To=Continue&Continue=p
 age226

I 385519 41 unknown 158.125.108.20 26
 PageName=log&User_Name=mat

I 385523 31 unknown 158.125.108.20 63
 PageName=page2&Go_To=Internet+General&keyword=&feedbacks=+
 ++++++

I 385550 29 unknown 158.125.108.20 83
 PageName=page226&Home=%3C%21--%23my+P+--
 %3E&feedbacks=++++++&Submit=Submit+Question

I 385550 44 unknown 158.125.108.20 61
 PageName=Thanks&User_Name=mat&Go_To=Continue&Continue=p
 age226

I 385550 56 unknown 158.125.108.20 56
 PageName=page226&Go_To=Home&Home=Thanks&feedbacks=+++
 +++

I 385551 16 unknown 158.125.108.20 68
 PageName=page226&Home=Thanks&feedbacks=++++++&Submit=Su
 bmit+Question

I 385551 24 unknown 158.125.108.20 61
 PageName=Thanks&User_Name=mat&Go_To=Continue&Continue=p
 age226

I 385709 31 unknown 158.125.107.119 29
 PageName=log&User_Name=mazlan

I 385709 42 unknown 158.125.107.119 29
 PageName=log&User_Name=mazlan

I 385711 43 unknown 158.125.107.119 33
 PageName=page0&Go_To=FAQ-Internet

I 385713 25 unknown 158.125.107.119 29
 PageName=log&User_Name=mazlan
 I 385713 36 unknown 158.125.107.119 33
 PageName=page0&Go_To=FAQ-Internet
 I 385720 3 unknown 158.125.107.119 29
 PageName=log&User_Name=mazlan
 I 385731 22 unknown 158.125.107.119 83
 PageName=page226&Home=%3C%21--%23my+P+---%3E&feedbacks=++++++&Submit=Submit+Question
 I 385731 32 unknown 158.125.107.119 64
 PageName=Thanks&User_Name=mazlan&Go_To=Continue&Continue=page226
 I 385740 18 unknown 158.125.107.119 37
 PageName=page0&Go_To=Internet-General
 I 385740 21 unknown 158.125.107.119 33
 PageName=page0&Go_To=FAQ-Internet
 I 385740 26 unknown 158.125.107.119 28
 PageName=page0&Go_To=How-WWW
 I 385740 29 unknown 158.125.107.119 38
 PageName=page0&Go_To=Interesting+Sites
 I 385740 33 unknown 158.125.107.119 26
 PageName=page0&Go_To=Index
 I 385743 1 unknown 158.125.107.119 29
 PageName=log&User_Name=mazlan
 I 385743 5 unknown 158.125.107.119 37
 PageName=page0&Go_To=Internet-General
 I 385743 13 unknown 158.125.107.119 33
 PageName=page0&Go_To=FAQ-Internet
 I 385743 15 unknown 158.125.107.119 28
 PageName=page0&Go_To=FAQ-WWW
 I 385743 21 unknown 158.125.107.119 28
 PageName=page0&Go_To=How-WWW
 I 385743 24 unknown 158.125.107.119 38
 PageName=page0&Go_To=Interesting+Sites
 I 385743 27 unknown 158.125.107.119 26
 PageName=page0&Go_To=Index
 I 385750 47 unknown 158.125.107.119 26
 PageName=log&User_Name=mat
 I 385751 21 unknown 158.125.107.119 28
 PageName=page0&Go_To=FAQ-WWW
 I 385752 35 unknown 158.125.107.119 37
 PageName=page0&Go_To=Internet-General
 I 385752 38 unknown 158.125.107.119 33
 PageName=page0&Go_To=FAQ-Internet
 I 385753 23 unknown 158.125.107.119 37
 PageName=page0&Go_To=Internet-General

Appendix G

Evaluation on Version 3

Subject: Help System
To: M.Harun@lboro.ac.uk
Date: Tue, 7 Sep 1999 08:59:28 +0100 (BST)
From: Simon Sheldrake <S.N.Sheldrake@lboro.ac.uk>

Mazlan,

Have reviewed your help system and my comments are as follows:

EASE OF USE – very easy to navigate around the various screens. Like the idea of main topics listed in left frame. Would be good to add highlighting of the current topic in the left that corresponds to the frame displayed on the right.

USER DRIVEN – hyperlinks are very intuitive so that even a novice could quickly learn to navigate the system. Always know where one is and useful to have a 'home' and 'top' link on each screen. Maybe consider having a 'back' link as well?

