Interaction Design Patterns in the Context of Interactive TV Applications

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Abstract: This paper discusses (a) the design and (b) the development of easy to use interactive TV applications. (a) Because of the specifics of interaction design for interactive TV applications specific design guidance for interactive TV is needed. This paper investigates how the design of interactive TV applications can benefit from existing software usability knowledge as well as from the interaction design pattern approach. Several interaction design patterns for interactive TV applications have been developed, e.g. for voting, betting and shopping applications as well as for personalised news applications. (b) In order to support the user-centred development of interactive TV applications, this paper investigates how proven software engineering methods can be used in the broadcasting industry. In order to facilitate the integration of the proposed interaction design patterns into a user-centred interactive TV application development process UML use case diagrams and UML activity diagrams have been integrated into interaction design patterns.

1 Introduction

Broadcasters are beginning to develop a wide range of interactive, digital television (iTV) applications, e.g. electronic program guides, voting and betting applications, interactive games, personalised news and tele-learning applications.

The Multimedia Home Platform (MHP) developed by the Digital Video Broadcasting (DVB) consortium as open standard for iTV is increasingly being supported by the international broadcasting industry and governments worldwide adding momentum to the development of iTV.

Compared to traditional software and web applications several specifics of iTV applications in regard to interaction design and application development have to be taken into account.

2 Interaction Design for Interactive TV Applications

User interaction with iTV applications usually happens via the four colour buttons, the four arrow buttons and the confirmation button on the TV remote control. The viewing distance is several metres and the screens resolution is low. The user is looking primarily for entertainment, is laid-back and user engagement is relatively low. ITV applications can generally be divided into two groups: Applications that are attached to a dominant video-stream and those that are not. Especially those applications which are intended to support the reception of the TV program must not destroy the dramaturgic flow of the program. Therefore the existing software usability knowledge cannot be applied to these applications directly. Specific interaction design guidance for iTV applications is needed. In the following it is investigated if interaction design for iTV applications can be supported by the design pattern approach, which has recently been introduced into the field of Human-Computer Interaction (HCI).

2.1 Interaction Design Patterns

A design pattern is a structured textual and graphical description of a proven solution to a recurring design problem in a given context. The term "design pattern" for solution patterns, that offer solution approaches for recurring or similar design problems was proposed by the architect Christopher Alexander (Alexander, 1977). Today design patterns are used widely in the discipline of object-oriented software engineering.

An interaction design pattern is a design pattern in the discipline of HCI. They document proven solutions for returning interaction design problems in a systematic and understandable way. Interaction design patterns differ from design patterns in the field of software engineering in that they are describing problems end-users have, as opposed to problems encountered by system architects. Interaction design patterns are user-centred.

Different formats of interaction design patterns have been proposed (Tidwell, 1999; van Welie, 2000; Borchers, 2001; van Duyne, Douglas K. et al. 2003). All of them are based on the form of design patterns introduced by Alexander (Alexander, 1977). The different existing interaction design formats vary in their elements, the number of elements and the elements´ title and order. Alexander's design patterns consist of the name of the pattern, a ranking of its validity, a picture as an example of its application, the context in which it is to be used, a problem statement and description, the central solution of the pattern, a diagram illustrating the solution and references to related patterns.

2.2 Interaction Design Patterns for Interactive TV Applications

For interactive TV applications no interaction design patterns exist so far. The first ones have been developed in this research project. When developing interaction design patterns for a new domain like iTV, it has to be taken into account, that unlike in the century-old discipline of architecture very few iTV application have been developed so far and there are no proven interaction design solutions. Therefore another criteria needs to be chosen in order to evaluate and select applications from which to extract interaction design patterns. Because the focus of this research is on the development of usable iTV applications, usability has been chosen as criteria to evaluate existing applications. Usability testing in an usability lab using the thinking-aloud method as well as heuristic usability inspection has been carried out for different iTV applications. Only those applications and functionalities evaluated as easy to use have been used to develop interaction design patterns.

Since iTV applications have not been through a selection process over a longer period of time and by a wider user group the extracted interaction design solutions can only be pattern proposals, which might become interaction design patterns over time.

3 Development of Interactive TV Applications

The specific of application development for iTV is that people with very different backgrounds and are involved, e.g. TV and online editors as well as TV and software engineers. Such different disciplines as television format development, media technology, object-oriented software engineering, interaction design and usability engineering are working together. The heterogeneous nature of these disciplines hinders their integration into the development process. In order to optimise the development process, broadcasters are now looking for instruments that

- simplify the development process
- reduce the development costs and time
- increase the usability of the applications
- support a consistent look and feel of the applications

The broadcasting industry also has no tradition and culture in software development, which makes it difficult to rely on proven software engineering methods and tools alone.

One of the objectives of the described research is to investigate, if existing software engineering methods and tools can support the iTV application development process and if they can enhance the development of easy to use iTV applications.

3.1 Use Case Based Interaction Design Patterns

Existing interaction design pattern collections cover visual presentation as well as dialog level aspects, without explicitly distinguishing between the two. For the development of interaction design patterns for iTV application this research focuses on the dialog level. In order to support the integration of the extracted dialog level interaction design patterns into a user-centred software development process a use case based approach has been chosen. In addition to the classic textual description of the problem element in an interaction design pattern the problem is described in form of a use case. Use case based interaction design patterns are not covering visual presentation aspects, but are task-related. Like interaction design patterns use cases have the advantage that they are easy to read and to understand for people not familiar to software engineering methods, e.g. end-user.

The development can be simplified, If functional requirements have been expressed in form of use cases they can easily be matched with the corresponding interaction design patterns, thus simplifying the user-centred development process.

3.2 Interaction Design Patterns and UML Diagrams

In order to further facilitate the integration of interaction design patterns into the object-oriented software development process, the Unified Modelling Language (UML) is being used to illustrate the problem and the solution element of each interaction design pattern. The problem is illustrated by a UML use case diagram and the solution is described using a UML activity diagram. Activity diagrams describe user actions in their timely order and are therefore a suitable illustration for timely aspects in use case based interaction design patterns.

The evaluation if and how the proposed interaction design patterns support the development of easy to use iTV applications will be carried out twofold: (a) Evaluation of their usefulness in the development process of iTV applications by iTV application development experts and (b) Evaluation of the form of presentation by other design pattern writers.

4 Conclusion

Interaction design patterns are a suitable instrument for describing iTV applications and their interaction components. Usability evaluation can be used to select iTV applications from which to extract interaction design patterns, when the primary goal is to support the development of easy to use applications. Use cases are an appropriate way to describe the problem element in interaction design patterns. This creates a wide context, that still allows a meaningful use of interaction design patterns. UML use case diagrams can be used to illustrate the use cases. UML activity diagrams can be added to use case-based interaction design patterns to better visualise the timely aspect of the solution.

To complete the research presented in this paper the proposed interaction design patterns need to be evaluated by iTV application development experts as well as by experienced design pattern writers.

Another research challenge is to investigate if interaction design patterns are a suitable tool for documenting proven design solutions in order to reuse them for applications on other technological platforms and/or other hardware devices. This is especially relevant for multi-channel publishing.

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