Prototyping Handout

CS 4173*

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1 Introduction

1. Many in the software industry have discovered that building the system the user really wants and needs is tricky
2. Often users are not sure of exactly what functions they would like the system to perform
3. Many times users have difficulty communicating their needs to the system developers
4. In addition, users may have faulty expectations regarding automation
5. Users may be unaware of some of the power, flexibility and features computer systems can offer. Alternatively, they may overestimate the functionality they can obtain for their projected investment.
6. Rapid prototyping facilitates the development of software projects and especially UIs

*Adapted from notes obtained from Laura Leventhal at Bowling Green State U., based on Chapter 9 of Hix and Hartson

2 Definitions

1. In the traditional Waterfall Model of software engineering, each phase of the software development cycle occurs in linear, non-iterative order.
   (a) Users often are unable to project what a system will look like, how it will be used, or even what it is supposed to do from these documents
   (b) UI development models advocate prototyping (as methods for evaluation and developement)
2. Rapid prototyping is a technique which directly addresses these user problems
3. A prototype is a model and is *not* a refined and finished product

3 Overview of Rapid Prototyping of UIs

1. Prototyping in general can be described as having a series of steps:
   (a) preliminary fact-finding
   (b) pregeneration design stage
   (c) prototype generation
   (d) prototype refinement
2. During the prototyping process the developer must decide whether to build a full prototype of the target system or only a portion of the system. (Hix & Hartson use the terms 'global prototype' and 'local prototype')
3. Developers must also decide whether the prototype will be incorporated into the final system or if it is to be a 'throw-away' effort
4. Additionally, developers must schedule and integrate prototyping into the development cycle.

4 Advantages and Disadvantages of Rapid Prototyping

1. Numerous advantages for rapid prototyping have been cited in the software engineering literature
   (a) developers only truly understand the system requirements when they can see some form of implementation in action
   (b) use of prototypes can lead to improved functional requirements, improved interaction requirements, and easier evolution of requirements
2. In addition, Boehm, Gray & Seewaldt (1984) performed an experiment comparing the prototyping approach to the conventional approach
3. In another experiment that compared a prototyping approach to a conventional approach, Alavi (1984) reported that prototyping led to enhanced communication between users and designers
4. Other potential advantages:
   (a) the user interface is carefully designed and tailored to the users' needs
   (b) the users become involved more completely in the evolution of the product
   (c) the low cost and ready availability of at least some prototyping tools make their acquisition feasible even on a low budget and less productive

5 Approaches to prototyping the user interface

Approaches may be distinguished by detail and goals of prototype. Hix & Hartson present other dimensions:

1. scenario (storyboard)
2. demonstration
3. version 0

5.1 Scenario/storyboard

1. The user is presented an example on paper or on a computer of actual system usage
2. However, the system only simulates the processing of fixed user data or queries
3. Each frame of the storyboard or scenario represents one page or screen the user might see output from the system

5.2 Demonstration

In this approach to prototyping, users are allowed to enter their own restricted set of data or to perform some limited set of functions

1. The system typically processes some limited range of user operations or data, using limited external resources (typically files)
2. The usefulness of this type of prototype is greater than the scenario/storyboard approach because some true system functionality is exhibited, giving the user and the designer a better picture of the proposed system

5.3 Version 0

In Version 0 prototyping the prototype is a working release of the system and is intended to be used under conditions similar to the final, targeted environment

1. The Version 0 prototype is not fully functional. It may be missing functions such as help and error messaging, and is expected to be altered through suggestions from the user
2. Clearly, it is a goal of the Version 0 approach to create code which will be evolved into the released version of the system
3. One advantage of this approach is that the prototype evolves into the final product, eliminating most throw-away code.
4. Another advantage is that the user sees progress being made on the product
5. The main disadvantage is that the producers of the prototype may be reluctant to throw out a bad design or to incorporate important refinements which significantly alter the prototype

6 Tools for Prototyping

1. To create storyboard prototypes, drawing software such as MacDraw, MacPaint, or Corel Draw can be used in place of paper and pencil to produce screen or report mock-ups

2. Several types of software support the creation of demonstration prototypes:

   (a) One approach is to use a programming language

   (b) Another approach to creating demonstration prototypes is to use hypermedia

3. Many products exist which support the creation of Version 0 prototypes. There are three broad categories of such tools:

   (a) Prototyping Software

   (b) User Interface Management Systems

      User Interface Management Systems (UIMS) were originally conceived of as tools to allow the user to customize the interface of a software package while maintaining the functionality.

   (c) Fourth Generation Languages

      By adding overlays and using macros, spreadsheet packages can be used to create prototypes

See Also

Paper protoyping articles from User Interface Engineering website:

- Five Paper Prototyping Tips by Matthew Klee at ⟨URL:http://www.world.std.com/~uieweb/paperproto.htm⟩
- Paper Prototypes: Still our Favorite [sic] at ⟨URL:http://www.world.std.com/~uieweb/prototyp.htm⟩
- Article: Using Paper Prototypes To Manage Risk at ⟨URL:http://www.world.std.com/~uieweb/paper.htm⟩

References

[1] M. Alavi. An assessment of the protyping approach to information systems development. *Communications of the ACM*, 27(6):556 – 563, 1984. Citation from Hix & Hartson [3, p. 281].

[2] B. W. Boem, T. E. Gray, and T. Seewladt. Protoyping vs. specification: A multi-project experiment. In *Proceedings of Seventh International Conference on Software Engineering*, pages 473 – 484, New York, 1984. ACM and IEEE. Citation from Hix & Hartson [3, p. 281].

[3] Deborah Hix and H. Rex Hartson. Rapid prototyping of interaction design. In *Developing User Interface Ensuring Usability Through Product & Process*, Wiley Professional Computing, chapter 9, pages 249 – 281. John Wiley & Sons, Inc., 1993.