SUPPORT – very user-friendly and helpful. Not too much graphics or colour which is a good thing. Also not keen on too much Java as this can take ages to load – especially on an old computer and can end up just annoying people. Keyword search very supportive – good feature for people who may be in a hurry and want answers quickly. Like the idea of an alphabetical index that complements the hyperlink approach.

COLLABORATIVE LEARNING – opportunities to make this a feature of the help system. The same 'look and feel' provided by the Web has huge benefits for international communications. Would have to consider other languages maybe, if not all managers understood English?

Hope this helps.

Simon.

From: "Mohd Noor Mohd Shariff" <M.N.Mohd-shariff@lboro.ac.uk>
To: M.Harun@lboro.ac.uk
Date: Tue, 7 Sep 1999 09:21:15 GMT
Subject: Self help system

Dear Mazlan,

Thanks for giving me an opportunity to try your help system through the Internet. I found your research helpful in helping managers in handling their jobs especially in handling the help system through the Internet.

The Help System you shown me has tremendous potentials for managers to utilise it as a tools because

- 1) It fulfil its objective as a support system for managers
I found it quite interesting to browse through the Internet and found the help system support me in my job especially when I am quite busy with my deadlines.
- 2) It also provides collaborative learning to users. I am very interested to communicate with my peers and I found it very interesting to give feedback and received information regarding the areas that needs urgent solutions to the problems.
- 3) The help system is a user driven system
To my knowledge there is no system that encourage interactive between the users, but your help system help me to explore further in areas that I am not quite familiar with.
- 4) Lastly it is easy to use.
For a layman like myself, I need a system that is easy to use and found that your help system fulfil my needs in this area.

Thank you again, and if anything that you like to enquire, please be free to contact me.

Mohd Noor Mohd Sharif
Research Student
The Business School
Loughborough University
Loughborough, Leicestershire
LE11 3TU
UK
Tel No: +44 (0) 1509 558025 (H)
Switchboard: +44 (0) 1509 263171
Fax : +44 (0) 1509 223962

To: M. Harun@lboro.ac.uk
From: Zulkarnaini <Z . Mat-amin@lboro.ac.uk>
Subject: Web Site Evaluation
Date: Mon, 6 Sep 1999 11:02:53 + 0100

Dear Mr. Mazlan

Few comments regarding your web site:

1. This web site does exactly what it says on the title.
2. It's an instance reference guide for managers who want to start learning Internet from scratch.
3. The site is not particularly technical and should appeal to both the beginners and more experienced users.
4. The site presents its information clearly and comprehensively, providing careful instructions, explanation and advice.
5. The crucial aspect of the site is that it allows users to submit questions on all aspects of Internet and IT and acts as a two-way communication environment between users and site (webmaster).

Thank you.

Zulkarnaini Mat Amin
Dept. of Civil and Building Eng.
Loughborough University.

Date: Mon, 06 Sep 1999 07:50:04
To: M. Harun <M.Harun@lboro.ac.uk>
From: "A.RAHMAN BIN AWANG" <A.R.B. Awang @lboro.ac.uk>
Subject: Internet System

Dear Mr. Mazlan Harun,

Thanks for informing me about your newly developed Internet system. I have briefly tested the system and found that:

1. To me the system developed is an information system, which cannot be found on other Internet systems. This information system is capable to provide support/help for users especially managers at the point of need.
- 2 The system will meet the user's demand because the users can provide inputs and comments on the future requirements
- 3 The system is very easy to use because the system developed is based on user friendly concept.
- 4 The layout and graphic used in the system are nice and attractive, this make the users enjoy to use it.

Having said that I wish you all the best and success in launching that Internet System.

Regards

AB. RAHMAN AWANG
PRINCIPAL ASSISTANT DIRECTOR
DEPARTMENT OF ENVIRONMENT
MINISTRY OF SCIENCE, TECHNOLOGY AND THE ENVIRONMENT,
MALAYSIA
12th FLOOR , WISMA SIME DARBY
JALAN RAJA LAUT
50662 KUALA LUMPUR
MALAYSIA.

From: "Azizul" <Azizul>" <Azizul@halim61.freeseaerve.co.uk>
To: <M.Harun@lboro.ac.uk>
Subject: Opinions on Help System
Date: Sun, 5 Sep 1999 22:39:04 +0100

This is a multi-part message in MIME format.

