A USER CENTRED WEBSITE DEVELOPMENT APPROACH

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Abstract: Website development activities are a growing aspect of the IT work within many organisations. However, there appears to be few methodologies or frameworks for website development currently in existence, and numerous researchers have commented that the majority of website development work appears to be done in an ad hoc manner. In this paper, a user centred website development approach is described, and a case study in a UK University department is provided to demonstrate and evaluate the approach.

Key words: Web development, Methodology

1. INTRODUCTION

Many organisations now operate web-based IT systems, and website development and maintenance work is a growing aspect of the IT activities within such organisations. However, there appears to be few methodologies or frameworks for website development in existence. In addition, numerous researchers have noted that much website development work appears to be done in an ad-hoc manner, without the use of any formalised approach (Gellersen and Gaedke, 1999; Gunter *et al.*, 2000; Wiegers, 1999; Russo and Graham, 1998). If future website development projects are to be undertaken in a competent professional manner, then it is important that guidance in the form of frameworks, approaches, methodologies, standards or best practice

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guides be available to website developers, in order to assist them in their work. In this paper we discuss a user centred approach to website design, based on three main interconnected techniques of website user requirements analysis, user centred website structural design and web page design. A demonstration and evaluation of the user centred website design approach described in this paper is provided based on a case study in a UK University department over a six month period.

2. LITERATURE REVIEW

A new approach for website design is required compared to existing types of IT systems because there are intrinsic differences between web-based systems and other types of IT systems (Russo and Graham, 1998). These differences are that a website may potentially have many different types of users whereas most other types of IT systems are intended for just one type of user. In addition, most other types of IT systems are designed for users internal to the organisation, or for known outside users. However, the potential users of a website may not all be known. Typically, most other types of IT systems have a standard interface mechanism for the user. However, the potential users of a website may interface to the website in a variety of ways, for example, with different versions of different Internet browsers, and arrive via a variety of Internet search engines or Internet directories. These differences mean that traditional information systems development approaches are limited in use for website development work, because they were not created with such potential diversity of user base in mind.

Although a limited number of methodologies and frameworks for website design have been put forward by academics and IT practitioners (e.g. Russo and Graham, 1998; Gellersen and Gaedke, 1999; Artz, 1996; Lu and Yeung, 1998) there are few actual case studies of such frameworks actually being put into practice.

In order to begin to develop an organisation's website it is first necessary to establish the purpose of the website. Abels *et al.* (1997) discussed the importance of the identification of user-based criteria for websites, and outlined the use of questionnaires and interviews to gather data regarding what the users require from the website. However, Abels *et al.* (1997) did not discuss how to model the actual requirements of users, but instead concentrated on user criteria such as appearance and use. Artz (1996) outlined a top-down methodology for corporate web applications, however this did not include techniques for modeling the actual user requirements. Berthon and Davies (1999) advocated careful design of the flow between the

pages of a company website to provide ease of use for potential users, but did not really demonstrate that they had examined how this could be achieved. Takahashi and Liang (1997) discussed the use of entity relationship diagrams for website design, which can model website users and their requirements. However, for websites of any size, entity relationship diagrams can prove difficult to use because of the large number of entities present.

Artz (1996) advocated the use of storyboards for structural website design, however storyboards do not really cater adequately for the needs of different website user groups. Artz (1996) also outlined general guidelines for the design of individual web pages, but did not actually outline how to design a given web page. Wan and Chung (1998) discussed how to use network analysis in order to optimize the location of web pages within a website. However, Wan and Chung (1998) did not discuss how to actually design the web pages themselves, nor the overall website structure. Lu and Yeung (1998) outlined a number of factors of importance when developing websites including social acceptability, political acceptability, and economic acceptability. However, no techniques were discussed explaining how to put these issues into actual practice when developing a website. Gellersen and Gaedke (1999) advocated the use of an object oriented model for web based applications. However, this approach centred more on website coding than actual analysis and design activities such as modeling potential website users requirements or website structure.

