TOWARDS COMPUTER SUPPORTED COLLABORATION IN ELECTRONIC PAPER PROTOTYPING

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ABSTRACT

Paper-prototyping is an established approach to the creation of early prototypes in the participatory design of interactive systems. Recent years have seen the rapid development of new interaction devices in which a display screen is combined with pen-based input to allow users to create sketches or hand-written notes in an interaction that is similar to writing with a pen on paper.

This paper reports my research on examining the feasibility of integrating pen-based electronic prototyping media within a framework of participatory design practice. The main purpose of this research is to discover to what extent an electronic paper prototyping tool could facilitate computer supported collaboration in the early stages of development process of interactive systems.

Keywords

Interactive system design, paper prototyping, collaborative design and GABBEH.

1. INTRODUCTION

It is generally accepted that user participation is central to the successful design of an interactive system. . The design and implementation of a successful interactive system must proceed iteratively driven by early and continued user feedback. Users can only give feedback and make informed choices when the proposals being discussed are meaningful to them. Prototyping is one popular method of helping users (and designers) to understand possible alternatives.

To encourage user participation in the design process, the use of pencil and paper as an established participatory approach for designing interactive systems has been suggested [1]. Whilst paper-prototyping has many advantages in promoting user participation, it also has some limitations. In particular:

- lack of an explicit representation of the navigational structure could make it difficult for users to understand and revise the dynamic behaviour of paper prototypes [7];

- it is difficult to review a paper-prototype when users and designers are not able to arrange a face-to-face meeting; and

- paper-prototypes may be difficult to relate to other representations being used within design, such as detailed specifications of behaviour and functionality.

As pen-based interaction devices have become more widely available, some software systems provide support for pen-based interaction in interactive systems design. Examples include SILK and DENIM [3], [4] and Freeform [6]. These systems might be described as supporting a form of 'electronic-paper prototyping'. Such approaches overcome some of the limitations of paper-prototyping. In particular, these systems can make the dynamic behaviour of the proposed system easier for users to perceive and can permit the prototype to be distributed electronically.

2. STUDYING DESIGN

To commence the research a literature review has been conducted to review existing prototyping methods and tools that are used in designing and prototyping interactive systems. To investigate the practice of using prototyping methods a number of informal interviews and a case-study were conducted. The case-study was conducted on developing a simple Student Marks program. The program was designed to allow users to assign students to a course module and allocate a mark to each student. A paper prototype of the proposed system was created. The paper prototype then was used in creation of executable prototype using 'electronic paper prototyping' systems (such as DEDNIM [4]).

The results of our studies showed that a major difference between 'electronic paper prototyping' systems and using a paper prototype is the limited support for *communication* of findings. In paper prototyping, post-it notes and hand written comments in form of scribbles can be used to indicate reasons for particular design choices, critiques of particular elements, or indications that further work is required or planned. The ability to add arbitrary additional material is an essential aspect of human communication. Green & Blackwell [2] suggest that 'Secondary notation' is important in *exploration* or modification of a design.

None of the tools studied in our research provide any form of secondary notation neither within the design view nor during execution of the model. The only marks that can be made are scribbles, which cannot be distinguished from the intended content of the design itself. In particular, this approach does not allow users and other stakeholders to give feedback directly through the medium of the prototype. Instead any feedback or comment must hold separately, resulting in a difficulty in identifying the items to which any comment refers. This problem will be acute if some stakeholders are not co-located with the designers. This may severely limit the ability of these 'electronic paper prototyping' systems to support *communication* among different stakeholder groups in the design process.

3. GABBEH

Gabbeh [5] is an extension to DENIM environment that extends the capabilities of existing tools by supporting dialogues between designers and other stakeholders. The core innovation in Gabbeh is in allowing different stakeholders to add arbitrary comments either when the model is being designed or when the model is executed.

Figure 1 shows an example of comments in Gabbeh. Gabbeh allows users to add arbitrary scribbles (free-hand notes) to a comment using a similar free-hand writing tool as is used to create elements in a web page.
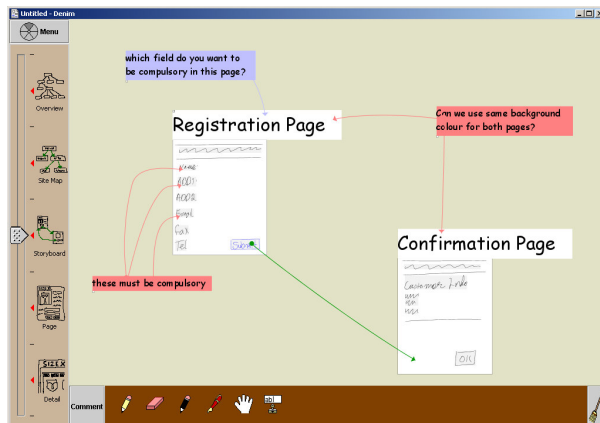

Figure 1: The Gabbeh prototype

A comment in Gabbeh can be associated with any arbitrary number of design components. Comments are given a background colour. This is intended to allow development teams to distinguish between different types of comments, or perhaps between comments from different speakers. The usage is left open deliberately to provide flexibility.

In the *evaluation* phase different stakeholders may execute Gabbeh using a limited functionality browser to review the design. Gabbeh allows users to view and add comments while they are reviewing the design in 'run mode'. This functionality is intended to promote user participation in *evaluating* the prototype. Also, it would support the *communication* when stakeholders are not located in the

same site. Gabbeh displays comments as coloured numbers on the page in 'run mode' and users can view them by selecting these numbers

4. FUTURE WORK

Gabbeh is at an early stage of prototyping. The design concepts have been developed from discussions with designers of websites, desktop applications and video games. Further enhancement will include being able to add comments in 'run mode' in more detailed level than a page level. This will expand the scope of user's feedback in design evaluation. Also being able to introduce comments on transitions, as well as being able to import images of existing applications so that the tool can be used to support design evolution and redesign.

At the time of writing, the basic functionality of Gabbeh has been completed, and I am conducting an empirical study to evaluate it. In particular, I am interested to discover to what extent Gabbeh facilitates the *communication* and *collaboration* among different stakeholders during the design process.

5. ACKNOWLEDGMENT

6. REFERENCES

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