-----=_NextPart_000_0011_01BEF7EF.752BC600

Content-Type: text/plain;
charset="iso-8859-1"

Content-Transfer-Encoding: quoted-printable

Dear Mr. Harun,

Pertaining to our meeting earlier, I would like to thank you for letting me to drop some views on your Help System which I consider impressive and ambitious. Generally speaking the whole concept or the nature of your system aim to able users, seeking for information at much reduces time despite the nature of their profession. After exploring your help system, I discovered the system could be beneficial to managers and researchers as it act as supporting tool. The system also could be seen to incorporate 'reasoning approach' or logic sensing which have close association with artificial intelligent which all queries by user could be kept in the provider database and monitored. Theoretically, all these kept information and the trend of the question by the users could be easily retrieved and used for future information seeking. On the contrary, the whole notion of this system has some similarities with others search engine in the web. However with the capabilities of systematise reasoning, the system could prove as quantum leap of its kind. However in order to achieve that, the system need to undergo an acid test with strenuous testing especially in order to cope with higher volume of users at the same time. If the system proven to be fool proof, I believe it could a standard or a must by programmer and web developer. Another interesting option that incorporated in the system is the mobility and flexibility in its usage. For instance, the system could be used as an add-on application for user when making a remote presentation whereby the user could retrieve the presentation through Internet linkage. This indigenous idea is parallel with the future computing approach as been suggested and predicted by many computer pundits which secondary storage is no longer needed and applicable in personal computer.

Lastly I wish you with all the best and hoping to see you idea used by many in the cyberspace technology.

Thank you.

Sincerely,

Azizul Yahya

-----=_NextPart_000_0011_01BEF7EF.752BC600

Content-Type : text/plain;
charset="iso-8859-1"

Content-Transfer-Encoding: quoted-printable

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">

<HTML><HEAD>

<META content=3D"text/html; charset=3Diso-8859-1"
http-equiv=3DContent-Type>

<META content=3D"MSHTML 5.00.2014.210" name=3DGENERATOR>

<STYLE></STYLE>

</HEAD>

<BODY bgColor=3D#ffffff>

To: M. Harun@lboro.ac.uk
From: Roslan Abd Aziz <R.Abd-aziz@lboro.ac.uk>
Date: Sun, 5 Sep 1999 17:16:28 + 0100

Thank you for showing me your design system, I have not seen such a system before.

Eventhough the principle of the system already exists your design system some how make it simpler for individuals to access information from various sources. This not only saves time but also avoids embarrassment to some extent and would be keenly appreciated especially by managers on the move. Being user-friendly the system helps panic-stricken managers who find themselves in places with no one to turn to, and the same goes for know-it-all managers who are reluctant or too embarrassed to ask colleagues for helps. In cases where urgent problem-solving solutions and instant information are needed this system would be very helpful.

To: M. Harun@lboro.ac.uk
From: A. R. Ahmad@lboro.ac.uk (Abdul Rahim)
Subject: "IT-mediated Help System for Managers"
Date: Sun, 5 Sep 1999 13:25:19 +0100

Mr. Mazlan Harun,

I managed to interact effectively with the 'IT support system for manager' that you have developed. As my line of works is related to managing education processes (curriculum development and delivery), your system will support the improvement process in our day to day activities. Here are some of the characteristics of the system that catch my eyes:

- a) It utilises the enabling capability of IT to provide supports at the place and time of needs, which will facilitate decision-makings. As we know that IT is the enabler but some kinds of systems must be developed in order for optimum its impacts.
- b) Its 'interactive' nature will be conducive for learning to take place at workstation.
- c) Its monitoring capability will provide valuable feedback information for further expansion of the system and also for providing the essential requirements of the learners. This will also ensure the 'learning nature' of the system so as to be flexible and responsive to demands.
- d) Suitable for supporting education process especially in the 'delivery' (teaching and learning) where web-pages containing modules or other materials can be incorporated into the system. This is due to the 'open' nature of the system.
- e) The system is user-friendly as from my experiences I was able to understand and use it immediately after getting access. Most of the facilities provided are simply and clearly indicated.
- f) I think the system has immense capacity for further expansion.

Thank you.

Abdul Rahim Ahmad,
Ministry of Education Malaysia,
Loughborough University.
5 September 1999.

Date: Sun, 5 Sep 1999 10:38:07 +0100 (BST)
From: AS Hamzah <A.S.Hamzah@lboro.ac.uk>
To: M. Harun@lboro.ac.uk
Subject: Helpsystem

Dear Mazlan,

Many thanks for demonstrating the help system to me recently. The system should be well sited to the managers especially on the ease of use and also the ability of one person to interact with another, efficiently. One drawback that I could foresee would be the unwillingness for them to share vital and secretive information amongst them.

Nevertheless, I personally think that this newly developed system should be commended as it would bring together a more collaborative thinking amongst the users especially in today's informative society.

Thank you

Sazali, Chemistry Department.