Overall, existing website development approaches appear to lack practical techniques to actively model potential website user requirements, design website structures, and design individual web pages. In addition, existing website development approaches appear to only weakly link such activities together, if they do at all. Finally, there are few detailed case studies available that demonstrate the existing website development approaches being put into actual practice.

2.1 Research Method

The research method used for this research exercise was case study. A case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context, when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used (Yin, 1994). Case studies allow explanations of particular phenomena derived from empirical research which may be valuable in other settings and organisations as interpretations of phenomena, but which are not wholly predictive for future situations (Walsham, 1995). Cavaye (1996) argued that case study results can be used to develop theory.

Darke *et al.* (1998) stated that case study research is the most widely used qualitative research method for information systems research and is well suited to such research.

The research exercise reported in this paper took place over a six month period, and involved interviews, discussions, and observation of staff involved in website development work within the case study organisation. The website development project in the UK University department researched involved four staff within the University department. The final departmental website constructed contained over five hundred web pages. The website development techniques described in this paper were developed and refined during the course of the case study using feedback from those staff in the University department involved in the website development project.

2.2 Research Results

The underlying philosophical basis for the user centred website design approach described in this paper is that the fundamental purpose of any IT system is to satisfy user requirements. Hence, the approach to website development described in this paper seeks to determine who the potential website users are, what they are likely to require from the website, and from that knowledge, to create a design for a website that will satisfy those requirements, both at a high structural level, and at the level of individual website pages.

2.3 Structure of the user centred website design approach

The main structure of the user centred website design approach described in this paper is:

Firstly to identify the potential users of an organisation's website, secondly to determine their potential requirements, thirdly to develop an overall website structure to support those requirements, and fourthly to develop individual website pages in order to support those requirements in detail.

The potential users of a given website and their potential requirements are modelled using a website user requirements analysis diagram (Figure 1). This diagrammatical technique is used to identify the potential website users (represented by rectangular boxes) and their anticipated high level

requirements (represented by ellipses). Figure 1 shows the potential website users, and their high level requirements for the case study website for a UK University department. The website user requirements analysis diagram described in this paper may be used at different levels, that is the high level requirements represented may be decomposed, and their relationship to the various potential website users further refined. Figure 2 shows how the high level user requirement for information regarding courses in the case study website for a UK University department would be decomposed, into requirements for information regarding subject areas, programmes of study, level, modules and module registrations. In addition the potential user groups identified may be further refined. For example, in the case study website for a UK University department the potential user group of companies would be broken down into two sub groups. These would be larger companies, which would have requirements for information on research projects and consultancy projects, and smaller companies, which would have requirements mainly for consultancy projects. As another example, the staff user group would be broken down in order to model the requirements of certain sub groups of the staff user group that have special requirements, for example website administrative capabilities.

Developing an overall website structure to support the identified user requirements is achieved via a user centred website structural design diagram, as shown in Figure 3. This technique maps the high-level user requirements identified in the website user requirements analysis phase by the website user requirements analysis diagrams onto a set of high level website page groupings. For example, in the case study website for a UK University department, the high level user requirement of information regarding courses would be mapped onto a high level website page grouping for courses. Like the website user requirements analysis diagram, the user centred website structural design diagram can be used at various levels to decompose the high level website page groupings into lower level groupings, until the level of individual website pages is reached. Figure 4 shows how the high level website page grouping of courses in the case study website for a UK University department is decomposed into website page groupings for subject area, level, programme of study, module and module registrations.

The user centred website structural design diagrams (Figure 3 and Figure 4) are used to determine the web page groupings required to support the website user requirements identified using the website user requirements analysis diagrams. It allows this to be done at various levels of abstraction, in order for the website designer to visualise the overall structure of the website, and to refine the structure down to level of individual web pages. The user centred website structural design diagram also allows the designer to determine the links between the various web page groupings that will be

required for the various website user groups identified by the website user requirements analysis diagrams. In this way, the technique provides a clear illustration of the navigational paths that will be required for each identified a website user group.

Developing individual website pages in order to support the identified potential website user requirements within the website structure is achieved via a website page design specification. Figure 5 shows an example outline website page specification for a timetable website page within the case study website for a UK University department. The website page specification technique is used to define the following attributes of a given website page: purpose, links to and from other website pages and other websites, main functions, user input, layout and security.

The user centred website structural design diagram can be used to refine the web page groupings down to the level of individual web pages. The website page design specification then links to these lowest level diagrams in order to specify the nature of each identified web page within the website. The purpose of the web page should match the description of the web page in the lowest level user centred website structural design diagram, which should correspond to the main functions to be provided by the web page. The links to and from the web page should match the links indicated on the lowest level user centred website structural design diagram.

3. EVALUATION OF USER CENTRED WEBSITE DEVELOPMENT APPROACH

The benefits of the user centred website development approach described in this paper perceived by those interviewed within the organisation studied were:

An identification of all the potential website user groups. When designing a website it is all too easy to concentrate on the material to be displayed or the layout and thus forget the most fundamental purpose of the website, that is to provide information / services for its users. Unless the users are anticipated, how can their requirements be anticipated?

An identification of sub groups and special cases within a given potential website user group. If we really want to design a website that will fulfil user requirements it is important to understand the variations in requirements across the different user groups.

An identification of the high level user requirements for the website being developed. Understanding the main requirements for the website gives

us a better chance of structuring the website in order to meet such main requirements.

Identification of differences in requirements between potential website user groups. Not all website users are necessarily going to want to view the same things, and navigate in the same way. In fact, certain website users may be put off using the website if they cannot easily find what they require. Hence, by identifying the differences in requirements between potential website user groups it can be possible to design a website that can provide ease of use for the different types of potential user.

Assisting in the design of a website that can cater for the different needs of different website user groups. The user centred website structural design diagram can assist the website developer in designing the website so that the different potential website user groups can easily navigate to the particular website page groupings that relate to their anticipated requirements.

Identification of which potential website user groups will require a given information/function set. The website user requirements analysis diagram can provide a series of views at different levels that increasingly refine the requirements for a given potential website user group.

Assisting in developing a website which provides ease of navigation for the different user groups. Using the user centred website structural design diagram, the website designer can determine the paths that a potential website user group will require and thus provide an easy navigation pathway, once all the required web page groupings have been identified.

Clarity of requirements for each individual website page. The website page design specification allows the website designer to clearly specify how a given web page will link into the website structure, the main functions it will need to provide, and the layout to be adopted.

4. CONCLUSIONS

In this paper we have described a user centred website design approach, and demonstrated how the approach worked in practice based on a case study in a UK University department. The main conclusions from this research exercise were:

It is important to identify the potential types of user for an organisation's website. Unless all the potential types of website user have been identified, then it can prove difficult to develop a full requirements set for the website. The website user requirements analysis technique described in this paper appears to be appropriate for assisting in this activity.

It is necessary to understand the different requirements that different types of website user will have in relation to the organisation's website. If

such differences can be identified then the website can be designed so as to provide the information and functionality that each given type of website user is likely to require. Based on the case study organisation, the website requirements analysis technique described in this paper appears appropriate for determining the differences in the requirements for different types of website user.

If organisations are to produce websites that users will find useful for finding the information that they require, then it is important to design such websites so as to cater for the different sets of requirements that different types of user are likely to have. The case study organisation appeared to find the user centred website structural design diagram described in this paper a useful technique for developing a website navigational structure that could cater for a variety of types of website user.

Website users can be put off using a given website if they find it confusing because of a lack of consistency between web pages. The web page specification technique described in this paper can assist in providing such consistency during the website development process.

It is hoped that the user centred website design approach outlined in this paper may prove useful for organisations undertaking website development activities, and for education and training organisations who wish to teach website development to their students. Thelwall (2001) stated that educators need to ensure that future website designers are aware of the issues in website design.