Appendix H

Evaluation of Version 4

To: M. Harun@lboro.ac.uk
From: Roslan Abdul Aziz R.Abd-aziz@lboro.ac.uk
Subject: Help System
Date: Wed, 20 Oct 1999 22:58:00 +0100

I noticed there are a lot improvements on the Help System from the one I have seen previously. By improving the advanced capabilities e.g. learning, monitoring, indexing etc., make the system complete and appealing for managers. I personally would like to congratulate you on your effort in producing this intelligent help system.

Good luck and may GOD bless you.

Roslan Abd Aziz

Subject : feedback
To: M. Harun@lboro.ac.uk
Date: Tue, 19 Oct 1999 08:58:06 +0100 (BST)
From: Simon Sheldrake S.N.Sheldrake@lboro.ac.uk

Mazlan,

Here is a copy of what I said in the feedback form on your system.

I like to idea of being able to make keyword searches that can narrow down the pages to be viewed. This is a good feature to aid busy management who often don't have time for haphazard browsing in the same way as casual users do.

The advanced features are better as you can now see where you've been. The ability to view all the questions that have been asked is similar to a newsgroup, and newsgroups have a proven track record in this area. So, the idea is a good one and will undoubtedly aid group learning capabilities. The ability to just add feedback is not found in user groups as a separate area, so this is a bonus.

Overall, the prototype system is a good one and I can see that its use across a wide community will be a major benefit to co-operative and co-ordinated group learning and dissemination of information generally.

Hope this is OK,

Simon.

Date: Thu, 21 Oct 1999 09:51:29
To: M Harun <M. Harun@lboro.ac.uk>
From: "AB. RAHMAN BINAWANG" <A.R.B.Awang@lboro.ac.uk>
Subject : Re: Internet system

Dear Mazlan,

I had tested your Help System, it looks fantastic! The additional features that you have added into the system are very good, as now I can see the log records. To me, this system is very interesting because it allows the users to provide feedback's, comments and questions. I feel that these facilities are very good since it encourages group learning and interaction among users.

Your idea of allowing users to create the index is superb since this shows that the system is user-driven and learns by itself. Frankly, this is a very good system and I admire it. As you explained to me before, I agree 100% that this system can be implemented as a support system for managers. It has all the ingredients – easy to use, group learning, user-driven and learning capabilities.

OK, Mazlan, best of luck. Bye.

Rahman.

Date: Sun, 17 Oct 1999 14:19:45 +0100
To: M. Harun@lboro.ac.uk
From: Mohd Noor <M. N. Mohd-shariff@lboro.ac.uk>
Subject: research

Dear Mazlan,

I am grateful to be given an opportunity to try your system and like to give some comments on this matter.

Firstly, I found out that your system have a monitoring capabilities and friendly with user. There is a collaborative interaction between each user.

Secondly, your system have learning capabilities in such a way that I can communicate with another user and suggest or comments on the topics. Furthermore, I found that indexing of keywords look very simple and easier to understand.

Lastly, thanks for the opportunity given and hope to hear from you soon.

Regards.

To: M. Harun@lboro.ac.uk
From: A.R. Ahmad@lboro.ac.uk (Abdul Rahim)
Subject: "IT-mediated Help System for Manager – The Advanced Features"
Date: Mon, 11 Oct 1999 12:25:18 +0100

Mr. Mazlan Harun,

I managed to interact with the advanced features of your 'IT support system for manager' that you have developed. I find that the features enabled me to get feedback on the usage of the system either from my own activities or other users as well. This will provide useful information for learning activities.

Furthermore, the features enabled input from me to be incorporated into the system such that as a user I can contribute towards the development of the system. This indicates the learning capability of the system, which I think, will ensure the 'dynamic or organic characteristic' of the system. I think this is essential to future development of a system of this type.

Thank you.

Abdul Rahim Ahmad,
Ministry of Education Malaysia,
Loughborough University.
11 October, 1999.