5. BIOGRAPHICAL NOTES

Mark Taylor is currently a Senior Lecturer at Liverpool John Moores University. In the course of his industrial career he has worked in both the manufacturing and finance sectors as an Analyst Programmer, Systems Designer, and Systems Analyst. He is a member of the British Computer Society, a Chartered Information Systems Practitioner, a Chartered Engineer, and an active IT consultant. He is the author of a book on systems maintenance.

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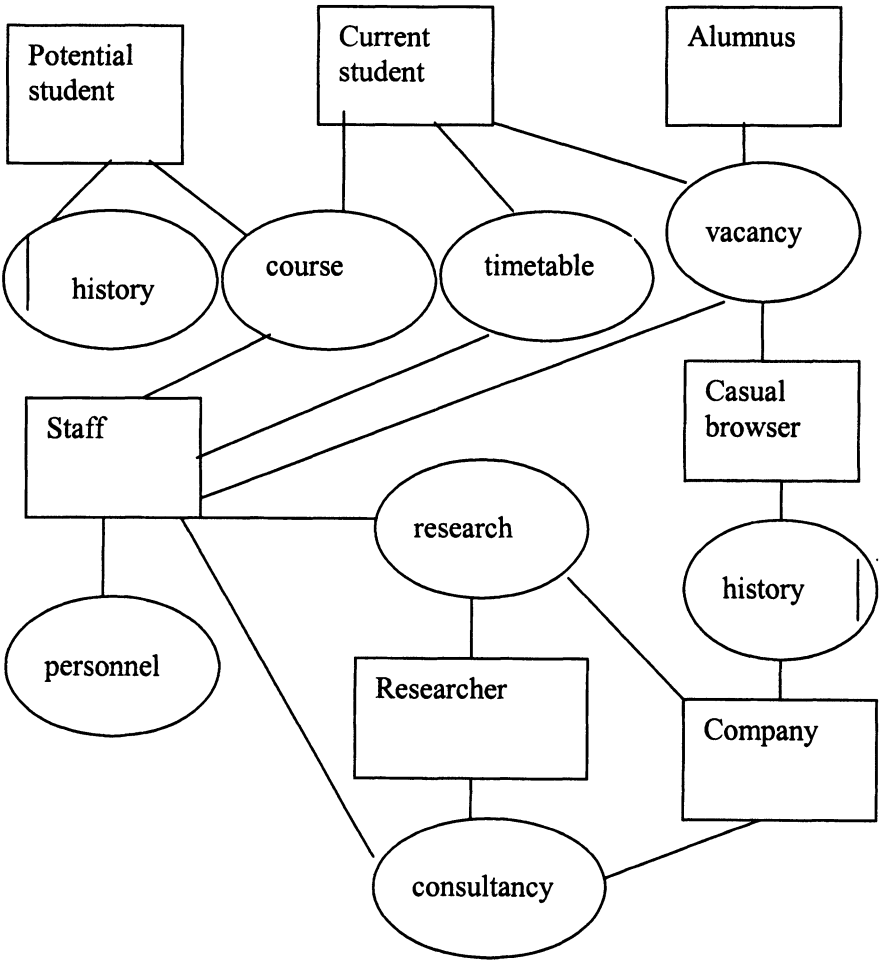