Appendix I

Samples of HTML programs for the Help System

Appendix I-1

File name: nav aids.html

```
<HTML>
  <TITLE>Navagational Aids (Internet)</TITLE>
<HEAD>
<BODY BGCOLOR="#DAA520">
<br>
<!------->

<FORM METHOD="POST" TARGET="display"
  ACTION="http://cos.lboro.ac.uk/~comh1/2/mh1.cgi">
<INPUT TYPE="hidden" NAME="PageName" VALUE="page0">

<TABLE BORDER>
<TR>
  <TD><font face="Arial,VAGRounded BT,Times New Roman"
    color="00ff00" size=3>
    <b>Existing Information</b></font><br>
  </TD>
</TR>
<TR>
  <TD> <font color="ffffff" size=1>
    <b><INPUT TYPE="submit" NAME="Go_To"
      STYLE="background:#0000ff"
      VALUE="Internet-general"></b></font>
    <font color="ffffff" size=1>
    <b><INPUT TYPE="submit" NAME="Go_To"
      STYLE="background:#0000ff"
      VALUE="FAQ-Internet"></b></font>
    <font color="ffffff" size=1>
    <b><INPUT TYPE="submit" NAME="Go_To"
      STYLE="background:#0000ff"
      VALUE="FAQ-WWW"></b></font>
    <font color="ffffff" size=1>
    <b><INPUT TYPE="submit" NAME="Go_To"
      STYLE="background:#0000ff"
      VALUE="How-WWW"></b></font>
    <font color="ffffff" size=1>
    <b><INPUT TYPE="submit" NAME="Go_To"
```



```

        STYLE="background:#0000ff"
        VALUE="Interesting Sites"></b></font>
        <font color="ffffff" size=1>
        <b><INPUT TYPE="submit" NAME="Go_To"
        STYLE="background:#0000ff"
        VALUE="Index"></b></font>
    </TD>
</TR>

<TR>
    <TD><font face="Arial,VAGRounded BT,Times New Roman" color="00ff00"
size=3>
        <b>Advanced Features</b></font><br>
    </TD>
</TR>
<TR>
    <TD> <font color="ffffff" size=1>
        <b><INPUT TYPE="submit" NAME="Go_To"
        STYLE="background:#0000ff" VALUE="Display Records"></b></font>
    </TD>
</TR>
</TABLE>

</FORM>
</BODY>
</HTML>

```

Appendix I-2

File name: intgenX.html

<HTML>

```
<!------->
<!-- AUTHOR    : Mazlan Harun ----->
<!-- E-MAIL    : M.Harun@lboro.ac.uk ----->
<!-- CREATED   : 24/6/1997 ----->
<!-- MODIFIED  : ----->
<!-- FILE      : intgenX.html ----->
<!-- PURPOSE   : This page links to pages on ----->
<!--           Internet in General ----->
<!------->
```

<HEAD>

<TITLE>Internet In General</TITLE>

</HEAD>

<BODY BACKGROUND="burong.jpg" LINK="#0000FF"
ALINK="#FF0000" VLINK="#0000FF">

<FORM METHOD="POST" TARGET="display"
ACTION="http://cos.lboro.ac.uk/~comh1/2/mh1.cgi">

<INPUT TYPE="hidden" NAME="PageName" VALUE="page1">

<TABLE><!-------Table Top----->

<TR>

<TD></TD>

</TR>

<TR>

<TD>

</TD>

</TR>

<TR>

<TD>Select area that relate to your
questions</TD>

</TR>

</TABLE><!-------End of Top Table----->

<TABLE><!-------Table of the body----->

<TR> <!------- Row 1 ----->

<TD width=50%>

<INPUT TYPE="submit" NAME="Go_To"

```

        VALUE="Internet-Basics"><br>
        <INPUT TYPE="submit" NAME="Go_To"
        VALUE="History"><br>
        <INPUT TYPE="submit" NAME="Go_To"
        VALUE="Internet Jargon"><br>
    </font></TD>

</TR> <!------- End of row 1 ----->

</TABLE><!-------End Table of the body----->
<br>
<br>
<!-------Search by Keyword----->

<P><b><font color="000000" size=5>Keyword Search</b><br>
<INPUT TYPE="text" NAME="search" size="30">
<font size="2">
<INPUT TYPE="submit" NAME="Go_To" VALUE="Search"><br>
</font>

<!-------End of Keyword Search----->
<br>
<P>
<br><br>
<br clear=all>
<font color="0000ff" size=+1><b>You can give feedback
    or ask question in the following textbox area. </font></b><br>
<br clear=all>

<TABLE>
<TR>
    <TD><font size=1>
        <TEXTAREA NAME="feedback" ROWS="5"
        COLS="50" WRAP=VIRTUAL>
    </TEXTAREA></font>
    </TD>
</TR>

<TR>
    <TD><font size="2">
        <INPUT TYPE="submit" NAME="Submit"
        VALUE="Submit Feedback">
        <INPUT TYPE="submit" NAME="Submit"
        VALUE="Submit Question">
        <INPUT TYPE="Reset" NAME="Reset"
        VALUE="Reset Button"></font>
    </TD>

```



```
</TR>
</TABLE>
<br>

<br>
```

```
</FORM>
</BODY>
</HTML>
```