Figure 1. Website user requirements analysis diagram

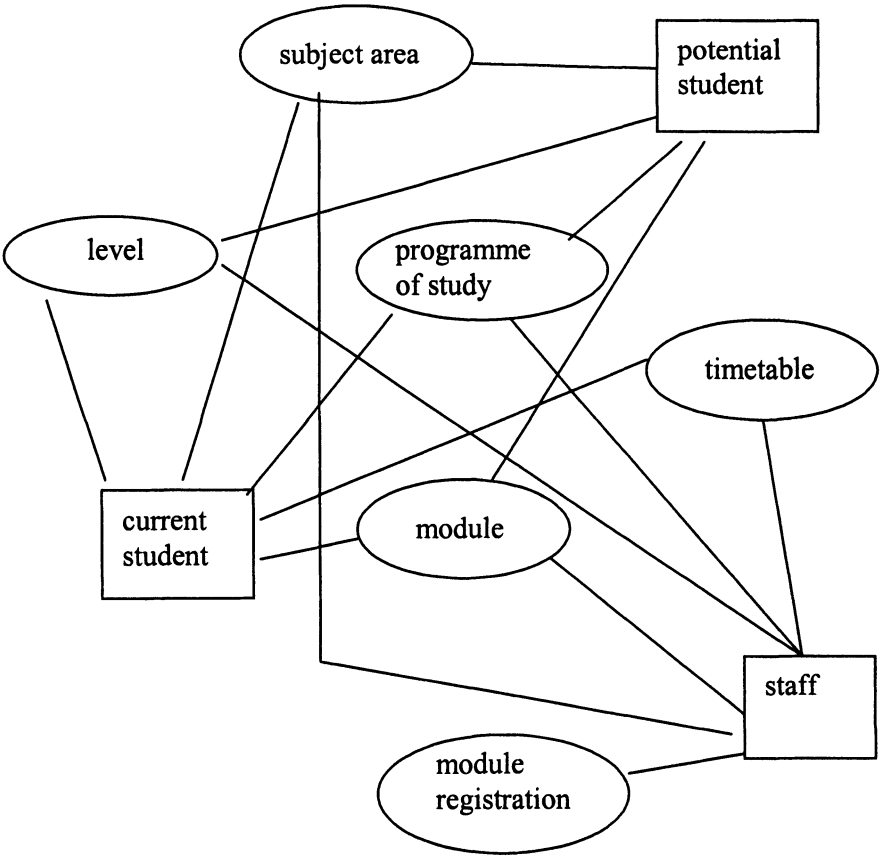
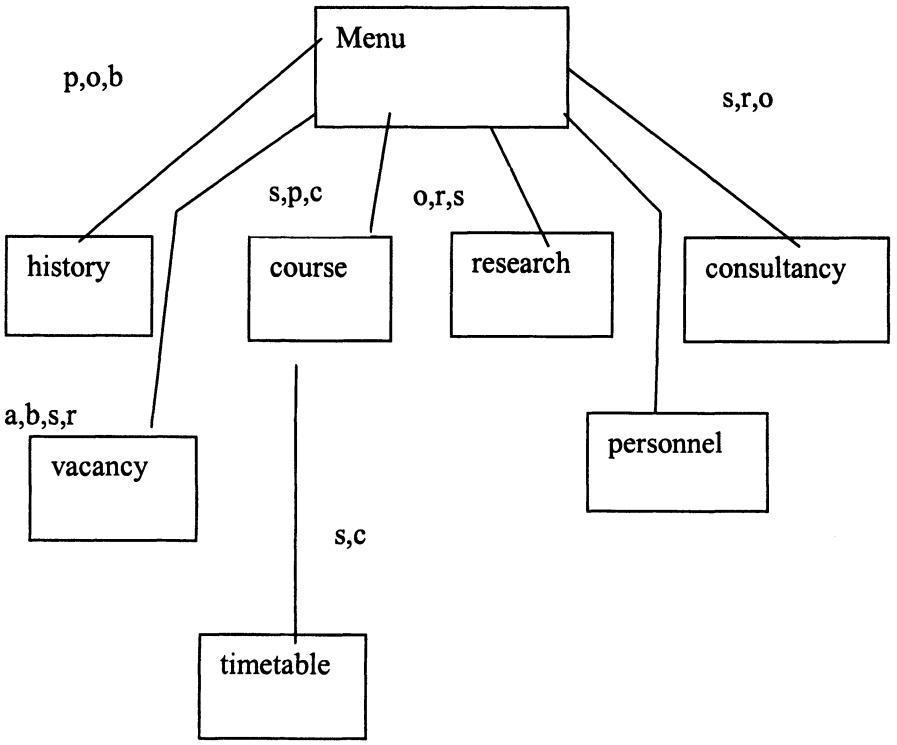
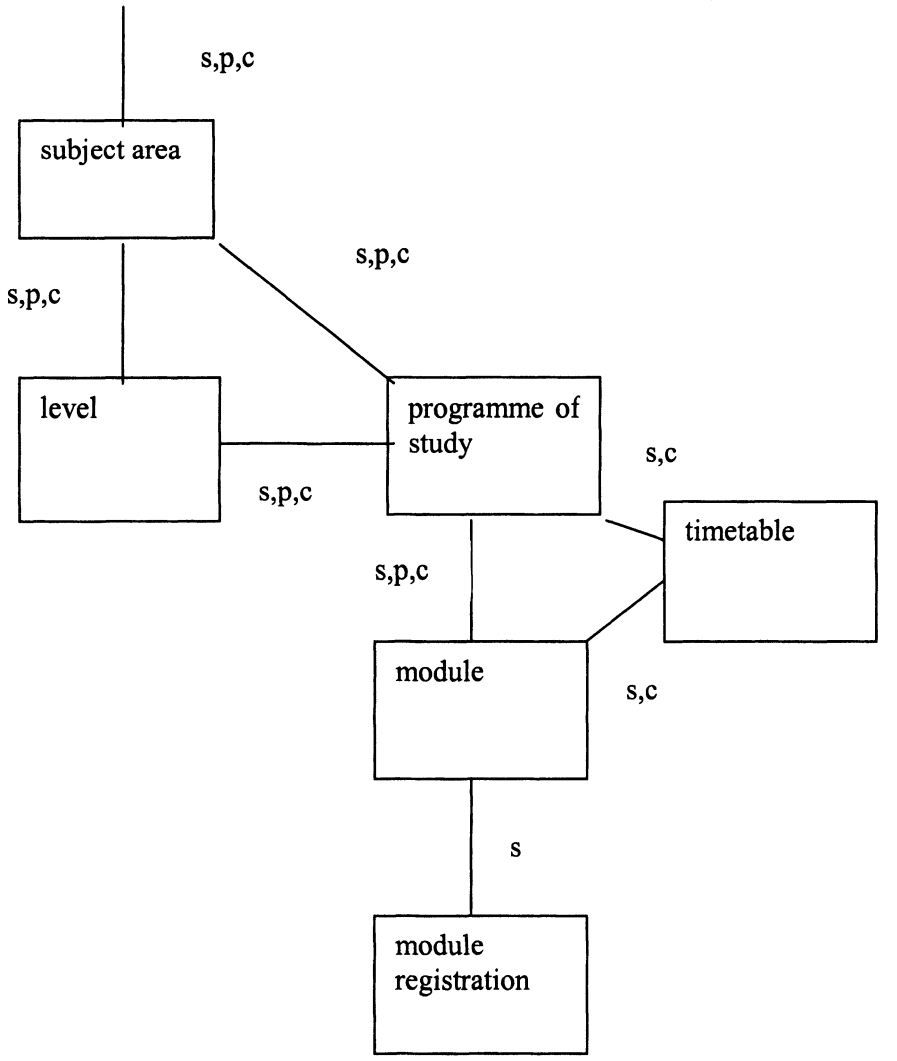


Figure 2. Lower level website user requirements analysis diagram



User groups = p (potential student)
c (current student)
a (alumnus)
s (staff)
r (researcher)
o (organisation / company)
b (casual browser)

Figure 3. User centred website structural design diagram



User groups = p (potential student)
c (current student)
s (staff)

Figure 4. Lower level user centred website structural design diagram

Website page design specification for timetable

Purpose	Display timetable information
Links from	Programme of study and module details website pages
Links to	None
Main functions	Retrieve timetable data for module (if module code parameter passed from module details page) from timetable database Retrieve timetable data for programme of study (if programme code and level code parameters passed from programme of study page) from timetable database Format and display timetable data
User input	None
Layout	Use standard timetable layout

Sketch of outline page layout here

Security	Only staff and current student access allowed. check userid of user. If userid not found in staff or student database display warning message.

Figure 5. Website page design specification